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# THE ELECTRICAL WORLD



A REVIEW OF CURRENT PROGRESS IN ELECTRICITY  
AND ITS PRACTICAL APPLICATIONS

VOLUME LXI

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# Electrical World

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## The Year's Progress

Continuing a practice instituted by this journal long ago, the first issue of the year presents again a series of editorial reviews on the progress made in the electrical industry during the twelve months just passed. Prepared as they have been by leaders in the many and diversified branches of the industry, these reviews comprise a summary of progress and achievement which could be secured in no other way and form a permanent record of inestimable value. Most impressive of all this marvelous array of accomplishments in the industrial world is the great overlying result that the applications of electrical energy in our complex modern civilization are second to no other physical agency in rendering useful service to mankind and increasing the sum total of happiness and wealth. And the end is not yet, nor can any man see the end, for the fields of scientific knowledge continue to unfold and expand before us, without limit except our own ability to follow. After pausing to take inventory of the achievements which have just passed into history and gathering to ourselves the lessons which come from healthy retrospection, let us turn to the new year and the future with new zest and enthusiasm for even greater things!

## Minimum Wage for Women

Much public commendation has been earned by the Public Service Corporation of New Jersey as the result of its announcement that with the new year it establishes a minimum wage scale of \$9 per week for women employees. While the major part of the female help required by a utility company must possess a degree of training and skill which insures compensation well above the low scales paid in other industries, the step of the New Jersey company nevertheless points another application of those broad humane principles which are making themselves felt throughout the business dealings of modern public-service corporations. The effect of the announcement on public sentiment in the community is also not to be lightly estimated, and there can be no doubt that viewed alone as a simple business proposition, resting on the same practical basis on which modern industry places its justification of welfare work, a utility corporation will not lose dollars and cents by adopting such a splendid humane measure. This instance of the Public Service Corporation is an example in point, for the announcement has already struck a popular chord and has been spread by the press throughout all the communities where the company furnishes lighting and railway service. As noted in our announcement of Dec. 28, 300 of the company's 10,000 employees are women. The admirable and altruistic motives which impelled Thomas N. McCarter and his directors to act promptly

on the results of their investigation and set a livable scale for women workers deserve the sincere appreciation of all who have the kindlier outlook on human responsibilities. For those administrators who hesitate to mix business and sentiment it may be of interest to study even the practical advantages that are sure to result from this as from any other broad humanitarian policy which is sound because it is simple justice.

## Central-Station Consolidation

One of the comments that have come to us on the discussion of central-station consolidation in our issue for Dec. 28 points out an omission in the enumeration of the faults or possible weaknesses of the holding company. This, one authority on the subject believes, is that a strong and prosperous subsidiary company may be in such a position, as the result of its control by a holding company, that it cannot raise money except through the latter. And if, as may be the case, the holding company is not in a position to get capital on attractive terms or is using for other purposes all the money it can obtain, a given subsidiary may suffer. This is an apt comment. It emphasizes the need for discrimination between holding companies good and bad, strong and weak, and it is something for the owners of independent plants to consider along with the more alluring aspects of being "absorbed." The prosperous company whose earnings go into its own treasury and whose credit can be used at all times for its own benefit can view without envy the position of the property whose resources are at the disposal of the weakly set up or badly managed syndicate.

## Electricity in Mail Handling

In the new United States Post Office building erected over the terminal yards of the Pennsylvania Railroad in New York City use is made of electricity for the handling of mail to an extent not previously attempted either in this country or abroad. The demand for speed without confusion in delivering the mail matter just where wanted, combined with the limits imposed by the movement of trains through the sub-basement of the building, rendered the problem of the engineers very difficult and necessitated the designing of special equipment for each task to be performed. The first instalment of an article by Messrs. L. B. Marks and J. E. Woodwell relating to the lighting installation, mail-handling equipment and other features of the undertaking appears in this issue. While many of the design details are more strictly mechanical than electrical, yet all of the motive power is derived from electrical sources and the plans adopted have been rendered possible largely by reason of the flexibility in mechanical performance and convenience in control of the electric motor. The installation

in the New York terminal Post Office represents one of the most interesting and important modern applications of electricity in mechanical service.

### The City as a Partner

One of the very interesting tendencies in Continental central-station development is described by Dr. Richard Passow in an important recent paper abstracted in our *Digest* this week. It is not necessary here to go into the details of the various plans for common ownership for electric service which have been carried out in Germany, but the fact that such plans have proved successful is a very important matter from the standpoint of applied civics. In America the line has been very sharply drawn as between private and municipal plants, as though company and city had radically different interests which could not be reconciled by any kind of mutual agreement. In Germany municipal electric plants are as commonplace as municipal water plants are here. A German business man may criticize the administration of his municipal electric supply works, but that it is a thing to be averted at any cost does not enter his mind. On the other hand, Germany has well administered and successful privately owned plants, so it does not stand committed to municipal ownership, however frequently it may be practised.

The system of common ownership described by Dr. Passow, including central stations and electric railways, opens a new phase of the municipal ownership matter. It practically amounts to the city going into partnership with private companies for the development of electrical distribution and transportation, in an attempt to secure the joint advantages of private and municipal control, the former in enterprising and efficient management, the latter in stability and that well-ordered control which it has been found only too difficult to reach by means of commissions and the like. In many cases, a number of which are cited in the paper before us, a single city has an absolute majority control of the enterprise. In other cases a group of cities may together hold control, and in still others municipalities are only minority stockholders. Even in this case, of course, the city as a governing body can exercise more efficient control in holding a formidable minority of stock than it could without it. Such partnership seems to be of service in raising capital on the one hand and in affording a keen incentive for economical and careful management on the other.

German practice as recounted by Dr. Passow shows great variety in the relations existing between the two chief parties to the enterprise. But the main thing is that they seem to work together with a reasonable degree of harmony and the city gets continuing benefit from its own growth, a lack of which is one of the weakest points in the usual plan of giving over a city to exploitation by a private company, which, while generally well disposed and usually under some manner of control, yet gathers to itself most of the benefits which come from municipal growth. With mixed ownership the city obtains its share and is likely thereafter to take a more judicious and reasonable view of the economic situation than it otherwise would. Someone should make

a careful study of the situation with respect to such plants in Germany with a view to ascertaining, not the obvious things, but the possible difficulties and the sources of friction which have been found in practice to interfere with the working of a plan otherwise attractive.

### Experiments with Umbrella Antenna

The article published on page 47 of this issue, giving the results of a series of tests on radio-transmission efficiencies, is not only intrinsically very interesting but is worthy of especial attention in connection with the measurements recently furnished by Prof. C. A. Culver. In the present paper Mr. Joseph O. Mauborgne reports in some detail, and with excellently stated quantitative data, a group of experiments upon a small umbrella transmitting antenna having a counterpoise earth. It is pointed out that the four radial wires near the ground, but insulated from it, do not form a true "counterpoise" or balancing capacity image of the aerial system, but, rather, are the upper armature system of a condenser in which the earth itself is the lower half. In this connection it is perhaps worthy of note that nearly all present-day counterpoise grounds are in effect capacity earths, since their height above the earth is usually negligible as compared to their lateral dimensions or to the wave-lengths with which they are used.

The exact reason for a 17 per cent gain in efficiency merely through a 45-deg. angular displacement of the earth wires is somewhat puzzling, but perhaps may best be explained by considering that a highly conducting earth path for the sliding wave-feet is provided at points where, in order to reach it, there need be only slight wave-front distortion. The increase of received energy, as measured by the galvanometer, when eight shorter wires were substituted for the four 85-ft. conductors might be expected, if only from the reduction of resistance and consequent lowering of heat losses at the transmitter.

Mr. Mauborgne's figures concerning the change of efficiency due to alteration of the height of the outer ends of the radial antenna wires are of especial practical value. In the normal case the effective height of the antenna was 29 ft. When this was increased by 38 per cent. to 45 ft., the received signal increased to about 140 per cent the original strength. When it was reduced by 27 per cent. to 21 ft., the signals remained nearly constant, falling off only 6 per cent. This result is not in agreement with earlier work carried through on much higher antennas, but it is really not to be expected that the same laws of radiation efficiency would hold when wires are close to the earth and when they are raised well above it. The safe conclusion would appear to be that, even with the outer ends of the antenna wires in their normal position, 18 ft. above the ground, they are too low for good results—a deduction which is strongly supported by the observed fact that a given percentage change in effective height causes a far greater variation in efficiency in the positive than in the negative direction. It is hoped that many additional data of this kind will be forthcoming, since it is through comparison of many experimental results that there will be reached a final understanding of the phenomena involved in radiation from wires.



# Electrical Industrial Growth in 1912

By T. C. Martin

IT may be doubted whether many years can be cited as more active in electrical development than was 1912.

It was certainly much better than 1911, and back of that lay the dreary stretch of years beginning with the spectacular troubles of 1907. How great the improvement has been no one can tell exactly. In these days of governmental control and supervision, data and statistics become increasingly available, but with the greatest willingness and the best effort applied, they still must be quite a little behind the times. Obsolescence bears more heavily, perhaps, on statistics than on apparatus; and nothing can be so dangerous to the man who would shape his course by them as outgrown and outworn figures in relation to such an industry as electricity. For the four great divisions of electrical application in America—manufacturing, communication, traction, lighting and power—the most authentic data are those of the Census Office of 1905-6-7, but these, as required by the census act, will not be taken again until next year; so that in trying to arrive at some definite result, in setting down the actual expansion in dollars and cents, a good deal of guesswork is inevitable. But there are many bases of calculation. Some companies and systems in each of the fields make regular reports, and through lean years and fat ones electricity makes a steady gain over its entire area of operation that approximates 20 per cent. No one supposes that such a rate can be maintained, but nobody has yet found the point of "saturation" in electrical industries. We are sanguine enough to hope and believe it never will be found.

Coming to the latest possible statistics derivable, we may here set them down in a table, as has been done in these pages for many years past, and with the general pleasing fact that almost every time the new census figures, on coming out, have more than substantiated them.

It would thus appear that the amount paid by the American public for its electrical apparatus and service during 1912 was a little in excess of \$2,000,000,000. The actual amount was undoubtedly somewhere in that neighborhood and may easily have reached the estimate given in the second column. The activity of the electrical manufactur-

ers is well known, and the product of only three of the leading concerns if deducted from the total would leave an absurdly small amount for the 800 other concerns. In the traction field the reports of largely increased earnings have been practically universal throughout the year. In New York the subway has been breaking all records day by day. The central-station field has been busy beyond precedent, and most systems exceeded their Christmas peaks weeks ago. In telephony the Bell system alone reached \$180,000,000 in 1911, and this year up to August ran to

DATA ON ELECTRICAL INDUSTRIAL GROWTH

	1911	1912
Electrical apparatus made	\$325,000,000	\$350,000,000
Electric-railway earnings	575,000,000	625,000,000
Central-station earnings	375,000,000	450,000,000
Telephone earnings	310,000,000	350,000,000
Telegraph earnings	75,000,000	85,000,000
Isolated plant service	125,000,000	125,000,000
Miscellaneous electric service	100,000,000	125,000,000
	\$1,885,000,000	\$2,110,000,000

\$130,000,000. In telegraphy the Western Union increased its gross \$6,000,000 up to nearly \$42,000,000. As to the miscellaneous class, everybody is familiar with the gigantic expansion going on in electric vehicles, electric heating and cooking, electrochemistry, electrometallurgy and other branches, all running into their millions of output.

The total increase estimated over the whole area of industry for which this journal speaks is about 15 per cent, and there is no known reason why such an assumption is not safe and conservative. And if such figures be correct, if such estimates be reasonable, what a fund of encouragement is in them as to the present, and what a stimulus to enthusiasm in attacking the vast opportunities of the immediate future!

## Progress of Electrical Science in 1912

By A. E. Kennelly

THE year which has passed has not been characterized by salient novelties in the applied science of electromagnetism, but has witnessed noteworthy progress in the developments of various branches of that science. These developments have been especially manifested in the increasing range, extent and control of electrical energy transmission for lighting, industrial service and communication of ideas. In regard to energy transmission, the Au Sable River power plant in Michigan, described in the *Electrical World* of April 13, 1912, has carried the range of three-phase transmission-line emf to 140 kilovolts at the generating end. Such working voltages call for and entail development of the sciences and arts of insulation and current-breaking, not only along the lines but also in the terminal apparatus of the stations connected.

The study of high-voltage insulation in air and other gases leads to, and properly includes, the study of coronal discharge and coronal losses. Very considerable progress has been reported during the year in this direction from the theoretical, experimental and applicational standpoints.

The year has also seen a notable activity in the extension and development of large hydroelectric plants, as well as a tendency toward the consolidation of previously existing plants.

Any notice of development in energy-transmission range would be incomplete, if attention were paid solely to long-distance transmission. The past year will be signalized in history as witnessing the application of electrical science to the transmission of energy at relatively large rate over the minimum distance, of engine-room dimensions, in electrical ship propulsion. The United States collier *Jupiter* launched on Aug. 24, 1912, is the first large ship to be propelled by electric motor. The *Jupiter* is not a steamship in the ordinary sense of that term, but floats in a class by herself and might be described as a steam-electric ship. Practical experience with this type of vessel must remain a matter for the comment of another year.

The disastrous loss of the steamship *Titanic* in April had the effect of directing universal attention to the protective possibilities of duly organized marine wireless telegraphy,



since the boats containing some 700 survivors were speedily picked up in midocean, with the aid of wireless distress signals, while it might have been possible for the entire ship's company to have been saved if a continuous wireless lookout had been organized on all ships in the vicinity. As a result of the disaster, much study and impetus have been given to the subject of radio-telegraphy scientifically, practically and legislatively. An engineering working theory of the average range and capability of radio-telegraphic antennas, although by no means satisfactorily completed, already exists, and much activity has been displayed during the year in erecting long-range wireless stations over the world by the principal industrial nations.

The international radio-telegraphic congress at London last June was a notable event, not merely from the international, legal, commercial or sociological aspect but also from the electrical-science standpoint. The convention arrived at by the Congress, and signed on July 5 by the delegates of thirty countries, is virtually a treaty for the keeping of the ethereal peace. The service regulations appended to the convention constitute the scientific text of this treaty. While not of a highly technical character it is a characteristic of the age that electromagnetic waves should be the subject matter of this international agreement in 1912.

In regard to the wonderful science of electromagnetic metrology as conducted internationally among the various national laboratories of the industrial nations, whereby the ohm, volt, watt and other engineering units are maintained industrially, noteworthy progress has been made in the electrochemistry of the electrolytic apparatus for determining the international ampere. A considerable share of this work has been done at the United States Bureau of Standards. The work of the national laboratories, taken collectively, constitutes a steadily increasing share of the applied science research of the world.

In telephony the year 1912 has been signalized by the laying of a continuously loaded submarine four-conductor telephone cable across the English Channel, between Abbotscliff and Cape Gris-Nez, which supplements the previously existing Pupin-loaded cable across the same straits. Good progress has also been made in the study and scientific analysis of the behavior of telephones and telephonic apparatus.

As illustrative of the co-operation between sciences rendered necessary by the progress of engineering, the past

year is notable for the report of the Commission on Resuscitation from Electric Shock, composed of delegates from medical and engineering organizations. The report, delivered at the Seattle convention of the National Electric Light Association, institutes a marked advance over the resuscitation procedure which had been generally followed up to that date.

Although no plenary meeting of the International Electrotechnical Commission was held during the year, yet very effective international sub-committee meetings were held at Paris in April. Good progress was reported from these sub-committees to the respective national committees in the directions of international nomenclature, symbols and the rating of machinery.

Professional ethics may be regarded as a subject lying outside of the range of electrical science. Nevertheless the progress of applied science in electricity is necessarily closely bound up with the growth and development of the electrical-engineering profession, while the recognition of a profession is in its turn closely connected with the recognized standard of its internal ethical relations. The past year has witnessed the first promulgation of a code of ethics by the American Institute of Electrical Engineers. This code presages much for the future of the profession, in so far as it signifies that an internal ethical relation is recognized as existing on a higher plane than that of promiscuous good citizenship.

In electromagnetics good progress has been witnessed in the realization of the electronic theory. The determination of the absolute value of the electronic charge, or quantity of electricity associated with any single electron, has advanced in precision. Moreover, the experiment displayed at the London convention of the Royal Society in June, which actually visualizes the paths in air of the alpha particles projected from a small mass of radium salt, has brought home to the senses the actions of these ultramicroscopic but enormously swift projectiles, in a most convincing manner.

In engineering mathematics good advance has been made in Bessel functions, hyperbolic functions and theta functions toward the solution of some of the numerous problems that confront the electrical engineer. The *Proceedings* of the international mathematical congress at Cambridge, England, contained some important papers on subjects coming into touch with applied electromagnetics.

## The Patent Situation

By W. D. Weaver

THE recent public awakening to the need of patent reform appears to be due not to any particular interest in the inventor or even in the righteous administration of the patent monopoly, but to the relation that monopoly has been discovered to bear to the great political issue of the present period—the subjection to proper control of great combinations of capital. The perversion of the patent monopoly has, in interested circles, been notorious for years, but even the eloquent outburst of indignation of Chief Justice White against the majority opinion in the Dick case would perhaps have had no effect on the public at large in the absence of a bearing on the great question of the day. There is a danger in this situation to those interested in patent reform as affecting the inventor and the progress of the useful arts; for with public attention concentrated only on what has become a political aspect of the question, the wrongs of the inventor may pass unrighted and no attempt be made to relieve the patent system from more than a portion of the crushing burden of judge-made law that so largely nullifies the plain intent of

the constitutional clause providing for the reward of actual inventors and the advancement of the useful arts. That fear on this subject is not unfounded is indicated by the differences between the amended and the original Oldfield patent reform bill, the present bill omitting all provisions having the specific purpose to remove some of the most glaring abuses of Patent Office procedure. This omission in itself points to the desirability of separating the several issues involved in patent reform that each may receive the fullest consideration on its merits.

The first of these in general importance is the relation of the patent monopoly to great combinations of capital with respect to restraint of trade, to destructive warfare under the patent banner on the small manufacturer, and to the exaction for patented articles of prices that bear no relation to the reward of the inventor and little to the cost of manufacture and distribution. This part of the subject has become a national question, which will be discussed more as a matter of public policy than of general patent reform, and which will finally receive some answer dictated

by the people at large. Those more immediately interested in the rights of the inventor and in the untrammelled progress of the useful arts cannot expect to have an influence in the determination of the great issue much beyond that of any citizen, and therefore might well reserve their forces for combination in advancing directly those objects which without them will have no natural champions. It is true that the gentlemen of the legal fraternity always come to the front with offers of championship whenever redress of inventors' grievances is under consideration; but the wisdom is doubtful of allowing this element any prominent part in councils where measures of relief are planned or in the conduct of campaigns for securing justice. While the body of patent attorneys and lawyers contains unquestionably at least as large a proportion of highly honorable men as any of the other professions, common prudence would seem to dictate that sight must not be lost of the fact that the active agent in connection with practically every abuse of the patent monopoly, whether in the Patent Office or in the courts, has been a patent attorney or lawyer, and that every law or rule which decreases the expense of Patent Office procedure or court litigation will correspondingly reduce their professional revenues.

The other issues above referred to relate more particularly to the manner in which the plain intent of the patent constitutional provision has been perverted to the direct injury of the inventor and to the practical nullification of its expressed purpose to promote the progress of the useful arts. It should be explained in passing that the word "inventor" as herein employed refers to the kind of inventors who actually invent, and does not include those whose salaried work consists in writing patent applications to cover improvements incident to the normal development of an art, nor that class whose inventive faculty is limited to great skill in drawing up specifications and involved claims ingeniously formulated to conform technically to Patent Office criteria of invention as fixed by court decisions, but which in fact are merely speculative anticipations of what some day a real inventor may make an actuality—and then be deprived of the fruits of his labors. The patent constitutional provision—and on this alone rests our entire present patent system—reads as follows: "Congress shall have power to promote the progress of science and useful arts by securing, for limited times, to authors and inventors the exclusive rights to their respective writings and discoveries" (Art. I, Sect. 8). The influence of modern industrial development has practically substituted the manufacturer for the "inventor" as the beneficiary, and judges have so construed the term "exclusive rights" as to establish a monopoly unrestricted by considerations of public policy or of gross injustice to others engaged in forwarding the progress of the useful arts. The justification of this construction can only be on the strictly utilitarian ground that evils which it sanctions are overbalanced by benefits to inventors serving to incite them to the exercise of their inventive faculty to a high degree. In point of fact, the stated object of the constitutional provision is today practically a dead letter, both with respect to promoting progress of the arts and to encouraging inventors. This deplorable condition has been brought about primarily by court constructions of the patent monopoly which have largely transferred its benefits from the inventor to manufacturing combinations controlling an industry; and secondarily, by the growth of great abuses in the administration of existing patent law, which have placed the independent inventor at a hopeless disadvantage in securing his rights in the Patent Office or in maintaining them in the courts. It is the correction of these evils which should receive the support, both individual and organized, of those specially interested in inventions and in the untrammelled progress of the useful arts.

Of specific proposals for remedying in a measure the existing evils of the patent system, two are embodied in

bills now before Congress. One of these, introduced by Representative Oldfield, chairman of the House patent committee, relates directly to patent reform, and the other, introduced by Representative Sulzer, Governor-elect of New York State, provides for the creation of a patent court of appeals. Assuming that the Sulzer bill is not subject to future misconstruction in a manner unsuspected by its official sponsor and the numerous public bodies that have indorsed it, the measure should receive the hearty support of all friends of patent reform and have their active aid in procuring its passage at the close of the present session of Congress. The qualification relates to a matter that could be readily cleared up, namely the presence of a clause requiring every case determined by the Court of Appeals to be remanded to the court whence it came for further proceedings taken in pursuance of such determination; which requirement, if not merely of an administrative bearing, might add still another stage of delay and bill of expense to patent litigation. Entirely aside from the special competence, after a time, of such a tribunal to consider patent cases, and aside also from the practical finality of its decisions and from the anticipated reduction in expense of patent litigation, the Sulzer measure should have a far-reaching effect through confining so far as possible the interpretation of the patent monopoly to one judicial body and, of even more importance, through the great facility with which legislation could be formulated and brought to bear if this interpretation at any time should be thought not in accordance with the intent of the constitutional provision establishing the monopoly.

The Oldfield bill represents the long and disinterested thought of able men, instructed in numerous patent hearings which, as reported in printed form, cover almost 1000 pages and reflect the opinion of practically every class specially interested in the patent system. The bill also represents, at least in part, the result of the experience with and observation of patent abuse by the United States Patent Office, and also of unofficial contact by those who drew the bill with the minds of many men who can speak with weight on its subject matter. Its provisions are therefore worthy of the highest respect, but owing to their radical nature, it seems doubtful if the opinion of even the most disinterested friends of patent reform is predominantly in favor of the passage of the bill at the present session of Congress. Should it fail of passage, the situation after March 4 will be ideal for the appointment of a commission similar to that recommended by the Inventors' League and the American Institute of Electrical Engineers for further study of the subject and the report, in full or in outline, of a bill that will place the patent monopoly on a basis in accordance with the constitutional provision which authorizes it. Such a commission might well take for a preliminary basis of consideration the Oldfield bill as representing the political aspect of the patent question and determine in what respect it might be revised. This would, to an extent at least, discourage aimless propositions and render discussion of the whole question more definite. In addition, however, it would be very necessary, should the powers of the commission permit, to report in separate form the basis of a bill relating specifically to the curbing of abuses which otherwise would be transferred from the old to the new system. The original Oldfield bill was largely devoted to such preventive measures, and perhaps it was the part of wisdom to confine the revised bill to the great central principles it was desired to establish.

The substance of bills reported by such a commission might not be satisfactory in very many details, for the result of the deliberations of a body of this kind is apt to be a compromise between contending interests rather than a code of even justice not concerned with the commercial effect of its application. With a commission, however, composed of men of the character proposed by the American Institute of Electrical Engineers, measures recommended

would at least better the present intolerable conditions and be likely to receive favorable action from Congress; whereas, lacking a similar standing with the country at large and with conservative men directly or indirectly affected by its provisions, any bill originating solely in Congress would meet with enormous difficulty in overcoming powerful influences brought to bear to prevent passage, or to permit passage only in emasculated form.

While present indications seem to point to delay in the radical reconstruction of the present discredited patent system, there should be no halt in the endeavor to wipe out at the earliest possible moment abuses that are now daily working injury and which, even if the Oldfield bill become a law, would have to be the subject of supplementary legislation. The grand strategy of enemies of patent reform has been to impose through their overwhelming influence a Fabian policy on their opponents instead of taking direct issue with them—to work to adjourn all action to the Greek Kalends—and this danger should be guarded against. As to any fear that until the greater issue is disposed of legislation affecting the patent system in any manner is unwise, it is difficult to conceive how any action taken at the present time to correct, say, the evil of "dragnet" Patent Office applications can possibly affect the success of pending or future measures for the revision of the principles of the patent system. It is true that any patent bills introduced at the present session of Congress could not, except under extraordinary circumstances, become law; but such measures would serve to place in definite form on prominent record crying specific needs of immediate redress, and thus would have extremely greater weight with a future commission than if presented in ordinary form to a body likely to be deluged with such matter, good, bad and indifferent. It would appear to be a wise policy in aid of the cause for any person or groups of persons who have a strong feeling as to an evil flourishing, with the protection of court precedent, under the present administration of the patent system, to seek for means whereby a bill to right the wrong may be presented before Congress. This is particularly applicable to cases which can be established by reference to published court decisions, Patent Office proceedings or recommendations, or "contents of the file wrapper." Many glaring abuses could be established on the basis of these documents alone, and cases thus supported could not be waved aside as merely representing the grievances of inventors whose devices failed by reason of their own lack

of merit to receive the recognition that was sought for them.

A still simpler procedure would be to endeavor to secure the introduction of bills based upon the numerous disregarded requests of Commissioners of Patents for authority to suppress abuses which are committed under the cover of statute law or court decisions. It may not be inappropriate to quote here from the record, for illustration, a few of such requests made for legislation but not granted: A law "To prevent applicants from holding their applications in the office awaiting developments of the art by others and thereafter taking out broad patents which cause those who have made independent inventions during the pendency of the application to pay tribute to an applicant who has merely lain in wait for such developments." A law to prevent "applicants and manufacturers who desire to do so to retain applications in the Patent Office for many years and to use the same as a 'dragnet' to scoop in the inventions of others which have been conceived and matured and a business established thereon during the pendency of these applications." A law to protect the past and present practice of preserving all applications in secrecy, which practice, it appears, is menaced by a decision of Judge Lacombe (thus far disregarded by the Patent Office) that the element of secrecy as fixed by law applies only to applications interfering with caveats—and caveats were abolished by law in 1910. Commenting on the effect of removing the seal of secrecy, the Commissioner of Patents states that "the files of the Patent Office would be continually searched by people who desire to obtain knowledge of others' inventions for the purpose of interferences and otherwise, and it would lead to the appropriation by unscrupulous parties of inventions made by others."

Numerous other abuses flourishing under the protection of law surely excuse impatience over any further continuance of the invariable practice of the past to defer to the indefinite future action on definite patent evils calling for immediate correction. Naturally a preferable way to attack the class of abuses referred to specifically above would be in a systematic manner and more or less completely, through the agency of organized bodies representing the technical arts, and it would be most desirable to secure such support. Lacking this, however, or while awaiting it, the independent inventor should join every force he can command in the battle which, after decades of apparently hopeless waiting on his part, is now opening with his grievances as one of the war cries.

## The Water-Power Situation

By Louis Bell

**D**URING the past year the complex problems relating to the water-powers on the public domain or otherwise within public control have been the subject of considerable discussion, mostly fruitless, although not wholly without avail. None of the proposals for federal control has met all the reasonable objections that could be urged against it, and the situation as a whole is still in a turmoil. The discussion late in November in which the State of California and the Pacific Coast interests were concerned came nearer to being a frank consideration of the situation than anything which has yet occurred.

There have been a good many scare-head lines announcing and denouncing the existence of a so-called water-power trust. Those best acquainted with the situation take the view that there is no such thing as a water-power trust, but that if the hydraulic interests of the country slip out of the intimate control of the federal government or of the states the consummation of a water-power trust is a thing reasonably to be expected. At present the situation is merely that

certain large groups of interests have been quick to appreciate the value of hydraulic privileges and active in investing in them. Anybody who has the money can buy and develop a water-power quite unhindered by any aggregation of capital thus far disclosed, but if he proposes to borrow a large amount of capital to carry out the development he naturally goes to one of the groups known to be willing to invest in such property and to take an active interest in the subject. In this way has originated the control of a large amount of water-power by a comparatively small number of interests. There is no menace to the general rights of the public in this, and in point of fact it has over and over again been shown that whenever the hydraulic resources of a considerable territory can be physically merged into unified control they become more valuable to the community than if operated independently. The only thing from which the community rightly desires protection is an era of extortionate prices brought about by improper use of the monopoly thus obtained.



The problem for the general government to undertake with respect to the unutilized hydraulic powers within its sphere of influence is merely to control these valuable privileges in the interests of the general public to the best advantage. This condition is certainly not met by setting up regulations which will discourage the utilization of these powers. The potential annual value of hydraulic privileges now unutilized and wastefully pouring their water seaward is to be reckoned in hundreds of millions of dollars per annum. It is sheer continuing waste for which the world gets no kind of recompense. Granting that the government under reasonable conditions should permit and encourage the use of the water-powers it controls, the next question which arises and which has been a constant subject of indeterminate discussion is whether the control suitable to what one may properly classify as a natural monopoly should lie with the general government or with the states. In theory, local control, like local self-government, has much to recommend it. In practice, state control of very many things now regulated thereby turns out to be extremely unsatisfactory. Questions are constantly arising in matters of great importance to the country at large, in respect to which conflicting policies are in force in various states, to the utter confusion of good government. With the more general development of water-powers interstate complications of a very embarrassing character are certain to arise if unrestricted control is left to the state. For example, the very serious question comes up as to whether a state may prohibit the export of hydraulically generated energy or may levy a tax upon its export. Many power companies are constantly doing an interstate business, and if conflicting interests of any kind result in a conflicting policy, a perfectly sound enterprise doing business with energy derived from the public domain may find itself in all sorts of trouble. For this reason the trend of what the writer believes to be the sounder opinion turns toward effective government control.

To preserve the equity of the people as a whole in these powers some provision must be made for close, effective and continuing regulation, including regulation of prices. The projects for regulation now in force or on foot are open to criticism because of their establishment of a rental basis. The ultimate result of this must of necessity be an increase of the price to the consumer, as was pointed out in the recent conference at Washington—an increase which in some cases might rise to a very substantial amount. It would seem to be more in line with the policy of ultimate public usefulness to charge no rentals, or at least no more than a nominal sum to cover the expenses of supervision, and to adopt such regulations of the activities of the plants concerned as will

keep the price of their product down to the irreducible minimum consistent with a suitable return on the capital actually invested; and as a mere matter of decent fairness this return, considering the laborious and uncertain nature of the development especially in its early stages, ought to be a liberal one. The main thing for which the government must look out is that whatever this fair return may be, it should not be permitted to increase by methods of indirection only too well known in the history of public-utility enterprises of various sorts. This is the same question that arises in the case of the work of the ordinary public utility commission and which in general is rather badly bungled. An allowance of profit apparently fair and conservative in case of a plant built for cash and operated for profit becomes extortionate when the same percentage is reckoned on a plant built via an elaborate chain of promotion and underwriting, very likely through a construction company and an operating company, with a subsequent line of consolidations and extensions. When a process such as this has been gone through one has to peel off successive allied, associated and affiliated corporations like the successive skins of an onion before reaching the core which represents hard dollars invested in the enterprise.

The time of wild-cat exploitation in power enterprises should be considered as long past. If properly planned, they are sound, sane, conservative investments entitled to be treated as such. If the government would bend its energies toward getting the available powers promptly and effectively utilized and protecting the public by rigorous supervision of the financing and operating involved in this utilization, it would do far more to benefit the ultimate consumer than it can do by hanging back, hesitating, and taking out in rentals the surplus that ought to be applied to reducing rates. The legal aspects of the question are intricate and ample precedents are to be found for almost any point of view which has been taken in the matter. It ought to be comparatively easy, however, to secure through Congress legislation by which, when a public power site is taken up, it should be by the very terms of its lease under full and direct control by the properly constituted department of the general government. This accomplished, there need be no fear of a hypothetical water-power trust or of injustice being done to the public by the lessees of public water-powers. It is to be earnestly hoped that the final straightening out of the difficulties of this particular situation will be undertaken by the new administration at an early date and carried to a conclusion, so that we may no longer have to see, so to speak, a golden stream pouring down our watercourses into an abyss from which it can never be recovered.

## Developments in Prime Movers

By W. F. Durand

THE past year has witnessed little of revolutionary character in prime movers so far as concerns the field of central-station practice. There has been, none the less, steady advance along lines marked out by characteristics noted in these columns during the past years and indicating a consistent and continuous development in accordance with well-settled principles. It may not be too much to say, so long as we are to deal with the present balance in the matter of cost and character of fuels, efficiency, reliability and adaptability of the various forms of prime movers, that progress and development will be concerned with matters of detail along present lines rather than with deep and radical changes. This means no more than that during the past decade, to go no farther back, the design of central power stations has become more and more perfectly adapted to the existing balance, as referred

to above, and a typical design of the present day represents within the limits imposed by this balance and by our present scientific knowledge a very refined solution of the problem of the economical development of power from natural sources of heat energy. This does not imply that changes and improvements, possibly profound in character, will not come, but they will be the outgrowth of changes in the balance as noted above, or of the discovery of new laws, or of some combination of such causes.

Referring briefly to fuels, coal and oil retain substantially the same relation as in previous years. The question of choice is simply economic. The general program for the effective combustion of both types of fuel and for the economic use of the heat liberated is now well understood. Matters of improvement relate to details. Thus in general there seems to be a well-marked increase in the use of

carbon dioxide indicators or recorders. This shows a growing appreciation of the necessity of stopping wastes, especially those unseen or unrecognizable by ordinary means, and of the aid which the  $\text{CO}_2$  recorder may yield in this respect. It may not be amiss, in this connection, to warn against blind dependence on such indications alone. The waste heat escaping by way of the stack depends on both the quantity of the gaseous products and the stack temperature. The  $\text{CO}_2$  recorder gives indications regarding only the first of these two main factors. The stack thermometer must be used as carefully and its indications studied as critically as are those of the  $\text{CO}_2$  recorder.

In the matter of fuel oil combustion, some continued progress is noticeable in the extension of mechanical methods of atomization as a substitute for atomization by means of steam or compressed air. The use of steam entails a tax required for atomization usually of 3 to 4 per cent of all the steam generated by the boiler. With mechanical atomization, including steam condensed in high-pressure heaters, this tax can be reduced to about 1 per cent. Recent extended tests in California on this matter have clearly established the high economy of atomization as such when carried out by suitable mechanical means. Such tests, however, have not always shown as good gross boiler efficiency as with steam atomization, so that the final net economy is not far different in the two cases, though usually with some advantage for mechanical atomization. The next steps would appear to involve a more careful study and adaptation of furnace forms, proportions and air inlet arrangements adapted as perfectly to the mechanical atomizing burner as present forms are to steam atomization. A further requirement is indicated in the need for flat or fishtail flames rather than divergent conical flames. The latter form, naturally given by several types of mechanical burners, is harder on tubes, requires greater furnace height and is not well adapted to the usual type of central-station boiler. With these details in hand, it seems reasonable to look for continued extension in the use of mechanically atomizing burners.

#### Turbines and Reciprocating Engines

The competition between steam-turbine and reciprocating engines as prime movers for large units is a thing of the past. The turbine alone is considered the normal type and a reciprocating steam engine for a large unit would now be an absolute anomaly. In the field of small units and for auxiliary equipment the reciprocating type still holds its own, though even here the turbine is making rapid and notable gains. Alternating-current units in decreasing sizes are offered with turbine drive; gear reduction provides similar drive for direct-current units, while pumps and blowers of various designs are now offered with turbine drive. Many of the special forms of turbine developed for small units or for auxiliary drive show good economy and are giving excellent satisfaction. The reciprocating engine in ratings up to 200 hp or 300 hp, however, shows such marked thermal superiority over the turbine that in cases where economy is of controlling significance the reciprocating type must still have the preference. This superiority may be still more definitely assured in engines using superheated steam and units designed to operate on the "inflow" principle.

The trend of development in steam-turbine practice during recent years has taken on a most interesting and significant phase. Whereas in earlier years the line of separation between the various types was very strictly drawn, especially between the so-called impulse type with fixed nozzles and the reaction type with nozzle effect in the space between the moving blades, in more recent years there has been a gradual coalescence of types until we now find Curtis turbine types with reaction stages in addition to the normal fixed nozzles and velocity stages, and also Parsons turbine types with fixed nozzles in addition to the normal

reaction effect. In general it has been found that each type has its special advantages and troubles, and it is only to be expected that the best possible turbine will show features of both fundamental types. In particular it has been found with the Parsons type that the high-pressure end is relatively less efficient than the low-pressure end and that fixed nozzles and an impulse effect may be used with advantage in this part of the program. Similarly it has been found that a reaction effect may with good effect be introduced in the later stages of a Curtis type machine. In this manner design is becoming eclectic, freely choosing the best features from the whole field of turbine practice. A further feature of interest is found in the continued development of Curtis turbines in the horizontal form. At the present time this form is built in all sizes except the largest, and it yet remains to be determined whether the vertical form will be permanently retained for such or will gradually be displaced by the horizontal form for all sizes.

Among reciprocating types of steam prime movers the development of the Stumpf "uniflow" engine has been the most significant in recent years. During the past year the Nordberg company, which has undertaken the construction of the engine in this country, has made extended investigations on an experimental engine, with gratifying results both as to economy and overload range. By reducing the effect of cylinder condensation to a small part of its normal value in the single cylinder type, the uniflow engine realizes the economy of the compound type without its complication in construction.

#### Superheated Steam

Developments generally in the use of superheated steam are slow but steady. In the field of large central power stations the almost universal use of the steam turbine with its ready and effective utilization of superheated steam has forced upon boiler manufacturers the necessity of reliable and effective superheating boilers. This demand has been met and there is now on the market a wide variety of superheating boilers, safe, reliable and effective in operation and suited to any engineering demand. So far as the provision of superheated steam is involved, the problem is well in hand, and it remains to extend the field of its use in the prime mover. Following the example set by European engineers we should look for a continued, even if gradual, extension in the use of superheated steam with reciprocating engines as well as in turbines.

Certain experimental work carried on during the year brings into prominence the fact that a steam pipe carrying superheated steam may also carry moist steam or even slugs of water along as well. The water present will not, of course, be in thermal equilibrium, but will be in the process of vaporization. This, however, is a process requiring time, and with the high speeds of steam flow commonly employed it may be quite possible for a slug of water to pass through the superheater and along the steam pipe to the engine. These observations indicate that due precautions regarding water must not be relaxed even with superheated steam equipment.

A remarkable investigation by Armand Duchesne at the University of Liège reported during the year by Dwellshauvers Déry seems to call in question the large amount of work done recently in connection with the determination of the physical properties of superheated steam. Mr. Duchesne has found a marked discrepancy between the temperature of superheated steam as indicated by a mercury thermometer and by a very sensitive thermocouple which he has devised and employed in a long series of studies in this field. If further examination should serve to verify these observations, a new set of steam tables will be called for so far as the superheated field is concerned. The further examination of the points raised by Mr. Duchesne will be awaited with the keenest interest by the engineering and scientific world.

### Internal Combustion Engines

The development of the internal combustion prime mover in recent years, and especially of the Diesel type, has been nothing short of phenomenal. While most of the growth has taken place in Europe, recent tendencies in the United States indicate a growing interest among engineers in this type of prime mover, and we may anticipate in the near future a very marked extension in its use. At present, however, it must be recognized that the Diesel engine is not a rival of the large steam turbine or adapted for use in large central stations. In large sizes the steam turbine will show the more economical and more satisfactory results, while in small sizes the internal combustion engine in general, and the Diesel engine in particular, will show much the higher efficiency. The two general economy curves will cross at some size of unit variously estimated at 1500 kw, more or less. In any event for small units of 1000 kw or less, and where satisfactory guarantees may be obtained as to the supply of oil, the Diesel engine unit may fairly be said to have won the right to first consideration.

When the units are 2000 kw and upward the limit of present size is quickly reached and the indications are still in favor of the steam-driven unit.

Engines of the Diesel type are now guaranteed between full and three-fourths load to give 1 kw-hr. on 0.5 lb. of oil having a heating value of not less than 18,500 heat units or on a heat input of not exceeding 9250 thermal units. Engines of this type, however, are expensive in first cost and require careful and systematic attention in operation. The final determination must include consideration of all elements of annual cost of energy, both fixed and operating, and first appearances may not always be reliable. In general, however, engineers having to deal with small power units will be well advised to investigate carefully the possibilities of engines of the internal combustion type as prime movers in such cases.

Economy and reliability still remain the touchstones of engineering practice and all questions must be resolved in the light of the conclusions derived from the application of these tests.

## Developments in Electrical Machinery

By B. A. Behrend

AS it is easier to summarize the past than it is to forecast the future, so it is easier to study evanescent types than to make predictions as to those which will replace them. With the sounding of the death knell of the reciprocating steam engine in large units, the virtual disappearance of large engine-type generators has commenced. It seems pathetic that the labors of the last thirty years, culminating in the development of almost perfect types of slow-speed electric generators, have not been of more permanent value. Their effect has been chiefly instructive, as far as the present types of electric machinery are concerned. The gas engine has not taken the important place which its friends predicted for it half a dozen years ago.

Although statistical figures are not available, it is not unreasonable to assume that the aggregate horse-power of gas engines produced per annum is only a small fraction of the horse-power of steam turbines produced in a corresponding period. The numerous attempts at compounding these generators which used to be made have been altogether given up and, if there is any notable tendency in regard to the regulation of these generators, it is in favor of coarser regulation, rather than finer regulation, leaving the task of keeping the voltage constant to the switchboard operator.

### Low-Cost Tendencies

There is a general tendency, noticeable here as elsewhere, aiming at a reduction of cost and, while this tendency is of course natural, it is probably accentuated by the knowledge of the relatively short time during which any particular type of machine has been able to hold its own. Quick succession of types directly tends to a desire to install short-lived machinery of low cost, rather than long-lived machinery of high cost, as new ideas and improvements may lead to obtaining economies and advantages which could not be obtained with the older types. This is really to-day a characteristic of engineering development in all fields. Rapid progress has unsettled our opinions and played havoc with our standards. Quality has to yield to cheapness as permanence is called in question, and the guiding principle of natural selection, leading to the evolution of types no better than necessary to hold their own, finds application here as elsewhere.

We may now turn from this field to another. The ener-

gies of the electrical designer have been concentrated upon the development of the high-speed generator for direct connection to steam turbines. The progress achieved in this direction is brought out clearly by the accompanying table, giving the maximum rating obtained for certain speeds during the last eight years.

DATA ON HIGH-SPEED GENERATORS DIRECTLY CONNECTED TO STEAM TURBINES

Year	R.P.M.	Maximum Rating, kw
1904	3600	400
1909	3600	2,800
1912	3600	5,000
1904	1800	1,500
1909	1800	10,000
1912	1800	20,000

The tendency to push the limit of speed farther and farther and to reduce the cost of the unit and increase its economy of operation seems to have reached a goal. Not only have almost all known special alloys been called into use and taxed to the limit of their strength, but as it seems as if a further increase in speed would increase the losses and thus lead to lower efficiency, while the need of higher grades of material and greater care of workmanship and inspection would enhance the cost of production.

### Special Materials

Thanks to the stimulation of the automobile, alloy steels have been produced of an elastic limit of 100,000 lb. per square inch, and of an ultimate strength of 125,000 lb. per square inch, showing a ductility better than that ordinarily obtained in the regular carbon steels, and this even in comparatively large forgings. Although such large forgings, which have to be used extensively for turbo-generators, have been improved from year to year, and although their manufacture is now less of a speciality than it used to be, yet the difficulty of heat treatment and the danger of concealed flaws is such as to make the careful designer prefer the use of rolled materials wherever possible to large steel



forgings. A rolled plate receives a more thorough work through its texture than a forging, insuring greater homogeneity, which is of prime importance. Thus, in the building of turbo-generators, the use of steel plates marks what one might almost be tempted to call an epoch.

### Ventilation

It is evident that the great development of heat, due to the concentration of comparatively large losses in single units, represents a formidable problem for the engineer. In a 20,000-kw unit the losses dissipated in heat will reach approximately 400 kw, and this heat is developed in so small a compass that the old methods of carrying it away from the generator are no longer efficacious. It has been found necessary to subdivide the iron and the copper, not only through the regular ventilating ducts, but also through longitudinal ducts through the cores of both the rotor and stator. In fact, the tendency toward the utilization of such axial ducts for carrying off the heat is clearly in evidence. We are passing in these machines from radial ventilation to axial ventilation and, while heretofore powerful fans, mounted on the ends of the generator shafts, were sufficient to pass air currents through the generators to carry off the heat, in the latest units it has become advisable to install separate blowers, which can be operated at speeds more economical than the generator speeds, leading to a greater efficiency on the part of the ventilating mechanism, besides allowing a more scientific design unhampered by the constructive features of the turbo-generator. Future power plants will have large blower plants carrying away the hot air developed by the electric generators, similar to the present installations used for air-blast transformers.

### Friction Losses

With the high rotative speeds of turbo-generators there has come as a grave difficulty the great loss due to aerial friction. This loss, usually styled windage loss, has become so great that it constitutes a serious argument against further increase in speed. The gain in efficiency due to the better utilization of steam in the steam turbine must, at a certain point of speed of the generator, be counterbalanced

in the increased windage losses of the generator proper. This is a matter of calculation for each size and speed where the efficiency of the steam turbine is accurately known beforehand. There is no doubt that ideas at present seemingly abortive, as, for instance, operating the generators in a vacuum, irresistibly suggest themselves to the designer, and he must remember that here as elsewhere new ideas are the heresies of to-day and the superstitions of to-morrow.

### Direct-Current Turbo-Generators

The direct-current turbo-generator has been a will-o'-the-wisp during the past few years. Attempts to adapt the unipolar type to it have not been altogether unsuccessful, and this seems really the best that can be said. More and more we begin to realize that large direct-current units are not necessary, and that they are certainly not desirable. The necessity of distribution of electric energy leads logically to the generation of alternating currents which are transformed into direct current by means of synchronous converters and motor-generator sets. For the time being, we must see the solution of the problem of generating direct current at high rotative speeds in this method of transformation, without considering it at all as final.

### Electrical Devices for Automobiles

To sum up, the progress in the development of electrical machinery during the past year has been largely in the refinement of details, and even there it cannot be said that the year 1912 has been remarkable for notable improvements. The attention of the electrical engineer has been directed toward the development of small electrical devices for the automobile industry, as the electric lighting of automobiles, the starting of the gasoline motor and the combination of these two electric devices with the ignition of the gasoline motor. Marked and ingenious work has been done in this field, and, in view of the great commercial and industrial importance which the automobile has assumed, the manufacture of these auxiliary devices for the automobile is the most important event in the electrical industry during the year 1912.

## The Distribution of Electrical Energy

By H. B. Gear

THE developments of the year in the distribution of electricity have been made rather in the direction of refinements of detail than in modification of systems. Standard practice has fixed upon the use of three-phase alternating current as the most desirable medium for the general distribution of electricity except in the very congested centers of the larger cities. Direct-current low-tension networks will be continued in those parts of large cities where the load is very dense and the requirements as to continuity of service are such that the expense of storage-battery installations is fully justified. Alternating-current distribution in the form of a secondary network is being adopted more generally each year where the distributing systems in the central portions of medium-sized cities are being put underground. Four-wire, three-phase systems, operating at approximately 115-200 volts, seem to have the predominating advantage in such situations. With this system lighting and motor service may be given for all ordinary retail purposes from the same means, the principal disadvantage being that there are three phases to keep balanced. Wholesale consumers having installations of 50 kw and upward are most advantageously supplied by an installation of transformers made on the premises.

### Protection of Circuits

The security of service supplied by networks is still unfortunately dependent on the operation of protective devices which are prone to go into action when no emergency exists and at very inopportune times. A network protector designed to cut out defective transformers without interfering with the service has been developed during the past year, and other improvements will doubtless be made which will minimize these difficulties. The development of secondary networks has been encouraged by the substitution of tungsten lamps for inclosed-arc lamps and by the development of compensated types of induction motors having high power-factors. Every step toward the elimination of inductive loads among retail users brings nearer the possibility of secondary networks operating on the same basis as direct-current networks.

### Primary Distribution

In primary distribution 2200-volt, 60-cycle distributing mains are becoming universal. Three-wire delta-connected three-phase systems are quite general in cities having loads of 200 kw to 1000 kw. In the larger cities there is a steady trend toward the four-wire, three-phase

Y-connected system, operating at 2200/3800 volts. This system has very marked advantages where feeders are extended more than 2 miles from the point of supply and where adjacent towns within a radius of 5 miles may be served without step-up transformers or substations. Ability to regulate the phases of a four-wire feeder separately and freedom from the necessity of maintaining a carefully balanced load give this system a flexibility which is being taken advantage of more and more each year.

The four-wire, three-phase system has been very successfully applied to the supply of scattered districts where the distances between towns are as great as 10 miles to 15 miles, by stepping the distributing voltage up to 4400/7600. The various towns connected to the feeder are served by a two-to-one-ratio transformer of 50-kw to 100-kw rating, stepping down to the ordinary distributing voltage. The regulation of these circuits is accomplished entirely at the point of supply, thus eliminating attendance in the various towns supplied and keeping the substation investment down to the cost of an out-door transformer on a platform supported by a few poles.

#### Increasing Use of Alternating Currents

The use of alternating-current distribution has been encouraged by the development of rectifier equipments and other refinements which have greatly facilitated the charging of electric vehicles from an alternating-current supply. Indeed, the progress being made in the introduction of electric trucks is resulting in the establishment of garages of such size that alternating-current supply may be installed more economically than is possible with direct-current feeders. The advantages of induction motors in many kinds of manufacturing where direct-current commutators are troublesome have led to a demand on the part of some wholesale users for alternating-current supply in direct-current territory, and the tendency for the direct-current system to be gradually extended in response to demands for direct current seems likely to be offset, if not entirely reversed, by the demand for alternating-current service for manufacturing purposes in direct-current territory.

#### Street-Lighting Systems

Street-lighting systems are being steadily improved by the use of tungsten lamps both in substitution for inclosed alternating-current arc lamps and as an auxiliary to existing arc lighting systems. The tendency at present appears to be toward the introduction of flaming-arc lamps in the central districts where high intensity of illumination is required and tungsten units in outlying districts where a distributed illumination of lower intensity fulfils the requirements. The general introduction of distributed tungsten lighting is, however, retarded by the rather high cost

of installing the circuits which are necessary for an ideal location of lighting units. The use of single and multiple conductor, steel-tape cable for tungsten series street-lighting systems has been started with very satisfactory results as to first cost, the cable being laid directly in the parkway without the expense of conduit construction. The adoption of such construction for residence districts will permit the use of underground lighting systems far more generally than would be possible with a draw-in conduit system. It is to be hoped that operating experience will prove that the steel tape is sufficient protection for such cables. The installation of ornamental street-lighting systems by means of iron posts has made immense strides forward. Such systems are being operated on both series and multiple distributing circuits, the series system being used chiefly where the posts are made part of the general street-lighting system. The multiple system is preferred where the post lighting system is maintained separately from the general street-lighting system and is not paid for out of the public funds.

#### Overhead Construction

In overhead construction methods there is a definite movement toward the improvement of appearance of distributing lines in residence districts. This has led to the use of a neat design of concrete poles where work is done on private property, these poles being utilized for both lighting and telephone service and being limited in height. The use of cross-arms has been eliminated as far as possible, the secondary mains being supported by vertical brackets carried on the side of the pole. Still further improvement has been made in some localities by the use of multiple-conductor wire for service drops. The general trend toward the removal of overhead lines from streets continues, and the use of lines in alleys and on private property where there are no alleys becomes more extensive each year.

#### Unified Systems

Having survived the vicissitudes of the alternating-current versus direct-current controversy and outgrown the obsolete policy of separate systems for lighting and motor service operating at various odd voltages and frequencies, electrical distribution moves steadily forward toward its ultimate goal of ideal service to all consumers. The ideal system must be one which serves lamps, motors and all energy-consuming devices from the same mains at the same frequency and at as few voltages as distances will permit. It must finally combine the security of the battery-protected direct-current system with the flexibility of alternating-current distribution, and should serve all parts of the system equally well.

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## Progress in Transmission

By Ralph D. Mershon

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THE past year has not been marked by any startling advance in the art of high-voltage power transmission, though there has been that evolutionary progress that might be expected in so active a line of work. A number of high-voltage plants, 100,000 volts or over, some of them of voltages considerably higher than any used heretofore, have been put into commission, and a number of others are in course of construction or have been projected. A considerable number of outdoor high-voltage substations have been put in, both switching and transforming stations. There has been a thorough try-out of a system devised a year or so ago for removing short-circuits or grounds caused on transmission lines by flash-over of the insulators. This is the system which suppresses such dis-

turbances by automatically producing a short-circuit at the generating station and immediately afterward removing it. As shown by practical experience, it effectually removes or suppresses line disturbances of the kind mentioned with practically no interruption to the service of the system.

#### Increase in Voltage

Transmission voltages are gradually creeping up to higher and higher values. In some cases higher voltages have been used than would seem to be economically necessary. Presumably this is in some measure due to the desire of the engineers having the plants in hand to be in the vanguard of progress. But even though in some cases a lower voltage might, from an economical standpoint, be equally satisfac-

tory with, or even more satisfactory than, the high one adopted, the art of power transmission is undoubtedly indebted to these enterprises and to their engineers for the adoption of the higher voltages, by reason of the aid which such adoption and the carrying out of the enterprises lend to the progress of the art. There is no doubt that so far as our present knowledge goes there is no physical limitation to the transmission voltage which may be employed. The limitation, as with most other matters, is a purely economic one. It is purely a question of cost and the return that can be derived therefrom.

The highest transmission voltage put into practical operation during the last year is 140,000 volts. This is the voltage now regularly employed on the lines of the Au Sable Electric Company in Michigan. The highest projected voltage is 150,000 volts, for which the lines of the Pacific Light & Power Corporation are being constructed. Although the value of voltage, in common with other considerations affecting the transmission line, is usually fixed by economic considerations, there is one element in connection with all transmission lines, whether high voltage or low voltage, not ordinarily considered as being strictly subject to economic limitations alone. This is the matter of interruptions due to lightning. Strictly speaking, this question is also determined by economics. Because if we chose to spend a sufficient amount of money on an installation it would be possible to make it immune to atmospheric disturbances. To do this in the case of a long high-voltage transmission would mean such an enormous first cost as to be entirely prohibitive. So it might be considered, in view of the enormous cost involved, that these costs themselves compel the classing of the problem as a physical one instead of an economic one. That is, it may be considered that such drawbacks as still exist in the art of transmission due to atmospheric disturbances are drawbacks which from practical considerations must necessarily be overcome, not by an enormous increase in first cost, but by some solution having to do more directly with physical conditions—by some solution having mainly to do with the working out of a problem in the arrangement of transmission lines, or the insulation of transmission lines, or both—and which is, therefore, more immediately physical in its nature and does not greatly involve the relation between cost and the result obtained.

### Insulation of Line

While this physical problem of procuring for transmission lines practical immunity against atmospheric disturbances involves in some measure the arrangement and disposition of the lines, the present tendency is to consider it more a problem of insulation and its accessories. This is shown in the investigations that are now beginning to be actively taken up with relation to the effect on insulators of such electrostatic stresses as may be met as the result of lightning; in the study that is being made as to the relative effectiveness of insulators when subjected to voltages at ordinary commercial frequencies and to the same voltages at frequencies approximating those which we are led to believe exist in the case of many lightning disturbances.

It has long been known that insulators which would flash over at ordinary frequencies, rather than puncture, are often punctured on a transmission line by lightning disturbances without any evidence of accompanying flash-over. In other words, there seems to be no question that there is some very considerable difference in the condition which exists when an insulator is, on the one hand, subjected to a given voltage at a commercial frequency and when, on the other hand, it is subjected to the same voltage at an enormously greater frequency. Or, to put the matter in a little more exact language, the behavior of insulators when subjected to a difference of potential whose rate of change, or steepness of wave front, approximate those which are met with in commercial work is quite different from the behavior of the same insulator when subjected to a difference of poten-

tial whose rate of change is enormously greater than that normally impressed upon the line.

### Need of Better Insulators

The results obtained so far seem to point to the possibility of obtaining insulators which will meet that condition usually considered most desirable for enabling them to withstand lightning disturbances; that is, that of always withstanding the tendency to puncture to such an extent as will force the abnormal voltage to flash over the insulator instead of going through it. If this condition of affairs could always be insured, we might have a line practically immune to every condition save that of malicious interference. Because, if we could be sure that the insulator would always flash over and never puncture, it is comparatively easy, at relatively small additional expense, to make such provision as will insure the insulator not being harmed by the power arc following such flash-over.

The direction in which the greatest progress to-day can be made in the art of high-voltage power transmission is that indicated above. Undoubtedly the greatest desideratum at the present time is an insulator which will always flash over, rather than puncture, under any voltage to which it may be subjected, and will not be damaged by a flash-over. As a secondary matter, it is desirable that the power arc following a flash-over will not interrupt the service rendered by the transmission system. But, as previously mentioned, means are now available by which such interruption can be almost entirely insured against. The need, therefore, is only for an insulator which will never puncture and which will not be injured by the power arc following a flash-over during such period of time as may elapse from the time the power arc starts to the end of the very short period of time during which the auxiliary apparatus referred to has had an opportunity to suppress the arc.

### Outdoor Installations

The tendency is more and more toward installing high-voltage apparatus outdoors. Undoubtedly the time will come when all high-voltage apparatus whatsoever will be so installed. There is no good reason, either logical or financial, for going to the expense of bringing a high-voltage terminal through the metallic case of a transformer or switch of which it is a part and then going to a similar expense to bring the same terminal out through the wall or roof of the building housing the apparatus. A terminal built to withstand the weather might just as well be put on the metallic tank in the first place and the apparatus placed out of doors, thus saving not only the insulating bushing but practically all of the building as well, since with such an arrangement no protection is necessary save that for switchboard panels and operators.

### Operation of Transmission Systems

The tendency at the present time as regards the operation of transmission systems is undoubtedly more and more toward the creation of enormous networks extending over large areas of country, into which is fed energy from a plurality of sources. The desirability of such combinations is unquestionably indicated by all the economic considerations bearing upon this class of work. Such networks not only benefit by the diversity factor of the various customers they supply, but their utility is also strongly indicated by the additional insurance of continuity of service resulting from energy supply from a number of sources instead of from one. We may continue to expect the amalgamation of transmission systems into transmission networks wherever such systems are within economically reachable distances of one another. We may expect in the not distant future such development in the insulation and construction of transmission lines as will guarantee to them practical immunity from any interruption save that due to malicious interference.



# Consolidation of Central Stations

By L. H. Conklyn

**B**Y far the most notable development in the field of the small central station during the past year has been the rapid—one might say, almost hysterical—haste to purchase the smaller plants by existing or newly organized holding companies. Some of these companies have been operators in name only and owe their excuse for existence solely to the desire of some banking house to manufacture securities of a kind that is finding such a ready sale to the indiscriminating public. But such absorption of small properties into holding companies which really have an efficient operating organization and good financial backing offers, of course, undoubted advantages to the investor and is a great boon to the communities served by the combined companies.

As a consequence of this general movement there is coming about one feature of the evolution which, to old timers at least, is almost pathetic, and that is, the passing of the old-time small-plant manager with the full control and responsibility he enjoyed. His has been a picturesque figure in the past, for on his shoulders rested the responsibility of all problems from the disposal of ashes to the paying of dividends. His duties were those of lineman, engineer, fireman, solicitor, bookkeeper, diplomat, etc. A man who could perform them all fairly well was called a good manager; the man who was an expert in them all did not exist, hence the present tendency toward extreme specialization. These old-time versatile managers, while now only cogs in a big wheel, will nevertheless fill important places in the new era, for past experience has endowed them with judgment and knowledge which will be badly needed. Their superior ability will soon place them on a high level in the final consolidation, and they will contribute a giant's share in solving the new problems of group operation; for the success of any consolidation depends upon the individuals who make up the organization.

## Advantages of Consolidation

Disregarding for the moment the unsound consolidations, let us consider the effect of logical and proper grouping of many small plants under one management in a holding company. The more obvious advantages are: more effective results obtained by the division of labor among specialists, resulting in better engineering, cheaper operation, more detailed accounting and more scientific commercial development; a uniform policy under one head; the benefit of comparison and a friendly rivalry in the operation of the separate plants; better attention to legal and corporate affairs, and the ability to get money for extensions and improvements by the sale of a security with a broad and ready market.

Some of the more apparent disadvantages of consolidated operation are the lack of direct personal contact with the public, which is very important; the necessity for more red tape; the natural prejudice of a town against a "foreign" corporation; the chance for "internal" politics, and the delay in getting quick action or decisions on matters where often time is the deciding element. In spite of the gravity of these disadvantages, even a casual comparison will show that they are easily outweighed by the advantages.

Anyone who has visited many small stations must have observed what a tremendous waste poor engineering has caused. The local man probably did his best, but his experience was very limited, and he had no time, or could not afford, to travel about and see what others had done: so he depended upon his own judgment, backed up by rosy tales of salesmen who appealed to his egotism or played upon his ignorance. He fortified himself, perhaps, by

making a few inquiries from men who probably knew as little or less than he himself. The result, unfortunately, has often been a large and useless expenditure, resulting in a hopeless lack of uniformity. The profits of many electric-light companies are thus buried in their own scrap heaps. No man can succeed unless he knows, from his system of accounts, just where he stands, and an electric-light company cannot know where it stands by keeping only a customers' ledger and a cash book. By pitting one manager's results against the other, or by comparing one with many, greater developments can be obtained both in getting new business and in effecting savings in operation. When full advantage is taken of the "deadly parallel" in these comparisons, astonishing results are obtained.

No small company by itself can employ, of course, the staff of specialists which constitutes the operating force of a holding company, yet each individual property in a holding company of the proper kind can enjoy the advantage and services of such specialists. Legal and corporate affairs, for example, are often sadly neglected in the small company, but naturally receive more careful attention in consolidations.

The raising of money for the growing needs of the property has been the blank wall beyond which many a small company could not go. The company's credit may have been exhausted, and the stockholders, already tired of putting surplus earnings back into the plant to keep pace with the growth, refuse to invest new money in what seems such a profitless venture. What a blessing, then, to be part of a holding company whose securities have a ready sale, so that all the money necessary can be raised, and the expansion, previously only the manager's dream, can become a reality!

## Disadvantages of Consolidation

Of the disadvantages little need be said. These disadvantages are common to all lines of big business. Organization details are tiresome, but to some extent necessary. In a large company the memory of the individual must be eliminated, and, unfortunately, his integrity cannot be made an elemental part of a transaction. Everything must be made a matter of record, so that in case of death, sickness, forgetfulness or dishonesty the affairs of the company will not suffer anything more than a temporary inconvenience. This necessity breeds "red tape," which can be made obnoxious or beneficial according to the individual qualifications of the man or men responsible for it.

The lack of personal contact with the public and the odium toward a "foreign" corporation can both be offset by insistence on the "square deal" policy, by keeping out of the unpleasant side of politics, by contributing to the growth of the town by both effort and money, and by doing locally all possible purchasing. Difficulty of quick action in time of emergency should be viewed as a lack of efficiency in the organization in not anticipating such happenings so as to reduce to a minimum the too common heart-breaking eleven-hour haste to catch up with a vanishing opportunity.

The writer of these paragraphs is an enthusiast on the possibilities of the smaller town, for it is surprising what a competent manager can get out of a very small community, even from a small plant. But from a property which is part of a general system, with proper rates and with better and unlimited service, much more should be expected.

Primary lines are now being sent out as advance agents, creeping into territory formerly considered unworthy of adequate investment. Such lines are already showing a

profit, so that new lines are being built, and thus it will continue. Our brethren of the Western States have shown us the lead in this, and soon the country will be covered with a primary network connecting up small communities as our secondaries now connect up individual customers. The station manager is realizing more and more that it is the increment cost of the additional business, and not the average cost of all service, that counts in gaging the possibilities of new fields and additional business.

The past few years, especially the last year, have been periods of tremendous development in all lines, and statistics, when compiled, must show great development in the electrical field. Holding companies with capital stock running into many millions of dollars no longer cause more

than a passing comment, and those built on a firm foundation present one of the safest forms of present-day investments. Those in which properties have been purchased at prices which discount future growth for years to come, or which represent in their securities issued large personal profits for the promoters, may be sad exceptions, but it is inevitable in any great movement for the general good that there shall be such exceptions, and they can but educate the public to a proper discrimination.

The year has been one of great achievements all along the line. It stirs the red blood to be a part of such a conquering army, and makes one glad to be alive and wish to live to see and help in the consummation of this ultimate expansion.

## Industrial Electrical Applications

By E. W. Lloyd

ONLY a person closely associated with the central-station business during the past ten years can realize the tremendous increase in the use of electricity for these stations for industrial purposes throughout the United States. This increase can, perhaps, be better understood when we consider that ten years ago in a center as large as Chicago the amount of electric service furnished manufacturing plants was so small that a contract for approximately 400 hp was one of the first permanent large installations and was considered in its day to represent a great advance. While incomes from other kinds of business had been greater still, the furnishing of electrical energy for motors to a manufacturer was thought to be quite a wonderful achievement.

Large buildings in the retail business district had already been supplied with electrical energy in comparatively large quantities, and in the clothing industry contracts of reasonably large proportions were in force. But in the manufacturing districts in the outskirts of the city it was considered impossible to purchase electricity from central-station companies, not only because of the high cost, but on account of the unreliability of the service.

At that time it was also true that very few central-station companies had organized sales departments, and this, without question, was one of the reasons for the slow development of the business. Of course, consideration must also be given to the fact that there were then very few men who had been trained as central-station salesmen. Indeed, even up to this time too little definite work is done in this connection, although we see in all lines of industry attempts to increase the efficiency of salesmen. Manufacturers in the electrical field are now giving a great deal of attention to the subject, and several of the larger central-station companies have established, or are about to establish, schools for the education of their men. The demand for men of this class is very great at the present time. For one having a fairly reasonable knowledge of salesmanship and the necessary technical training that is required of a central-station salesman, the future seems very bright indeed.

Those foremost in the development of the work of the National Electric Light Association have recognized the desirability of establishing a branch of the association devoted exclusively to the sales end of the business. The result has been the formation at the St. Louis convention in 1910 of the Commercial Section. This section has rapidly developed and to-day is recognized as a valuable addition to the association. It not only has the support of the men in the sales end of the central-station business but has also interested the manufacturers. The latter recognize with approval the achievements of the central-station salesmen,

knowing that their success means more and larger sales for manufactured apparatus and supplies.

The N. E. L. A. Commercial Section has endeavored to place information of value in the hands of central-station salesmen. This information consists in part of statistics on the motor requirements of different industries. The latest result of this work has been the publication of the "Electrical Salesman's Handbook," which is being issued quarterly by the N. E. L. A. The first number of this publication was delivered to Commercial Section members in June, 1912, and the first quarterly has just been mailed. Contained therein is valuable matter from different companies all over the United States. In addition, the section has endeavored to place in the hands of member companies such pamphlets as "Electricity in the Home," "Decorative Street Lighting," "Sign Lighting," "Factory Lighting," etc. All of this work is part of the plan for the betterment of central-station business, as applied not only to industrial service but to other branches of the industry as well.

More men with better training have been attracted to the sales end of the business in recent years, and the interest of these men has resulted in a tremendous increase in the number of kilowatt-hours sold per annum. These companies have thus been able to reduce their rates, with the result that as their business has increased they have expanded and taken on more and more business until to-day the question whether industrial service shall be furnished by central-station companies as against isolated plants has been practically settled in a large number of communities. Not that the field has been entirely covered, but central-station men can show the possibility of serving electricity economically to any industry or business in many places throughout the United States.

The development of water-power plants has been very great during the past few years, and this, of course, has increased the number of manufacturers buying electrical energy. After securing data from these installations, companies having steam developments have found that the motor requirements of some classes of business (thought to be beyond the reach of such central stations) made it possible for the companies to sell service to these industries in their communities.

### Ice Making

A direct example of this tendency has been the rapid increase in the number of electrically driven manufactured-ice plants. The peculiarities of this business at first seemed such as to make it impossible for central stations to furnish the energy, but during the past year or two a number of artificial ice plants have been installed in several large cities, and service is being furnished by central stations. The de-

mand for artificial ice is rapidly increasing, as it is recognized that the water in lakes adjacent to large cities is apt to be in a condition unfit for use. Furthermore, the cost of transportation and labor and the very great outlay for wagon distribution in cities have driven the ice-selling companies to manufacture ice.

These conditions interested central-station companies and considerable time and money were spent in the endeavor to learn the actual requirements of the service, together with the cost of making ice. It is now possible to meet the competition of isolated plants in many places, and already quite a number of motor-driven ice factories are in successful operation.

This is only one of a number of developments of a similar character which have resulted in central-station companies examining into the question of rates for service of this class, known in some cases as "off-peak" service. This term is not always an advisable one to use, because in different parts of the country peak loads occur at different times of the day. In some cases, owing to manufacturing conditions, the peaks occur in the middle of the day in summer, rather than at night during the winter. It is impossible, therefore, to use such a term generally in this connection. In speaking of it the term "limited-hour service" perhaps better defines the class. Central-station companies in many instances can well afford to consider seriously the

making of such contracts. The possibility of increasing their annual load-factor is great where such business is available in their community.

#### Furnace Processes

Another class of business having similar characteristics is in the varied applications of the electric furnace. While a number of large furnaces are installed, the general use of electric furnaces has been very limited. Recently, however, a very active interest has been taken by manufacturers in this development. A number of experiments are now being carried on in various parts of the country, not only in the manufacture of high-grade steel, but in the making of malleable iron and the melting of softer metals, such as brass. The results of these tests are being watched with great interest. A number of central-station companies are able to offer attractive rates for this service. If the brass experiments under way are successful, there will be a very decided increase in the sale of electricity by central-station companies. The increased price of crude oil has, no doubt, had something to do with the interest recently aroused in the possibilities of electric-furnace development.

Taking it all together, there seem to be many reasons for believing that the increase in electricity sold by central stations during the next ten years will greatly extend the progress made in the last decade.

## Electric Heating Devices

By W. S. Hadaway, Jr.

THE evolution of new and the refinement of older types of electric heating apparatus have steadily progressed during the year. Manufacturers of materials used in electric heating appliances, as well as assemblers of it, have reached higher standards in their product.

#### Resistors

Resistor alloys of the nickel-chromium group continue to show commercial value in appliances where the temperatures are high and the size is relatively small. Increased use has been made of these alloys in radiation heaters in which the active material is operated at a glowing temperature.

Incandescent lamps of various kinds have been used as radiation heaters in many ways, although it is obvious that a lamp filament supported in an exhausted glass container is fragile and its field of usefulness limited.

With simple forms of open wire coils available as glowers, the number of applications is materially enlarged. The electrical insulation is simplified, assemblage and inspection of parts are facilitated, and the cost of the finished device is cheapened.

A glower comprising a filamentary carbon core with a synthetically formed envelope of carbide of silicon has recently come into the market. This resistance can be run in open air at incandescence and has many interesting features. Its ability to withstand the rough handling of commercial service, particularly at the terminals, is, however, still to be determined.

Nearly twenty years ago immersion heaters were developed in which insulated resistors were armored so that the structure could be used in liquids with the instrument in circuit. These have found extensive use and a modification has recently been made by which the armored resistor is used in air in a radiation pattern stove.

Glower resistors are of immediate interest in toasters, small room warmers, therapeutic applications and industrially. But of greater importance than the present uses is the possibility of developing the whole problem of space warming in buildings, cars and steamships more effectively

than could be done hitherto. Important as the radiation glower is, it must be clearly understood that devices in which the heating resistance is in thermal conductive relation to the active surface constitute by far the greater number of applications. This heat conduction was secured in the earliest constructions by pressure plates which clamped the insulated resistor against the working surface.

The next important step was the development of the vitreous enamel process in which the fused enamel adhered to the working surface, hermetically sealing the resistor within it, which insulated it electrically and supported it mechanically. As the severity of service increased, experience showed that mica under compression was a dependable electrical insulator under the hardest usage. It was necessary, however, to use pressure plates or other comparatively expensive mechanical structures to hold the resistor and its mica insulation in place.

During the past year apparatus has been put on the market in which the metal carriers of mica-insulated resistors are electrically welded to the active surface. This structure gives good thermal conduction from the resistor to the working surface, secures the value of mica under pressure as the electrical insulation to the fullest extent, and is simple and cheap. This construction is probably the most widely adaptable that has been developed in recent years.

#### Controllers

More attention has been paid during the year to suitable controllers for electrically heated devices and to segregating them as independent items. It has not been generally appreciated what a large percentage of cost the various attachments for connecting heaters to the circuit and for varying the input represent. By treating these devices as separate items a complete line of controllers may be adapted to a group of heaters, as in the home, making it simple to get the greatest refinement in detail at a moderate price.

Light and rugged cord switches giving one, two or three heats are now available. Accessories such as attachment



and connection plugs have been improved and flexible heater cord is now made more carefully. These items in combination make up a group of controllers for heating devices of the greatest importance and are appreciated by the user in the added convenience and security which comes from their use.

Controllers for electric irons comprising a metal box in which a switch, fuses and signal lamp are placed, together with cord-supporting arm, iron-stand bracket, etc., are properly regarded as integral parts of an iron installation. An equipment of this kind is the best possible answer to any criticisms which may be raised by the Underwriters or others as to the fire hazard caused by electric irons.

One make of electric irons is equipped with an automatic temperature regulator which employs a condenser to protect the contacts. Other makes of heavy irons are fitted with external points and lever arm so that the temperature can be regulated manually. Light metal parts subjected to heavy vibration as well as to the oxidation resulting from the high temperatures at which these devices are used do not prove durable. It is desirable, therefore, so far as possible, to eliminate delicate parts from apparatus of this kind.

Integrated temperature control of the larger devices, such as ovens, has been developed. These controllers employ the same automatic accessories that have been used in motor-controlling devices. The features of accurate and automatic temperature control are of the same relative importance to heaters as the various forms of motor control have been to the growth of the motor industry and are an essential part of the broad development.

Practically all kinds of heating apparatus require heat insulation in some degree. The electric oven is perhaps the most important device, requiring heat insulation of the highest order, though the advancement of heat-storage systems in which electricity is absorbed at unity load-factor depends upon the development of effective heat insulation. Fibrous or wooly silicates, usually made from molten slag, have been extensively used as heat insulators. A "popped"

silicate has recently been made available. This may be obtained by drying a soluble silicate and continuing the heating until the water of crystallization is driven off and the mass "pops" or effloresces. It is a very light material and can be made up in fine or coarse pieces as desired.

### Heat Storage

The work which was done many years ago on heat-storage systems is now beginning to receive recognition. The first installations were designed to absorb energy in large volume at off-peak periods so that heat could be made available continuously without overlapping the heaviest loads. Many modifications have been tried, including the use of electrical energy continuously in small quantity or at unity load-factor, so that large amounts of heat can be made available for short periods.

Apparatus to accomplish this latter purpose is now in the market designed for attachment to the ordinary kitchen boiler. The heaters generally use from 300 watts to 500 watts and are commercially effective according to the care used in placing heat insulation on all parts of the system and the price paid for energy for this special service.

The heat storage at high temperatures is ordinarily obtained by the use of thoroughly insulated materials such as iron or soapstone or the two in combination. Materials the heat capacity of which increases rapidly with temperature rise are preferable. These devices have been made in the form of recessed blocks, serving as oven chambers, with pipes cast or molded in for heating the water rapidly as required, and also as cylinders which may be rotated or moved laterally when imparting the stored energy.

Heat-storage ovens of varying types are broadly included in this problem. These may be comparatively small, as in the "fireless cooker" for home use, or very large and heavy, as in the bake ovens adopted by some of the navies.

Enough has been done in the past dozen years on heat storage to show the merits of the various possible methods and to show it to be the most important question with which the heating engineer has to deal at present.

## Tendencies in Illuminating Engineering

By L. B. Marks

A BRIEF résumé of some of the activities in the lighting field during the past year will serve to indicate the trend of lighting practice and the tendencies in the development of the science and art of illumination. It can hardly be said that any single stride in illuminating engineering marks the past year as epoch-making. The work of the year represents rather the crystallization of thoughts and ideas of former years and the extension and widening of recent activities.

### Education and Co-operation

If any one fact stands out more prominently than another, it is the great activity of the members of the lighting fraternity in educating themselves in the use of light, whether from the economic, hygienic or esthetic standpoint, and in educating the public. The broad attitude of the electric light companies, the gas companies and the manufacturers of lighting appliances in educating the public to use light properly is especially notable; witness the extensive publication by these interests of articles dealing with the intelligent use of light in the home, the workshop, the store, etc., and the wide publicity given to the primer entitled "Light: Its Use and Misuse," which has been prepared under the direction of the Illuminating Engineering Society.

The up-to-date central station or gas company now has

its illuminating engineering department, whereas only a few years ago such a department was the exception rather than the rule.

The spirit of co-operation between the diversified interests that have to do with light and illumination has been more marked during the past year than in any year since the formation of a separate society devoted to the development of illuminating engineering. Joint meetings between societies of engineers, architects, decorators, oculists, manufacturers' associations and others for the purpose of exchanging views have been numerous, and as a result of these meetings the importance of the subject of lighting in its various aspects has been impressed to a greater extent than ever before not only upon those immediately interested but upon the general public.

Although no well-rounded college course in illuminating engineering has been established, the colleges are gradually including illuminating engineering work in their curricula and are devoting some time to lectures on the subject, notably in England.

A significant step in the world-wide spread of illuminating engineering is instanced in the recent formal organization (November, 1912) of the Illuminating Engineering Society of Germany, under the auspices of the Physikalisch-Technische Reichsanstalt. The latter body is a government institution.

### Safety and Hygiene

The subject of light as a factor in safety has received special attention at the hands of the American Museum of Safety. The latter institution has organized a lighting section, the purpose of which is to preach the gospel of hygienic lighting and to disseminate information calculated to lessen the loss of life and limb due to inadequate or faulty lighting.

The hygienic aspects of lighting received special attention during the past year at the international Congress on Hygiene at Washington, and notably at the Congress for the Prevention of Industrial Accidents at Milan, at which a paper on the subject was presented by the president of the Illuminating Engineering Society. A committee recently appointed by the government of France is charged with the investigation of questions relating to the hygienic use of light.

### Legislation

Lighting legislation received a great impetus in Great Britain because of the disclosures that were made in the report of the chief inspector of factories and workshops. This report contained the results of an elaborate investigation of the lighting of some 125 factories and workshops in which measurements of illumination were made. The bad lighting conditions revealed in the report prompted the British government to take steps to enact such legislation as will compel the owners of industrial establishments to remedy existing evils.

The New York State Factory Investigating Commission has just formulated a bill for the provision of "adequate and sufficient lighting of factory buildings." This bill was submitted to the Illuminating Engineering Society to consider the technical features of the proposed legislation from the illuminating engineering standpoint, with special reference to safety and ocular hygiene. It is expected that the proposed legislation will be enacted during the first session of the new year.

Plans are now on foot to extend the scope of lighting legislation to cover schoolrooms, public buildings, etc.

### Interior Lighting

The growing introduction of "indirect" and notably "semi-direct," as distinguished from direct, lighting has been one of the features of the past year. Illuminating engineers have preached diffusion of light to such an extent that the public has been led from one extreme to the other; that is to say, from the use of lighting units in which clear glass lamps are exposed to the use of lighting units in which the lamps are totally concealed by opaque reflecting shades. The tendency now is to compromise between these two extreme limits by the use of units in which the lamps are concealed by diffusing shades of glass or other material, the lighting thus being carried out partly by direct but mainly by indirect means.

The study of glare from the lighting source and glare from the objects illuminated has received marked attention during the past year, especially at the hands of a committee of the Illuminating Engineering Society, and has led to a better understanding of the principles of diffusion of light. The increasing use of diffusing shades on lamps is an illustration of this tendency. Another illustration is the introduction of table lamps and desk lamps in which all of the light comes indirectly from a comparatively large diffusing shade which surrounds the lamp. In connection with the elimination of glare and the conservation of vision the increasing use of paper having a dull finish, in monthly magazines and other literature, is worthy of note.

There has been a marked tendency in lighting installations to give more consideration than heretofore to the artistic and esthetic aspects of lighting.

The production of artificial daylight has received con-

siderable attention during the past year, but progress in this field has been in the direction of subtractive rather than synthetic methods of producing light of daylight quality.

For restricted use, as, for example, in a small room for color matching, it is now possible to produce without forbidding expense artificial light approaching in quality any desired quality of daylight.

The year has witnessed a growing tendency on the part of manufacturers of shades and reflectors to supply complete lighting units including the fixtures. This plan makes for a proper co-ordination of the parts of the lighting fixtures as such, to secure the best illumination results.

The tendency of the times is to apply illuminating engineering principles to decorative lighting, not only to secure esthetic effects hitherto unattained, but to secure these effects with the least expenditure of money for electric energy or for gas.

### Exterior Lighting

The open and the inclosed carbon arc lamps for street lighting are gradually giving way to luminous and inclosed flame-arc lamps and to high-candle-power tungsten lamps. The replacement of the older type of lamps by these newer and more efficient types has been especially notable during the past year.

High-pressure gas lamps rivaling the most efficient electric lamps have made some headway abroad, but owing to adverse conditions that obtain in this country have been introduced here to only a limited extent.

The quartz tube mercury arc lamp has come into the field as an active competitor for exterior lighting by high-candle-power units.

The tendency in street lighting has been to increase the standard of illumination not only for the commercial and main thoroughfares but also for the residential streets.

The movement begun a few years ago to install in the main thoroughfares, and especially in the business districts, ornamental standards usually equipped with four or five tungsten lamps inclosed in diffusing globes has made much headway during the past year. The mantle gas burner has also been used for this purpose.

With the development of the more efficient lamps of high candle-power, the tendency has naturally been to mount the lamps at a greater height from the street level, thus reducing the glare effect and widening the distribution of the light.

There has been a marked tendency to evaluate street lamps on the basis of total flux of light and distribution of flux rather than according to any arbitrary candle-power rating of the lamp. The old arc lamp rating of 2000 nominal candle-power, which formed the bone of contention in many litigations between lighting companies and municipalities, may be said to have received its death knell during the past year, notably in the decisions of the Wisconsin Public Service Commission.

### Photometry, Nomenclature and Standards

The development of illuminating engineering created a demand for accurate portable photometers for the measurement of light and illumination. Photometers of this class, compact in size and comparatively inexpensive, have been developed in this country and abroad, and during the past year several simplified types have been placed on the market at a price low enough to be within the reach of most people that have need for such instruments. Developments in photometers and photometry have made it easier than heretofore to obtain quickly an accurate measurement of the total light flux of a lamp and have made it possible to secure a correct comparison of lights of different color value. The use of photography in the solution of photometric problems has opened up a new field.

In the development of a new science the need of agreement as to the exact meaning of terms is manifest. The language of illuminating engineering has not only been inexact but has led to confusion which, in a measure, has retarded the development of the science.

An important step looking to the establishment of definite nomenclature and standards throughout the world was taken the past year in the movement to hold an international congress which will deal with the terminology of photometry and illuminating engineering.

## Developments in Electric Lighting

By Preston S. Millar

**D**URING the past year, 1912, there has been an appreciable improvement in illuminants and in lighting practice, but there has been no radical improvement in any one feature. Progress has been evolutionary rather than revolutionary.

### Illuminants

The carbon-filament lamp has become an outcast during the year. The demand for it has become so small that it is impracticable for manufacturers to furnish the same rating and selection of product as formerly, and, indeed, it is understood that they will be unable to sell carbon lamps under close specifications hereafter. It may be recorded that the carbon lamp, as far as general practice is concerned, became obsolete with the close of the year 1912.

The metallized-carbon-filament lamp, which was adopted some two or three years ago as the standard free-renewal lamp by the larger central stations, took its place during the year as the standard central-station type for use wherever tungsten lamps were not employed. Although at all times slightly more fragile than the carbon-filament lamps and therefore less suitable for use where ruggedness is of paramount importance, the higher efficiency of the metallized-carbon-filament lamp has won for it its place as the principal central-station type of lamp. Minor improvements in manufacture bettered its performance until it is to-day fairly satisfactory, though of shorter service life than the lower-efficiency carbon lamp. As far as general use is concerned the 60-watt lamps are practically the upper limit for wattages. The 30-watt lamp, now the smallest size, was a newcomer during the year.

Domestic tungsten lamps have attained such a degree of general excellence that they leave no adequate excuse for the further extensive use of carbon or metallized-filament lamps. Extreme fragility may no longer be urged against them; in fact, they exhibit less mechanical breakage in railway and surface car service than do metallized lamps. In life the product has been improved so rapidly that the performance, at least in the laboratory, exceeds the guarantee of 1000 hours to 80 per cent of initial candle-power or to earlier failure.

Probably the most far-reaching and important improvement in illuminants during the year has been the general introduction into the construction of tungsten lamps of a bulb-blackening preventive which very greatly improves the candle-power maintenance. Prior to the successful development of this feature of construction, the candle-power maintenance of the smaller lamps was excellent, but that of the larger lamps, 150 watts and above, left much to be desired. It is, therefore, in these larger lamps that the bulb-blackening preventive has been applied with greatest success. To illustrate its effect it may be stated that the life to 80 per cent of initial candle-power, which for the 500-watt lamps of 1911 was of the order of 300 hours, has been found during the year 1912 to be of the order of 1500 hours for the improved lamps. Great as this improvement has been, it is understood that there are probabilities of further successful development.

With this improvement in performance in tungsten lamps there is gradually coming about a greater ruggedness, a

greater consistency in candle-power and wattage rating and an improvement in the mechanical construction of the lamps. All things considered, the domestic tungsten lamps are now a thoroughly satisfactory product.

The inclosed carbon arc lamps are still used largely in street lighting. The intensified carbon arc lamps, because of the desirable color of the light, which is almost white, still find application in certain classes of store lighting.

The feature of the year in the arc-lamp situation in this country has been the development of the long-burning flame-arc lamps with mineralized electrodes for street-lighting purposes. The further development of this type of lamp is awaited with much interest. The progress has been very encouraging, although the lamps still leave something to be desired in reliability of operation and constancy of light output. If the manufacturers succeed in making these lamps as reliable and steady as the old carbon arc lamps, it is probable that they will be adopted for street lighting in many installations, displacing the inclosed carbon arc lamps, with a consequent increase in illumination intensities, which is much to be desired. The sacrifice in efficiency which is made in order to secure the long-burning feature will not militate seriously against the usefulness of the lamp for American street-lighting service, provided thorough reliability and steadiness may be assured.

The growing demand for white-light electrodes in flame-arc lamps is not being met in a satisfactory way, attempts so far resulting in light which is not white.

The magnetite or metallic-flame lamps with metallic electrodes have continued to demonstrate their worth in street-lighting service. The principal development has been the modification of the lamp in order to apply it for street-lighting service in connection with an ornamental pole which adapts the system for decorative street lighting.

There have been no notable developments in low-pressure glass-tube mercury-vapor lamps. The high-pressure quartz-tube mercury-vapor lamps which have been used in Europe to some extent in recent years have been exploited commercially in this country during the year. In industrial lighting of large areas the lamps have rendered service which is encouraging to the manufacturers, and in Chicago they have had a limited trial for street-lighting purposes.

### Central-Station Attitude Toward Tungsten Lamps

During the past five years the problem created for central stations by the tungsten lamp has occasioned much study and discussion. Extended consideration and preliminary trials appeared to give weight to the view that opportunities which the new lamp created for extension of lighting and motor service were sufficient to counterbalance the immediate loss in revenue due to the use of lower wattage lamps.

In varying degree the lamp has been exploited by the central stations of the country. It is general practice for the central stations to sell rather than give the lamps to their customers. Prices range from the standard retail values down to values which are considerably below the net cost of the lamps to the central station. Probably only about one-third of the lamps produced in the country during the past year have been tungsten-filament lamps. It is there-



fore seen that, in spite of the good qualities of the newer lamp, carbon and metallized-carbon-filament lamps are still used very largely. As the price of the newer lamp is reduced—and it appears reasonable to anticipate some further reductions—and as its merits become more generally appreciated, it is likely to be used more and more generally, displacing the older, less efficient lamps. Its general use, however, is not likely to be brought about until central stations which give free renewals of lamps to customers adopt the tungsten lamp as the standard type. It is understood that progressive central-station sentiment has had this in view for some time and that the performance of the lamps is being studied closely with a view to ascertaining when the price shall become sufficiently low or the life sufficiently long to permit the lamps to be given to customers without increase in the free-renewal cost. This problem is intimately connected with efficiency adjustments and therefore the lamp manufacturers have it somewhat within their control. Further improvement in the lamp life or further reduction in price of the lamps may make free renewal practicable, unless it is accompanied by an increase in the efficiency which will shorten the life.

### Illumination

The activities of manufacturers of lamps and lighting auxiliaries in co-operation with central stations have brought about large advances in some classes of lighting practice. The lighting of large stores and the better type of shops has been improved and developed to a greater extent than has lighting of other classes. Wherever the advertising incentive is present the problem of improving the lighting is simplified and progress is made. Fortunately the principles of good lighting, as rapidly as they are made

known, are being embodied to a greater or lesser extent in the commercial output of lighting auxiliaries as well as in the installations of new lighting systems. In consequence the improvement in the new installations is very manifest.

The commercial incentive being lacking, the practice in lighting residences and certain classes of offices lags behind, and there has been little improvement during the past year.

In street lighting the demand for higher intensities is gradually making itself felt, although in some cases it serves merely to reveal more clearly the inadequacy of street-lighting appropriations. Merchants' display lighting has been very influential in creating and emphasizing this demand. Tungsten cluster lighting appears to have attained its zenith, at least as far as existing forms of application are concerned. Its notable success has naturally led to the development of competitive systems, such as the decorative magnetite system, and it is probable that the effect of this will be to react upon tungsten street lighting in a beneficial way and that the latter will be applied in a more generally acceptable and wholesome manner in the future.

In New York State legislation has been proposed in connection with factory inspection laws with a view to eliminating some of the more serious ills from defective lighting in industrial establishments. While the effectiveness of this effort remains to be demonstrated it is worthy of note that the increasing attention which is being given to illumination in general is thus reflected in proposed state legislation.

In general, the growing appreciation of the esthetics and hygiene of illumination is one of the most satisfactory developments of the year. Taken as a whole, the progress has been material and along right and proper lines, but the year has not been characterized by any single radical improvement which outshines all other improvements.

## Progress in Photometry

By Herbert E. Ives

**A**MONG the photometric researches of the year two lines of endeavor are of paramount interest. One is the study of colored light photometry, the other the continuing effort to find an objective photometer or substitute for the eye. In a review of photometry these deserve the first and most detailed comment.

The difficulties of colored light photometry, together with the requirements of a method for such photometry, have been so often stated as to need but little recapitulation. The drawbacks are of three kinds—those due to the physiological or psychological characteristics of the eye and brain; those due to differences between observers, and those peculiar to the instruments or methods of photometry used. The requirements of a method of colored light photometry are, first, that it shall measure true brightness and not some other complex function of radiation and seeing mechanism; second, that it shall conform to certain simple mathematical axioms—things equal to the same thing must measure equal to each other and the sum of the parts shall equal the whole—and, third, that it must have a certain degree of sensibility.

### The Flicker Photometer

Investigations published during the year show that just one photometer—the flicker photometer—possesses these requirements. While measurements by so-called equality-of-brightness, visual-acuity and critical-frequency-of-flicker are subject to most extraordinary deviations from the requisite axiomatic conditions—deviations which are due to more or less obscure psychological influences, chromatic aberration of the eye and what not—the flicker photometer, on the other hand, rises serenely to every test. It

has also the advantage of showing the greatest sensibility of all methods in working with differently colored lights. Finally, it gives the same relative brightness values as the "equality-of-brightness" method when the mean of many observers and many observations is taken or when the "cascade" method (steps of small hue difference) is employed. However, while the flicker photometer gives the results at once, the other procedures are long and tiresome.

There is every reason for confidence, and even for enthusiasm, over the flicker instrument, but such feelings must be held within proper bounds by the knowledge of certain of its restrictions. It is not so quick or so easy to operate as an equality photometer when the latter is used with lights of the same color. It has peculiarities of its own, such as a reversed Poyntage effect when operated at very low illuminations. It does not abolish the difference between observers; hence, it is just as necessary with it as with any other method that will ever be found to use a normal eye, or the same thing—the mean of many observers. But to catalogue the limitations of the flicker photometer is to point out the means to minimize them. The flicker photometer must be looked upon as a standardizing laboratory instrument, whereby auxiliary standards of the various colors required in the industries shall be prepared by observers of normal vision. A definite illumination, preferably a high one, must be selected as standard and at this illumination lights of different color shall be rated and shall be one candle-power or some multiple thereof, just as a standard metal bar is one meter long only at a standard temperature. All observers of whatever type of vision may use these auxiliary stand-

ards by the usual sensitive methods of homochromatic photometry, securing concordant results, of values such as would hold under standard illumination and visual conditions. Only under unusual conditions or in special problems would correction be called for, such as under very low illumination or where great detail-revealing power is needed. Recourse to such "quality factors" may be aptly compared to the use of temperature coefficients of expansion in delicate linear measurements.

### Physical Photometers

Granting that the results yielded by the flicker photometer under certain conditions be adopted as standard, a new impetus is given to physical photometers. In these might be incorporated the characteristics of the normal eye, thus doing away with the need for numerous observers or for correcting factors to abnormal observers in the standardizing laboratory. Long before colored light photometry became important, objective photometers were, of course, sought, but it has always been doubtful whether any of the suggested schemes promised as great sensibility for homochromatic photometry as that wonderful instrument the eye. Among these suggested means are included the selenium cell, the bolometer and thermopile, the photographic plate and, lately, the photo-electric effect.

The main requirements of an objective photometer may be summarized as sensibility, convenience and adherence to some simple law of response to varying light intensity. If colored lights are to be measured, it must besides be possible to give to the device, as by screening, the color sensibility of the normal eye.

Selenium has long held the center of the stage because of its great change of electrical resistance when exposed to light. But work recently published shows that far from obeying a simple law the resistance varies as the square root of the intensity for parts of the spectrum and directly for other parts of it. So extremely complicated are these phenomena that selenium seems definitely ruled out, except of course for strict substitution work with monochromatic light. The bolometer and the thermopile are altogether too insensitive for present requirements.

### Photography in Photometry

The photographic plate has been experimented with during the year and found applicable to certain special cases, such as the recording of candle-power distribution curves and of fluctuating light sources. With steady illuminations of ordinary color photography cannot claim to equal the eye, either in convenience or in accuracy. Of all physical photometers the photo-electric cell made of one of the alkali metals seems most promising. Its response varies directly as the illumination over an enormous range; it possesses great sensitiveness, and its maximum of color sensibility lies in the visible spectrum. Unless further study should prove it to have eccentricities similar to those found in selenium, there is good ground to hope for the applicability of such a cell, properly color-screened, as a laboratory normal eye. Mention should be made, too, of the application of the photo-electric cell to measurements of the transmission of microscopic areas, such as the densities of photographs of spectral lines. But on the ground of quickness or convenience for ordinary photometry none of these visual substitutes can make great claims. They require special and delicate auxiliary apparatus. The eye is still supreme as a judge of the equality of illumination of the same color, and it is only when it becomes inadequate, as in colored light photometry, or where the illuminated surfaces are of peculiar size or position that a less convenient instrument has an opportunity to play its part.

Other aspects of photometry of course have not been neglected. Among the novelties of the year are two types of binocular photometers, for which great sensitiveness is claimed, a reflectometer, a type of variable neutral-tint screen and a special candle-per-watt meter.

In the matter of photometric standards, undoubtedly the most important feature is the discussion which still continues of the proposal to measure light as radiant power, weighted according to its ability to cause the sensation of light. By this means we shall attain an absolute standard of light, defined as nearly as possible in terms of the fundamental c. g. s. units. The theoretical merit of this standard seems generally admitted, and we now only await its practical achievement.

## Developments in Electrochemistry

By E. F. Roeber

**I**N most of the large and firmly established electrochemical industries of carborundum and alundum, artificial graphite, calcium carbide, phosphorus, caustic soda and chlorine, electrolytic copper refining, etc., no radically new development during the past year can be recorded, but note can be made of a quiet, steady, effective evolution along conservative lines and in various respects a commercial expansion into new fields of industrial usefulness. Three particular subjects, however, deserve a special review at this place—the status of the electric furnace in the iron and steel industry, the activity of inventors in reducing the cost of production of alumina for the manufacture of aluminum, and the various electrochemical processes in the fertilizer industry.

### The Electric Furnace

In the use of the electric furnace for steel refining the United States Steel Corporation has taken a leading part, especially with respect to large-tonnage products, such as rails. The long list of breakages of rails, resulting in disastrous railway accidents, has become a very serious matter, and credit is due to the United States Steel Corporation for having undertaken to determine what can be done with the electric furnace to relieve the situation. From Mr.

W. R. Walker's authoritative statement, made for the corporation in his paper before the American Iron and Steel Institute, the following sentences are significant: "At the present time (May, 1912) there are approximately 5600 tons of standard electric steel rails in service in the United States. These rails have been in the track about two years. During the past winter some of these rails have been subjected to very low temperature—in some cases as low as 52 deg. Fahr. below zero—and are being exposed to all the possible conditions of severe service. . . . Up to the present time we have not heard of any basic electric rails in use in this country being broken in service." It will be remembered that the steel for these rails is basic Bessemer converter metal transferred while in molten state to the electric furnace for refining. Mr. Walker's statement augurs well for the future of the electric steel rail. But it is evident that before transportation companies shall be willing to pay somewhat higher prices for electric steel rails for general use the experience of more years must be available. Although the commercial development will be necessarily slow, yet the outlook is bright.

The electric furnace for refining steel for high-quality products (tool steels, etc.) is proceeding quietly and very

satisfactorily. Several new furnaces have been erected. The electric furnace has been introduced into foundry practice for high-quality castings. A special type of electric furnace for heating bars, billets and forgings is finding particular favor at present as a result of the recent considerable increase in the cost of crude oil, which puts oil-firing very much on the defensive.

The use of the electric shaft furnace for iron ore reduction on a large scale (in competition with the blast furnace) is still restricted to the Scandinavian countries and California, where specially favorable conditions prevail. Under ordinary conditions the blast furnace has little to fear from its electric competitor. One result obtained with the electric iron-ore reduction furnace is noteworthy. By reducing the amount of carbon and running the furnace at a low temperature a metal is produced containing 2.2 per cent or less of carbon, a very small amount of manganese and silicon, and one low in sulphur and phosphorus. Being produced directly from iron ore in the electric furnace, it is called "pig steel," as it contains fewer impurities than pig iron and therefore requires less refining for making finished steel. This is probably the most hopeful feature of the evolution of the electric iron-ore reduction furnace.

#### Aluminum Production

Any progress that promises to cheapen aluminum is of particular interest to the electrical industries in view of the competition between aluminum and copper especially for line construction. The electrolytic production of aluminum from alumina is now so developed that little saving may be hoped for in this step of the process. The trend of invention is, therefore, to cheapen the cost of the raw material—the alumina—and there is at present a large activity in this field. Besides several processes which are being kept carefully secret, two loom large in the limelight. The first of these is a new process of Mr. Alfred H. Cowles for obtaining alumina, hydrochloric acid, caustic alkali and white hydraulic cement from clay, salt and lime. The cheapness of the starting material, clay, and the production of the various by-products are to result in a much reduced cost for alumina. A plant for developing the process on a commercial scale has been erected at Sewaren,

N. J. The second or Serpek process, which has been in use for a longer time on an experimental scale in a plant in France, produces aluminum nitride as an intermediate product and finally yields pure alumina and ammonium sulphate. It therefore represents a combination of the production of alumina with the fixation of atmospheric nitrogen. The production of the by-product, the ammonium sulphate, reduces the cost of alumina. Both processes are interesting in another respect. Mr. Cowles hopes to make his process available for the extraction of potash and thus to found an American potash industry which should make this country independent of Germany. In the Serpek process the ammonium sulphate by-product is also a fertilizer. Both processes, therefore, also afford an indication of the marvelous present activity in fertilizer chemistry.

#### Electrochemical Fertilizer

Among the electrochemical processes for the production of fertilizers the two largest are utilized in the production of nitrates from atmospheric nitrogen by electric discharges through air and in the production of calcium cyanamide. Both are commercially successful. Concerning the wonderful growth of the Norwegian nitrate industry, using the Birkeland-Eyde process, it is noteworthy that in less than ten years this industry has grown to be one of the largest in Norway, utilizing that country's enormous available water-powers, which can be developed at a very low cost while the electric energy could not be utilized in full for other purposes under local conditions.

As to the progress of calcium cyanamide, it is interesting to note that the Niagara Falls works are to be largely increased. Finally, it may be mentioned that the synthesis of ammonia from elementary nitrogen and hydrogen gases is now an accomplished fact, as a result of the commercial development of the Haber process by the Badische company. While it is not an electrochemical process itself, it is likely that the hydrogen gas needed as raw material will be made electrolytically.

Thus in the wonderful present growth of fertilizer chemistry—one of the greatest developments undertaken by science for the welfare of mankind—electrochemistry is taking properly a prominent part.

## The Storage Battery Industry

By Lamar Lyndon

THE storage-battery business for the year 1912 has been satisfactory, several manufacturers having made provision for substantially increased productions. The demand for vehicle-type batteries in particular has shown a heavy increase, and steam railroad companies have been liberal purchasers of batteries for train-lighting equipments. Electric-light companies having three-wire direct-current distribution systems have installed a number of extremely large standby or reserve batteries, and a considerable number of small batteries for 30-volt or 60-volt distribution have been installed in connection with gasoline-engine-driven outfits for house and farm lighting.

No striking improvements in either cell or plate construction have been made during the year. With lead batteries for stationary purposes there is an increasing proportion of the output furnished with pasted, or Faure type, plates, both positive and negative, and where the required number of discharges a year is limited or low charging rates only are available this type of cell shows certain advantages. Initial cost and floor area are considerably reduced, and with a limited number of discharges, as with "standby" or reserve batteries, the maintenance is not materially increased. For vehicle batteries of the lead type pasted

plates are now used exclusively, Planté-type plates adding too much weight requiring too much space and being too costly. It is still premature to express a definite opinion as to the merits of the special vehicle types, including the envelope lead and alkaline nickel-iron batteries, as they have not been in service sufficiently long. The much higher first cost of these types would seem to cover amply even the claims made for longer life. The different lead-battery makers seem to have revised their opinion in regard to giving pasted-plate batteries "boosting charges," and this practice is now frequently recommended where the service requires it. Planté-type positives are still recommended as being far more durable for regulating work or for those applications requiring frequent discharges. The Planté-type negative has demonstrated its excellent life.

#### The Storage Battery and the Automobile

Electric pleasure vehicles are increasing in use, especially in the cities of medium size. The electric truck, however, while showing a great increase in application, is not being adopted as rapidly as its economy would warrant. While those technically informed are clearly recognizing the proper respective fields for the gasoline and electric wagons,



those who are making their initial venture in motor trucks are not always so fortunate. Impressions gained from experience with pleasure gas cars are carried over into trucking applications and are not likely to be correct. The much more extensive advertising of the gasoline truck and the results obtained point a strong moral to the electric truck builder. The Electric Vehicle Association of America, the National Electric Light Association and the Association of Edison Electric Illuminating Companies are conducting campaigns which will no doubt lead to a more satisfactory increase in electric vehicles. In many cities extremely promising results are already obtained. The importance of the battery-charging load is clearly brought out by the result obtained by the Denver Gas & Electric Company, whose revenue from vehicle battery charging during the past year has been approximately \$60,000. This is double the income for the preceding year, and the same ratio of increase is confidently expected for the coming year.

It will be noted that a large proportion of the gasoline car manufacturers are offering electric lighting outfits and electric self-starters as a part of their standard equipments. While the required batteries for these purposes are small, the number of batteries is great. Small electric freight transfer and baggage trucks are being employed by steamship and railroad companies at their terminals with profit, and this application of storage batteries promises to be of great importance. Storage-battery locomotives for mining, tunneling and industrial works are being widely used, and one prominent electric manufacturing company is offering a complete line of such locomotives. The contracting companies for the New York City aqueduct tunnel have a number of such locomotives in service and express themselves as being thoroughly satisfied with their economy.

The storage-battery car venture of the Third Avenue Railroad Company has proved completely successful, and the days of the antiquated horse car in New York City are surely numbered. An additional 200 or 300 storage-battery cars are in immediate prospect for the remaining horse-car lines. Storage-battery cars are now in operation on a number of lines outside of New York and meeting with favor. A number of double-truck cars have been

built and a complete multiple-unit three-car train has been shipped for operation in Cuba. Large storage-battery cars are promised for branch-line operation on steam railroads in the immediate future.

Several battery companies have developed 30-volt and 60-volt house or farm lighting plants for gasoline-engine drive, and these are being built in large numbers. It is interesting to note in this connection that several agricultural implement companies and a prominent mail-order house are extensively advertising and selling such plants. A great volume of business is predicted in this field.

#### The Storage Battery and the Central Station

Few new regulating storage-battery plants have been installed the last few years. The consolidation of generating plants and the load equalization thus obtained from the combination of various loads have seriously reduced this application of storage batteries, excepting in connection with long transmission systems in which case the "reserve," or "standby," feature is of importance. The rapid approach of some of the larger transmission systems to their limit of available transmitting capacity will, no doubt, occasion the installation of some large batteries with automatic regulation as a minor feature within a short time. In fact, there are now being installed several batteries where this condition obtains and tenders are requested on others.

The larger companies have made notable installations of "standby" batteries during the past year, and several have either completely changed over their distribution systems in downtown districts from alternating to direct current, largely to secure the advantage of storage-battery reserve, or extended the previous limits of their direct-current service. A number of such batteries capable of discharging at from 40,000 amp to 44,000 amp have been installed, and batteries of 60,000 amp are in prospect.

The submarine boat has attained no mean development, a submerged speed on storage-battery drive of 11 knots an hour having been reached. At a speed of 5 knots an hour, submerged runs of 125 miles are possible. Both our own navy and foreign navies are adding largely to the number of such vessels, and the sizes of submarine boats are rapidly increasing.

## Status of the Electric Vehicle

By W. H. Blood, Jr.

THE electric vehicle is fast coming into its own, for the ill effects of its premature start some ten or twelve years ago are rapidly being overcome and forgotten. The success of the newer types of electric cars, with their lighter and more effective batteries, their improved motors and chassis, to say nothing of the better condition of the roads over which they travel, is an established fact. That competition does not exist between the electric and the gasoline vehicle the public is beginning to realize. The first is fundamentally for city service, the second for touring and long-distance duty.

#### Electric Vehicle Tires

The electric truck is peculiarly adapted for handling heavy loads at comparatively low speeds, and the increasing number of large fleets of trucks that are being installed by companies which are not actuated by esthetic motives but which count every cent demonstrates conclusively that the use of electric trucks is advantageous and commercially economical. Such a vehicle to be successful must, however, be kept in motion; it should not be used in the place of a single horse-drawn truck, but should rather take the place of several horse-drawn vehicles. Failure to recognize

this fact in the past accounts for some of the early disappointments.

The electric pleasure car, because of its simplicity of operation and its cleanliness, finds a ready market. All the manufacturers are reporting largely increased sales. The past year has, indeed, witnessed the starting of a number of new manufacturing concerns, which are getting out models of beauty and machines of excellence, rivaling the best product of the well-established concerns.

#### The Electric Vehicle and the Central Station

The central stations of this country have quite generally adopted the electric vehicle for their own work and are strongly and consistently advocating it for their customers. The impetus which the central stations have given the business, together with the fact that the advantages of motor-driven vehicles are now generally recognized throughout the country, will, it is believed, soon so increase the demand for them that the manufacturers will find it exceedingly difficult to meet it. Unless the electric-vehicle manufacturers put their business in order financially, they will, it is predicted, find their business going to the gasoline manufacturers, who in the main are well

organized financially and are producing results economically. As a matter of fact, many of the gasoline manufacturers are already making, or preparing for the market electric trucks to supplement their gasoline cars, thus silently but effectively attesting the value of the electric vehicle.

The impetus given to the industry by the Electric Vehicle Association of America cannot easily be measured. This association is to be congratulated on having brought the scattered and competitive electric vehicle and battery manufacturers into connection with the well-organized central-station men of the country. The great amount of general publicity work which this organization has effected during the past year is unquestionably making prospective users of motor trucks consider carefully the electric vehicle, and for the tremendous increase in sales already reported the vehicle association is entitled to considerable credit. The adoption by this association of standard charging plugs and the establishment of a standard base for incandescent lamps are steps in the right direction. A further standardization with reference to the number of battery cells and the speed of vehicles would be welcomed as marking advances in the art.

Reduction in the price of energy charged by central stations is still going on, the larger companies, as usual, taking the lead and the smaller companies fast falling into line. The cost of energy is a small part of the expense in the operation of an electric car, yet the high price previously charged by the central-station companies has militated against the installation of electric vehicles.

Some central-station companies, realizing the difficulty of getting outside capital to start electric garages, have adopted the policy of temporarily opening public garages themselves. This tendency is spreading among the com-

panies in much the same way that the business of "inside wiring" spread in the early days, when there were no reputable wiring concerns to do the business. As soon as reliable independent electric garages can be started the central stations should, and probably will be glad to, go out of this business and confine themselves to their primary function of making and selling electrical energy.

Competition between the two types of batteries, the lead and the nickel-iron, is recognized as an advantage to the industry. While neither is perfect, both are commercially satisfactory, and yet they are so near together as regards merit, and each has its points of superiority so well defined, that the competition acts as an incentive to further improvements, all of which will inure to the benefit of the public.

Throughout the country the "good roads" movement has spread like wildfire. Attention, however, has been devoted almost entirely to roads outside of the city, and all of the money has been spent on the country roads between towns and cities. Little or no attention has been given to streets of cities, in the business sections of many of which the old cobblestone pavement, which is rightly termed a "relic of barbarism," still prevails. Such pavement is injurious to every kind of vehicle and particularly bad for motor-driven trucks. It is believed that considerable energy can profitably be spent in securing better city streets, for this will not only tend to increase the installation of motor trucks but will also reduce the congestion from which all large cities are now suffering.

The above remedy together with the adoption of better traffic regulations rigidly enforced, will do much to take the unsanitary horse from the streets and will materially increase the use of electric trucks and electric pleasure vehicles.

## Status of the Telephone in 1912

By Samuel G. McMeen

THE year 1912 produced no epoch-making invention in telephony, but more than any previous one in telephone history it was marked by attention to refinement of details. The early years of telephone development were filled with activity, and the motto was: "Results first, refinement of method afterward." The struggle to meet the demand for quantity of telephone equipment lasted during nearly the entire life of the original Bell patent. Only by the beginning of 1912 had a reasonably satisfactory degree of saturation been reached and attention been directed in a large way to the more promising reductions of wastes and losses and the increasing of important efficiencies.

### Utilization of Pupin Coils

One of these endeavors, which was operative in Europe as well as in the United States, was the further loading of long-distance lines and of inter-office trunk lines. The year 1912 closed with a gratifying history in this phase of the art. In the United States loading was continued as previously done, by the use of Pupin coils; that is, by using "lumped" inductance, instead of distributed inductance as employed in cables. In Europe, both methods continued in use with a growth in favor of the Pupin method over others. The year closes with a gratifying increase in practical knowledge of loading, on the part of telephone engineers and managers, and with a singular and interesting lack of knowledge on the part of the telephone-using public. Perhaps this is due to the fact, stated by Dr. Pupin himself, that "It is not a subject which lends itself to popular discussion." The loading of the largest copper wires commonly used in the United States (435 lb. per mile of wire) tends

principally to increase the radius of communication. Loading of circuits other than those requiring the largest wires may reduce the total cost of a line for a given grade of transmission over a given distance. The happiest way, however, of reducing the cost of a line, is to reduce the actual amount of metal in it and this, in telephony, is done by the use of phantom circuits. Out of the manifold difficulties of phantom operation has come finally the ability to phantom loaded circuits and to load phantom circuits. To have even one phantom circuit between two points requires the existence of at least two physical circuits. The more physical circuits there are, the more direct phantom circuits may be made from them, and there are no ultimate reasons why phantoms cannot be built upon phantoms indefinitely. Theoretical development of phantom circuits has covered a long period; practical development and wide use of these developments mark 1912 as their banner year.

There are other economic wastes of wire facilities than those which are lessened by the uses of loading and phantom principles. Telephone companies have applied composite and simplex methods to long-distance lines for years but have suffered from the lack of a broad market for the telegraphic facilities so produced. On the other hand, telegraph systems have had within themselves the opportunity for similar economic gains because, fundamentally, two simple telegraph circuits are wasting one telephonic possibility. The coalition of commercial relations of the Western Union Telegraph Company and the American Telephone & Telegraph Company removed a difficulty in this regard. The best interests of the community require the best use of all property belonging to any part of the com-

munity. The years succeeding 1912 will mark further economies in the harmonious operations of the telegraph and telephone facilities in the United States. Such possible expansion was not great in 1912, but the year was notable in its preparatory work. Progress along these lines in Europe was less marked than here, for obvious reasons of governmental inertia. A fourth advance in the economics of wire uses was in the further spread of train dispatching by telephone. As the year closes it may be said that arguments against the handling of trains by telephone have ceased. Other industries than transportation have seen the advantage of the method, and to-day electric lighting and power systems dispatch their loads over lines and apparatus similar to those designed for train dispatching. Telephony has yet to cover that field thoroughly, but a satisfactory start was made during the year.

#### Common-Battery System

The common-battery multiple switchboard remained the standard manual equipment for large central offices. Substantial progress was made, however, in the development of semi-automatic equipment, designed to reduce the amount of incoming-trunk switchboard apparatus and the amount of labor required to operate it. In this regard the year may be taken as the last one of preparatory development and 1913 may be expected to include the installation of many important examples of this system. Its purpose is to eliminate a number of acts heretofore requiring to be done by hand and the substitution for them of the same or other acts performed by mechanisms, these, however, being wholly directed and partly controlled by the intelligence of an operator who retains communication with the calling subscriber. Development in these semi-automatic systems has been dominated by several distinct interests in the United States and is more recently attracting the attention of competent minds abroad. Several of the fundamentals of this practice were reduced to finality during 1912. The way thus is paved for substantial progress hereafter. Semi-automatic systems of the type just mentioned address themselves directly to the elimination of manual incoming-trunk apparatus and manual labor upon it. In a large city trunking 90 per cent or more of all originating calls such machine equipment is likely to be exceedingly important. The contributions of 1912 to that art may well be considered notable. In the greater number of exchanges both here and

abroad there is no inter-office trunking at all. In them, if operating labor is to be eliminated in any very great degree, automatic or semi-automatic systems must do all or some of the work of manual operators. The automanual system has had a wider trial during 1912 and has made useful history in the art of doing mostly by machinery what is done on a multiple board by hand.

#### Automatic Telephony

Automatic switching systems, wherein the subscriber directs and partly controls the switching mechanism and in which no operator other than the subscriber has part, reached a new relation to the using public during 1912. Heretofore the widest use of and interest in automatic switching equipments have been in the United States. The installation of new systems in this country has been less than in other years. The growth in systems already installed went on at a satisfactory rate. No previous year covered more important refinements of detail of automatic apparatus than did 1912, and considering the development of devices for both semi-automatic and automatic systems as a single kind of endeavor, 1912 exceeded all previous ones in total accomplishment. In Europe, furthermore, the automatic idea attracted more attention, received more thought and progressed further toward wide use in 1912 than in any previous year. Certain conditions attending governmental operation of telephone systems make the elimination of operators much more important there than here, and in some quarters it is felt that since automatic telephony is now where manual telephony was many years ago it may reasonably be expected to accomplish the same degree of advance as, for instance, the manual switchboard experienced during the years from 1896 to 1902.

Competition continues to exist in the sale of telephone service; in many cities there still are two telephone systems; in all cities which have or have had two telephone systems the good and bad results of such competition still are in evidence; in some cities where there have been two telephone systems and now there is but one there are murmurings against monopoly, as seems inevitable in all such cases. Happily, there is evident a growing appreciation by the public of the exceeding value of telephone service and of its importance to the general community. This, it is hoped, may simplify the maintenance of satisfactory relations between the server and the served.

## Status of the Telegraph in 1912

By William Maver, Jr.

THE most notable progress in the telegraph industry of late has been in the direction of refinements in operating equipment and in the standardizing of such apparatus and line materials, as well as in a closer supervision and better regulation of the traffic. To these factors may be attributed the perceptible improvements in the service rendered the public and in the economy of operation, notwithstanding the new and exacting conditions imposed upon the engineering and traffic staffs by the introduction of the night and day letter service by certain of the telegraph companies in this country, a service which it is said has already resulted in producing an increase of over 20,000,000 messages per annum in excess of the increase in normal business. Improved switching facilities have also been adopted, so that operators in large offices may transfer their table instruments from circuit to circuit by means of small switchboards at each position, in response to lamp signals. In the British telegraph service switching devices are used still more extensively, and at the London main office switching operators save the daily repetition of 18,000

through messages. In the actual transmission of messages over the telegraph wires of this country, while the Wheatstone automatic and the Buckingham-Barclay and the Morkrum telegraph printers are already in considerable use and increasing in favor, it remains a noteworthy fact that approximately 90 per cent of the traffic is still handled by Morse operators on simplex, duplex and quadruplex circuits. It is also interesting to note in the latest arrangements of circuits devised for quadruplex operation a perceptible tendency to revert to the methods employed in the early days of quadruplex telegraphy, such as, for instance, the use of the bridge method of neutralizing the home relays to outgoing signals, the employment of extended magnets on the neutral relay, etc., all resulting in marked improvement in the operation of quadruplex systems. In Canada automatic and printing telegraph systems are but sparingly employed, the use of the manual Morse system being general in that country. This condition prevails quite largely also in Europe, Australia and New Zealand, although in Europe a relatively larger use than elsewhere is made of the Wheat-



stone automatic and telegraph printers of the Bandot, Hughes and Murray type. It may be remarked also that the United States patent rights of the Murray printer have been acquired by the Western Union Telegraph Company, but, according to Mr. Murray, this printer may not be ready for commercial use in this country for some time. The operation of chemical systems has fallen considerably short of expectations, the last instance of this kind being the failure of the so-called telepost. The small independent companies which have undertaken to build up a commercial business with rapid chemical systems have almost invariably been hampered by the lack of adequate line facilities to avoid serious delays and interruptions to service attendant upon wire failures. But even in Great Britain, the birth-place of chemical automatic telegraphy, that system has not been employed in commercial service for over forty years. The original Morse telegraph system, after half a century of use, still exists as the most general means of handling telegraph business virtually the world over. The well-known simplicity, flexibility and reliability of the Morse telegraph system as compared with printing and other telegraph systems, requiring as it does only a key, relay and sounder, probably explains its continued employment throughout the world. Without doubt the general adoption of the typewriter by Morse operators for the printing of received telegrams has also exerted a strong influence for the retention of this system.

#### Consolidation of Telegraph and Telephone

The consolidation of the Bell Telephone interest with the Western Union Telegraph Company has been followed by a merger of many telephone and telegraph offices and has also led to a wider use of the telephone for the local delivery and collection of telegrams. The number of telegrams already handled in this way by both of the large telegraph companies in the United States probably exceeds 1,200,000 per annum. Apart from the economies effected

by the joint use of offices by the telegraph and the telephone in many cities and towns and general co-operation between these different methods of communication, the one naturally adapted for long distance, the other for shorter distance communication, great advantage must accrue to the public by placing within reach of the telegraph numberless hamlets and villages already reached by the telephone but which are too small to maintain a separate telegraph office.

#### Cable Telegraphy

In submarine cable telegraphy, while the mileage has steadily increased throughout the world, the type of cable laid and the methods of transmission and reception of telegrams have undergone little change in recent years. The automatic transmission of business over cables by means of perforated paper strips and a mechanical transmitter somewhat similar to the Wheatstone transmitter is almost general. In some instances repeating relays are employed at cable stations and in others a method is in vogue whereby the messages are automatically perforated on a paper strip as received from the land wires by Wheatstone, and the strip is then passed through another perforating instrument that automatically translates the Wheatstone perforations into the characters required for cable transmission. In transatlantic submarine telegraphy there has recently been effected a closer traffic arrangement than has hitherto existed between the so-called Western Union group of cables and the Western Union Telegraph Company, whereby these cables are now under a common operating control with the Western Union land lines, to the material advantage of the cable service. A similar arrangement, it is known, has always existed in the case of the Mackay group of cables and the Postal Telegraph Company, and this is generally acknowledged to be one of the principal factors in the success of that company. The immediate result of the new Western Union control has been the inauguration of reduced cable rates for deferred service.

## Commercial Wireless Telegraph Development

By John Bottomley

IN a commercial sense wireless telegraphy has made greater progress in the year 1912 than during any previous twelve months. In many respects the course of wireless telegraphy is following the corresponding early development of both the telephone and telegraph. The early days of reckless financing and unfair competition were not conducive to healthy growth and stability. The year just ended has witnessed the exit in bankruptcy or through the activity of the Department of Justice of all but those few concerns that were engaged in the wireless business on a legitimate commercial or experimental basis.

#### Legislation

It would be unfair in considering the development of the past year in wireless telegraphy to omit mention of the sinking of the White Star liner *Titanic* and the part played by wireless telegraphy in the rescue of passengers. While there was a tendency at first to criticise the wireless service, more sober thought, fortified by actual information instead of circumstantial newspaper evidence, eventually gave to wireless telegraphy that appreciation which it deserved. The result after a very careful Congressional inquiry has been the enactment of a federal law enforcing the installation of an efficient auxiliary transmitter and the carrying of two licensed operators on passenger vessels, as well as a statute placing all wireless stations under the control of the United States Department of Commerce and Labor. While it is true that the laws enacted are not ideal and that

more deliberate action would undoubtedly have produced a better result, it must be admitted that the lanes of the ocean have been rendered safer and that now if one would travel without fear he may well select an ocean voyage rather than a railroad journey. Not only have those vessels covered by the law been fitted with wireless equipments, but large numbers of owners of freighters, tugs, barges and other cargo carriers have also caused their vessels to be equipped with this modern method of communication. It is common experience for a line installing a first equipment to find that, instead of involving an added expense, wireless telegraphy really saves its cost many times over in ordinary operation, while it is impossible to estimate its value during emergencies in saving life and property. During the year over 200 vessels have been equipped with wireless telegraph apparatus, and the instances where life and property have been saved have become so common as no longer to require relating in detail.

#### Operation

From the operating point of view the principal development of the year in wireless telegraphy has been an increase in the power used rather than any well-defined difference in method. The experience of past years, gained by the expenditure of large sums of money and persistent effort, has opened up the way for the use of high-powered apparatus to span distances over which it was formerly thought impossible to communicate commercially during day and night.

Owing largely to the glibness with which the public press insists upon printing the freak transmissions accomplished only at night over great distances by stations of small power, the layman gathers the idea that such results may be commanded at will, while as a matter of fact nothing could be further from the truth. To transmit over a given distance at night under favorable conditions is one thing, but to provide a twenty-four-hour night-and-day service under all kinds of adverse conditions is another matter.

America bids fair to lead the way with the first comprehensive chain of high-power stations for overseas transmission, for already thousands of tons of steel are being fabricated for the necessary masts, and the high-powered apparatus is under construction. Before another year shall have passed large stations will be in competitive operation across the Pacific to Honolulu and Japan, and also across the Atlantic by way of one route to Great Britain and by way of another to Norway.

## Electric Railway Developments

By H. M. Hobart

THE most significant developments in the railway-electricification situation during the year 1912 have related to the splendid progress made with the high-pressure continuous-current system. While the favor with which this system is regarded is by no means confined to this country, nevertheless at present America has more rolling stock operating with high-pressure continuous-current equipments than has any other country. There is now an aggregate of considerably over 1000 route-miles of American railways either already equipped and operating with the high-pressure continuous-current system or in process of being equipped for such operation. The rolling stock comprises over 500 motor cars and locomotives. Three standard pressures have come into use for these American roads, namely, 1200, 1500 and 2400 volts. The latter pressure has been adopted for the Butte, Anaconda & Pacific Railway. On this road pairs of 1200-volt motors are connected in series and operated from the 2400-volt supply. Although the road is not yet equipped, much of the apparatus has been built and tested.

### Direct-Current System

The Washington, Baltimore & Annapolis Railway has now been operated for a sufficient length of time on the 1200-volt continuous-current system to permit of valuable comparisons of the results with those formerly obtained when this road was operated on the single-phase system. The carhouse expenses, which with single phase amounted to 3.72 cents per car-mile, have been reduced with continuous-current operation to 1.37 cents per car mile. The energy consumption has decreased to the extent shown by the following figures: Per car-mile, single-phase with 59-ton cars, 6.54 kw-hr.; continuous-current with 39-ton cars, 3.56 kw-hr. Per (2000-lb.) ton-mile, single-phase with 59-ton cars, 110 watt-hours; continuous-current with 39-ton cars, 92 watt-hours.

The Piedmont & Northern Railway is a typical example of a 1500-volt continuous-current road. The rolling stock comprises six locomotives and thirty-one motor cars. Pairs of 750-volt motors in series are connected across the 1500-volt supply. The system comprises 300 miles of main line.

Although in America there are as yet no instances of continuous-current operation with a pressure higher than 2400 volts, there is already running in England an experimental line employing a continuous-current pressure of 3500 volts. This is a 3-mile section of the Lancashire & Yorkshire Railway. On this experimental line a locomotive equipped with pairs of 1750-volt motors connected in series is in operation. The Lancashire & Yorkshire Railway has for several years operated many miles of its suburban lines with the 600-volt continuous-current system. Renewed attention will naturally be given to this road as the result of this radical experiment with 3500 volts. It is interesting in this connection to note that in 1905 Mr. F. J. Sprague made the following statement: "I am prepared to engineer and carry to a successful conclusion a continuous-current installation at a

working pressure, even on a third-rail, of not less than 1500 volts. And I venture further to affirm that 1500 volts is not the limit of practical continuous-current operations."

One of the most important electric railway events which have occurred during 1912 is the decision which has recently been made to electrify some 250 route-miles of suburban and country lines in and about Melbourne, Australia, on the 1500-volt continuous-current system with overhead contact conductors. Messrs. Merz & McLellan were retained by the Victorian government to deal with the situation and the decision to employ the 1500-volt continuous-current system was reached only after carefully considering the best tenders which had been submitted for both the continuous-current and the single-phase systems. For this Melbourne electrification some 500 motor cars and a considerable number of locomotives are required. Thus in magnitude this undertaking eclipses any of the high-pressure, continuous-current systems which have as yet been installed or even projected in America.

On the European Continent there are a good many instances where the high-pressure continuous-current system has been adopted. Several Budapest suburban railways are operated at 1000 volts. A line between Cologne and Bonn has been operated at 1000 volts for several years, and the individual motors are wound for 1000 volts with a single commutator. There are a couple of dozen or more other Continental railways which employ pressures of at least 1000 volts.

An important factor in the situation is found in the fact that high-pressure continuous-electricity equipments have been supplied by most of the leading manufacturers of electric-railway machinery. Messrs. Ganz & Company, of Budapest, Messrs. Thury, of Genf, and Messrs. Krizik, of Prague, have built the apparatus for a score or more of Continental railways. The Allgemeine Elektrizitäts Gesellschaft, of Berlin, and Messrs. Siemens-Schuckert, also of Berlin, have shared the task of building the 800-volt equipments for the Hamburg Hochbahn. Messrs. Siemens-Schuckert equipped the 1000-volt railway from Cologne to Bonn. Messrs. Dick, Kerr & Company, of Preston, England, built the 3500-volt apparatus for the 3-mile experimental section of the Lancashire & Yorkshire Railway. In America certain of the high-pressure, continuous-current roads have been equipped by the Westinghouse company. Most of the roads, however, at present employ General Electric apparatus.

### Single-Phase System

So far as America is concerned, the only single-phase extensions carried out during the last four or five years have been for the New York, New Haven & Hartford Railroad system. The work done for this railroad has, however, been of an extensive character. Including the Westchester system which has recently been put into commission, and including also the projects now definitely in hand, the New Haven's electrical system may be taken as comprising some

500 miles of single track with about 150 locomotives and motor cars. The New Haven's generating costs are at present high owing partly to the very poor load-factor and the low power-factor. The load-factor will be improved when, as is intended, the freight trains are also hauled by electric locomotives.

The New Haven road in America reminds one of the London, Brighton & South Coast Railway in England. Some 30 route-miles of this latter railway are already electrified on the single-phase system and the rolling stock comprises about fifty motor coaches. The adoption of the single-phase system on the Brighton line has been the subject of much criticism. However, the officials of the road profess complete satisfaction with the results and intimate their purpose ultimately to equip their entire railway for electrical operation. With the exception of two single-phase motor-coaches supplied some years ago to the Midland Railway (and presumably still employed in operating a desultory service on an obscure branch of the Midland Railway), no other single-phase railway apparatus is in use in England. Furthermore, although many of the large main-line railways are at present earnestly engaged in planning for the electrification of important sections of their systems, there is no reasonable indication that any of these railways will adopt the single-phase system. Two of them—namely, the Lancashire & Yorkshire Railway and the Northeastern Railway—have already in operation a large number of trains equipped with 600-volt continuous-current apparatus, and in so far as any departure is made from this system, it would appear that it will be in the direction of merely employing a higher pressure.

On sections of both the London & Northwestern Railway and the London & Southwestern Railway, electrification plans for which have recently been announced, electric trains of the Underground Electric Railways Company of London are already operated, and it is important, in developing a comprehensive suburban system for the London area, that there should be a considerable interchange of running powers among the several railways serving London. The Underground Electric Railways Company of London already has a very extensive system, comprising large urban and suburban sections in and near London at present aggregating more than 200 miles of track. The entire service is operated on the 600-volt third-

rail system, usually with a fourth rail for the return, the track rails being required for the automatic signaling system. In view of all these circumstances, both the London & Northwestern Railway and the London & Southwestern Railway, have found it desirable to use the 600-volt system for the first instalments of their electrical service. The first instalments comprise in the case of each railway some 7 miles of track and about 100 motor cars. Each of the two railways is proposing to build a 25,000-kw power house. The London & Northwestern Company's already matured plans involve the early equipment of a further 173 miles of track. There will obviously be nothing to prevent these railways from adopting, on outlying sections, a working pressure of 1200 volts.

Thus the Brighton line in England and the New Haven line in America are the only large main-line railways in their respective countries to employ the single-phase system for a heavy and frequent service of which the suburban passenger traffic is an important component.

### Three-Phase System

A railway electrification system which is peculiarly appropriate for an infrequent service of heavy trains, especially for operation over roads with heavy grades, is the three-phase, which has been rather neglected in most countries. In Italy, however, and to a certain extent in Switzerland, a considerable amount of rolling stock is operated with three-phase motors. The only notable instance in America is the Cascade Tunnel section of the Great Northern Railway. The three-phase locomotives there in use are giving entire satisfaction. An important feature of the three-phase system of railway electrification relates to the availability of regenerative operation on down grades. The simplicity and ruggedness of the polyphase squirrel-cage motor, combined with its unrivaled compactness, its non-pulsating torque, and its low weight and cost, should in some cases render it an attractive proposition.

To sum up the matter of systems, it may be stated, with but little likelihood of occasioning any serious disagreement in America or in England, that continuous-current equipment is usually much the most appropriate. It is also evident that by adopting a reasonably high pressure the continuous-current system is, to say the least, at no disadvantage when contrasted with the single-phase system.

## Regulation of Public Utilities

By William J. Hagenah

EVERY great economic movement consists of three well-defined stages, namely, first, the period of public protest against existing conditions; second, the period of legislation, and, third, the period of readjustment to the new legal status. The first period in the movement for regulation of utilities supplied the cause for action against the abuses of corporate power, excessive capitalization, franchise scandals and the occasional close relationship between local politics and public-service corporations. The protests of citizens and civic bodies which grew out of this condition crystallized in the public sentiment which marked the second period and was expressed in the public-utility laws of Wisconsin, New York and nearly a score of other states. This was the period of revolution, when radical doctrines were advanced concerning the powers of the state to regulate such corporations, the character of the franchises through which they operated and the limitation of their profits. Though regarding at first with many serious misgivings the public administration of such laws and their effect on the utilities, the industry as a whole, after several years of experience with regulation, has now

entered upon the third stage, characterized by its readjustment and adaptation to the legal theory that a utility is subject to public control and to the political theory that the public is capable of regulating utilities.

The year 1912 will not be historic because of the creation of a large number of public-service commissions. Neither will it be remembered for the establishment of any far-reaching doctrine of law or economics. The movement for utility regulation has now passed the legislative stage. The adoption of public utility laws no longer excites national comment because the doctrine of regulation has become so firmly established that an increase in the number of commissions is accepted as but the natural and inevitable extension of a wise public policy. Neither do the provisions of such new statutes attract general attention. The law-makers who in 1907 and 1908 framed the leading public-utility measures of the country constructed so well that the latter-day legislation has largely been fashioned after the laws of such states as Wisconsin and New York.

The work of the public service commissions has continued undiminished throughout the year. Complaints concerning



madequate service and excessive rates have been frequent, necessitating extensive investigations along engineering and accounting lines. The decisions have to a considerable extent followed the precedents of earlier years and emphasized the correctness of the opinions then advanced. Certain fundamental principles have been more generally recognized and hence more firmly established, notably that competition among public utilities is inconsistent with the theory of a regulated natural monopoly and that the reasonable rates contemplated in utility regulation are predicated upon a rate of return which will encourage the development of business as opposed to the rate of return which falls just short of confiscation of property as judicially defined.

The year 1912, however, will always be of historic importance, not because of the growth of utility control, but because of the more important reason that during this year the substantial results of state supervision which have accrued during the last five years have become generally apparent and the policy of public regulation of utilities recognized as successful. Present conditions give definite promise of the early completion of the third stage of the economic cycle, from which the public utility will emerge greater because of its increased efficiency, more popular because of the diversified ways in which its service has become a public necessity, and more firmly established because of the confidence which it commands and the resulting distribution of its securities among the investors of relatively small means. Less than five years ago the rapid increase of regulatory statutes was regarded with mixed sentiments of fear and approval. The legal power to regulate was recognized, but the ability of a public swayed by misconception and prejudices to lodge such power with men of trained minds and judicial temperament and to create commissions which would occupy positions of dignity and respect not unlike that of a court was seriously questioned. It was feared that capable men could not be secured for such services, that the commissions would become subservient to politics and that capital would grow timid and seek other fields of investment. Events of 1912 have proved these fears to be groundless and have justified the confidence in the public. Unfortunately not all those who possess the power to regulate public utilities are imbued with the judicial spirit which their office demands, and occasionally decisions are rendered which give evidence that considerations of political expediency have not been overlooked. Generally such conditions will be found in the first efforts at regulation, or may be accounted for in the same manner that a popular but incompetent individual is sometimes elected to public office, but on the whole our utility-regulating authorities are composed of men who fairly represent the sentiment of the public, and that sentiment is one which seeks to do justice.

The closing year will therefore be remembered as the period when confidence in public regulation was established, when the justice of regulatory statutes was generally accepted, and when capital frankly sought the profits and the protection which this doctrine affords. No other year in the history of the industry has witnessed such gigantic strides in the development and extension of utility services. The new capital invested in public utilities during 1912 exceeds by far that of any other year. Not only is this true of American capital, but the safety and general attractiveness of the American utility security has appealed to the wealth of Europe, and the present year has witnessed the shipment to this country of funds conservatively estimated to be in excess of \$100,000,000 for investment in public utility issues.

Not only has this year been marked by unprecedented activity in the growth of public utilities but it has witnessed the development of the holding company to a remarkable degree. Scarcely a week has passed during the last year that the financial news has not chronicled the formation of some new holding company which has absorbed many scat-

tered utilities and welded them into one great system under a single directing head. Such consolidation has brought to the smaller and scattered plants technical skill which each alone could not command. Capital has been made available for the smaller utilities because of the efficiency resulting from the many hundreds of formerly isolated plants being brought under the control and direction of the most experienced engineers and managers which the industry affords and because of the greater degree of security which a diversified investment provides.

This movement for concentration among utilities so conspicuous in 1912 corresponds to the similar movement in the field of commercial industries during the period from 1897 to 1903. The effect of the industrial combinations in most cases was to increase the cost of the commodities sold. Recent events have shown that whatever profits resulted from the economies made possible through consolidation were not shared with the public but not infrequently formed the basis for additional capital issues. The consolidation of public utilities under the actual or potential supervision of the state has been attended with no such results. It has already been the means of installing the most modern equipment, of greatly bettering the service in small cities and of extending it to cities and communities to which the independent plants would not have ventured, and often this has been accomplished with a reduction in rates. Obsolete and inadequate stations have been reconstructed or abandoned for large new central stations, and hundreds of miles of transmission lines have been constructed to enable the use of such centralized energy. Through the medium of high-tension transmission systems many small settlements along the routes of the lines are being supplied with service equal to that of the larger cities, while in many states this movement has made it possible to extend the benefits of electricity to the agricultural classes.

The rapid growth of the holding company is an expression of utility progress under state regulation. The consolidation of many properties will result in greater uniformity of methods, the standardization of equipment, abatement of discriminations and increase of publicity in operations, all of which simplify the work of regulation. The development and ultimate success of the holding company lies in the direction which utility commissions have sought to enforce, namely, the efficiency and adequacy of the service and the reasonableness of rates. The intelligent management finds that the greatest profits result from a service beyond criticism. The public service commissions recognize that the best service is possible only with rates which yield a return attractive to capital. Courts possessing only judicial powers must regard the question of reasonableness of return merely from the standpoint of confiscation of property. Public service commissions, on the other hand, act as legislative and administrative authorities and under their wider scope of statutory power are enabled to permit a rate of return which will produce the best results for the public and at the same time will properly reward private initiative.

The year 1912 has therefore been one of importance to the public-utility industry as a whole. It has been free alike from instances of corporate abuse inclined to inflame public sentiment and from radical legislation which would discourage development, but it has witnessed the recognition by both the corporations and the public that each is charged with an obligation to the other and that when these obligations are properly respected the public will be assured against exploitation and capital will be safe from confiscation. The immediate future holds forth much work in the continuation of the reconstruction, but so definitely is ultimate success assured that the public utility industry is progressing by rapid strides. The central fact of 1912 has been the public's appreciation of the needs of capital and the increase of the confidence of capital in the public sense of justice.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Transmission Line 245 Miles Long for Ontario

The municipality of Windsor, Ont., has contracted with the Hydro-Electric Power Commission of Ontario for 2500 hp at a rate estimated at not more than \$38 a hp-year. In connection with the contract the Hydro-Electric Commission through its chairman has announced its intention of purchasing a right-of-way from St. Thomas to Windsor and to have the transmission line completed within a year. At present the 110,000-volt circuits of the Hydro-Electric Power Commission extend only to St. Thomas, which is 135 miles from Niagara Falls, and the extension to Windsor will be in the neighborhood of 110 miles long, so that when completed the line between Windsor and Niagara Falls will be 245 miles in length, making it one of the longest transmission lines in the world.

### Minimum-Wage Discussion at Boston

At the meeting of the American Economic Association held recently in Boston Prof. Henry R. Seager, of Columbia University and president of the American Association for Labor Legislation, read a paper entitled "The Theory of the Minimum Wage." Prof. Seager stated that the economic interest of society requires the payment of living wages to all workers, except possibly children learning trades and defectives who must be treated as wards of the state. In the United States, he said, the great majority of interests pay such wages to the great majority of their employees and starvation wages are found only in exceptional circumstances. The minimum wage will be of distinct economic benefit, in his opinion, in curing the evils of the sweatshop system and the underpayment of female employees in department stores. It would increase the health and efficiency of those employed in these two kinds of institutions. It would also, declared Prof. Seager, put a stop to exploitation by grasping employers and hasten a better distribution of the labor force of the country. Finally, it would compel society to face the problem of caring for the unemployable, through insurance or pensions for those who should not be expected to be self-supporting and through the better distribution and industrial training of those who might be self-supporting. The principal objections to the minimum-wage plan are essentially practical, but the most convincing answer is the fact that several countries are actually making minimum-wage regulations effective.

### National Automobile Show in New York

The thirteenth National Automobile Show will be held simultaneously in Madison Square Garden and in the New Grand Central Palace, New York City, Jan. 11 to 25. From Jan. 11 to 18, which is to be known as the Part I period, pleasure vehicles will be shown in both buildings, and from Jan. 20 to 25, known as the Part II period, commercial vehicles will be on exhibition. Accessories will be on display during both weeks. The show is given under the auspices of the Automobile Board of Trade, and the list of exhibitors indicates that at present there will be forty-three makers of pleasure vehicles and 272 accessory concerns at the Garden during the first week, and forty-six

exhibitors of complete pleasure cars, twenty-five displays of motor cycles and more than 100 accessory displays at the Palace. During the second week the Garden will house twenty-five companies showing complete lines of commercial vehicles, while at the Palace there will be on exhibition the house models of forty-one truck manufacturers. Both gasoline and electric cars will be on exhibition during both weeks.

### Governor Sulzer on Conservation

In his first message to the New York Legislature, on Jan. 1, Governor William Sulzer stated that the question of the conservation of the natural resources of the State and their development and utilization for the benefit of all the people is a matter of vital importance to the commonwealth and demands most careful consideration by the Legislature. He contends that the forests should be preserved by intelligent forestry legislation, the watersheds protected and the powers of the numerous rivers utilized to the utmost. As a people, he said, we have always been proud of our ability to accomplish results and have long boasted of our magnificent heritage of natural resources. During the first period of development, physical energies and intellectual abilities were directed toward utilizing the natural resources of the land and in the haste to achieve immediate results the wealth that seemed inexhaustible was often wasted. When forests were laid waste, lakes and rivers began to shrink, the power problem became more insistent, and conservation became the plain duty of the hour.

### New Cable Rates

On Jan. 1 a new schedule of cable rates, as previously announced, was jointly placed in effect by the Western Union cable lines and the Post Office Department of Great Britain. Most important in the new schedule is the twelve-word cable letter which may hereafter be sent to all points in the United Kingdom, Belgium, Holland, Denmark, Austria, Germany, France and Switzerland for 75 cents. This is a substantial reduction from the existing cable letter of twenty words, for which the charge was \$1.50. Under the new arrangement 5 cents will be charged for each additional word, and the telegraph company will add a code word designating whether the message shall be telephoned or mailed at the place of delivery without extra charge to the sender. The week-end letter, for which the charge was \$1.50 prior to Jan. 1 for thirty words, will hereafter cost but \$1.15 for twenty-four words.

All deferred-rate messages to the United Kingdom have been reduced from 12½ cents to 9 cents per word. The deferred-message rate to points on the Continent and also to points in Africa, India, China and Iceland will remain at 12½ cents per word, which is half the regular rate. The new rates, it is said, are the outcome of the agitation to reduce the number of code messages and encourage the sending of messages couched in plain language. These cable messages will be received at local offices of the Western Union Telegraph Company at any time before midnight and will be delivered within twenty-four hours after their receipt.

### A. I. E. E. Meetings

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Jan. 10 under the auspices of the power station committee. Mr. B. G. Lamme will present a paper on "High-Speed Turbo-Alternators—Designs and Limitations."

The midwinter convention of the Institute to be held in February under the auspices of the standards committee gives promise of great interest. A large number of papers are being prepared under the direction of Dr. A. E. Kennelly, chairman, and under the special supervision of Messrs. B. G. Lamme and C. P. Steinmetz, of the subcommittee on general revision of rules, and Messrs. W. L. Merrill, Charles Robbins and W. H. Powell, of the subcommittee on ratings. The convention will close with a reception and dance to be held at the Hotel Astor on Friday evening, Feb. 28.

At a special meeting of the Institute's executive committee on Dec. 18 Mr. Ralph W. Pope was appointed to fill temporarily the office of secretary, owing to the sudden illness of Mr. F. L. Hutchinson.

### N. E. L. A. Committees on Energy Transmission

Mr. W. N. Ryerson, chairman of the hydroelectric and transmission section of the National Electric Light Association, has completed the selection of the section committees which will report to the Chicago convention in June. Mr. L. H. Conklin, of Scranton, Pa., will serve as secretary for the section. The list of committees is as follows:

*Operation of Transmission Systems*—D. B. Rushmore, chairman, Schenectady, N. Y.; J. B. Foote, C. S. Ruffner, J. B. Mahoney, P. W. Sothman, Max Heben, C. S. McCalla, R. M. Wilson, J. C. Smith, H. W. Buck, R. S. Kolsch, F. B. H. Paine.

*Distributing Lines*—P. M. Downing, chairman, San Francisco, Cal.; H. H. Cochrane, W. R. Thompson, Markham Cheever, J. A. Lighthipe.

*Receiving Apparatus*—M. R. Bump, chairman, 60 Wall Street, New York; L. C. Nicholson, E. A. West, Prof. E. L. Corey, F. Darlington.

*Irrigation*—C. H. Williams, chairman, Denver, Col.; L. P. Hammond, O. G. F. Markus, J. C. Parker, and a representative of the Pacific Gas & Electric Company.

### The Electric Truck in New England

At the December meeting of the New England Street Railway Club Mr. Day Baker, president of the Electric Motor Car Club of Boston, delivered a lecture upon the latest advances in electric-vehicle practice, outlining features of the work in New England in particular. Industrial concerns are rapidly learning to appreciate this class of transportation, which appears likely to displace all other forms of trackless service within a radius of 10 miles from the starting point. One of the largest users of electric trucks in New England is the Amoskeag Manufacturing Company, of Manchester, N. H. The installation of this company originally gave a great deal of trouble on account of snow and ice, but as soon as the operators became experienced in handling the machines they found that by the application of chains to the rear wheels and by sanding the roadways where ice had to be overcome the vehicles could be forced to climb any of the stiff grades in the place. Each of the 2-ton machines owned by the company is obliged to make twenty trips per day, the course being up and down a 14 per cent grade. After from four to six years' service the machines are doing their work with the utmost success.

The Pacific Mills at Lawrence, Mass., operate nine electric trucks in their yard service. The company recently stated that in the first two years of service these trucks have saved 22.5 per cent over the cost of horse haulage. Many of the hauls are shorter than 200 yards. With the present increased experience of the truck operators a saving of 29 per cent over the cost of horse service is made. Seven 3.5-ton machines are in use at the Pittsfield (Mass.) shops of the General Electric Company in hauling castings and finished machinery. Twenty-five additional machines will shortly be placed in service in Boston by the American Express Company for short-haul work. The Jenney Manufacturing Company of Boston has found it more profitable to deliver gasoline around town to the local garages by means of two 5-ton electric trucks carrying twenty-seven barrels each than to use gasoline-driven machines for this service. Mr. Baker also referred to the noteworthy electrification of the Springfield (Mass.) fire department, which is now standardizing on eighty cells of battery to secure suitable speed and interchangeability. The Boston Edison company now has twelve electric roadsters in regular service and some fifteen lamp delivery wagons. The roadsters run about 100 miles per charge and can maintain a speed of 20 miles per hour. Mr. Baker said that in the near future a guarantee of 150 miles in seven hours is to be expected and pointed out that this will enable a man to ride practically all day long at 20 miles per hour.

### Court Refuses Long Acre Company Permission to Issue Bonds

The Court of Appeals of the State of New York handed down a decision on Dec. 31 on a writ of certiorari obtained by the New York Edison Company to review an order of the Public Service Commission of the First District authorizing the Long Acre Electric Light & Power Company to issue \$2,000,000 worth of bonds. By a vote of four to three, the court decided that the Long Acre company has no power to issue bonds for the purpose of entering the electric-light business in the boroughs of Manhattan and the Bronx without obtaining first a certificate of convenience and necessity from the Public Service Commission.

The Public Service Commission originally denied the application of the Long Acre Electric Light & Power Company for permission to issue securities and also denied a rehearing. Thereafter the Long Acre company caused this determination to be reviewed by a writ of certiorari issued by the Appellate Division of the Supreme Court. That court reversed the determination and referred the application back to the commission for consideration and action. The court said in substance that the reasons for the denial of the application by the Public Service Commission were based on the underlying proposition that there should be no competition in the business of public lighting, as it was the just policy of the State to prevent such competition. The court held, however, that there was nothing in the public service law relating to gas and electric companies to show that the right to determine whether such competition should be permitted had been delegated to the Public Service Commission. In June, 1910, the Public Service Commissions law was amended and the section relating to gas and electric companies was re-enacted so as to give the right to the commission to determine the question of public convenience and necessity. Subsequently the petition of the Long Acre company was considered again by the commission and the New York Edison Company appeared as an interested party under the amendment of 1910 to show that the franchise claimed to be owned by the Long Acre company was never operated and used according to law and also to show that no public necessity exists for a competing company. The commission granted the application of the Long Acre company against the objection of the New York Edison Com-



pany, and the latter thereupon applied for a rehearing by the commission, which was denied. The New York Edison Company appealed to the court, with the result that by a divided opinion the Appellate Division upheld the authorization of the issue of \$2,000,000 bonds on certain conditions.

The New York Edison Company then took the case to the Court of Appeals, with the result stated above. The Long Acre company will now have to apply for a certificate of convenience and necessity from the Public Service Commission and meet the arguments of the New York Edison Company to the effect that corporations subject to the prevailing public-service regulations cannot at the same time be subject to competition. The New York Edison Company contends that if it is to be regulated in the present manner it should be protected by the State against competition and that if competition is to be permitted it should be relieved of such regulation and allowed to meet competition in competitive districts at competitive rates.

The Long Acre company was incorporated to manufacture and distribute electricity in the boroughs of Manhattan and the Bronx and could put poles, wires and conduct on and under the streets with the consent of the municipality. It did not apply to the Public Service Commission for permission to construct its plant, claiming that its right to do so is superior to the restrictions imposed by the Public Service Commissions law.

### Government Suit on Retail Price Agreement

On Dec. 26 the federal Department of Justice filed suit at Detroit in the District Court of the United States for the Eastern District of Michigan, Southern Division, against the Kellogg Toasted Corn Flake Company and its officials, of Battle Creek, Mich., alleging violation of the Sherman law. The specific violation charged by the government is the agreement imposed by the Kellogg company on the jobbing trade to sell toasted "corn flakes" contained in a patented package at a fixed price per case and in requiring the retailers to sell the product to ultimate consumers also at a fixed price per package. According to reports, the Department of Justice officials say that this suit is a test case and that it is the first suit of the kind in which the government centers its attack chiefly on agreements requiring jobbers and retailers to sell at fixed prices. It is alleged that the Kellogg company advises the jobbers that if they fail or refuse to observe the fixed price they will be cut off from further supply and, furthermore, gives the retailers to understand that they must sell each carton and its contents at 10 cents per package or also have their supply cut off. The defendants, according to the government's allegations, have invoked the patent laws and seek shelter under the general right to impose restrictions upon the sale or use of patented articles, as upheld, for example, in the Dick case.

The government alleges that the Kellogg company obtained by assignment a patent issued on March 10, 1912, to John F. Byrne for a carton, application having been filed Nov. 6, 1911, or about four months earlier. These cartons, in which a food product called "corn flakes" is distributed and sold, are alleged each to bear the following restriction:

"This package and its contents are sold conditionally by us with the distinct understanding, which understanding is a condition of the sale, that the package and contents shall not be retailed, nor advertised, nor offered for sale at less than 10 cents per package. Retailing the package at less than 10 cents per package is a violation of conditions of sale and is an infringement on our patent rights, and renders the vendor liable to prosecution as an infringer."

The plaintiff alleges that the carton was not in fact patentable, in that all its features were old; that the value

of the carton is insignificant compared with its contents, the later being the thing wanted by purchasers while the carton is purely incidental; that when the defendants sell a carton and its contents they part with all legal title thereto and violate the act of July 2, 1890, in imposing restrictions thereon.

To the layman it seems clear that the principle established by the majority opinion of the United States Supreme Court in the Dick case can be extended so as to cover apparently such a case as this one, even though the food product or commodity contained within the package has no relation nor any apparent effect upon the patent covering the package or container itself. The position taken by the defendants seems to give ground to the fears which were raised by the Dick decision, that the unbridled right to impose all sorts of restrictions on patented articles would lead to commercial abuses of the most burdensome and serious character. This case raises sharply the issue whether the patent laws can be invoked as an adequate defense for acts which would otherwise clearly be in violation of the Sherman law. The course of this suit will therefore be followed with the utmost interest and a decision awaited with much eagerness.

### Federal Investigation of the American Telephone & Telegraph Company

Attorney General Wickersham has recently informed a representative of the *Electrical World* that the government's investigation of the methods of the American Telephone & Telegraph Company and its numerous subsidiaries is practically completed and that a decision has been reached as to whether a suit should or should not be instituted against the company. What decision he had reached he would not state, but indicated that when the new administration takes over the reins of authority in the Department of Justice it will find itself confronted with much new big business. It is now frequently rumored in Washington that the Attorney General has finally decided to bring suit against the "telephone trust," alleging violation of the Sherman law.

Mr. Wickersham has now before him a mass of data in relation to the case which has been accumulated by special agents of the Department of Justice following months of investigation which covered the whole country. These reports make a record almost as voluminous as that in the Standard Oil case. The chief point which is now said to be under consideration is that of determining whether or not the Bell interests have restrained trade in an illegal manner. This involves the whole matter of telephone and telegraph service throughout the country, and many interwoven questions of a complex character, such as whether the Western Union Telegraph Company is using patents in restraint of trade. If the latter complaint reaches the courts, there is said to be involved a new interpretation of the patent law relating to a highly complicated structure.

The business relations of the Bell company with the Western Union Telegraph Company form one of the subjects into which the reports of the special agents are known to have gone in detail, including the practice of connecting with the Western Union Telegraph Company any person calling by telephone and desiring to send a "telegram." Alleged difficulty on the part of telephone subscribers and the public generally in securing connection with the offices of the Postal Telegraph Company is another matter under investigation. The reports deal, furthermore, with the alleged attempts of the Bell interests to secure a monopoly of the telephone field through buying up independent telephone companies throughout the whole country, but particularly in the Middle West, where the independent companies flourished in great number some years ago but are now disappearing.

### Oregon Electrical Contractors' Association

State supervision of electrical installations, closer co-operation between contractors and central-station men and better systems of credit and cost analysis were the topics of the first annual convention of the Oregon Electrical Contractors' Association, held at Portland, Dec. 17 and 18. Business sessions occupied the first day, and on the second the members of the convention were taken to the Estacada power plant of the Portland Railway, Light & Power Company. Later an election of officers was held, and in the evening the annual banquet took place. On Dec. 19 there was a rejuvenation of the Sons of Jove.

The sessions of the convention were attended by contractors from all parts of the State, the audience at times numbering nearly 200. Tuesday's opening session was held in Moose Hall, the address of welcome being made by Mr. Gus Mosier, of the Portland bar. Mr. J. H. Ralston, retiring president of the association, replied in well-chosen words, mentioning the importance of the contracting business to the electrical industry at large.

Mr. George H. Duffield, of Utica, N. Y., special representative of the National Electrical Contractors' Association, opened the program, outlining the history and growth of the national association and showing its value to the contracting industry of the country. The association was organized about twelve years ago with only a few members, and it now has over 1200. It issues a great deal of matter of value to contractors and supplies information on accounting, standardization, etc. Mr. Duffield stated that in his travels he found about two-thirds of the manufacturers are standardizing their manufactured goods, resulting in great advantage to the contractors. Mr. Duffield next discussed the question of price standards, bringing out questions from the audience relative to prices on the Pacific Coast and why they should be higher than in the East.

Mr. F. D. Weber, of the Underwriters' Equitable Rating Bureau, who followed, said that the Underwriters' attention was forcibly called to the necessity of electrical inspection in 1881 by the occurrence of a number of electrical fires in the textile mills of New England. Immediately local rules were formulated, and from these grew the National Electrical Code, which was first adopted as such in 1896. The Underwriters have endeavored with the aid of other national organizations to set a standard below which no workmanship or material should fall. In connection with the present work there are maintained in Chicago the Underwriters' Laboratories, Inc., which now dispense labels at the rate of 20,000,000 a year.

The things to consider in devising a system of inspection are, said Mr. Weber: (1) The amount of labor required to place the defects under a system—in the field and in the office. (2) Flexibility of the system regarding addition of new defects and the addition of new buildings. (3) Simplicity of the office system, so that one not an electrical engineer can find the defects on any risk. (4) Simplicity and ease of understanding for the layman as well as for the electrical contractor. (5) Avoidance of mistakes on the part of the layman and contractor by double meaning being attached to any defect pointed out. (6) Return of proper certificate of correction, signed by the proper party, as owners' or tenants' signatures cannot be accepted. (7) Ability of formal notice to make the proper impression

on owners and tenants, so as to get the corrections made immediately without forcing them by rate adjustment.

(8) A method of protecting owners and tenants from the operation of dishonest contractors, by having the contractors' statements of proper correction in writing. (9) Division of responsibility between the contractor, local city inspector and bureau inspector for proper correction. (10) Means by which to adjust rates without inspection, thereby giving honest correction of defects the advantage of the best rate possible, without at the same time nullifying the original notice.

After luncheon, Mr. F. N. Averill, manager of the Fobes Supply Company, spoke on the relation of the electrical jobber and the electrical contractor, urging them to work hand in hand in seeing that proper material is installed so that the electrical business shall not fall into disrepute.

Mr. O. B. Coldwell, general superintendent of the power and light department of the Portland company, offered some practical statements as a central-station man, and dwelt upon the feature of co-operation, declaring as essential to the business interests of the electrical industry that jobbers, contractors and central-station men should always work in close harmony with one another.

An address on municipal inspection followed by Mr. Howard Joslyn, city electrician of Seattle, in which he described the system in use in his city and how effective it has grown to be. The public at large, he insisted, would become much less fearful of accidents resulting from the use of electricity if it knew that electrical work was installed and inspected properly during construction.

Mr. L. B. Smith, a local commercial credit manager, spoke on credit and its utility in the modern commercial world. Closely bearing on the same topic was a paper by Mr. P. L. Proctor, manager of the Pacific Audit Company, in which the author discussed cost and efficiency. Mr. Proctor urged contractors to keep accurate and complete books, so that they might know exactly how much it cost to handle a given piece of work. This practice, he declared, would not only increase the efficiency of their operations but would put them in a position where they could

submit bids and estimates with the full knowledge that they would be able to do the work at the price mentioned and at a profit.

On Tuesday evening the contractors were entertained at a vaudeville show. On Wednesday morning 125 members of the convention boarded a special trolley car to the Estacada power plant, located 35 miles southeast of Portland on the Clackamas River. After inspecting the station, a luncheon was given at the Estacada Hotel, Mr. J. E. Werlein, special agent for the Portland company, acting as toastmaster.

Returning to Portland, an election was held at which the following officers were chosen for the ensuing year: President, R. G. Littler, Portland; first vice-president, H. D. Lakoro, Portland; second vice-president, W. H. Baker, Eugene; third vice-president, John Vaughn, Pendleton; fourth vice-president, L. E. Dawson, The Dalles; secretary, F. C. Green, Portland; treasurer, J. R. Tomlinson, Portland; national director, R. G. Littler; executive committee, H. E. Knight, Portland.

In the evening a banquet was held at the Multnomah Hotel, and on Thursday evening there was a rejuvenation of the Sons of Jove, when forty-two were initiated.



PRESIDENT-ELECT R. G. LITTLER



## Federal Land Grants Held Up

By joint action of the War, Interior and Agricultural Departments on Dec. 28 extensive land patents of the International Power & Manufacturing Company, of the State of Washington, were held up on the ground that the company was attempting to free itself from all government control by securing patents to lands under the guise of mining claims or by railroad scrip filings in combination with a special dam license. It is said that the company was planning to build a series of hydroelectric plants, which it is estimated would produce 200,000 hp, having an annual value of upward of \$5,000,000. The power sites are in the so-called "Z" Canyon of the Pend d'Oreille River, situated partly in the Kaniks National Forest and partly in a power-site reserve set aside by President Taft. Secretary of the Interior Fisher charges that many so-called mining schemes have been located along the river in the National Forest and within the power-site reserve, but no attempt seems to have been made to press the mining claims for patent, the company apparently relying upon the special act licensing its dam. The plans filed with the War Department show that the company will use the public lands in the National Forest for flowage and public lands in the power-site reserve for the same purpose, and also for a right-of-way for conduits and sites for the power houses. The mining claims had been previously acquired by the Pend d'Oreille Development Company, which also obtained scrip land from the Northern Pacific Railway and later sold both to the International Power & Manufacturing Company. Secretary Fisher characterized these cases as an example of the methods used to defeat federal ownership.

## New York State Hydroelectric Scheme

At the last session of the New York Legislature a bill was introduced by Senator Bayne providing for a state-wide scheme of hydroelectric development and high-tension transmission under state ownership and operation, for the purpose of selling electrical energy to municipalities and the public. The proposed act was introduced as an amendment to Chapter 647 of the Laws of 1911, entitled "An act relating to the conservation of land, forests, waters, parks, hydraulic power, fish and game, constituting Chapter 65 of the Consolidated Laws." It was proposed to repeal Article VI thereof and enact a new article in its place covering the general project just mentioned. The provisions of the new article stipulated the general powers and duties of the State Conservation Commission, which would be charged with the administration of the scheme. The character of service to municipal corporations, contracts for distribution, purchase or construction of distribution plants, construction of transmission lines, the letting of construction contracts, appropriation of property and other allied matters were covered in the fourteen sections of the act. In view of the extensive scope and far-reaching effect of such a scheme if carried through, and in further view of the agitation in favor of it carried on by the Conservation Commission since the adjournment of the last Legislature, it seems worth while to give our readers some account of his proposed undertaking and the arguments advanced in its behalf.

### General Features of Proposed State Project

The scope of this state-owned hydroelectric undertaking was described in a recent issue of the *Engineering Magazine* by Mr. A. H. Perkins, who since 1909 has been engaged with the State Water Supply Commission and the Conservation Commission. In its general features the proposal is quite similar to the hydroelectric system recently completed by the Province of Ontario and now operated under the management of the Ontario Hydroelectric Commission.

It will be recalled that a committee of the last Legislature made a trip to Ontario for the purpose of inspecting the system in operation there and obtaining first-hand information in reference to its advantages. The Hon. Adam Beck, chairman of the Ontario commission, also gave testimony regarding the system before the legislative committee at the State capital.

In order that the original proposal contained in the Bayne bill may be compared with the Ontario system, the map of the New York scheme has been reproduced from Mr. Perkins' article on the same scale as a second map showing the Ontario high-tension distribution system. It will be apparent at once that the proposed New York system is much more extensive than the Ontario plant. According to statistics advanced by Mr. Perkins, the present total rating of primary power plants of all sorts in the State of New York is approximately 4,000,000 hp; of this, 2,200,000 hp is developed in central station and railway generating plants, 1,200,000 hp is generated in steam power plants situated in industrial establishments, and 700,000 hp is developed from water-powers utilized in manufacturing industries. At the present rate of growth the power requirements of the State will be 5,000,000 hp in 1915 and 7,200,000 in 1920. The present installed rating of steam power plants in the State is now therefore about 3,300,000 hp, but Mr. Perkins estimated that no more than 2,500,000 hp of this total could be replaced by hydroelectric power, owing to the use in some instances of waste products for fuel and also to the use of large amounts of steam in certain industrial processes, making it possible to obtain steam-generated power as an inexpensive by-product. He estimated that the total diversity factor of the different individual demands for the whole State would not exceed 50 per cent, thus requiring but 1,250,000 hp of installed hydroelectric capacity.

In connection with the map of the proposed high-tension distribution system, which shows also the location of the proposed generating station, the installed rating of each hydroelectric plant and the estimated requirements for steam auxiliaries in each instance are given in Table I. These nine developments have a total estimated hydroelectric rating of 1,669,000 hp, with a total of 809,000 hp in steam auxiliary plants, and a peak load rating of 2,153,000 hp.

TABLE I.—RATING OF HYDROELECTRIC PLANTS AND PROPOSED STEAM AUXILIARIES

	Rating of Hydroelectric Plant	Rating of Steam Auxiliary	Total
Niagara River	800,000	—	800,000
St. Lawrence	—	200,000	200,000
Canal System	—	—	105,000
Cornwall River	—	—	—
Schoharie River	—	—	40,000
Black River	—	—	—
Richmond River	—	—	—
St. Lawrence River	—	—	—
Hoosier River	—	—	—
Totals	1,669,000	809,000	2,478,000

Mr. Perkins pointed out that the economic and legal problems arising in connection with a proposed development of this magnitude are very difficult. In justification of the general scheme the following clause was quoted from the title of the 1907 act: "To devise plans for the progressive development of the water-powers of the State for the public use under state ownership and control." The platforms of both political parties contained similar declarations in the 1910 elections, and since that time the chief executive of the State and the Conservation Commission have both labored for the realization of such a State project as that contemplated in the Bayne bill and here described.



Under the title "Cheap Electricity for All" the State Conservation Commission has distributed copies of a little pamphlet intended for popular consumption, setting forth in question and answer form its reasons for advocating the construction of a comprehensive hydroelectric system under state ownership and management. This prospectus is of considerable interest and its principal statements have been abstracted here in order to reveal fully the reasons for such a tremendous project as that which the people of the State have had placed before them. The commission makes at the outset the sweeping statement that there is enough undeveloped water-power in the State now going to waste to furnish light in every house and supply power to every factory. The utilization of this power, it is declared, will cut monthly electric bills in half and make electric cooking cheaper than the time-honored coal range. Again it means the stimulation of industry and employment for more men and women. This vast power, being the people's property, should be developed for their benefit.

#### Undeveloped Water-Power of the State

The undeveloped water-power is said to be about 1,500,000 hp, of which the greatest amounts are at Niagara Falls and the Long Sault Rapids in the St. Lawrence River. Three companies are developing hydroelectric energy on the Canadian side at Niagara, paying the Canadian government a large sum yearly for the privilege, and selling energy in Canada at about half the price charged in New York State for energy proceeding from the same source. Two companies operating on the New York side pay our own government nothing for their privileges. About 250,000 hp additional can be developed at Niagara without impairing the scenic grandeur and later on still more can be developed by the use of more efficient machinery, more favorable locations and regulating the flow of the river. About 1,000,000 hp is developed at the Long Sault, but only part of this would belong to the State.

In 1907 the New York Legislature granted the entire rights to the Long Sault site to a company controlled by the so-called "Aluminum Trust," which is said neither to have yet done anything toward actual development nor to have obtained the necessary consents of the Ontario authorities or the United States government. This grant is declared to be the greatest single power grant to a single company in a single place on record and the greatest power monopoly in the State. It is furthermore said to be under investigation by the Attorney-General of New York.

By building storage reservoirs on the watersheds of the principal rivers, such as the Hudson, the Genesee, etc., the flood waters could be controlled and much additional power developed as the result of more uniform stream flow. The State also owns about 85,000 hp developable along the Erie and Barge Canals, from water by-passed at the locks, and at dams and locks in tributary rivers and lakes. The State now actually owns, in the Barge Canal, in reservoir sites and stream beds, about 400,000 hp. In regard to the rest of the undeveloped power, it will be necessary for the State to resume the right to develop these powers by revoking the franchises granted by the Legislature to various companies, which, so far, have done nothing toward development, and reimburse them for actual financial outlays.

It is proposed to develop these water-powers one at a time, as the demand arises, and transmit the energy therefrom to municipalities at actual cost. This energy will then be retailed at actual cost for public, domestic and commercial service of all kinds. The municipalities, by vote of the citizens, will enter into power contracts with the State at fixed annual prices. Thirty-year State bonds will be sold to pay for the hydroelectric generating and transmission system. Each contracting municipality will pay annually such proportional part of the cost of building the State system as will cover the interest, the sinking fund to retire the bonds, the depreciation, the maintenance and the oper-

ating expense. The municipal payments will thus cover the bond interest and retire the bonds at maturity. Furthermore, each municipality will finance the local distribution and delivery of energy to its customers by similar bond issues, under the same general plan. Citizens will contribute nothing toward this project in way of direct taxation, but each municipality will pay the established rates for public lighting, which will be covered in the general tax levy.

The commission declares this plan will halve the cost of house lighting, greatly reduce the cost of public lighting, and also halve the cost of factory power and motive power for transportation systems, all with greater efficiency than is possible under private ownership. Taking hard coal at \$6.50 per ton and gas at 80 cents per 1000 cu. ft., in New York, electric cooking will be less expensive. In Ontario electric energy competes with 60-cent gas for cooking. It is even promised that energy will be so cheap that manufacturing can be successfully carried on in workmen's homes, if desired. At present, it is said, the small user of power is discriminated against and made to pay a big price. It is also promised that this scheme will make New York the world's manufacturing center, building up factories in rural districts and relieving city congestion. The scheme, so the commission says, will save \$15,000,000 annually to electric consumers in ten of the principal cities and conserve 20,000,000 tons of coal per annum. The small communities will be on equal footing, as regards rates, with the densely populated districts.

It is proposed to build a great trunk transmission line along the Barge Canal from Niagara Falls to Albany and thence to New York City, with loops to every municipality in the State. The project will be successful, it is argued, because of what has already been accomplished in Ontario under a like plan. The latter system is declared to have been operating in Western Ontario for two years and in Ottawa for seven, with an interruption of not to exceed thirty seconds in that time. Over 300 miles of high-tension lines serve thirty cities under contract, and 100 more applications are pending. That system is also declared to be financially successful and to have cut rates in half. Ninety-nine per cent of the houses in Ottawa are lighted by means of this cheap energy, where one inhabitant in every five uses electricity, compared with one in twenty in Albany and one in thirty-five in New York City. In Ontario the ordinary small house is said to pay \$1 per month, whereas a fourteen-room house with thirty lamps pays \$2 per month on the average. The commission says these are one-half the New York prices.

In Ottawa the rate for continuous power is \$22.50 per hp per annum and less for summer season service and for restricted use. In Toronto, 90 miles from the Falls, the city purchases continuous power at \$18.50 per hp and sells ten-hour power at \$28 per annum. In London, 138 miles from the Falls, the city buys at \$28 and sells at \$40 per hp; whereas in Albany eight-hour power costs \$45 per hp up and in Buffalo, 22 miles from the Falls, the city pays \$25 per hp. The private companies in Ontario were arrogant in the extreme toward the small consumer, so the commission says, before the government system was established, but that has all passed. Nearly all of the private companies in Ontario are declared to have profited by state competition and enlarged their business, instead of suffering any loss, financial or otherwise. By comparison with state or municipal waterworks and electric-light plants, there is nothing socialistic in the proposed state-wide hydroelectric system. Water-power is a natural monopoly in itself and should be in the people's hands.

The commission claims that under private ownership the proposed scheme would not carry nearly the same measure of public benefits, even under the present administration of the Public Service Commissions law. The case of Buffalo is cited in proof of this contention, as follows:

"Niagara Falls was to make Buffalo the great power city

of the country. By adroit corporation jugglery Buffalo, is supplied by local companies with power generated by Canadian companies. It has appropriated \$35,000 for hearings before the Public Service Commission to get relief from unreasonable rates, and it is claimed by the power interests that the Public Service Commission has no power to regulate

4,000,000 hp in developments of 1000 hp or over, and of the latter class a total of about 700,000 hp is situated in New York State. On the basis of 75 per cent efficiency in development, without storage, the revised estimates of the Geological Survey credit New York State with a potential water-power of 1,037,000 hp minimum and 1,698,000 hp assumed maximum. The undeveloped water-power owned by concerns having 1000 hp or over was given as 193,000 hp; this included no power at the Long Sault Rapids of the St. Lawrence. The Aluminum Company of America was credited with 48,000 hp developed at Massena, on a canal from the St. Lawrence, and 48,000 hp undeveloped.

Under the 1910 treaty Canada may divert 36,000 second-feet at Niagara and this country 20,000 second-feet. The total is approximately 25 per cent of the river flow, as computed by government engineers, and if fully developed would be about equivalent to 1,300,000 hp. On the American side the Hydraulic Power Company of Niagara Falls has an installation of 144,000 hp (and 20,000 hp undeveloped) and the Niagara Falls Power Company has 118,000 hp, making a total of 262,000 hp. On the Canadian side there are four companies, with 238,000 hp installed, or a grand total of 500,000 hp of installation. All the energy generated on the American side and considerable of that on the Canadian side is sold in this country. In this connection it may be noted that Mr. Perkins assumed a 300-ft. head at Niagara as possible, in estimating a total development of 540,000 hp from 20,000 second-feet, and allowed for only 160,000 hp of present installation in reaching the conclusion that 380,000 hp is still undeveloped.

#### Closing Comments

The Bayne bill received the support of the Governor and passed the Senate, but was not reported in the Assembly. It appears on the face of the matter that the State project

prices at Buffalo because it has no jurisdiction over the price paid for power by the local distributing companies. State regulation of price cannot be either cheap, expeditious or effective, because it is generally true that the stock of most private power companies is entirely water, and yet, being in the hands of innocent purchasers, it cannot be interfered with."

At the third annual conference of mayors of New York cities, held in Utica June 10, a strong resolution was unanimously adopted recommending such a state-wide system. The federal control of water-power in Switzerland is also cited, as well as the municipal and state ownership in Germany, where electric energy is in greater use on the farms than in any other country of the world. The large hydroelectric developments in Norway and Sweden are cited, and it is stated that Winnipeg has built its own hydroelectric system and furnishes electric energy for cooking at the low rate of 1 cent per kw-hr., or one-tenth the price charged for similar service in New York State. Hydroelectric systems owned by the cities of Chicago, Los Angeles and Seattle also come in for mention. It is denied that politics would creep into the handling of the proposed New York project or diminish its efficiency in any respect, and the successful handling of other large government projects is quoted in the resolution in substantiation of this contention.

On March 14 last the Commissioner of Corporations, then Mr. Herbert Knox Smith, transmitted to the Secretary of Commerce and Labor a most important report on "Water-Power Development in the United States," with special reference to concentration of ownership and control. Out of about 6,000,000 hp of developed water-power in the whole United States, there are some

would be independent of the two Public Service Commissions and that enforced competition with central-station companies now operating in the State would be inevitable, whether warranted or not. No estimates of cost under the proposed scheme either as to investment, annual charges or service rates have been circulated among the taxpayers, who are bound to accept the final responsibility. There

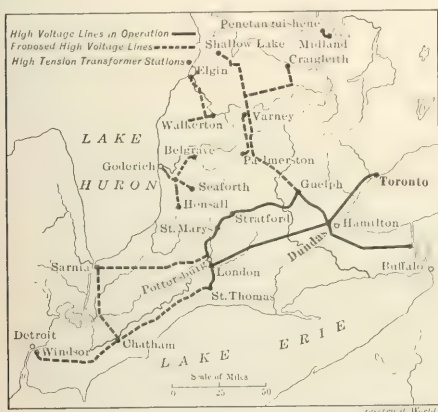


FIG. 1—MAP OF TRANSMISSION SYSTEM OF HYDROELECTRIC POWER COMMISSION OF ONTARIO

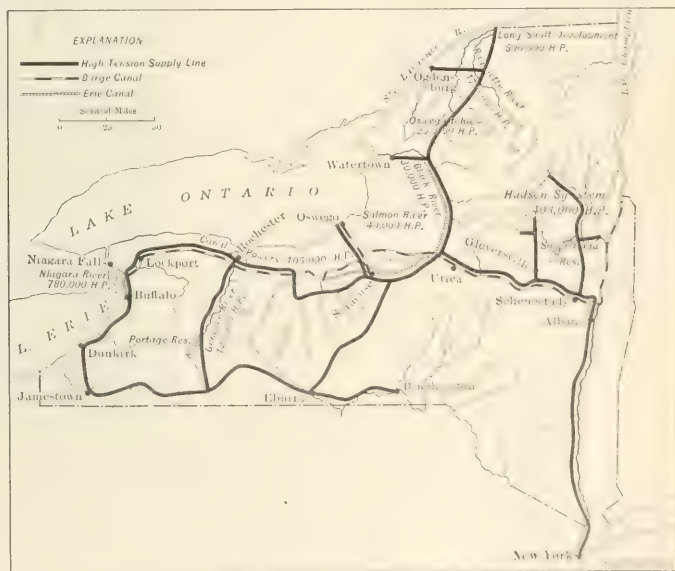


FIG. 2—PROPOSED HYDROELECTRIC SYSTEM FOR NEW YORK STATE



seem also to be legal questions in connection with the titles to some of the proposed water-power sites yet to be settled, involving perhaps litigation or even international arbitration. The plans from an engineering standpoint, so far as announced, are also in very rough form and the estimates of power available are apparently open to revision. Control of the flood-waters of the principal streams in the State involves so many serious questions that details of each proposed development should be made public and scrutinized with great care. There is need for going slow with such a vast undertaking as this one discloses itself to be.

## Public Service Commission News

### New York Commission

The Public Service Commission, Second District, has authorized the New York Telephone Company to put into effect Jan. 1, 1913, new rates for general telephone service in Dunkirk City. The reductions in the annual rates will be for business direct line \$12, two-party line \$18, and for residence direct line \$9, two-party line \$6, four-party line \$8. The rate for farm lines served by such central office for residence service is reduced \$3.

### Connecticut Commission

The first annual report of the Connecticut Public Utilities Commission, covering the period from Sept. 9, 1911, to June 30, 1912, recommends enactment of laws giving the commission jurisdiction over mergers of public-service companies and the right to exercise closer scrutiny in general. The commission made the following declaration of principle in relation to the use of surplus earnings:

"We believe that the net income and profits of any public-service company, after the payment of reasonable dividends, should be used for the improvement of the plant and equipment of such company, rather than in unwarranted expansion or the acquisition, management and control of business and property more or less foreign to the chartered purposes of the parent company."

The commission also recommended an investigation of the condition of the water supply of the State and its conservation.

### New Jersey Commission

The New Jersey Board of Public Utility Commissioners has just handed down one of the most important decisions of its comparatively brief existence, ordering a reduction of the gas rates charged by the Public Service Gas Company in the Passaic division from \$1 net per 1000 cu. ft. to 90 cents per 1000 cu. ft., effective on and after Feb. 1. The board also recommended that the company make the same reduction throughout all of the other divisions in the State where it is now charging the net rate of \$1. In determining the valuation upon which the gas company should be allowed a reasonable return the board allowed \$1,025,000 to cover intangible property, including organization, franchises, cost of establishing the business, etc., whereas the company claimed a value of \$3,091,000. Nothing was allowed for "good will." In respect to "going-concern value" the board decided that a public-utility company can have an excess in value over and above the value of its tangible property, or, in other words, a plant with a business attached is of greater value than the mere plant without the business. In respect to franchises the board stated that the present policy of the State is not to allow the capitalization of franchises for an amount in excess of the actual cost involved in obtaining them. The decision states that the 90-cent net rate will afford a return of approximately 8 per cent on the value of the property as found by the board. This rate of return is not a precedent to be applied indiscriminately to other cases. The board further decided that securities issued in mergers, as was done in

this case by the Public Service Corporation, are not a proper basis for rates. The company contended that the par value of securities originating in the merger of six different gas and electric concerns in this district in 1899 determines an amount below which the board's aggregate valuation should not fall. This contention was expressly denied by the board, which held that the capitalization resulting from the consolidation was in excess of the real assets.

### Massachusetts Commission

The Gas and Electric Light Commission recently gave a hearing upon the petition of the Gardner Electric Light Company for an increase of capital stock by 800 shares. A feature of the hearing was an extended discussion of the practice of flat-rate incandescent lighting with excess indicators as conducted by the company. Mr. J. D. Whittemore, local manager, stated that the usual price of 1 cent per watt of connected load per month applied to residence lighting service in the Gardner district, the customer also having a choice of meter service if desired. The majority of contracts are made for four 25-watt tungsten lamps. Feeders are metered at the station, there being no meters on the individual flat-rate services. The amount of flat-rate energy sold is estimated on the basis of 10 cents per kw-hr., the line losses being estimated by subtracting the sum of the total estimated input to flat-rate installations and the total metered input from the combined readings of the switchboard feeder meters. The percentage of error introduced in this way is small, as the number of flat-rate installations is still a small proportion of the total lighting installations. The company maintains a flat rate of  $1\frac{1}{4}$  cents per watt of demand per month to stores open not later than 10 p. m. and not more than three nights a week. A charge of 3 cents net is made for all-night lighting by doctors. The company recently purchased 285 5-amp, 110-volt excess indicators at \$2,565, thirty 10-amp indicators at \$270 and five 25-amp indicators at \$70, transit, oil, freight and cartage adding \$127.

Among the cost data presented at the hearing was the expense of building a 66,000-volt spur line 16.8 miles in length from the Connecticut River Transmission Company's trunk line to South Barre, the items being as follows: Right-of-way, 100 ft. wide, and land damages, \$9,368.64; 579 40-ft. chestnut poles with 14-in. butts and 9-in. tops, including rigging, stringing wire and clearing of right-of-way, \$23,041.35; four special steel towers for railroad crossing, erected, \$993.58; wishbone steel cross-arms (6-ft. equilateral triangles), \$3,202.93; high-tension insulators and pins, \$5,224.89; phase wires, three No. 6 copper-clad steel, 40 per cent conductivity, \$2,616.42; ground wire, one No. 6 copper-clad, 40 per cent conductivity, \$870; telephone wires, two No. 10 copper-clad, 30 per cent conductivity, \$593.16; ground wire insulators and pins, \$87; telephone insulators and pins, \$161.45; sectionalizing disconnecting switches, \$505.50; junction tower, \$121.61; surveys, engineering, inspection, testing and superintendence, \$4,799.44; telephone apparatus, \$276.52; miscellaneous, \$315.61; total, \$52,148.10, or \$3,104 per mile.

### Maryland Commission

A demurrer to the petition for an injunction to restrain the Public Service Commission and the Chesapeake & Potomac Telephone Company from taking out the flat-rate telephones in Baltimore was filed last week in the Circuit Court by the telephone company through its attorneys. Mr. William Cabell Bruce, chief counsel, on behalf of the commission, demurred to the petition several days ago. The petition was filed by certain members of the Maryland Telephone Protective Association and others.

### Ohio Commission

Application has been made by the Lima Telephone & Telegraph Company, Lima, for permission to purchase the Central Union Exchange in that city. The price agreed upon is \$205,000. This application was accompanied by a



similar one from the Central Union Telephone Company. The purchasing company also seeks authority to issue \$500,000 in bonds, of which \$205,000 will be used to pay for the Central Union exchange and the remainder to liquidate debts and make improvements. The Lima Telephone & Telegraph Company is capitalized at \$150,000. This is perhaps the largest consolidation that has been effected between Bell and independent companies since the enactment of the public service law and the creation of the commission. The hearing will take place on Jan. 22. It has been announced that rates for business lines will be increased from \$3.50 to \$4 per month, and there are prospects that the consolidation will be vigorously opposed before the commission for this reason. It is said the number of subscribers will be increased to 7000.

The Dayton Power & Light Company has applied for permission to issue \$100,000 preferred and \$49,750 common stock to be exchanged for \$100,000 Xenia Gas & Electric preferred at par and \$99,500 common at 50. This will give the Dayton company the entire stock capitalization of the Xenia company. It has two large plants and is reaching out to larger territory. The acquisition of the Xenia property will open up a good market for its surplus energy.

#### Oregon Commission

The Railroad Commission of Oregon has issued calls for conferences with various public utilities throughout the State, this being its first act toward regulation of utilities as provided in the law passed by the people in November. On Friday, Dec. 27, a conference with electric power and light and street-railway companies will be held at Salem, and on Dec. 28 a conference will be held with gas, water, telephone and telegraph companies at the same place.

#### California Commission

The city of Palo Alto, Cal., after voting the control of its utilities to the California Railroad Commission, complained against the rates of the Palo Alto Gas & Electric Company. The defendant applied to the Superior Court of Santa Clara County for a writ of prohibition to prevent the commission from proceeding to hear the case, contending that the city trustees of Palo Alto had already fixed the rate for the ensuing year and that the Railroad Commission could not act until the end of that year. The decision of the Superior Court sustained the Railroad Commission, enabling it to proceed with the hearing.

The commission has decided to conduct a series of tests in the induction cases in which the Pacific Telephone & Telegraph Company complained of serious interference with the operation of its telephone lines by induction from high-tension transmission lines in proximity to its wires.

## Current News and Notes

**EXPLOITATION OF FINLAND WATER-POWERS.**—According to a recent report, the water-powers of Finland are to be exploited by a Belgian company with a capital of \$6,000,000.

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**TELEPHONE PENSION SCHEME GOES INTO EFFECT.**—On Jan. 1 the pension plan of the American Telephone & Telegraph Company and its subsidiaries, as previously announced on page 1028 of our issue of Nov. 16, became effective. A ten-million-dollar fund has been set aside to provide for the payment of benefits.

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**GOVERNMENT INVENTORY OF CALIFORNIA WATER RESOURCES.**—The results of the work undertaken by the United States Geological Survey in compiling an inventory of the water resources of the State of California are being published in six volumes, designated as Water Supply Papers 295-300 inclusive, notice of several of which has already

appeared in these columns. The first three volumes are gazetteers and the last three contain the results of stream-flow measurements.

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**GREATER NEW YORK RAILROADS AND STREET RAILROADS KILL ONE VICTIM PER DAY.**—Reports of accidents on railroads and street railroads in Greater New York for the month of November, 1912, as made to the Public Service Commission for the First District, show that the total number of accidents was 5783, against 5291 in November of last year. Of these accidents, 3651 involved injuries to persons, against 3221 in November, 1911. The number of killed was 32, against 31 in November of last year, and the total number of serious injuries was 192, against 216.

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**INCREASE IN PATENT APPLICATIONS.**—In his annual report the Commissioner of Patents, Mr. Edward B. Moore, gives the receipts of the office for the fiscal year ended June 30, 1912, as \$2,094,059, compared with \$1,987,778 for the previous year. The number of applications for patents for inventions aggregated 69,236, against 65,154 for the fiscal year ended June 30, 1911. The commissioner recommends the establishment of the Patent Office as an independent bureau of the government and also that a new building be erected, the present quarters being overcrowded and the records in danger of destruction by fire.

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**LONG SAULT WATER-POWER GRANT DECLARED VOID.**—In an opinion rendered by Attorney-General Carmody to the New York State Senate at Albany, Jan. 1, the charter granted by the Legislature of 1907 and signed by Governor Hughes authorizing the Long Sault Development Company to utilize the Long Sault Rapids in the St. Lawrence River is declared to have been unconstitutional. No power has yet been developed by the owners of the franchise, which recently passed to the control of the aluminum interests. Mr. Carmody holds that the grant contravenes the section of the constitution inhibiting the passage of private privileges or franchises, and also that it infringes on the state forest-preserve laws.

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**THE INVENTORS' LEAGUE OF AMERICA ORGANIZED.**—An organization which has tentatively adopted the name "The Inventors' League of America" was recently formed at a meeting of inventors held at the Stevens House, 21 Broadway, New York City. Two meetings of the new organization have already been held. At the second meeting there was a general discussion of ways and means for raising funds to protect inventors against those who are seeking unfairly to exploit their brains and labor. It was decided to draw up a prospectus and circulate this among prospective members and others generally interested in the movement. The temporary president of the league is Mr. George Whigelt, and its membership includes Prof. P. W. Nelson, of Pratt Institute, and Messrs. Edward S. Gleason, Herman D. Sears, Charles E. Smith and M. J. Langan.

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**WESTERN UNION TELEGRAPH COMPANY SECURES INJUNCTION AGAINST LOUISVILLE & NASHVILLE RAILROAD.**—On Dec. 28 the federal court at Louisville, Ky., granted the application of the Western Union Telegraph Company for an injunction to prevent the Louisville & Nashville Railroad from removing the telegraph company's equipment from the road. It is said that the Western Union Company will now push its suit to condemn a right-of-way along the railroad. Following the announcement of the injunction counsel for the railroad company asked that the Western Union Company be required to furnish a bond for \$250,000 to cover possible damages and alleged indebtedness for right-of-way rental amounting to \$110,000 for the last three months. Action on this request was deferred. The present controversy between the companies dates from the expiration last August of a contract for reciprocal service.

### SOCIETY MEETINGS

**ELECTRICAL JOBBERS' CONVENTION.**—The annual convention of the Electrical Supply Jobbers' Association will be held at the Lafayette Hotel, Buffalo, N. Y., on Feb. 11, 12 and 13. The secretary of the association is Mr. Franklin Overbaugh, 411 South Clinton Street, Chicago Ill.

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**WISCONSIN ELECTRICAL ASSOCIATION.**—The fifth annual meeting of the Wisconsin Electrical Association will be held at the Hotel Pfister, Milwaukee, on Jan. 15 and 16, 1913. The annual dinner will take place on the evening of the first day. Mr. Irving P. Lord, of Waupaca, is president of the association, and Mr. George Allison, Stephenson Building, is the secretary-treasurer.

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**N. E. L. A. COMPANY SECTION IN ST. LOUIS.**—At the December meeting of the Union Electric Company Section of the National Electric Light Association in St. Louis, Mr. J. F. Dechant, of the Sheldon School of Chicago, gave an address on "The Science of Business Building." Instrumental music was furnished by the Union Electric Orchestra, while the Glee Club of the company sang several selections.

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**ANNUAL MEETING OF THE ILLUMINATING ENGINEERING SOCIETY.**—On Friday evening, Jan. 10, the Illuminating Engineering Society will hold its annual meeting at the Aldine Club, Fifth Avenue Building, Twenty-third Street and Fifth Avenue, New York. A dinner at 6:30 p. m. will precede the annual business meeting, which will commence at 8 o'clock. Members who cannot attend the dinner are urged to make an effort to be present at the business meeting. Chairman C. Alfred Littlefield anticipates an interesting and enjoyable evening on this occasion. Those desiring to attend the dinner should make reservation not later than Jan. 8 through Mr. Littlefield at 55 Duane Street, New York.

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**LOS ANGELES SECTION, A. I. E. E.**—On Dec. 17 100 members of the Los Angeles Section, A. I. E. E., the Electrical League and the local Architects and Engineers' Society listened to a lecture on "Light, Color and Illumination," by Mr. W. D'A. Ryan, of the General Electric Company, who was in the West in connection with the lighting of the twin expositions at San Diego and San Francisco in 1915. The speaker was introduced by Mr. George A. Damon, chairman of the Los Angeles Section, A. I. E. E., and spoke on the subject of colors, lighting effects, light sources, the illumination of Niagara Falls, the Hudson-Fulton celebration and the Panama Canal, telling also something of the plans for the lighting to be used at the California expositions in 1915. The lecture was illustrated with many lantern slides.

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**ECONOMIC ASSOCIATIONS CONVENE AT BOSTON.**—The American Economic, Historical, Political Science and Statistical Associations, the American Sociological Society and the American Association for Labor Legislation held a joint convention at Boston from Dec. 27 to 31, which was largely attended by industrial and political economists from all parts of the continent. Among the features of the program were a discussion of the "Minimum Wage," opened by Mr. H. R. Seager; a study of the "Relation Between Statistics and Politics," by Mr. Leroy D. Pavey, of Babson's Statistical Organization; "The Rising Cost of Living," by Prof. Irving Fisher, of Yale University, and papers on training for industrial efficiency by Messrs. C. A. Prosser, H. G. Valentine and others. Former President Theodore Roosevelt was the chief speaker at one of the early sessions, and an aftermath of the gathering was a joint open meeting on Jan. 1 of the Special Libraries Association, Eastern District, and the Boston Co-operative Information Bureau, whose program included visits to the libraries of Stone & Webster,

Arthur D. Little, Inc., the Boston Society of Civil Engineers and other working book and periodical collections.

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**AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS.**—At the sixth annual meeting of the American Society of Agricultural Engineers, held in Chicago on Dec. 26, 27 and 28, a new constitution was presented and discussed. The object of the society is to promote the art and science of engineering as applied to agriculture, and considerable attention is devoted to the economical use of energy in farming operations. The testing of gasoline tractors, for instance, had a prominent place in the program of the Chicago convention. Prof. H. W. Riley, of Cornell University, president of the society, occupied the chair. In his opening address he recommended the establishment of standards and said that one of the features of agricultural engineering is the designing of machinery that will run in spite of the ignorance of the operator. None of the papers discussed related to electrical subjects. Prof. L. W. Chase, of the University of Nebraska, Lincoln, Neb., was elected president, and Mr. I. W. Dickerson, University of Illinois, Urbana, Ill., secretary.

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**WEST PENN ELECTRIC COMPANY ACTIVITIES.**—Covers were laid for fifty-six persons at the fourth annual banquet of the West Penn Electric Company, held at Greensburg, Pa., Dec. 11. At the regular monthly meeting preceding the banquet Mr. W. R. Kenney, superintendent of lighting, presided, later turning the meeting over to District Superintendent Snite. Papers were read by Mr. E. I. Barnard on "Electric Motors Versus Gas Engines," and by Mr. L. T. Jackman on "Meter Reading and District Work." With Mr. Kenney as toastmaster, responses were made by Messrs. E. D. Dreyfus, statistician; H. P. Chambers, superintendent of lighting, and T. S. Henderson, manager of the new-business department, all of the Pittsburgh office, and by Mr. F. A. Moesta, district superintendent at Kittanning, and Mr. W. S. Anderson, chief clerk of the Connellsville office. A score of towns in western Pennsylvania, in which the West Penn Electric Company operates, were represented, including Brownsville, Connellsville, Uniontown, West Newton, Scottsdale, Latrobe, Monongahela, Charleroi, Greensburg, Washington, Canonsburg, McDonald, Kittanning, Butler, Waynesburg, Leechburg, Saltsburg, New Kensington and Sewickley.

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**ANNUAL MEETING OF THE EFFICIENCY SOCIETY.**—The Efficiency Society will hold its annual meeting at 29 West Thirty-ninth Street, New York City, Jan. 27 and 28, and the following program has been announced: On Monday, Jan. 27, following the president's address a business meeting and election of officers will be held, a symposium on organization, discussion on the necessity of charts of organization, symposium on management, discussion on democracy in industry and "securing the consent of the governed," and in the evening a dinner at the Aldine Club, after which will be held a symposium on efficiency in the government organization, national, state and municipal, and a discussion on a readjustment of the governmental departments. Tuesday's program includes a symposium on industrial relations, a discussion on the relations between employer, employee and the community, and in the afternoon a symposium on industrial hygiene and safeguards against occupational disease and accident, and symposiums on safety in marine and land transportation, crowded buildings, city conflagrations, forest fires, mines, dam-protected districts and freshet floods. This last session will be illustrated by moving pictures and lantern slides demonstrating the efficiency obtained by conserving the human element in industry. The meeting will close at 5:30 p. m., following the final business session. The secretary of the society is Mr. H. J. F. Porter, and the headquarters are at 29 West Thirty-ninth Street, New York.

# New Terminal Post Office in New York—I

**Electrical and mechanical equipment, wiring and illumination of the government building over the Pennsylvania Railroad yards. By L. B. Marks and J. E. Woodwell**

**I**T is safe to say that the average man has very little realization of the intricate problems involved in the design of the electrical and mechanical equipment of a huge modern post office building. To the average man such a building merely represents an enlargement of a smaller building and means simply more floor area to provide for additional employees and increased business.

The fact is, however, that with the increase of post office facilities engineering problems not involved in smaller buildings arise. The handling of a few thousand pieces of mail is a simple matter, but the handling of many millions of letters and parcels each day with accuracy and celerity is a complicated problem, involving the consideration not only of electrical and mechanical machinery adapted to handling an enormous business but also a study of the special problems of heating and ventilation, electric lighting and installation of motors, elevators, etc., which come into play in the case of large establishments.

The general idea of a large post office is perhaps that it is a big office building for housing a large number of clerks who will receive and distribute the mail, whereas such a building is more likely to be a gigantic machine, with complicated mechanism for automatically handling hundreds of tons of material daily, with all the refinements of modern engineering devices.

The engineering problems in such a building become all the more important when taken in connection with the terminal facilities of a great railroad station, and as the

new United States Post Office in New York City is directly connected with the Pennsylvania Railroad Terminal, the problem of handling the mails involves most careful consideration of the terminal facilities and the co-ordination of the work of the Post Office Department with that of the railroad company.

## Post Office Building

Erected of Milford granite in Roman-Corinthian style of architecture, extending 375 ft. from Thirty-first to Thirty-third Street, with its principal façade and approach on Eighth Avenue, the building is perhaps the most imposing structure of its kind in the country. A broad flight of steps spans a colonnade of twenty columns bearing Corinthian capitals, extending along Eighth Avenue from the north to the south pavilion. For the erection of the building, of which Messrs. McKim, Mead & White are the architects, Congress appropriated \$4,500,000, approximately \$800,000 of which will be expended for the electrical and mechanical equipment including the mail-handling facilities at the Pennsylvania Terminal. It is not unlikely that the total volume of business in the building will eventually represent the equivalent of an average of over 5,000,000 pieces of mail matter daily—about double the present amount. The building is the largest terminal post office in the United States and is the headquarters for the postal service of the city of New York. It occupies a site over the Pennsylvania terminal yards and contains five floors and a basement.



FIG. 1.—NEW U. S. POST OFFICE OCCUPYING TWO CITY BLOCKS, VIEWED FROM EIGHTH AVENUE AND THIRTY-THIRD STREET



Both the terminal station and the new post office building span the tracks of the Pennsylvania Railroad, 50 ft. below the street level. Mail bags are sent through spiral chutes or elevators down to a trucking subway extending under the tracks nearly 1000 ft. To facilitate the rapid transfer

ground railway tracks. The mechanism referred to had to be free of all possibility of causing delay in train movements or interfering with lines of sight on signals. In other words, a complex conveying machine had to be installed in waste underground space that had already been

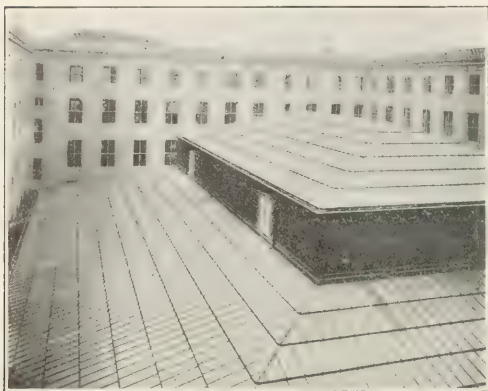


FIG. 2—UPPER SKYLIGHT OVER MAIN WORKROOM ON FIRST FLOOR, COVERING 33,000 SQ. FT. OF FLOOR AREA

of mail from point to point on the various levels and through the elaborate system of subways, a large number of electric motor trucks have been provided, each having a carrying capacity of 4000 lb., and plunger elevators between the different levels have been designed of sufficient size and capacity to raise and lower these trucks.

Such facilities, however, are not of themselves adequate to provide for the prompt handling and dispatch of the enormous quantities of mail—250 to 300 tons, comprising from 12,000 to 16,000 bags, weighing from a few pounds to 300 lb. apiece—which daily depart from and arrive at this station. Since the trains are moving quickly in and out of a very restricted underground trackage network, this immense mass of mail must be handled with great celerity.



FIG. 3—VIEW IN MAIN WORKROOM; 33,000 SQ. FT. OF FLOOR SPACE UNDER ONE SKYLIGHT

Therefore a mechanism had to be devised which would be not only capable and reliable in operation but would embody such dimensions as to go into a space cramped in the nature of things by the building structure itself—the latter being, virtually a monumental traffic gateway straddling the under-

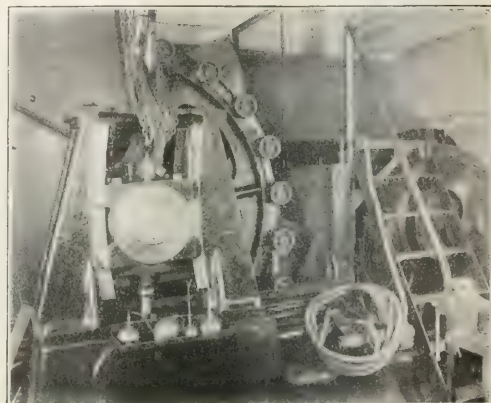


FIG. 4—BUCKET LIFT FOR ELEVATING INCOMING MAIL FROM PENNSYLVANIA RAILROAD TRAIN PLATFORM TO BUILDING

ground railway tracks. The mechanism referred to had to be free of all possibility of causing delay in train movements or interfering with lines of sight on signals. In other words, a complex conveying machine had to be installed in waste underground space that had already been

#### GENERAL DATA POST OFFICE BUILDING

Length of building north and south, ft.....	375
Length of building east and west, ft.....	335
Height from basement to roof, ft.....	109
Gross cubic contents of building, cu. ft.....	11,000,000
Total interior floor area, sq. ft.....	500,000
Area of mailing platform, sq. ft.....	9,800

The working zone for handling mail in the post office building comprises two narrow spaces on the first floor at



FIG. 5—STORAGE-BATTERY TRUCK, CAPACITY 4000 LB., SPEED 6 MILES PER HOUR

basement levels extending north and south and spanning the Pennsylvania Railroad tracks below reserved for the postal cars.

The railroad mail service, coincident with the operation of the Pennsylvania railroad and train service, began at

the new terminal on Nov. 27, 1910. Four train platforms and six tracks, providing for a maximum of twenty-six mail cars at one time, were set apart for the railway mail service.

Two classes of machinery are provided, one for handling

unloading mechanisms, which may be set opposite the door of any of the cars of the mail train, thus automatically unloading and transferring the mail through parabolic slides directly into any one of the mail cars for which the apparatus has been set. Two belt conveyors are provided over

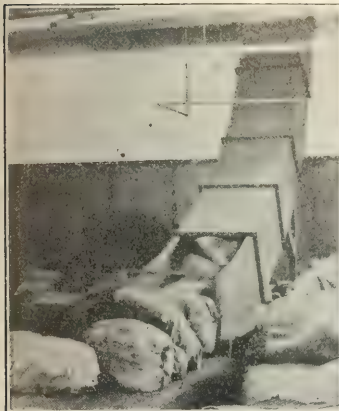


FIG. 6—NEWSPAPER SLIDE FOR CONVEYING BAGS FROM FIRST FLOOR TO BASEMENT

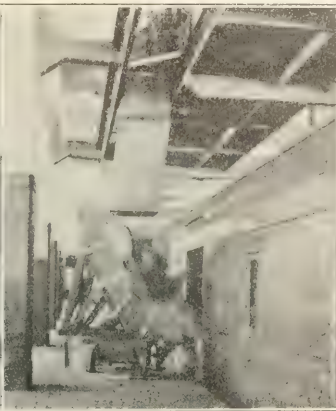


FIG. 7—CHUTE FOR DIRECTING THE MAIL INTO THE WAITING CARS



FIG. 8—BELT CONVEYOR OVER TRACKS FOR AUTOMATICALLY UNLOADING BAGS FROM BELT INTO CHUTE

the outgoing and one for handling the incoming mail. The mail to be dispatched on departing mail trains arrives at the station in wagons which are unloaded on the mailing platform. Here the mail pouches are sorted, some of them being sent to the basement level through spiral chutes, where they are opened and the contents re-distributed and

each of the four mail track platforms, one belt extending east and one west of the connecting spiral chutes, which are constructed with separate compartments, one for each belt. By this means two mail cars at each of the four track platforms may be loaded simultaneously by machinery.

The accompanying diagram gives a key to the arrange-

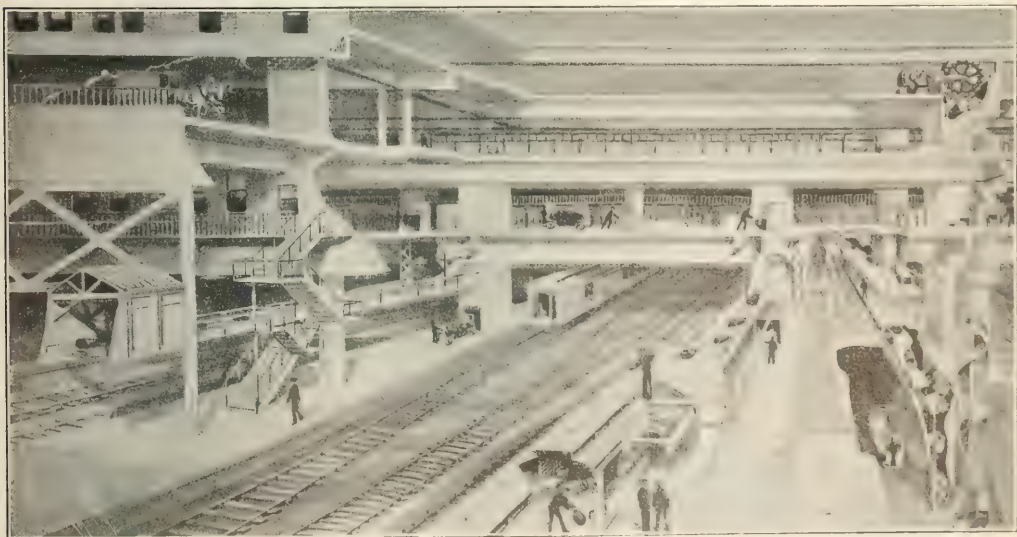


FIG. 9—GENERAL PICTORIAL SECTION OF THE MAIL-HANDLING INSTALLATION AND EQUIPMENT IN OPERATION AT THE PENNSYLVANIA TERMINAL

finally re-pouched. The reassembled pouches, together with the unopened pouches, are then fed into spiral chutes which deliver them to conveyor belts located over the track platforms and above the mail cars, and also to the trucking subways. The belts are provided with automatic trippers or

ment of the mail-handling machinery and shows a section looking east and a section looking north. Another diagram shows a side elevation and plan of belt conveyor and bucket lift for handling the incoming mail. The illustrations show the bucket lift for elevating the incoming mail from the



train platform to the basement and first floor of the post office building; the belt conveyor over the tracks for automatically unloading the bags from the belt into the chute leading directly to the cars; a view of this chute; a newspaper slide for conveying the bags from the first floor to the basement; a view of the assembly of the driving mechanism of the bucket lift, and a general view from the track yard at the rear of the post office building, showing the mail conveyor structures in process of erection.

The supports for overhead belt conveyors, driving motors, etc., are hung on the overhead framing of the post office building above the limits of train clearances, being so disposed as to avoid interference with lines of sight of train signals.

One of the salient features of the work was a fourfold system of spiral chutes. This system was grouped into double, triple and quadruple chutes, with single chute compartments designed for simultaneous loading at the different levels without interference.

The problem of designing suitable chutes was rendered extremely difficult by reason of the wide variation of loads, ranging from that of the small and practically empty canvas bag to a full bag of periodicals weighing as much as 300 lb. The spiral curves are so designed that the speed and certainty of delivery of bags of the two extremes in weight and size is regulated or controlled by centrifugal force.

There are eight overhead belt conveyors for outgoing mail. The motors for these are of the semi-enclosed type, designed for 650 volts direct current and arranged to secure a speed control of 20 per cent above normal speed by shunt-field control and a decrease of 20 per cent below normal by added armature resistance. The motors are capable of de-

Track platform No. 13: West belt, 192 ft. long (two belts in series), 10-hp motor; east belt, 60 ft. long, 5-hp motor.

Track platform No. 14: West belt, 192 ft. long (two belts in series), 10-hp motor; east belt, 60 ft. long, 5-hp motor.

The motors have drum-type non-reversible compound controllers, no-voltage, overload and push-button release fea-

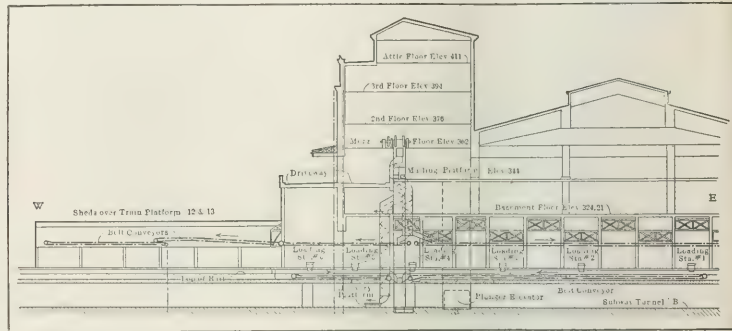


FIG. 11—SECTION OF POST OFFICE, LOOKING NORTH

tures. The individual motor drive for each of the belts consists of two reduction mechanisms between the motor and the conveyor belt-driving pulley. The first reduction mechanism between the motor and the countershaft consists of a Reynolds silent chain, and the second reduction between countershaft and driving pulley is made with spur gears. The entire drive is rigidly mounted upon the structural members supporting the conveyors. The bearings of the countershafts and the driving pulleys are of the self-aligning, ring-oiling type with renewable bronze shells and cast-iron pedestals. The spur gears are of cast steel with cut teeth of extra wide face, and the pinions are of forged steel cut from the solid. Beneath each motor is placed an oil-tight galvanized-iron drip pan.

A hand lever operates the controller for bringing each motor to the desired speed. In case of abnormal load on the motor due to too rapid starting or to the clogging of the driving mechanism, the overload release coil will cause a solenoid switch to be opened, and this switch will not close again until the controller lever has been returned to the "off" position. Push-button release stations are located along the gangway of the conveyor structure for the respective belts at intervals of approximately 40 ft. By pressing a button at any one of those stations, the release coil becomes energized and causes the main-line solenoid switch to be opened in the same manner as for the overload device. In the event of failure of the supply of energy the no-voltage release feature is brought into action, opening the main-line solenoid switch, which protects the motor from inrush of current should the supply be restored before the controller handle is moved to the "off" position. The only manual operation required is the setting of the motor-operated tripper and the insertion of its spout into the door of the car. The stream of pouches then pours in at the door of the car, there to be stored away.

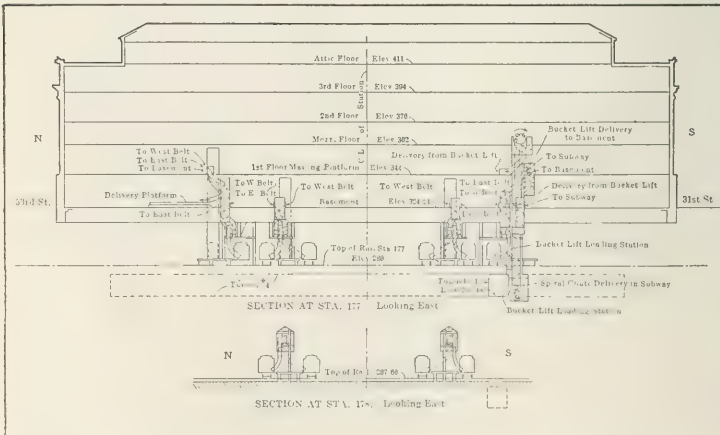


FIG. 10—ARRANGEMENT OF MAIL-HANDLING MACHINERY, NEW UNITED STATES POST OFFICE AND PENNSYLVANIA TERMINAL

veloping the following rated horse-powers when operating at a maximum speed of 20 per cent above normal:

Track platform No. 4: West belt, 73 ft. long, 5-hp motor; east belt, 185 ft. long, 7.5-hp motor.

Track platform No. 8: West belt, 65 ft. long, 5-hp motor; east belt, 195 ft. long, 7.5-hp motor.



The motor drive of the bucket lift includes a combination of spur and bevel gears, reducing the speed of the 650-volt, 50-hp motor from 150 to 4 r.p.m. for the head shaft and the main driving sprockets.

The bucket lift motor is equipped with a magnetic self-starting controller fitted with "no-voltage," "overload" and

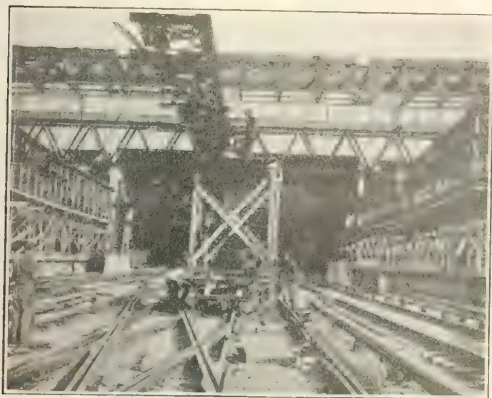


FIG. 12—GENERAL VIEW FROM TRACK YARD AT REAR OF POST OFFICE BUILDING, SHOWING MAIL-CONVEYOR STRUCTURES IN PROCESS OF ERECTION

"push-button release," one at the train-platform level and the other located near the motor.

In addition to the two operating stations mentioned, release push-buttons are located at the train platform convenient to the automatic loading stations for shutting down the machinery in case of emergency. Immediately above each of the manual loading stations and the loading stations of the bucket lift are installed U-shaped pivoted bars extending around the front and sides of the path of the buckets, so that any mail pouches protruding beyond the front edge or sides of the bucket will raise the bars, which in turn will close a switch connected with the push-button release circuit, thus shutting down the machinery and preventing damage to the mail sacks or machinery. The bucket elevator can handle 1200 bags an hour.

There are two sources of energy supply for operating the

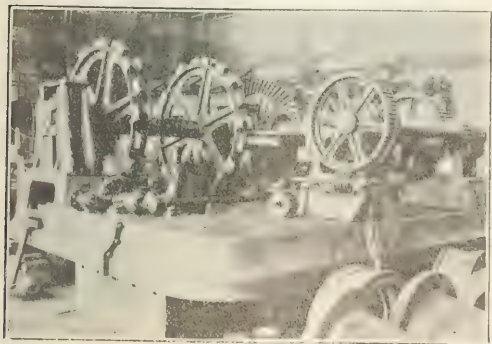


FIG. 13—ASSEMBLY OF DRIVING MECHANISM OF BUCKET LIFT

mail-handling motors, one consisting of separate feeders from the main switchboard in the power plant, terminating in a distributing tablet located in the transverse tunnel below the track level. This distributing panel is fitted with switches and separate feeders to each of the four groups of conveyor motors. The other source of supply consists of

a connection taken from the third-rail operating the train service, the feeder connecting to a distributing panel, on which is mounted a double-throw switch. This insures uninterrupted service for the conveyor motors.

#### Operation of Mail-Handling Equipment

Some idea of the speed of the mail-handling apparatus may be gained by watching the loading of one of the heavy Western mail trains which carries the early morning newspapers and steamer mail, together with an enormous quantity of first-class matter to Western points, amounting in all to 50 or 60 tons, comprising from 1500 to 1800 mail pouches. The mail for this train is unloaded from the wagons, much of it re-sorted and segregated for the different cars and dispatched from the station in less than three hours. Over 25 tons is handled during the last hour, the bags being frequently unloaded into the cars at a rate as high as sixty a minute. From the entrances in the spiral chutes the bags descend through the winding convolutions of the chutes continuing their journey along the rapidly moving belts, and finally emerge at the door of the car, almost noiselessly, the entire journey occupying about thirty seconds.

The average daily weight of mail loaded on the regular outgoing postal trains of the Pennsylvania Railroad and the duration of the loading periods are shown on the accompanying chart, each train being designated by its regular number. By reference to the chart showing the total weight of mail loaded and time of loading it will be seen that about

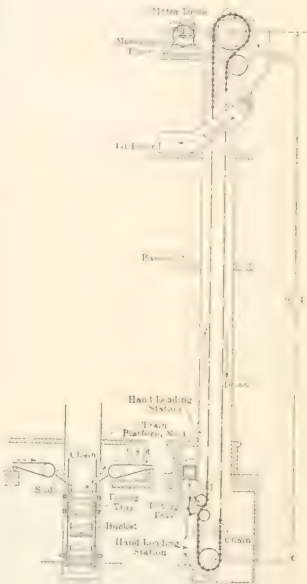


FIG. 14—FRONT AND SIDE ELEVATION OF BELT CONVEYOR AND BUCKET LIFT FOR HANDLING INCOMING MAIL

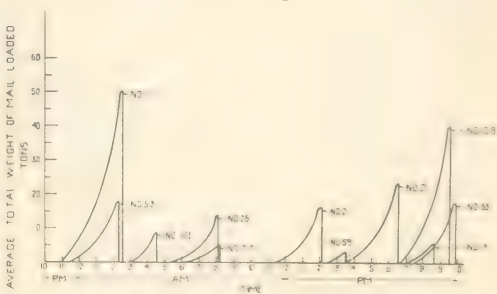


FIG. 15—CHART OF LOADS OF MAIL HANDLING MACHINERY

50 tons of mail are loaded on train No. 11 and during this period over sixteen tons are loaded on train No. 53. Simultaneous loading of mail aggregating over 60 tons also occurs on trains Nos. 19, 55 and 1019.

In a later issue will be given a description of the wiring, illumination and other features of the installation.

## Utilizing Electrical Energy in the Construction of Subway at Boston

The Boston Transit Commission is busily engaged at present in building a new double-track subway which will extend from the Charlesgate district in the Back Bay to the Park Street station of the Boston Elevated Railway Company's system, a distance of about 2 miles. When completed, the subway will establish an unobstructed entrance into the heart of the city for surface cars operating between Allston, Brookline, Brighton, Watertown and Newton and the business center. Stations are to be built near Massachusetts Avenue and at Dartmouth Street, and it is probable that the running time between the suburbs and Boston proper will in consequence be reduced by seven or eight minutes with the completion of the subway. In order that the present rolling stock may be used the subway is to be equipped for overhead trolley service. The Hugh Nawn Contracting Company of Boston is building the first three sections, which extend substantially from the intersection of Commonwealth Avenue and Beacon Street to the Boston Public Library, near Copley Square. Advantage being taken of the contractor's previous experience with electrical energy in the construction of the Cambridge subway (*Electrical World*, July 28, 1910, page 199), electric lighting and motor service is employed almost exclusively in the building of this very important addition to the Boston underground line.



FIG. 1—CONCRETE MIXING PLANT

Electrical energy is supplied by the Edison Electric Illuminating Company of Boston and by the Boston Elevated Railway to seventeen motors having a combined rating of 723 hp and to 2500 100-watt incandescent lamps which are in use in the work. The motors range from 1 hp to 200 hp in individual ratings and are in service on the three sections above referred to, which occupy a total length of about a mile. The average rating per motor is 42.5 hp. The applications include the operation of hoists, pumps, cableways, air compressors, woodworking and metal-cutting machinery and the driving of a large concrete-mixing plant. Reinforced concrete is extensively employed in the construction of the subway, and as the latter traverses residential and business districts of the highest class, the substitution of electric and pneumatic equipment for the ordinary steam-driven type machines has done much to minimize the noise, dirt, smoke and confusion usually associated with such extensive undertakings. With one or two minor exceptions, all machinery used on the work is either primarily or secondarily driven by electrical energy. The subway is being built by the "open-cut method," and a large part of the traffic ordinarily occupying Boylston Street west of Copley Square is being temporarily diverted to other thoroughfares. A large amount of excavated material is raised to the surface by electric cranes covering hatchways in the sidewalk or roadway, and as the forces of the contractor

frequently work twenty-four hours a day, the load has excellent characteristics from the central-station viewpoint.

### Contractor's Plant

All of the machines in use, with the exception of portable electric hoists and pumping equipment of moderate size, are located in the Charlesgate district. The field headquarters of the contractor are located at the so-called Beacon



FIG. 2—MOTOR OPERATING CONCRETE MIXER PLANT

Street yard, at the intersection of Beacon Street and Charlesgate East. At this point are situated a large concrete-mixing installation, a rod-cutting shop, blacksmith shop and bolt-cutting shed, and a woodworking plant. The mixing plant, shown in Fig. 1, has been arranged so that it may handle the material as economically as possible. It contains a belt conveyor gallery leading to overhead bins the storage capacity of which is 416 tons of crushed rock, 60 tons of sand and 90 tons of stone dust. The bins are located near the top of the frame structure shown in the background and discharge their contents into measuring hoppers connecting with a 1-cu. yd. concrete mixer. The outlet from this mixer is about 8 ft. above the ground, and from it wagons can be loaded easily. Stone, dust and sand received on the premises are dumped from wagons or motor trucks into a hopper installed at the ground level, over the belt conveyor. The belt ascends a 17.5-deg. incline, at 350 ft. per minute. Its width is 18 in. and its capacity is 60 cu. ft. of stone a minute. The installation also contains a vertical cement-bag conveyor running from the ground to a storage compartment in the building, from

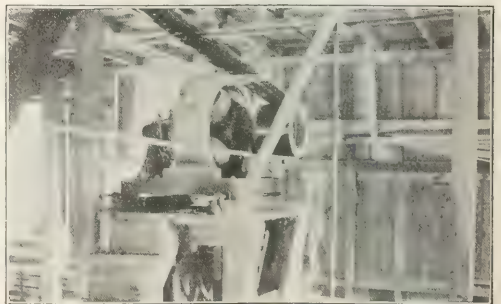


FIG. 3—MOTOR DRIVING CARPENTER SHOP

which quick deliveries can be made to the mixer. About ten bags a minute can be handled, and the storage capacity is about 1800 bags. The two conveyors and the mixer are all group-driven by a 35-hp, 550-volt direct-current General Electric motor running at 1200 r.p.m. The motor is located, as shown in Fig. 2, in a separate compartment and is mounted on a concrete foundation. It is belted to a main



shaft equipped with pulley and clutch connections by which any portion of the plant can be shut down without interfering with the remainder. The motor switch, starting box and fuses are located near the motor.

#### Auxiliary Shops

The carpenter shop contains a 12-in. joiner, a 24-in. planer, an 18-in. circular saw, band saw and grindstone,



FIG. 4—MOTOR-DRIVEN SHEAR AND PUNCH

which are group-driven from a main shaft and countershafts operated by a 40-hp, 550-volt Holtzer-Cabot direct-current motor running at 900 r.p.m. The motor is mounted on a platform 5 ft. above the floor, as shown in Fig. 3, and is equipped with a 14-in. pulley, from which a 7.5-in. belt drives a 42-in. main pulley in the center of the main shaft. Short stairs are provided to facilitate access to the motor from the floor. The starting box is mounted at the rear of the platform.

The bolt-cutting equipment consists of a No. 12 Greenfield bolt cutter housed in a small shed near the carpenter shop and driven by a 5-hp, 550-volt Westinghouse series motor. A short 4-in. belt is used, enabling the motor to be located in a corner out of the way of the operator. The blacksmith shop is provided with a forge blower driven through a 2-in. belt from a 1-hp, 550-volt General Electric motor running at 1500 r.p.m. The motor is located in a cabinet with a removable cover giving access to the commutator and brushes. Fig. 4 illustrates one of the rod-cutting machines which is installed in the open with a light covering overhead. Each machine consists of a combina-

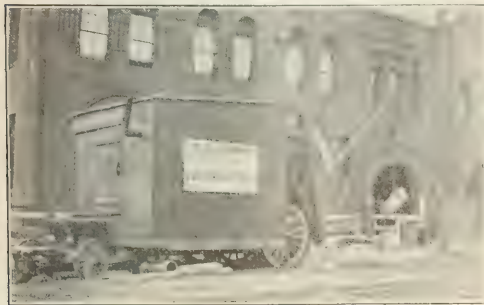


FIG. 5—ELECTRIC CRANE

tion shear and punch capable of dealing with a maximum of 2-in. stock and is gear-driven by a 5-hp, 550-volt General Electric motor operating at 1800 r.p.m. The two machines and the hand-bending equipment in use have handled over 32 tons of stock in eight hours. The motors are each provided with a starting rheostat having a no-voltage release. The lighting of the Beacon Street yard is provided by a

number of 100-watt incandescent lamps connected in series circuits of five each and supplied with energy from the same lines as the motors. Connection is made with one of the railway company's overhead feeders at the yard entrance, and a cut-out box containing a watt-hour meter fuse and main switch is placed between the feeder and the yard service. The ground return is connected from each motor to the regular negative conductors of the railway system.

#### Compressor Plant

The air-compressor plant, which is housed in small temporary buildings, is located at the intersection of Commonwealth Avenue and Charlesgate West, near the Hotels Somerset and Canterbury, in a neighborhood where a steam-driven installation would be highly objectionable. Two Ingersoll-Rand 22-in. by 13-in. by 16-in. compound compressors are installed in these buildings, in order that they may be out of wind and weather, and each supplies air at a pressure of about 100 lb. per square inch through a 6-in. delivery pipe to a tank 4.5 ft. in diameter and 12 ft. long, located immediately outside the building. Each tank is arranged to feed into a 4-in. main leading to the extreme eastern end of the work, about a mile distant. A main also leads from the tanks to the outlet of the subway about 500 ft. from the plant. The compressed air is used in the operation of hoisting engines, pumps, a Caniff grouting machine and portable tools located at various points in the field.



FIG. 6—ELECTRICALLY OPERATED CABLEWAY

Each compressor has a capacity of 1300 cu. ft. per minute at normal pressure and is belt-driven by a 200-hp, 550-volt, three-phase, 60-cycle General Electric induction motor of the internal rheostat type. The motors are installed on concrete foundations and operate at 600 r.p.m. The motor switches are of the oil type, mounted on the wall near each unit, and provision is made by means of a double-throw switch to supply energy to the motor from the regular Edison 440-volt service in case of failure of the other supply line. Normally energy is taken for this plant from the Boston Edison company's 13,200-volt, three-phase underground lines traversing the outer Back Bay. The transformer house, built for the contractor, contains two 20-kw oil-cooled transformers which reduce the potential from 13,200 volts to 2300 volts, and in a separate compartment, partitioned from the first by an asbestos-lined barrier, are 100-kva transformers of the oil-cooled type, which further reduce the potential to 550 volts for motor service. Watt-hour meters installed here register the entire motor load. A brick wing at one side of the temporary substation contains the cable terminal and high-tension oil-switch equipment, connection being made to the service mains through an adjacent manhole by a short temporary underground line. Two large ventilators are provided on the roof of the transformer house to facilitate the dissipation of heat, and a similar installation is in service on the roof



of the compressor room, with risers at the end of the building directly connected to the compressor intakes.

#### Electrically Driven Cableway

Near the compressor plant is installed a cableway 370 ft. long, which spans a small stream under the bed of which the subway passes. The cableway is used in hoisting and

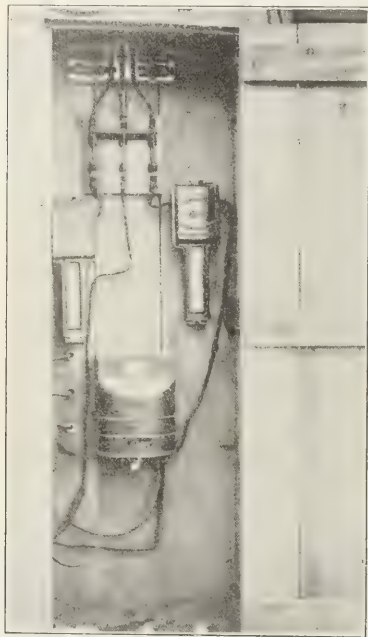


FIG. 7—TYPICAL DISTRIBUTION BOX FOR LIGHTING

lowering material, handling waste, etc., in a small basin between Charlesgate East and Charlesgate West which is difficult to reach with teams. The towers are about 40 ft. high, and on the cableway a traveling bucket of 1-cu. yd. capacity is operated by a 37-hp, 440-volt induction motor. The motor is geared to a hoisting drum and the equipment has handled a maximum load of about 5 tons, consisting of a boiler and engine for pile-driver service. Fig. 6 shows the motor housing and a portion of the adjoining tower.

Electrical energy is used in a permanent pump well near the bottom of the subway invert at Charlesgate East for the operation of pumps handling the drainage on each side of this point. The equipment, which is mounted in a concrete chamber above the well, consists of a 6-in. horizontal centrifugal pump directly connected to a 30-hp, 550-volt direct-current Westinghouse motor; a 4-in. centrifugal pump directly driven by a 15-hp, 550-volt direct-current General Electric motor, and a Warren steam pump operated by compressed air. The two motor-driven pumps are controlled by float switches attached to Cutler-Hammer starters. When the subway is completed the water from the well will be discharged into Muddy River and thence into the Charles River Basin. A 6-in. Lawrence centrifugal pump driven by a 40-hp, 550-volt direct-current Holtzer-Cabot motor is also installed in a pump house on the street near the permanent chamber to handle ground water, part of which is directed to a well to prevent it reaching the subway. Energy for the operation of the foregoing pump motors is normally supplied by the Boston Elevated Railway Company through a No. 4-0 tap containing a switch and watt-hour meter installed on the surface near the pump

well. An emergency connection is also made with the railway company's feeder lines near the Beacon Street yard, to be used in case of trouble on the railway system in the district supplying energy to the former feeder circuit.

#### Operation of Hoists

Near the site of the Massachusetts Avenue station of the subway two electrical hoists, one located on the surface of the highway and the other in a depressed area adjacent to the Boylston Street bridge over the Boston & Albany Railroad, are in operation. At the former location mentioned is a road derrick with an 18-ft. boom and is operated by a 22-hp, 440-volt, 60-cycle, three-phase motor. The latter is provided with a revolving boom 30 ft. in length and is operated by a 22-hp, 440-volt motor of the induction type. A bull wheel in the equipment is operated by 5-hp, 440-volt induction motor. A portable stiff-leg derrick is in use near Hereford Street and is operated by a 20-hp, 550-volt motor. Among the other equipment in this neighborhood are a radial jib hoist of 10-ton lifting capacity operated by a 20-hp, 550-volt direct-current motor on the hoisting drum, a 5-hp motor of the same type being used in turning the derrick on a vertical axis, and also a centrifugal pump, direct-driven by a 15-hp, 550-volt direct-current motor.

Energy is supplied for the operation of the induction motors and the cable hoist motors mentioned above from the Edison underground service. In some cases armored cables are used to convey energy from the nearest distributing center to the under side of the hoist; in other instances the feed is taken from a temporary overhead line carried along the side of the work. On the radial jib hoist the king-pin is equipped with insulated-contact rings and carbon brushes to facilitate the supply of energy while the machine is rotated. Fig. 8 illustrates the method used in carrying the three-phase, 440-volt motor circuit under the sidewalk at a point in the Charlesgate district where sheet steel piling driven below the surface made extra precautions necessary in handling the wires. The circuit is carried in a 3-in. suction hose, and the entrance of the leads is fitted with a temporary covering of tar paper to prevent the entrance



FIG. 8—POWER CIRCUIT AT TEMPORARY SIDEWALK CROSSING

of water. This 440-volt service is carried across the Muddy River basin by overhead lines of No. 4-0 cross-section.

#### Lighting

Emergency lighting is provided for on Boylston Street by a No. 6 feeder off which taps are taken at intervals to groups of five lamps. Energy thus used is metered by the

railway company at the point where the feeder joins the regular distribution system. The remainder of the lighting energy in the field is supplied from the Edison three-wire, 110/220-volt direct-current underground circuits, through switch boxes typified in Fig. 7 and containing the usual demand indicators, watt-hour meter switch and fuse equipment. Electric car-heating equipment is used in warming the interior of a temporary oil house. The energy consumption for the entire outfit of the contractor averages about 135,000 kw-hr. per month at present.

## Experiments with Umbrella Antenna

By JOSEPH O. MAUBORGNE

Recent experiments made at Fort Leavenworth, Kan., by Field Company D, United States Signal Corps, under the direction of Captain George S. Gibbs, Signal Corps, and with the assistance of the writer, with a view to determining the relative received strength of wireless signals, corresponding to various methods of setting up the umbrella antenna and counterpoise, resulted in the measurements given below.

The "regular antenna" and counterpoise system of the Signal Corps pack sets mentioned in this article consists of a four-wire antenna of the umbrella type, supported by a pole 40 ft. high, ribs of umbrella usually set up 90 deg. apart, each wire 85 ft. long, and connected by three insulators in series with a guy rope 150 ft. long, which is tied to a pin in the ground, thus guying the pole. When set up in this position the lowest ends of the antenna are about 18 ft. above the ground. The counterpoise consists of four wires of a special stranded cable, each wire 100 ft. long, rubber-insulated, laid upon the ground, outer ends insulated from ground and inner ends all joined electrically and connected to the sending apparatus by a short lead of the same insulated cable. Normally this counterpoise is spread out so that each wire of the counterpoise is directly under one of the antenna wires. It will be observed that this is not really a counterpoise but a capacity ground.

For the purpose of the measurements recorded herein (except in the last case, when only a hand generator was used) both storage batteries and small hand generators were alternately used as the source of energy for the sending set, which was the regular 1909 model Signal Corps pack radio set. This sending station was set up about 5 miles from the radio station of the Army Signal School, where there was installed in series with the telephone receivers of an inductive receiving set a fairly sensitive reflecting galvanometer, the deflections of which were considered to be proportional to the sound in the telephone receivers, since both strength of received signals and deflection of galvanometer are proportional to the square of the current through the telephone receiver and galvanometer respectively. No arrangement was made actually to measure the strength of the received current in these tests. With the sending station emitting constantly and regularly the American Morse signals "VL," the receiving observer took the average deflection over sending periods of three minutes for each test, deflections of the galvanometer being read at the end of each "L" made by the sending station. A Pyron detector was used at the receiving station, and its adjustment and the adjustment of the receiving apparatus to resonance were not varied during the tests on any particular day. Tests were made on two different days, and hence with two different adjustments of the detector, which accounts for the difference in strength of received signals obtained on different days.

Three different experiments were made in the following manner:

First: To determine the relative sending efficiency of the umbrella antenna and counterpoise system as a radiator, when used normally as described above, and again, every-

thing else remaining the same, when the counterpoise was rotated so that its horizontal projection made an angle of 45 deg. with the horizontal projection of the aerial wires.

Second: To determine the relative sending efficiency of an eight-wire antenna of the same natural period as the four-wire antenna.

Third: To determine the relative sending efficiency of a regular antenna and counterpoise system set up in the normal way, as compared with the same aerial when the antenna wires are guyed further out so as to result in a "flat-top" umbrella.

Fourth: The relative efficiency when the ends of the antenna wires of the normal set are lowered to within 3 ft. of the ground.

Case 1. Normal set-up. Four-wire antenna, outer ends of antenna wires 18 ft. above ground and counterpoise coinciding with horizontal projection of antenna wires. The average strength of signal (galvanometer deflection) was 11.62.

Case 2. Normal set-up except that each counterpoise wire was moved from its position directly under an antenna wire to a position half way between two adjacent aerial wires. The average strength of signal was then 13.2, or a gain of 14.45 per cent over Case 1. On July 9 another test was made, and an average reading of 7 was obtained for the normal set-up, against 8.43 as the average reading for the arrangement with counterpoise wires removed 45 deg. from the horizontal projection of the antenna wires. This was a gain of 20.4 per cent, or an average of 17.43 per cent, as the result of the two experiments.

Case 3. Eight-wire antenna on 40-ft. pole, wires each 65 ft. long. This gave the antenna system the same natural period as that of the four-wire antenna normally used. Length of supporting antenna, 170 ft.; height of lowest ends of antenna, 29 ft. A normal counterpoise was employed in the usual arrangement. The average strength of received signals was 13.32, or an increase over the four-wire antenna of Case 1 amounting to 14.63 per cent.

Case 4. Regular four-wire antenna and counterpoise, with normal set-up; height of outer ends of antenna, 18 ft. In this case the average deflection of galvanometer or strength of signal was 26. The outer ends of the antenna were then raised from 18 ft. to 40 ft. above the earth, making a four-wire umbrella "flat-top" aerial. Then the average reading was 39.3, or a gain of 39.6 per cent in the strength of received signals. The change in wave length was so slight that no change was made in the adjustments of the receiving apparatus.

Case 5. (Experiments made on second day.) The regular antenna and counterpoise using a normal set-up first gave 7.45 as average strength of signal. The outer ends of the antenna were then lowered from 18 ft. to within 3 ft. of the ground. After this change the average reading or strength of signal was 6.8, making a loss of only 6 per cent caused by the lowering of the outer ends of the antenna.

While the experiments were few and the data so meager as to make it impossible to obtain satisfactorily the operating characteristics for the sending end of this form of antenna, they show conclusively the advantages of the "flat-top" antenna over the umbrella type for sending as well as for receiving, which is pointed out in a paper on the operating characteristics of umbrella antenna,\* published in the *Proceedings of the A. S. T. C.* a little more than a year ago. The inference of strength of signal due to moving the counterpoise from its regular position is still a matter for thought, and no satisfactory explanation of it has yet been found. One of the causes for the small loss of energy due to dropping the ends of the antenna wires from 18 ft. to 3 ft. above the ground. Theoretically, if Dr. L. W. Austin's work is considered, the diminution should have been considerably greater.

\* "Operating Characteristics of Umbrella Antenna," by Mr. David Ingram.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Minneapolis General Electric Company's Aid to Santa Claus

For the holiday season the Minneapolis General Electric Company offered to loan without charge to any church or benevolent institution planning a Christmas festival between Dec. 15 and Jan. 5 a complete electric Christmas-tree lighting outfit. No restriction was made as to the size of the outfit to be furnished in carrying out this generous offer, but it was necessary, of course, that the building in which the celebration was held should be supplied with electric service by the company.

## "Ky-El-Co" Domestic Advertising

The Kentucky Electric Company of Louisville plans to have an electric incubator hatching broods of succulent "springers" with startling regularity as the January feature of its window display. Its commercial department is also distributing among tens of thousands of local householders a useful advertising novelty in the shape of a paring knife for the kitchen, suitably stenciled with an advertising legend. The purpose of the knife is, of course, to keep the advantages of "Ky-El-Co" light and heat for culinary purposes constantly before prospective and present consumers.

## City Taxes Water-Power Washers

Since Sept. 1 the city of St. Louis has taxed every water-power washing machine in local use at the rate of \$3 per year. Experiments recently conducted by the engineers of the water department showed that the actual cost of supplying water to such a washer three hours per week is about \$2.95 per year for the requirements of the average small family. As the result of the new yearly tax of \$3 on the hydrant-operated machines, electrically driven washers have been mounting in popularity more rapidly than ever. The motor-driven washers, of course, are free from the annoying drippings of the water-power devices and can be used any place where there is an electric-lamp socket.

## Reporting Election Results Over Central-Station System

Communities supplied with central-station service by the great system of the Southern California Edison Company, "from the desert to the sea," were informed of the results of the balloting on the night of the recent presidential election by prearranged "blink" signals which affected every lamp on the system.

According to the schedule which had been printed in advance in the local newspapers of the eighty-four cities and towns reached by the signals, two "blinks," each consisting of five seconds of darkness, meant "Wilson elected." Three blinks would have indicated a Roosevelt success, and four that Taft had been elected. The scheme was carried through with entire success, the two five-second interruptions being sent out as soon as the results of the election were conclusively known. Customers of the company's

service in all the eighty-four communities were in this way able to get the final returns at the earliest possible moment without leaving their own homes. Los Angeles, Santa Monica, Redlands, Pasadena, Beverly, Long Beach, Riverside, Venice and San Bernardino were among the principal places furnished with election results over the central-station lines.

## Filing Information on Houses Wired

For filing away data collected by its solicitors and appliance representatives concerning the wired and unwired houses in its territory a Southern central-station company has adopted the plan of having each building, wired or unwired, listed on a separate card. When the building is wired the left-hand corner of the card is clipped, and when connected the right-hand corner is clipped. These cards are filed in drawers by streets. The extending corners indicate the unwired and unconnected buildings, and these, of course, are the ones on which the sales force concentrates. The cards give valuable information covering points of interest to the central station. Index numbers across the top of the card are used in connection with metal markers to indicate appliance "prospects." For instance, if the marker is on the first space, it indicates a prospect for a flatiron; if on No. 15, a prospect for a washing machine, etc.

## Starting Things Moving in a Town of 4500

Central-station service in a Southwestern town of 4500 was formerly furnished by a local company which had no downtown office or commercial department, but transacted such business as it had at its plant, located nearly a mile from the center of the little city. The service was equally primitive in other respects. There was no day circuit, except on Tuesdays and Thursdays, and little effort was made to connect up new business.

Recently the property was purchased by a syndicate whose new local manager immediately realized the undeveloped opportunities in the little community and at once opened a downtown sales office near the business center. The new headquarters is an attractive place by day and brightly lighted by night. "Taking its own medicine," the company has installed a complete line of lighting equipment, appliances and motor-driven apparatus and invites the townspeople to make the office their headquarters.

Day service has been inaugurated, and motor "prospects" are being aggressively canvassed. Among the long-hour day loads in sight is the municipal water pumping, which will require a 20-hp motor-driven pump. Arrangements are also under way to install forty-eight five-lamp ornamental tungsten standards around the public square.

When the new office was formally opened personal invitations were sent out to everyone in the town. In one window a toast-eating contest was held; the other window contained an electric washing-machine exhibit. Food cooked by electricity in fireless stoves, chafing dishes, etc., was served to the guests, who also received souvenirs in the form of electric iron holders, ice picks, etc. During the evening a special moving-picture show was held at the local opera house. Besides two regular films, there was an exhibition



of two reels on electrical subjects, depicting the education of a householder in the use of modern domestic appliances. These films were loaned by one of the large electrical manufacturers. Every guest of the company who attended the office opening received a ticket for the moving-picture exhibition.

### Electric Truck with Trailer for Newspaper Delivery

The Detroit *News* publishing company is planning to employ a 1000-lb. trailer wagon in connection with its electric trucks for making city deliveries. The trailer will be used for hauling the papers for two of the distributing stations, being dropped off at the second station while the battery-driven car goes on about its rounds. Returning, the trailer will be picked up at the last station and brought back.

Five 3000-lb. cars, four 2000-lb. cars and one 1000-lb. electric delivery car are already in use by the Detroit *News*, as stated in a recent item in these columns. The company purchased its first electric car three years ago and has since operated its delivery service each day of every month. An average for the 1-ton car which is typical of the service is 1577 miles a month, the daily average being 51 miles. Energy costs about \$10 a month. An exact record is kept of the cars and an experienced man cares for them in the garage adjoining the printing plant. Energy and distilled water, as compared with oil and gasoline for a similar gasoline vehicle, cost less than one-half, based on the actual figures per mile. The *News* cars are among the busiest in Detroit and average 40 miles or more daily.

### Rate Schedules from the Customer's Standpoint

The advantages and disadvantages of various types of central-station rate schedules, from the standpoint of the solicitor approaching a prospective customer, were discussed by Mr. J. E. Bullard in our issue of Nov. 16, in an article entitled "Rate Systems from the Central-Station Solicitor's Viewpoint." Mr. Bullard brought out some of the prominent disadvantages of the older forms of schedule

information about rates in simple language and intelligible form frequently does much to gain public confidence and good will. The force of these statements is sometimes best illustrated by an example of how not to do it.

In a recent instance a central station serving a well-populated territory of considerable size had a new residence customer, who, in addition to using energy for lighting, also had an electric cooking range and a 2-hp motor. This customer was informed that the range and the motor would be served through a separate meter, under the so-called power schedule. But, desiring to keep a separate record of the cost of operating the range, he finally succeeded, after some trouble, in having separate meters installed for the range and the motor. When the first bills came in this customer was unable to check the bill for energy consumed by the motor, under the terms of his contract. Already somewhat irritated by the tactless treatment he had received from the company, he demanded an explanation. Instead of sending a solicitor to call on this consumer, the company mailed him a discount schedule, shown below, accompanied by a letter which neither explained the schedule nor answered his inquiry and only irritated him further.

This table of discounts was printed on a simple two-leaf folder bearing on the reverse sides the caption "Rate Schedule for Ideal Power" and a brief enumeration of the uses of electric motors for various purposes. It will be noted that the base rate is 10 cents per kw-hr., and it is also fairly evident that the second column gives the minimum monthly bill for different sizes of motor. But beyond these simple observations nothing is self-evident to the layman or consumer who possesses no technical knowledge. Let us suppose that our consumer received a bill as follows:

85 kw-hr. at 10 cents per kw-hr.....	\$8.50
Less 20 per cent discount.....	1.70
Net bill.....	\$6.80

It is quite evident that the basis of computation is a 10-cent rate, and that the monthly minimum bill for a 2-hp motor would be \$2, but an explanation of the discount is

DISCOUNT SCHEDULE—BASE RATE 10 CENTS PER KW-HR.

Hp.	Monthly Minimum.	10 per Cent.	15 per Cent.	20 per Cent.	25 per Cent.	30 per Cent.	35 per Cent.	40 per Cent.	45 per Cent.	50 per Cent.	55 per Cent.	60 per Cent.
1	\$1.00	\$3.37	\$3.78	\$4.18	\$4.50	\$5.25	\$6.00	\$6.75	\$8.25	\$9.75	\$12.00	\$16.50
2	2.00	6.74	7.50	8.30	9.00	10.50	12.00	13.50	16.50	19.50	24.00	33.00
3	3.00	10.11	11.25	12.45	13.50	15.75	18.00	20.25	24.75	29.25	36.00	49.50
4	4.00	13.48	15.00	16.60	18.00	21.00	24.00	27.00	33.00	39.00	48.00	66.00
5	5.00	16.85	18.75	20.75	22.50	26.25	30.00	33.75	41.25	48.75	60.00	82.50
6	6.00	20.22	22.50	24.90	27.00	31.50	36.00	40.50	49.50	58.50	72.00	100.00
7	7.00	23.59	26.25	29.05	31.50	36.75	42.00	47.25	57.75	68.25	84.00	117.00
8	8.00	26.96	30.00	33.20	36.00	42.00	48.00	54.00	66.00	78.00	96.00	132.00
9	9.00	30.33	33.75	37.35	40.50	47.25	54.00	60.75	74.25	87.75	108.00	150.00
10	10.00	33.70	37.50	41.50	45.00	52.50	60.00	67.50	82.50	97.50	120.00	165.00
11	11.00	37.07	41.25	45.65	49.50	57.75	66.00	74.25	90.75	107.25	132.00	181.50
12	12.00	40.44	45.00	49.80	54.00	63.00	72.00	81.00	99.00	117.00	144.00	198.00
13	13.00	43.81	48.75	53.95	58.50	68.25	78.00	87.75	107.25	126.75	156.00	214.50
14	14.00	47.18	52.50	58.10	63.00	73.50	84.00	94.50	115.50	136.50	168.00	231.00
15	15.00	50.55	56.25	62.25	67.50	78.75	90.00	101.25	123.75	146.25	180.00	247.50
16	16.00	53.92	60.00	66.40	72.00	84.00	96.00	108.00	132.00	156.00	192.00	264.00
17	17.00	57.29	63.75	70.55	76.50	89.25	102.00	114.75	140.25	165.75	204.00	280.50
18	18.00	60.66	67.50	74.70	81.00	94.50	108.00	121.50	148.25	174.75	216.00	297.00
19	19.00	64.03	71.25	78.85	85.50	99.75	114.00	128.25	156.75	185.25	228.00	313.50
20	20.00	67.40	75.00	83.00	90.00	105.00	120.00	135.00	165.00	195.00	240.00	330.00
		1.73	1.92	2.13	2.31	2.69	3.08	3.46	4.23	5.00	6.15	8.46

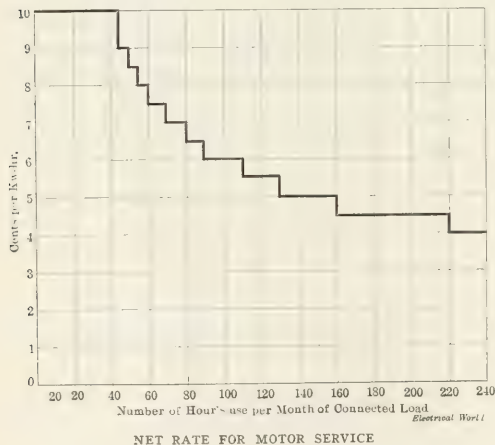
Note.—The figures on the line above indicate average hours run per day under full load at two-thirds efficiency.

and dwelt in particular upon the importance of approaching prospective consumers with tact and of taking care not to prejudice them by mishandling the presentation of a schedule. The consideration of rate systems and data from the point of view of a customer or layman is something to which every central-station manager and solicitor should give careful thought, because the presentation of

less simple. The question arises, Why is the discount 20 per cent, and is that particular discount the correct one under the terms of the contract? Of course, an expert would quickly see that the scheme of discounts is really equivalent to a rate which drops abruptly, step by step, from 10 cents to 9 cents, then 8.5, 8, 7.5, 7 cents, etc., to 4 cents as the lowest rate. An expert would also discover that

the figures in the row at the bottom of the table giving average hours of use per day, presented in awkward and unusual decimal values, are respectively equivalent, within a few cents' final difference, to 45, 50, 55, 60, 70, 80, 90, 110, 130, 160 and 220 hours per month (obtained by multiplying the average hours per day, given in the table, by 26, the number of active days assumed in a month). This net rate could then be represented by the curve shown herewith. This form of rate, incidentally, is open to the objections discussed by Mr. Bullard in connection with Figs. 1 and 2 of his article before mentioned.

Returning to the case of the consumer with a bill for \$6.80 for one month's energy, it is perfectly obvious that he could not translate kilowatt-hours to horse-power-hours, or vice versa, without knowing that 1 hp is equivalent to 746 watts or 0.746 kw. But there is still another factor present, because a motor yielding an output of 2 hp at the pulley would consume more than 2 electrical hp. If the commercial efficiency is 80 per cent at full load, the half-load efficiency will be somewhat less, and at quarter load still lower. Assuming 100 per cent efficiency and 55 hours' full-load use per month of a 2-hp motor, the total energy used would be 82 kw-hr. and the gross bill would be \$8.20. Looking in the table, we find a figure of \$8.30, which is



evidently the gross bill for such a motor used 2.13 hours per day (55 hours per twenty-six-day month). This indicates that the figures in the table stand for the gross monthly bill, taking the motor efficiency as 100 per cent and the horse-power equivalent as about 750 watts. If a 15-hp motor, for example, is used at full load 80 hours per month, the gross bill will be \$90, taking the horse-power equivalent as 750 watts; this checks the tabular bill for such a motor used 3.08 hours per day, or 80 hours per twenty-six-day month. It requires no argument to convince one that the average consumer could never check or understand the table without further explanation. Furthermore, the table is in error in every instance by the amount involved in disregarding the actual commercial efficiency of the motor.

According to the erroneous assumptions made in computing the table, the consumer's bill for 85 kw-hr. represents a 2-hp motor operated at full load for 56.7 hours during the month. Assuming, as a matter of fact, that the full-load efficiency is 80 per cent, the motor could have operated only 45.3 hours. Therefore the tabular values of the gross bill are all too low. The 20 per cent discount in the example we have used is explained after some study of the table. When the gross bill for supplying a 2-hp motor reaches \$8.30 the discount increases from 15 per cent

to 20 per cent, the last figure applying until the total bill reaches \$9, when it increases again to 25 per cent.

It would be preferable to state this rate schedule as follows: Minimum bill, \$1 per month per horse-power of rated motor capacity; monthly charge based on average use of connected load, each horse-power of rated motor capacity being taken as equal to 0.75 kw; unit rates given in the accompanying table.

UNIT CENTRAL-STATION RATE SCHEDULE

Use per Month of Connected Load.	Rate per Kw-Hr., Cents.
Under 45 hours	10.0
Over 45 hours and under 50 hours	9.0
Over 50 hours and under 55 hours	8.5
Over 55 hours and under 60 hours	8.0
Over 60 hours and under 70 hours	7.5
Over 70 hours and under 80 hours	7.0
Over 80 hours and under 90 hours	6.5
Over 90 hours and under 110 hours	6.0
Over 110 hours and under 130 hours	5.5
Over 130 hours and under 160 hours	5.0
Over 160 hours and under 220 hours	4.5
Over 220 hours	4.0

Stated even in the simplest and most direct manner, this schedule is not likely to be well understood, and it is the wisest policy to have it explained to new customers by personal interview in each case. The table given in the first instance is suitable only for the information of solicitors and should not be distributed in its present form to consumers. It is also very desirable to depart from any plan of expressing the monthly bill in terms of horse-power rating and hours of use, because the central-station service ends at the meter and consists of delivering electrical energy at that point, but not of delivering mechanical power at the motor pulley. The motor is the property of the consumer and responsibility for its operation, attendance and upkeep is his also. The simplest method of expressing a rate schedule is the best one, and none but the carefully prepared, least technical statements of rates should be placed in the hands of consumers or the public at large, with simple concrete illustrations of their application.

## Purchased Electrical Energy for All Nebraska State Institutions

According to a recent special dispatch from Lincoln, Neb., to the St. Louis *Post-Dispatch*, Nebraska has found state ownership of isolated electric plants undesirable, and the Board of Public Lands & Buildings has decided to contract with private electric-service companies to furnish energy to state institutions. The old isolated plants on the state properties will be closed and probably sold. The Secretary of State is reported to have said that the state-owned plants are operated at a loss and that energy can be purchased from private companies for less than it costs the State to produce it.

For years it has been the fixed policy of the State of Nebraska to install public-owned light, power and water plants in all state institutions. These plants have been under the direct control of the Board of Public Lands and Buildings. After years of trial, however, the present board has decided to go out of the business of making electricity and it is said that some contracts have been made already with central-station companies. Mr. Wait, Secretary of State, is reported to have said that the State will save considerable money by the change. In the past the state board has paid the higher cost of production in its own plants and the taxpayers have made up the difference. But it has been decided to execute two-year contracts with private companies at the lower rates which are available.

# Wiring and Illumination

## Standard Street-Lighting Fixtures for Chicago

Amended to comply more closely with the practical experience of the electric-service company, the ordinance providing for standard posts for electric street lighting in Chicago was introduced into the City Council of that city on Dec. 16, with fair prospect of becoming a law. For the purposes of the ordinance, street posts for electric lighting are divided into three classes—those used for commercial incandescent lighting, for downtown-district arc lighting and for outlying-district arc lighting respectively. The city electrician designates the "downtown" and "outlying" districts for arc lighting. The limits of these districts may be changed by him from time to time at his discretion.

One of the designs for street-lighting posts of Chicago made obligatory by this ordinance is shown by the accompanying drawings, which shows the standard post for commercial incandescent lighting. This refers to the ornamental or curb lighting paid for by merchants and in many cases installed and maintained by the Commonwealth Edison Company. It is provided that this post shall be of cast iron. Throughout the city except within the area bounded by Kinzie Street, Canal Street, Twelfth Street and Lake Michigan (that is, the "downtown district") the height of the post shall be such that the center of the lower globe shall be 12 ft. above the curb on which it is placed, while the upper globe shall be 2 ft. above the lower globe. In the excepted or "downtown district" the height of the post shall provide for lower globes to be 16 ft. above the adjacent curb.

Each post shall be equipped with five lamps. The upper globe shall be at least 12 in. in diameter; the lower globes shall be 9 in. in diameter.

An important provision of the ordinance makes it not applicable immediately to posts now installed. However, it is required that within six years from the date of the passage of the ordinance all lighting posts, either gas or electric, used for private and commercial purposes which are now standing and are lower or higher than 12 ft. to the center of the lower globes shall be replaced by posts of the prescribed height and design.

The posts in the "downtown district" and the "outlying district" for general arc street lighting are nearly, but not exactly, the same as those described in the article on "New Street Lighting in Chicago" in the *Electrical World* of Oct. 12, 1912, page 772. Some slight changes have been made by the special committee which prepared the present ordinance. The "downtown" post consists essentially of a tubular steel mast, a malleable-iron bracket, a cast-iron pole top and an ornamental cast-iron base. The height of the pole shall be such that the arc of the lamp shall be approximately 25 ft. above the level of the curb adjacent to which the post is placed. The mast consists of three sections of standard steel pipe, respectively 4 in., 5 in. and 6 in. in diameter. It is to be noted that it is planned to replace all

the existing city street-lighting lamp-posts in the downtown district of Chicago with the new design within a very few months. This will work a great improvement.

In case of posts for "outlying-district" arc lighting the height of the post shall be such that the arc of the lamp shall be approximately 12 ft. above the level of the curb adjacent to which it is placed. This post also is made of tubular steel mast, but in only two sections, respectively 4 in. and 5 in. in diameter. The ornamental base of the downtown post is lacking.

Provision is made for setting this type of post in concrete. In sandy soil the pole shall be buried to a depth of 5 ft., while in clay the depth may be decreased to 4.5 ft. and in rock to 2.5 ft.

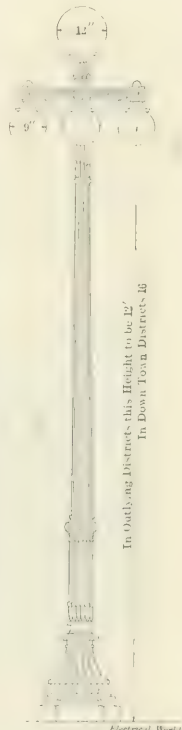
It is provided that all incandescent and arc lamps used for street lighting shall be equipped with approved diffusion globes "so constructed as to subdue the light intensity."

Hereafter no person or corporation shall erect any electric lamp-posts for commercial incandescent lighting or arc lighting within the city without first obtaining a permit therefor from the commissioner of public works. This permit shall be approved by the city electrician. Further, the permit shall contain an express provision that it is issued on the condition that posts erected pursuant to it shall be removed at once whenever the commissioner of public works shall order such removal. Blank forms are provided on which applications for permits shall be made, and a fee of \$2 must accompany each application. This amount must be paid before the application is issued.

One section of the ordinance provides that in places where the physical conditions or surroundings are such that a full compliance with the specifications of the ordinance are impracticable the city electrician may allow such variations as he may consider necessary. A fine of not less than \$20 or more than \$200 is provided for each offense in case of violation of the ordinance. Each day's maintenance contrary to the ordinance is considered a separate offense.

## Bracket-Arm Magnetite-Arc Lighting at Missoula, Mont.

Higgins Avenue, the 100-ft. main street of Missoula, Mont., is now lighted for a distance of nearly a mile by



STANDARD POST FOR  
CHICAGO STREET  
LIGHTING



FIG. 1. BRACKET-ARM MAGNETITE-ARC LIGHTING, MISSOULA, MONT.

6.6-amp magnetite arcs of the inverted type, carried on trolley-pole bracket arms at 100-ft. intervals along each curb. The ornamental standard used is a combination lamp and trolley post, 26 ft. high, with a round decorated base



7 in. in diameter. Trolley span wires are attached between the tops of the poles, the arcs being supported by 24-in. straight bracket arms 18 ft. from the street level. A mercury-rectifier outfit at the station of the Missoula Light & Water Company supplies direct-current energy for this series installation.

The erection of the Missoula ornamental lighting was



FIG. 2—NIGHT VIEW HIGGINS AVENUE, MISSOULA

facilitated, according to Mr. J. F. Derge, new-business manager for the local company, by the Montana state law which provides for the creation of special lighting-improvement districts. This law specifies that "the portion of the entire cost of erecting and maintaining posts and of the annual maintenance of lamps therein in such district, not less than one-fourth nor more than three-fourths, as shall be determined by the City Council, shall be borne by property embraced within said district abutting upon some portion of the street or avenue within such district to be lighted." To create such an improvement district requires the consent of 51 per cent of the abutting property holders, in



FIG. 3—"INVERTED" MAGNETITE LAMPS ON TROLLEY POSTS

addition to an ordinance passed by the local city government. The Missoula Light & Water Company, however, went even further in its initiative, offering to assume the entire expense of installation on the assurance of a three-year contract for the lighting. The proposition was accepted without opposition.

The standard set by the magnetite lamps is creating a

demand for better lighting generally, both in and out of doors. Agitation has already begun for extensions onto other streets and into the residence sections. The lamps have also brought the city considerable publicity. The bright lights make a good impression on travelers, as is evidenced by reports of passenger conductors on trains which pass through Missoula. Higgins Avenue forms the approach to the stations of two transcontinental railroads, and the brilliantly lighted street earns the compliments of passengers both by day and by night.

The unique design of globe employed to reduce the intrinsic brilliancy of the light source gives an excellent diffusion of white light, and with the equidistant spacing of the lamps affords even illumination over the entire area lighted. Although it might seem that the shadow of the standard would be cast on the sidewalk side, this is not noticeable on account of the illumination from windows, signs and other ornamental lighting. The greatest portion of the light from the arc lamps is, of course, thrown below the horizontal plane, but there is enough above to bring into complete outline all the buildings on the street.

## Notes on Underground Conduit Construction

By GUY F. SPEER

It is not intended that the matter given herewith shall be looked upon as an article on present-day practice in under-



FIG. 1—MOVING GAS MAIN TO MAKE ROOM FOR CONDUIT

ground-conduit construction, but rather as a collection of notes taken during the erection of an underground-conduit system in a New Jersey city with a population of about 23,000. However, the article does reflect modern practice, especially in the laying of fiber conduit, and the methods used are typical of those employed in many cities throughout the country.

### The Conduit Line

The trunk line extending through the principal thoroughfare and business section of the town consists of nine fiber ducts, laid three high, with 1 in. of concrete between ducts and a 3-in. envelope of concrete surrounding them. Extensions of four ducts, six ducts and eight ducts, are made in several of the side streets to manholes. From these manholes laterals extend to poles whence taps are made to the overhead wires.

The longest section is 530 ft. and the average is 285 ft. For purely transmission purposes the sections should run longer, but for distribution purposes a manhole should be built at every intersecting street at least.

At suitable intervals in the trunk line, depending, of course, on the length of the section and the demands for service connections throughout a block, distribution holes or

hand holes should be installed. On the other side of the street from these distribution holes other distribution holes should be built, and the two should be connected by a four-duct cross-over. (See Fig. 2.) In this manner both sides of the street are served without unduly long service pipes and without having to tunnel under car tracks or other obstruction whenever a new service is cut in. This method

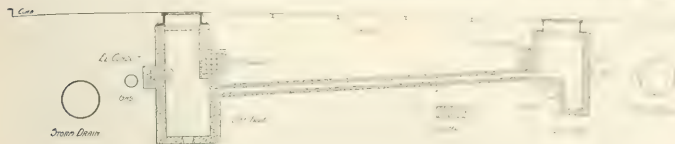


FIG. 2—TRUNK-LINE MANHOLE AND DISTRIBUTION HOLES

also eliminates overcrowding of distribution holes. These holes should be spaced on an average 120 ft. apart.

Before beginning excavation on the line described, test holes were dug from curb to curb, except under car tracks, at street intersections to determine upon which side of the street the main conduit line should be run, and also to discover if space were available for constructing manholes. These test holes were sunk about 7 ft. deep, and the exact location of all obstructions such as gas and water mains, sewer drains, railway and telephone conduits, etc., was carefully noted. In this case the space between the gas main and the railway conduit was not sufficient to permit the building of distribution holes and the main conduit line, and the 10-in. gas main was moved transversely from 2 ft. to 4 ft. for a distance of 1020 ft. The task, including excavating, moving the main, recalling joints, etc., occupied two weeks and cost about \$500. (See Fig. 1.)

The location of the conduit line being determined, a trench 22 in. wide and 43 in. deep was laid out to line and excavated. Theoretically a trench 18.5 in. wide is sufficient for a nine-duct (three-wide and three-high) line; but to permit a man to work in the trench the latter should be dug wider. The lower portion of the trench may be made nar-

row, however, and the depth depends on the nature of the obstructions encountered. A grade of 1 in. in 200 ft. is enough to allow for drainage into manholes. Care should be taken to avoid traps or water pockets in the conduit line. As the soil encountered in building the line in question was hard clay, no side-bracing or sheeting was necessary. Fiber duct (3.5 in. outside diameter and 0.25 in. walls) was

used throughout the work except in crossing through the road of city or large sewer, where 3 in. wrought-iron pipe was used. Fiber duct is light in weight, cheap, easy to handle and can be laid by installed labor. No attempt was made to waterproof the conduit, the concrete envelope forming only a support and protection to the duct. The socket joint was found to be more satisfactory than the sleeve joint, because the latter required more time to fit and the sleeves very often slipped down over the end of the duct, leaving an opening. After the trench was dug a 3-in. footing of concrete was put in, 1:3:6 mixture with 1/2-in. stone being used. On this footing the duct was laid on 4.5-in. centers, a "rake" being used for this purpose. Concrete was then rammed between the ducts and a 1-in. cover of concrete put on. This process was repeated until the top layer of duct was reached, when a 3-in. cover of concrete was put on. The trench was then refilled, tamped thoroughly and the street opening repaved. During construction care was exercised to keep the conduit as far as possible from the gas main so as to avoid danger

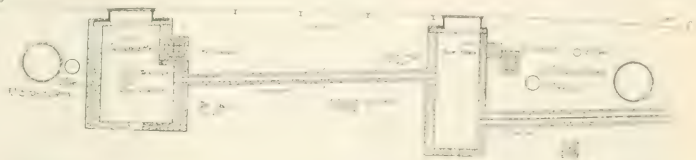


FIG. 3—CONDUIT AND MANHOLE CONSTRUCTION NEAR GAS AND WATER MAINS

of gas leaking into the line and manholes and ca explosions. Moreover, by this means danger of puncture the ducts when testing or "smelling" for a gas leak is also eliminated.

At street intersections, in the middle of long blocks and at sharp turns in the conduit line large rectangular concrete manholes were built. The sizes constructed were 5 ft. by 7 ft., 6 ft. by 8 ft. and 7 ft. by 9 ft., with 12-in. walls and 6 ft. clear depth. Plenty of head room was allowed so as to



FIG. 4—PLACING MANHOLE CASTING



FIG. 5—SEPARATING DISTRIBUTION CONDUIT FROM MAIN LINE

permit cablemen, splicers, etc., to work and to leave space for the installation of transformers. Monolithic concrete construction was employed throughout, a 1:3:6 mixture with 1 1/2-in. trap-rock and Portland cement being used. The concrete was put in quite wet and rammed thoroughly, especially next to the form, so as to give a smooth inside finish when the form was removed.

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The frames were made of shiplap, and the hard clay soil eliminated outer forms and sheeting. Section forms were not used, as these required the walls to be built and the form to be taken out before the roof could be put on. The walls and roof were constructed while the one form was in place, and after forty-eight hours this frame was taken apart and removed from the hole. On 5-ft. by 7-ft. holes four 7-ft. second-hand 4.5-in. car rails were used to support the manhole casting and to furnish the bond for the roof. In most cases, owing to lack of room, it was necessary to shelve under the railway conduit line (Fig. 4). In such cases a rail was placed at the corner of the shelf to take part of the pressure of traffic on the manhole head. Short pieces of fiber duct were plugged and placed in walls wherever future outlets might be required.

In building the manholes and distribution holes enough space was left between the walls and parallel gas and water mains to allow joints to be recaked. Circular cast-iron manhole heads with single cover were used, having inside diameter of 36 in. for large holes and 30 in. for distribution holes. A film of cast iron (about  $\frac{1}{8}$  in.) was left over the locations of perforations when the covers were cast. In time the traffic punctures these thin coverings and the cover becomes truly "perforated." Fig. 4 shows a large casting weighing about 1550 lb. being put in place. The manhole

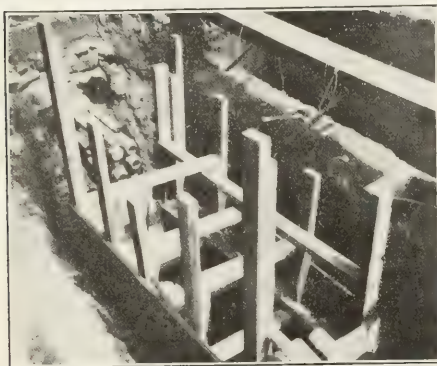


FIG. 6—CONSTRUCTING FORM FOR MANHOLE

heads were set to the grade of the improved street from data given by the county engineer. Monolithic construction is disadvantageous if a head has to be lowered because of street improvement. In such a case the roof of the manhole must be destroyed and the rails let down into the walls the required distance.

No attempt was made to waterproof the manholes, as this is useless unless the conduit line is also waterproofed. Sewer connections were not provided for draining the manholes; instead the water is pumped out when it is necessary to work in them. A cavity is left in the floor of the manhole with the object of facilitating the necessary pumping operations.

Fig. 3 is of interest, as it shows five different styles of underground conduit—fiber, single-tile, multiple-tile, "pump-log" and wrought-iron pipe.

#### Distribution Holes

Rectangular monolithic concrete distribution holes 3 ft. by 4 ft., with 6 ft. clear depth, 8-in. walls and 6-in. roof and floor, were standard throughout the work. Three ducts of the main line were cut in for distribution purposes, the remaining six ducts being used for transmission work, as shown in Fig. 1, which also shows construction in a nest of pipes (the distribution hole on the right). In this case it was advisable to extend the distribution hole down

between the water main and the gas main in order to provide standing room for workmen.

When no cross-overs are used it may be advantageous to cut in the top layer of duct and use only a shallow hand hole for distribution. Fig 5 shows the operation of separating the conduit for distribution work. It was advisable to keep the side wall between the separated duct so as to avoid any possibility of puncturing the duct when installing expansion bolts for angle irons, etc., later.

#### Services

For services 2-in. wrought-iron pipes were used, generally for three-wire distribution. For long services or where there were several bends to be made  $2\frac{1}{2}$ -in. pipes were employed. Care was taken in bending the pipes to avoid

#### COST DATA ON UNDERGROUND CONDUIT WORK

Time occupied, months.....	4
Average number men.....	40
Trench feet fiber conduit.....	9,802
Duct feet.....	75,700
Average cost per duct-foot (including Telford repaving, supervision and cost of duct).....	\$0.16
Service duct (wrought-iron pipe), feet.....	16,108
Cost of services per foot, average (includes cost of pipe).....	\$0.25
Distribution holes, 3 ft. by 4 ft. by 6 ft.....	52
Manholes, 5 ft. by 7 ft. by 6 ft. and 6 ft. by 8 ft. by 6 ft.....	39
Cost of distribution hole, average.....	\$48.00
Cost of manhole, average.....	\$152.00

kinks, as the latter make drawing in of service wires difficult. Generally right-angle "machine bends" were used. A No. 10 steel "drawing-in" wire was left in each pipe of any considerable length or one having more than one bend.

After the service wires are drawn in, the end of the pipe should be cemented or plugged with oakum and compound to prevent gas entering the cellar from the manhole.

Where a street is to be improved and the ordinance prohibits tearing up the street pavement for a period of years it is advisable to run pipes inside the curb to vacant lots and buildings where electricity is not at present used. In cases such as these an arrow is chiseled in the curb or sidewalk at the point where the service enters, the direction of the arrow indicating from which hole the pipe is run. With the aid of a record map and these marks a service can be readily "picked up." The service pipes were laid to drain into manholes or distribution holes.

In running services under patent concrete sidewalks it was convenient to use a trench jack or pipe jack to force the pipe from curb to cellar. This method saves time and leaves the sidewalk unharmed. In rocky soil, however, its advantages are doubtful, as a boulder will turn aside the steel nose screwed into the pipe, and the pipe will not strike the hole cut for it in the cellar wall.

In some cases because of obstacles semi-reamed-out couplings were used on bends, and when these are enveloped in cement mortar they are satisfactory.

## Letter to the Editors

### The Payment of Employees by Results—A Suggestion

To the Editors of the *Electrical World*:

SIRS:—One of the noteworthy political developments of the last ten years has been the increase in the socialist and socialist-progressive vote in all the large industrial centers of the world; and it seems to be acknowledged that this is due to the growing discontent of the working and salaried classes with the existing conditions rather than to any increased belief in socialistic theories. The sensational exploitation by the press of the mistakes and business methods of large corporations, the increased cost of living



and the growing feeling of helplessness in an unequal struggle are undoubtedly responsible to a great extent for the large silent following possessed at the present day by men like Eugene Debs, Lloyd George and August Bebel. It is true that the artisan's wage in the United States has increased appreciably during the last ten years, but he is inclined to feel that this increase has been granted by his employer only through fear of the strength of the unions. The income of the salaried classes has remained practically stationary. These latter have undoubtedly been under pressure, and, feeling it acutely, they have an ill-defined belief that they have not had their due share of the phenomenal prosperity enjoyed by the country during recent years. With such beliefs increasing and fermenting among the classes which should be the backbone of the nation, an economic or political upheaval would seem to be only a question of time, and the longer it is delayed the more violent it will probably be. The able, "stand-pat" policy of the conservative oligarchy that dominated England almost continuously for twelve years after the retirement of Gladstone has been finally swept aside by the wave of radicalism under Lloyd George, and it is possible the political life of the United States will experience an even more extreme change if the condition and feeling of the masses remain as they are at present.

The increasing power of the unions, the support they are receiving all over the world in spite of some of their unscrupulous actions, and the formation of societies for the protection of mutual interests among the salaried employees in some of the large manufacturing firms in Germany, together with the talk of similar developments in America, are surface indications of the growing indifference and even antagonism of their employees which the large corporations have felt for a long time. The pension systems introduced during the last few years by some of the large railroad and industrial interests and the selling of stock to employees under favorable terms have been among the first crude attempts to combat this growing evil in America. It would seem that the co-operative principle, by which the employees are at the same time the owners of the firm, should offer theoretically an ideal remedy for this discontent. But, although this system has been successful in a few cases, the impossibility of securing men of the necessary ability, character and standing for the management has resulted in a long series of failures. The holding of a few shares in the stock of a large corporation by its employees is of doubtful value, as it is seldom long before the employee feels that any additional effort on his part will have little effect on the prosperity of a large company. German firms have, in consequence of this, discouraged such holdings as having a tendency to introduce stock gambling among their employees.

On account of the severer competition and greater growth of socialism abroad, this question of the unsatisfactory relationship between the employee and the employer has been forced upon the attention of manufacturers in Germany to a considerably greater extent than has been the case in America. The remedy they have most generally adopted has been the introduction of a bonus system of payment of employees by results, combined with a system of old-age pensions, the intent of the latter being to give stability to the organization and to induce the employee to remain with one firm rather than to change whenever a favorable opportunity presents itself. The pension arrangement is a simple one to work out; but the payment by results is on the other hand very difficult, as the system of payment must be equitable to both the manufacturer and the employee, while the method adopted for judging of results must be such as to hold the confidence of the latter, who looks with distrust on any new proposition from his employer. With an artisan employed to a great extent on duplicate work, the question of payment by results is usually a simple one, and a piece work or premium system, if ably

and conscientiously administered, offers good possibilities when the opposition of the unions and the natural distrust of the men have been overcome. The amount of work produced by a mechanic can be readily determined and its quality examined at any time, if some adequate system of shop accounting and inspection is in force; but with the foremen, office force and salaried employees generally the proposition becomes much more difficult. These latter have in consequence been generally given, under such systems of payment by results, a bonus on the profits made or on the business done by the firm or by the department in which they are located. Such an arrangement works out well enough in a small concern where the management can be in close and intimate touch with the employees and their work, but for the large corporations which have grown up in recent years the results have been less satisfactory, as the size and complexity of the organization seem to render difficult any cordial relations or mutual understandings between the management and the employee.

It has been a disappointment to stockholders that the large manufacturing corporations formed during the last ten years have not been more successful. With their immense financial powers and with their sales policy facilitated by influential connections, it has frequently been found that the expected economies of manufacture were not realized, and that these corporations have at times had difficulties in meeting satisfactorily the competition of their smaller and more efficient rivals. It seems now to be recognized that the increase in size of a manufacturing concern beyond a certain point tends to lower its efficiency, on account of the increased complication and on account of the inevitable deadening effect of a large organization on the personnel. For this reason it appears probable that the large manufacturing corporation of the future will consist of a number of small factories, each complete in itself and manufacturing a single specialty. Such a decentralized organization, consisting of a number of small units, each with a system of payment of employees in proportion to the productiveness of their work, which would be judged by some unequivocal system in which the employees would have complete confidence, would undoubtedly result in a marked improvement in tone and would enable the firm to combine to a great extent the advantages of a large and those of a small organization. Under this system the employees would probably receive a comparatively small fixed cash salary, together with a bonus on the profits made by their particular factory, and once the organization was in operation, with the employees satisfied that the management was both able and willing to treat them fairly and liberally and to support a system of payment according to results, the success would in all probability be surprising. It would undoubtedly require time to carry out the details of such a system in any particular case, but the fact that the whole organization would have an incentive to work with the end in view would facilitate the mutual adjustment that would be necessary.

The introduction of any system of payment of all employees in proportion to the productiveness of their work, as a means of improving the tone and efficiency of a large organization, is undoubtedly a difficult problem; and it is hardly to be wondered at that the management is usually discouraged by the magnitude of the task and the opposition encountered from the conservative element. But the situation seems to be gradually becoming more acute, so that the growing discontent and socialistic feeling, with their effect on the political situation, on the one hand, and the comparative inefficiency of the average large organization, on the other, will in all probability before long convince the interests controlling the policy of the large corporations concerning the necessity that exists for pushing the introduction of some such system capable of producing more satisfactory results.

Pittsburgh, Pa.

WILLIAM L. WATERS

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Remedying Trouble Caused by Varying Voltage

Motors are often operated from street railway circuits on which there is a wide variation in voltage during the day, corresponding to the variation of the load on the street railway system. In one case a compound motor, rated normally at 550 volts, was used to drive a centrifugal pump taking water from a deep well to augment the water supply of a city. There was a variation of about 100 volts from the highest to the lowest voltage during the day at the panel controlling the motor. This caused the motor to run above normal speed on the higher voltage, and as the load on the pump corresponding to this speed was too large for the motor to carry, trouble was constantly experienced from the opening of the circuit-breakers. The load on a centrifugal pump under constant head is of such a character that a slight increase in the speed of the pump causes a large increase in the load on the motor. After making tests it was decided to increase the number of turns in the series field coils so that when the motor was running at normal voltage, and consequently at normal speed, more of the excitation would be supplied by the series field coils than formerly, and by placing a rheostat in the shunt field circuit, the excitation from the shunt coils was decreased, the total excitation remaining the same as before at normal voltage. When the higher voltage occurs the increased current has a greater effect on the field than formerly, owing to the greatest number of series turns, and the speed is not increased enough to change the load materially.

## Parallel Operation of Alternators with Composite Windings

By R. L. MOSSMAN

In general it is more difficult successfully to operate in parallel alternators having composite windings than any other type, and some experiences of the author in connection with working out a scheme for accomplishing such a condition may be of interest. The prime movers of the plant in question were two reciprocating steam engines with shaft governors which could not be adjusted while the engines were running, and the generators were of the 150-kw, 2200-volt, two-phase revolving-armature type directly connected to the engines.



FIG. 1—INDICATOR CARDS BEFORE CHANGES WERE MADE

The unequal division of the load on the two machines as they were at first operated is very well illustrated by the indicator cards shown in Fig. 1, card A being taken from engine No. 1 and card B from engine No. 2. At this time engine No. 1 had a speed variation from no load to full load of about 1 per cent, while the regulation of No. 2

was about 2 per cent. It was found that if each engine were allowed a wider variation the operation was more satisfactory, and the governors were accordingly set to give a regulation of about 4 per cent. In addition to this the dashpots on the governors were filled with an oil sufficiently heavy to prevent the engines from responding to the spasmodic surges in the load and still not heavy enough

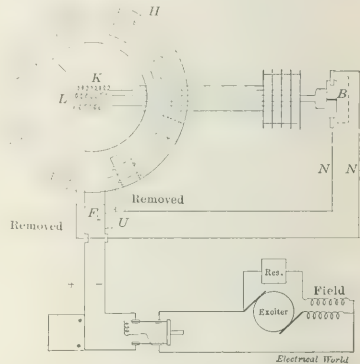


FIG. 2—DIAGRAM OF CONNECTIONS

to prevent their response to the bona fide changes that might occur. These changes greatly helped the operation but it was still unsatisfactory.

It was then deemed advisable to look into the electrical end of the equipment and see what changes might be made there which would be beneficial. In Fig. 2 one of the alternators and its immediate connections are shown diagrammatically. The compounding effect of the auxiliary field winding *H* in this type of machine is the same as the effect of the series winding of the compound-wound, direct-current generator. Thus when the load is increased the current in the primary winding of the series transformer *K* is increased and a greater current is produced in the secondary *L*. Since the energy from the secondary winding is taken through the commutator at *B* and after being changed to direct current is conducted to the auxiliary field winding through the leads *NN*, it is seen that any increase in load will in turn cause an increase in voltage, and a decrease in load will have the opposite effect.

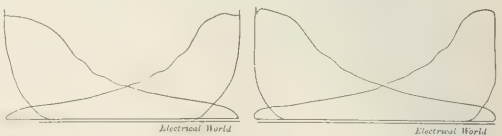


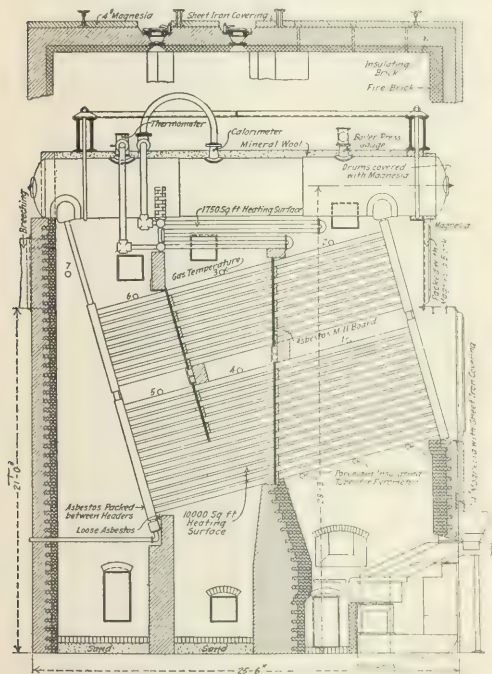
FIG. 3—DIVISION OF LOAD AFTER CHANGES WERE EFFECTED

As the exciters on the system were loaded to approximately only 60 per cent of their rating, it was decided to raise the brushes on the commutator *B* and place the composite field coils in series with the other winding, as shown by the dotted lines marked *U* and *F*. Following this the operation was highly satisfactory and any cross-currents

that developed could always be eliminated by proper attention to the governors. The indicator cards shown in Fig. 3 were taken almost simultaneously from the two engines after these changes had been made and when compared with those in Fig. 1 show how well the load has been equalized.

### Test of a 1000-hp Boiler Twenty-four Tubes High

Mr. B. N. Bump, of Syracuse, N. Y., presented an account of some tests run on a 1000-hp Babcock & Wilcox boiler, twenty-four tubes high, before the American Society of Mechanical Engineers, New York, Dec. 4, the investigation having been carried out to determine the advantages and disadvantages of using such an unusual height of tubes in a boiler of this type. The tests represented continuous operation in the regular service of a large plant, and they were continued from November, 1911, to



LONGITUDINAL ELEVATION OF 1000-HP BOILER

February, 1912. Among the points especially studied were the efficiencies at various ratings, the economy of the superheater when located above the twenty-four tube, effectiveness of the final boiler pass, and comparison of the exit-gas temperature with that of the steam.

A Foster superheater was placed between the top row of tubes and the boiler drums, and the gases entered the superheater after passing over twenty-four tubes. The superheat was found to go up with the boiler rating, increasing from 30 deg. to about 75 deg. Fahr. for a change in rating from 55 to 120 per cent.

The fuel was burned on a six-retort Taylor stoker having a grate area, exclusive of dump grate, of 62.5 sq. ft. One of the results of increasing the height of a boiler is a large ratio of boiler heating surface to grate area, which in this case was 160 to 1. Such a large ratio limits the capacity of the boiler, making it impossible to run at high boiler ratings.

The best combined efficiency, 81.3 per cent, was obtained

at about 56 per cent of rating. The efficiency decreases slowly with an increase in the boiler rating. The low rating tests show exit gas temperatures but little above the temperature of the saturated steam in the boiler. The radiation losses are low considering the exposed condition and the low atmospheric temperatures surrounding the unit.

### Choice of Motor Field Windings for Various Duties

In his paper on field coils, presented before the Association of Iron and Steel Electrical Engineers at Milwaukee, Oct. 1, Mr. R. B. Treat, of the Crocker-Wheeler Company, Ampere, N. J., included a tabulation of the different motor field windings best adapted for various classes of drive where the duty required of the motor is continuous, intermittent, uniformly loaded, or reversing. In several cases, as the following table indicates, a combination of shunt and heavy series would be preferable, but for practical reasons and continuity of service, entire series may be required.

Boring mill.....	Shunt
Car dumper.....	Dependent upon dumper design
Centrifugal blower.....	Shunt, or light series and shunt
Centrifugal pump.....	Shunt, or light series and shunt
Conveyor table.....	Shunt and light series
Continuous light friction.....	Series, or shunt and heavy series
Continuous heavy friction.....	Series, or shunt and heavy series
Reversing and intermittent.....	Series, or shunt and heavy series
Crane hoist, trolley and bridge.....	Series
Draw bench, continuous chain.....	Shunt and light series
Draw bench, reversing.....	Series, or shunt and heavy series
Drill press.....	Shunt
Hydraulic press.....	Shunt
Lathe.....	Shunt
One unloader.....	Series
Pipe threader.....	Shunt
Pipe welding.....	Shunt and light series
Planer, shifting belt.....	Shunt and light series
Constant speed.....	Shunt and light series
Adjustable speed.....	Shunt, or light series and shunt
Reciprocating pump.....	Series, or shunt and heavy series
Roll mill, feed tables.....	Series, or shunt and heavy series
Roll mill, screw down.....	Shunt and light series
Slayer.....	Shunt
Shear, with flywheel.....	Shunt and heavy series
With flywheel.....	Shunt and heavy series
And if sufficient friction.....	Series
Slitter, constant speed.....	Shunt and light series
Slitter, adjustable speed.....	Shunt
Straightener.....	Shunt and light series
Transfer.....	Series, or shunt and heavy series

### Employer's Right to Employee's Invention

Upon what ethical or legal grounds do some manufacturers base their rights to all improvements and inventions made by an employee who receives no compensation other than wages, even though the invention be conceived and developed outside regular working hours? It is said that some unscrupulous capitalists shrewdly contrive to sign a contract assigning to the firm without compensation all right to any invention made during the time of employment, and that this contract is binding even after the inventor has left the employ of the company. Such conditions seem discouraging to the production of improvements by employees and are hostile to the welfare of all human workers.

A. L. P.

It is difficult to state just what arrangement a company should make with its employees concerning inventions conceived by them. However, there can be no doubt whatsoever that if a person enters into a contract with a company to accept a certain amount of compensation for his services, and to assign to the company whatever invention he may make during his employment, he is bound both legally and morally to comply with his part of the contract just as the company is compelled to pay to the employee the amount of wages agreed upon. No one is compelled to enter into a contract with a company unless he at the time considers it advantageous to do so. Having once made the contract, he should live up to its provisions just as he expects the company to fulfil its part of the contract. It can hardly be agreed that the inventive employee will receive only bare wages, because if he has a real inventive instinct he will become of great value to his employer or to a competing employer, and his wages will be determined by this value rather than by the amount paid to an ordinary workman.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Armature Reaction.**—W. LULOFS.—A continuation of his mathematical article, illustrated by diagrams, on armature reaction in lap-wound machines. The circulating currents in a lap-wound armature due to unequal pole strengths are usually supposed to produce an armature reaction largely tending to remedy inequalities in the magnetic field. The author shows that only in the case of the four-pole machine is this counterbalancing true. This is in agreement with the fact that the four-pole lap-wound machine is superior to those having more poles.—*London Electrician*, Dec. 6, 1912.

**Induction Motors.**—E. BOULARDET.—The first part of a mathematical article on the calculation of the axle and the stator of induction motors of large diameter.—*La Revue Elec.*, Dec. 6, 1912.

**Speed Regulation of Small Motors.**—H. BARKHAUSEN.—An article illustrated by diagrams on the most suitable connections of the resistor employed for regulating the speed of small motors in laboratory practice within very wide limits.—*Phys. Zeit.*, Nov. 15, 1912.

**Vibrating Rectifier.**—W. A. BRACKETT.—An illustrated description of a simple device for mechanically changing alternating current of standard voltage to low-voltage direct current, especially for use with automobiles.—*Elec. Journal*, December, 1912.

### Lamps and Lighting

**Drawn-Wire Filament Mounting.**—A note on a recent British patent (No. 1180, Dec. 5, 1912) of T. W. Lowden. To support the filaments of incandescent lamps so that they may expand and contract without damage and may withstand shocks, the filament is formed into a zigzag, and a portion of the bends are then short-circuited so as to form a loop from the contact point. It may further, if desired, be twisted into a rope or may have its sides welded together. These loops may be bent over both at the top and base of the zigzag and the ends may be secured directly to the central glass support. If only one end is secured in this way, ordinary methods may be employed at the other.—*London Elec. Eng'g*, Dec. 12, 1912.

**Stability of the Electric Arc.**—G. W. ROOSE.—An article discussing the subject under the following headings: Normal arc, sustaining power, rigidity, abnormal arc, inherent properties, reducing stability, results produced by various forces acting upon the arc, action of several arcs on one another, action of magnetic fields.—*Elec. Journal*, December, 1912.

**Lighting of Industrial Establishments.**—A. J. AIRSTON.—The author first discusses the different items on which the design for an illuminating system depends, namely, the height or type of ceiling or roof, the class of work carried on in the location, the character of the surroundings, the area and shape of the location, the illuminating system to be replaced (if any) and the cost of the installation. He then gives some simple rules how to proceed in laying out the lighting system, and illustrates these rules by two examples from practice.—*Elec. Journal*, December, 1912.

### Generation, Transmission and Distribution

**The Grounding of the Neutral.**—An account of the extended discussion which followed J. S. Peck's British I. E. E.

paper, recently abstracted in the *Digest*, both in the London and the Manchester meeting. Mr. Brazil suggested that it is desirable to insert between the neutral and earth a resistor with a negative temperature-resistance coefficient. He described a resistor built up of seventy-two rectangular fireclay troughs containing carbon powder, arranged eight sets in parallel, each set consisting of nine in series and giving 200 amp with a fault. Mr. Partridge pointed out the desirability of providing a definite metallic path back to the generators, when the outer of a high-tension cable is grounded at the station and the middle point of the transformer secondary is grounded at the substation. If a spark-gap is provided at the distant end of the high-tension line, between the outer and earth, then, in the event of a connection between the primary and the secondary of the transformer, there will be a metallic return by way of the spark-gap, obviating the necessity which would otherwise exist of a considerable current through the ground to the station. Mr. Partridge, following the single-phase practice, grounds one phase of his three-phase system throughout. Mr. S. L. Pearce said that at Manchester they started in 1901 with ungrounded neutrals and that the arrangement continued to the present day. The problem had not been studied then as now, and it is, no doubt, considered that the insulated system is safer and that it offers the possibility of running with one phase grounded. This has been borne out in practice. Under present conditions, however, there is nothing to choose between one system and the other at Manchester, and it has been decided to ground the neutral at an early date in order to limit the current to earth. As there is 45,000 kw at Stewart Street, behind a fault, the switch which interrupts the circuit is subjected to severe treatment. He proposed to combine grounding through a high-resistance resistor (giving about 100 amp) with balanced protective gear. The resistance would be proportioned to allow sufficient current to trip the largest circuit-breaker. Mr. J. S. Peck, in closing the discussion, asked whether there is any change in the resistance of the carbon resistor referred to by Mr. Brazil and was informed that there is not. In many cases, he said, manufacturers are able to make considerable reduction in cost of apparatus where grounding is adopted owing to the limit voltage, but he does not favor this, because apparatus should be capable of working ungrounded if necessary. In regard to overhead lines, if it is only a case of a pierced insulator, he saw no reason why the line should not be grounded at the station and run. In the case of a low-voltage system it does not matter whether one phase or the neutral is grounded, but with a step-down transformer it is better to ground one phase than to work ungrounded. The tendency on very high-voltage systems seemed to be toward insulated neutrals and the use of delta-connected transformers. He thought it doubtful whether grounding should be adopted with the 200-volt or 400-volt supply systems in large industrial works, as it is necessary to keep going and impossible to shut down for temporary grounds which frequently occur.—*London Elec. Review*, Dec. 6, 1912.

**Peat.**—J. TEICHMUELLER.—A continuation of his paper read before the German Association of Electrical Engineers on peat and electrical engineering. The author describes the electric transmission plant in Ostfriesland, Germany, making use of large peat deposit. There are three turbo-generators, two of 1250 kva each and one of 1550 kva. The

author begins describing the methods of mining the peat.—*Elek. Zeit.*, Dec. 12, 1912.

**Determination of Capacities.**—J. W. WOODROW.—A mathematical paper on the determination of capacities by means of conjugate functions. Among the problems solved is the determination of the capacity of a three-phase overhead system in which the wires are arranged so that they are on the corners of an equilateral triangle and the determination of the capacity of a three-core cable of the clover-leaf type.—*Phys. Review*, December, 1912.

### Traction

**Future of Electric Traction.**—H. LABOUR.—In an article on the future of electric traction the author says that the three-phase system has probably only a very limited future. The fight is between the high-tension direct-current system and the single-phase system. The latter has made rapid progress in recent years and seems destined to still greater development. The author thinks that for distances up to 40 km (24 miles) the direct-current high-tension system may be recommended. For longer lines the single-phase system has no competitor.—*La Lumière Elec.*, Dec. 14, 1912.

**Gasoline-Electric Automobiles.**—A note on a recent British patent (No. 2817, Dec. 5, 1912) of MacFarlane Engineering Company, Ltd., and W. A. MacFarlane. There are two direct-current machines with their armatures in series. One member of the primary machine is coupled to the prime mover and the other to the driven shaft. On the auxiliary machine one member is coupled to the prime mover and the other is fixed. Exciting windings on the poles of both machines are so connected that the voltage produced in each armature acts in the same direction round the main circuit. There are series windings on the poles of the auxiliary machine so arranged that the voltage due to them opposes that due to the exciting windings. The mid-point of the series-connected exciting windings is brought out for the purpose of reversing one of them.—*London Elec. Eng'ing*, Dec. 12, 1912.

**Interpole Motors.**—LEHRMANN.—A French translation of his paper presented before the German Association of Tramways and Light Railways on the results obtained with interpole motors in actual traction.—*La Houille Blanche*, November, 1912.

**Electrification of Main Lines.**—The first part of a long paper on the electrification of trunk railroads. In the present instalment the author discusses the different systems and expresses himself in favor of single phase.—*London Electrician*, Nov. 30, 1912.

### Installations, Systems and Appliances

**Mixed Private and Municipal Stations.**—RICHARD PASOW.—While in Germany public opinion was formerly very much in favor of municipal ownership there has been a change in recent years. Privately owned plants are again increasing in number. But the most significant development is the evolution of the mixed private and municipal plant. The first case was the Rhenish-Westphalian Electricity Works in Essen. Since 1902 this station has undergone a steady and rapid enlargement, and when it undertook to acquire all the street railways in the industrial district in the neighborhood the cities and counties concerned decided to acquire some stock in the electricity works. This was done by three cities and eleven counties, each of them having a representative in the board of directors. A sketch is given of other mixed private and public stations. In some of them the city is the majority stockholder, in others the majority of the stock is held by private parties. Most cities and counties are chiefly interested in having a representative in the board of directors, while the business management and the executive officers are left to the private parties. The author thinks that the mixed private and public electricity works will become even more important in the future.—*Elek. Zeit.*, Dec. 12, 1912.

**Italy.**—An editorial on the enormous development of the electrical supply industry in Italy during the last few years. From 1899 to 1908 there have been built in Italy 3364 new stations with an aggregate rating of 436,000 kw. At the end of 1908 there were in operation in Italy 6750 stations with a total rating of 510,000 kw, of which 360,000 kw was furnished from water-power. In contradistinction the manufacturing electrical industries have not developed to a similar extent in Italy. Out of 5953 stations installed in ten years, 3329 stations were equipped by foreigners, especially by German firms. Some general questions relating to this situation have been discussed by Legouez, who concludes that the chief disadvantage of Italy as a manufacturing country is that it is obliged to buy some of the most important raw materials, especially iron, from foreign countries. Sixty-seven per cent of the value of the electrical imports to Italy comes from Germany, only 5 per cent from France. This is thought to be due to the influence which Germany has on the banks and financial institutions of Italy.—*La Revue Elec.*, Dec. 6, 1912.

**Tariff.**—BERKOVITZ.—In view of the many advantages of the flat rate the author thinks that the following limiting device made by a German company will be found suitable. It limits only the watts used for lighting, but the momentum of inertia of the movable armature is so chosen that it prevents the lighting current exceeding a predetermined amount, though it does not prevent the use of cooking and heating apparatus. For instance, if this limiting device is adjusted to 100 watts for lighting it is nevertheless possible to use 300 watts and more for cooking and heating. When the lighting current is using the heating and cooking apparatus cannot be used.—*Elek. Zeit.*, Dec. 12, 1912.

**Argentina.**—A. H. GIGGINGS.—The first part of a statistical article on the industries and industrial conditions in the Argentine, giving data of imports from different countries and tables of various industrial works and factories in the Argentine.—*London Elec. Review*, Dec. 13, 1912.

### Electrophysics and Magnetism

**Volta Effect.**—F. SANFORD.—The fundamental question as to the nature of the Volta effect seems to be whether the different metals when in electrical contact with the earth or with the inside of the same hollow conductor are still at different potentials relative to each other, or whether the potential difference which may be observed between two of them when they are brought very close together is due to some kind of electrolytic polarization in the medium between them. The author describes a series of experiments from which he concludes that the Volta effect is not due to any electrolytic action between the opposed metals, but different metals when in contact with the earth or with the inside of the same hollow conductor may be at different potentials relative to each other.—*Phys. Review*, December, 1912.

**Magnetic Resolution of Fine Spectral Lines.**—**Vacuum Arc Lamp.**—C. H. WANI-MOHAMMED.—An account of an investigation in which the author studied the Zeeman effect exhibited by certain fine lines of bismuth, cadmium, thallium and zinc. For this purpose he used a modified form of Janicki lamp and an excellent echelon spectroscope. The general conclusions are as follows: It was found that the Janicki type of oxide cathode lamp gave very fine, intense satellites so that it became an excellent source for studying the Zeeman effect. A few satellites were investigated for the first time. Some of the satellites were resolved by the magnetic field into three, four, five, six and even nine components. In general, the separation was proportional to the magnetic field strength. One comparison line of cadmium  $\lambda = 4800$  gave an extraordinary type of resolution. Another satellite of this principal line showed that the line of displacement changed as the intensity of field was increased. The cadmium line  $\lambda = 4678$  has satellites which are visible in the magnetic field but

which cannot be seen under ordinary conditions. The bismuth line  $\lambda = 4722$  has a very complicated structure, and two of its satellites suffer a magnetic displacement which is proportional to the square of the field strength. Finally, the author found that the resolution of sufficiently fine lines could be measured in very weak fields, such as 300 gauss.—*Ann. der Physik*, No. 11, September, 1912; abstracted in *Amer. Journal of Science*, December, 1912.

**Weight and Charge of Condenser.**—P. G. AGNEW AND W. C. BISHOP.—An account of an experimental attempt to detect possible changes in weight or momentum effects on charging a condenser. The results are negative and are summed up as follows: Charging a 10-mf condenser to 240 volts was found not to change its weight by as much as 0.01 milligram, or one part in 100,000,000. In charging and discharging the same condenser no momentum effect having opposite signs on charge and on discharge as great as 0.01 dyne-second was detected. Similarly no momentum effect having the same sign on charge and on discharge as great as 0.0004 dyne-second was detected.—*Phys. Review*, December, 1912.

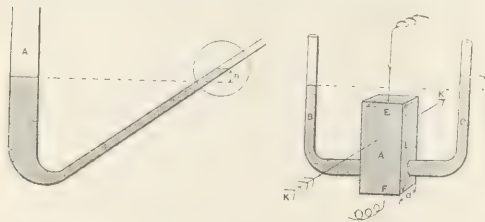
**Two Spherical Electrodes.**—G. R. DEAN.—A mathematical paper on the potential and electrostatic force in the field of two metallic spherical electrodes.—*Phys. Review*, December, 1912.

### Electrochemistry and Batteries

**Electric Furnace Electrodes.**—A note on a recent British patent (No. 14,267, Dec. 5, 1912) of the Planiawerke. The metal core and the electrode bore are so adjusted that the contraction during solidification of the metal or alloy cast in the bore causes the metal to be firmly pressed against the surrounding wall of the electrode.—*London Elec. Eng'ing*, Dec. 12, 1912.

### Units, Measurements and Instruments

**Measurement of Magnetic Fields.**—P. H. S. KEMPTON.—An illustrated article on various methods of measuring magnetic fields. The author first discusses magnetic methods—(a) magneto-metric methods in which deflections and oscillations of magnetic needles are observed; (b) a second magnetic method, that of Quincke and Dubois, which depends on the variation of pressure at right angles to the right of forces with the permeability of the medium. Fig. 1 illustrates the



FIGS. 1 AND 2—METHODS OF MEASURING MAGNETIC FIELDS

principle of the method. *A* is a V-tube containing a liquid of known permeability; Du Bois used nickel sulphate and water. A magnetic field is applied to the narrower limb, so that the lines of force pass parallel to the liquid surface, some in the liquid and some above it. The pressure at right angles to the lines of force, and hence at right angles to the surface of the liquid, is  $\mu H^2/8\pi$  in the liquid and  $H^2/8\pi$  in the air above. The difference of pressure  $(\mu - 1)H^2/8\pi$  causes the liquid to rise in the narrow limb until equilibrium is established; that is, when  $(\mu - 1)H^2/8\pi = h\rho g$ . By tilting the tube as shown in Fig. 1 and reading the elevation of the column by means of a microscope, Du Bois rendered this apparatus more sensitive and capable of measuring fields of strengths from 500 to 10,000 gauss, with an error of less than half of 1 per cent. The second class of methods uses electromagnetic effects: (a) The induction of current

in a conductor moving in a magnetic field is used in the earth inductor and search coils. (b) The motion of a conductor carrying current in a magnetic field is used in the instrument shown in Fig. 2. The force exerted by a magnetic field of strength *H* on a conductor of length *L* carrying a current of *C* c. g. s. units is given by the product *HCL*. The central rectangular cistern *A* is connected to side tubes *B* and *C*; all contain mercury. Current is led in at the top of *A* by an electrode *E* and passes out at *F*. The magnetic field is applied across the cistern, as shown by the arrows *KK*. The resulting force on the conducting fluid (*HLC*) is transmitted to the side tubes, and the mercury rises in one of them until equilibrium is reached; that is, when  $HCL = h\rho g\delta L$ ; where  $\delta$  is the density of mercury, *g* the gravitational acceleration, and *L* the section of the mercury perpendicular to the magnetic field. (c) The variation of electric resistance with magnetic field intensity is used in pure bismuth wire coils. Finally, optical methods are considered. In summing up the author thinks that the electromagnetic effects are the most fruitful of practical methods for measuring magnetic fields of all strengths, and that the search coil and bismuth coil are the most likely to serve practical purposes satisfactorily. Finally, a few notes are given on the measurement of rapidly changing field intensities.—*London Elec. Review*, Dec. 13, 1912.

**Telephone Receiver in Alternating-Current Zero Measurements.**—PHILLIPS THOMAS.—A paper in which the author describes a method of employing the watchcase telephone receiver in the comparing of capacities by the alternating-current bridge method. The use of this scheme does away with the difficulties ordinarily encountered in attempts to use the receiver in this way. The success of the method is due to the fact that the human ear is much more sensitive to a noise or sound of very low frequency, in the presence of a barely audible note of high frequency, than to the latter alone. By this method, which is here denominated the "method of beats," such a receiver may be used to balance an alternating-current capacity bridge (1) on frequencies too low to affect the ear sensibly and (2) in cases where the time-constant balance is a function of the current strength in the bridge circuit. Simple means are suggested for the ready application of the method to commercial as well as to laboratory measurements.—*Journal of the Franklin Inst.*, December, 1912.

### Telegraphy, Telephony and Signals

**Three-Plate Condenser.**—E. GRUENEISEN AND E. GIEBE.—An article on the determination of the dielectric constants of solid insulators, like porcelain, etc. With a two-plate condenser certain precautions are necessary and several corrections must be made. With a three-plate condenser, for the capacity of which a new formula is given, fewer precautions are necessary and the corrections are also smaller.—*Phys. Zeit.*, Nov. 15, 1912.

**Submarine Telephone Cables.**—J. G. HILL.—The conclusion of his long paper on the loading of submarine telephone cables giving a comparison between Pupin-coil-loaded and continuously loaded cables. Tables and diagrams are given showing comparative costs. According to the author it appears clear that a coil-loaded cable is of greater electrical efficiency and therefore is to be preferred to a continuously loaded submarine cable, if it can be satisfactorily maintained. It follows from the nature of the case that it is not possible to state absolutely the life of such a cable, and this is, of course, a necessary consequence of its recent introduction, but the Anglo-French loaded cable has now been immersed nearly two and one-half years and has not yet required any attention whatever. The Anglo-Belgian cable also has not been interrupted since it was handed over to the post office authorities by the contractors. Those who have the greatest knowledge of the design of such cables, moreover, do not anticipate any exceptional difficulty in the future. So far as continuous loading is concerned, con-



siderable attention has been, and doubtless will continue to be, devoted to its development, but even if it be assumed that material progress is made, now or at an early date, the increase in the diameter of the conductor brought about by the iron wrapping, and the necessity for an increased weight of gutta percha as compared with a coil-loaded cable, would in any case appear to be a serious drawback. The type of continuous loading examined in this paper, that produced by the Telegraph Maintenance & Construction Company, represents good work in that direction, inasmuch as the speaking range of the cable so loaded was rather more than doubled as compared with an unloaded cable. It will, however, be necessary to decrease the ratio of resistance to inductance and to increase considerably the permeability of the iron winding before continuous loading can be considered to be electrically equal to coil loading as an efficient electrical device.—*London Elec. Review*, Dec. 13, 1912.

**Artificial Telegraph Line.**—K. W. WAGNER.—The first part of an illustrated paper in which the author describes a new artificial line for the investigation of telegraph currents. The line is made up of resistors, Pupin inductance coils and condensers. The construction is described in some detail and the phenomena on this artificial line are shown to be quite analogous to the phenomena of real long lines. The author discusses the currents at different points of a long line and the effect of inductance. The article is to be concluded.—*Elek. Zeit.*, Dec. 12, 1912.

#### Miscellaneous

**Future of Electricity.**—MAURICE LE BLANC.—The great problem of the future is the direct transmission of heat into electricity. From the viewpoint of immediate practical importance, however, the greatest developments are to be expected from energy transmission. Energy transmission by means of waves without wires is a very interesting problem, but from ordinary transmission with wires it seems that agricultural districts will profit most in the near future. A problem in this respect is what the highest voltage that can be used in practice will be. As to overhead lines versus cables, the cable seems to have a promising future, especially for direct current and for alternating current of very low frequency. The direct-current high-tension Thury series system may come into favor again, as it will permit the use of cables instead of overhead lines without any danger from capacity currents or resonance phenomena. As to the alternating-current system, the author thinks it will expand chiefly in the form of three-phase currents. The lower the frequency the easier are the large transmission schemes. A three-wire lamp with three filaments supplied with energy from three phases does not suffer in its light-giving qualities from a low frequency. In machine design Le Blanc is working at present on the realization of some important novelties. His studies on rotary compressors have led to the design of machines of very high speed, actually up to 37,000 r.p.m. The secret of the design consists in the very great liberty of movement of the rotary axle and in the use of automatic equilibrators.—*La Lumière Elec.*, Dec. 14, 1912.

practical engineer engaged in transmission-line work, and he offers these figures in such a manner that they may be of real use to the reader. Mr. Lundquist has taken great pains to enhance the value of all cost figures by giving such information as he deems necessary for their proper understanding. Information of the kind given here is available from various sources, but we do not know of any other one publication in which so much useful cost data on transmission line construction has been collected or in which it has been so intelligently presented. As stated in the preface to the book, the author does not attempt to cover the electrical and mechanical calculations involved in the design of high-tension transmission lines: "the book treats the subject from the standpoint of the construction man rather than that of the office engineer." This does not mean that the book is not of value to the man who makes the necessary calculations, because his end always is, or always should be, an economic one; and the material as presented by Mr. Lundquist cannot fail to be of interest to him.

Where the author states his own personal opinions we are generally inclined to agree with him, as, for instance, when he says that the actual planning and systematic preparation for the carrying out of a transmission-line project deserve more attention than has usually been accorded to them in the past, and when he recommends on economic grounds that more attention be paid to the proper seasoning and treatment of wooden poles. When dealing with specifications for wooden poles the author appears to criticize adversely the not uncommon practice of specifying the top diameter and the length of poles only, without making mention of the required butt measurement; but is it not true that a cause beyond the will of man determines the average "natural taper" of each particular variety of tree suitable for transmission-line poles, and is it not, after all, best to let the butt measurement take care of itself? It is not suggested that strength calculations on poles for the more important transmission lines should not be made, but such calculations should be based on the known natural taper of the selected timber.

Among the best portions of the book may be mentioned Chapters II and VII, the former because it is original and explains in concise language the author's own views as to the proper way to lay out a transmission line, and the latter because it sums up the case for the concrete pole and clearly explains the modern methods of manufacturing and erecting these poles.

PRINZIP UND WIRKUNGSWEISE DER WATTMETER UND ELEKTRIZITÄTSZÄHLER FÜR GLEICH UND WECHSELSTROM. By Alex. Königsworther. Leipzig: J. A. Barth. 71 pages, 84 illus. Price, 3.30 marks.

A well-illustrated little descriptive treatise on wattmeters, watt-hour meters and similar instruments. The fundamental principles of each instrument are indicated, the connections with the circuit are clearly and diagrammatically shown, and the relative advantages of the different types summed up. The book will be of service to students of elementary electrical engineering, and particularly to those interested in German meter practice.

DIE ELEKTROLYTISCHE ALKALICHLORIDZERLEGUNG MIT STARKEN METALLKATHODEN. By Dr. Jean Billiter. Halle a.d.S.: Wilhelm Knapp. 265 pages, 189 illus. Price, 16.50 marks.

The first volume of a treatise on the electrolytic decomposition of potassium and sodium chlorides. In this volume the author compiles, describes and discusses the various processes for these electrolytic industries as they appear in German, British and American patents up to a recent date. The author has contributed to this art, and his own patents are included in the discussion. The book will be of interest to all students of this branch of electrochemical industry, especially from the inventor's standpoint.

## Book Reviews

TRANSMISSION LINE CONSTRUCTION. By R. A. Lundquist. New York: McGraw-Hill Book Company. 285 pages, 180 illus. Price, \$3.

The title aptly indicates the nature of the matters dealt with in the pages of this book. The up-to-date methods of planning and constructing transmission lines are clearly described, and the numerous illustrations which supplement the text have been wisely selected. The author has presented prices and cost data that are of great value to every

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Push-Button and Lock Wall Switches

The new push-button wall switch marketed by the Manhattan Electrical Supply Company, 17 Park Place, New York, is provided with an irremovable dust-proof fiber cover, which also acts as an insulator and is held permanently in place by the cross-bar. This cover effectually incloses and protects the switch mechanism from coarse dirt

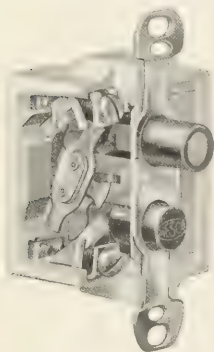


FIG. 1—PUSH-BUTTON SWITCH

FIG. 2—LOCK SWITCH

and grit and, being permanently attached, need not be removed when the wire connections are made to the switch binding posts. It is thus impossible for plaster, mortar or grit to fall inside the porcelain cup, endangering the operation of the switch mechanism. The switch has been approved by the Underwriters' Laboratories. The binding post, with its L-shaped base and head, is set snugly into a recess in the wall and into the reinforced bottom of the porcelain cup. Here it is held rigidly in place by two screws passing through the porcelain base, so that the post cannot be thrown out of alignment when tightening the binding screw. The push mechanism is supported top and bottom. Below it is fastened with two screws through the base of the cup, and above it is held firmly in position by the cross-bar, which is in turn attached to the porcelain base by two screws.

The operating mechanism is made of hardened and tempered steel. The spring contact parts are of phosphor bronze and of ample cross-section. Edges and corners of the porcelain base or cup are smoothly rounded, rendering them much less susceptible to breakage than when left rough or unfinished. The heavy, easily accessible binding screw, with its large, strong head, makes the switch easy to wire, and ample pressure is secured on the connecting wire without stripping the threads.

By an ingenious method the upper part of the binding post, where the binding screw enters, is punched to form a collar. This adds to the number of threads through which the screw shank passes and doubles the amount of compression which can ordinarily be brought to bear on the point of contact under the screw head.

The buttons project the least possible distance through the plate, making it a truly flush switch. Temporary plates are not required when these switches are installed, as only the push-buttons and binding-screw heads are exposed. The

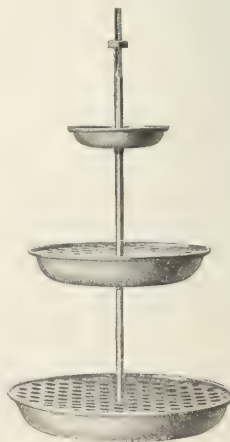
fiber cover protects the mechanism of the switch. An improved cam construction gives the switch mechanism an extremely quick make and break. Shallow construction of the cross-bar allows a stamped faceplate, with reinforced screw holes, to rest firmly on it, so that buckling of plates is an impossibility.

The lock switch (Fig. 2) is similar in construction, except that the locking attachment is substituted for the push-button. It can be operated only by the proper key, irrespective of whether the faceplate is attached or not. The switches are shallow and are made to fit any standard wall box.

### Device for Making Ground Connection

The accompanying illustration shows a type of ground connection which is now being manufactured by the L. S. Brach Supply Company of New York City. It is claimed that this device will produce a low-resistance contact between the ground wire and the earth itself which it is impossible to secure through the ground wire or plate in common use. To accomplish this the ground connection has been designed to retain the moisture in the vicinity of the contact, to present a sufficiently large area of metal surface to the earth, and to insure firm contact between the earth and the metal plates. To secure moist earth three bowls or cups are fastened to a center ground rod, providing a means for rain water as it seeps through the earth to be caught and retained within the grounding device itself. This water will remain in bowls as long as the surrounding

earth is moist. When, by reason of the hot sun, evaporation takes place and the earth becomes dry, there still remains a local moist area due to the water that will be given off from the bowls. To aid in attracting and holding water, small pieces of charcoal are placed within the bowls and covered by a perforated metal screen. The perforated screen itself is intended to protect the space in the bowls from being displaced by the surrounding earth, so that ample water space may be retained. The three bowls being sweated to the center rod offer more than three times the exposed surface which the common ground plate can offer for a hole of given size. The third essential, that of securing firm contact with the earth, is provided for by reinforcing the bowls and the metal



DEVICE FOR MAKING GROUND CONNECTION

screw so that the earth may be packed tightly around the ground connection.

At the top of the center rod a slot milled in a threaded portion affords a convenient means of joining the ground wire to the earth connection. These hydro-grounds, as they are called, are now being manufactured in three standard sizes, each size carrying three bowls of varying diameters.

## The Cooper Hewitt Quartz-Tube Mercury-Vapor Lamp

By JOSEPH C. POLE.

The quartz-tube mercury-vapor lamp represents an additional commercial development of the principles involved in the vapor lamp invented by Dr. Peter Cooper Hewitt. In principle the difference lies only in the greatly increased pressure of the luminous vapor. The standard Cooper Hewitt lamp is operated at a pressure equal to about  $\frac{1}{8}$  in. mercury column, while the pressure in an operating quartz lamp may be that of the atmosphere or higher. The result is that the temperature of the luminous vapor is extremely high, necessitating a potential per inch of the luminous

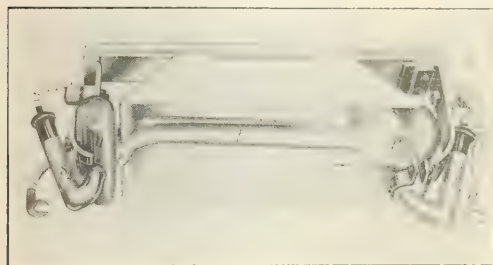


FIG. 1—QUARTZ BURNER

column which is very great and the use of a correspondingly short tube. In spite of having been built upon the same physical foundations, these two types represent, from the practical point of view, a decided contrast. One possesses great area of luminous surface with a consequent small intrinsic brilliancy and so low a temperature that it may be considered near the "cold light" of the scientist; the other has a radiant of small surface giving a very concentrated and intense light and operating at high internal temperatures. In addition to the discontinuous spectrum characteristic of mercury, the quartz lamp emits a luminous spectrum, and it is due to this circumstance that its light contains, besides the predominant yellow, green, blue and violet lines of the mercury spectrum, the red and orange

electric energy through small upright U-tubes  $s_1$  and  $s_2$ . Rods of a special alloy slightly conical in shape are ground into the wall of these upright tubes, and the joints are covered with mercury, which again is closed in by a layer of a suitable compound. This prevents the access of air and serves the purpose of keeping the mercury from being spilled or vaporized.

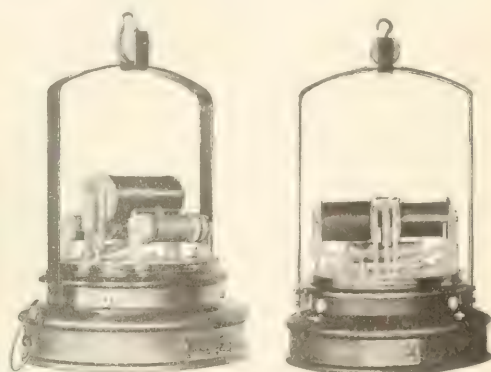


FIG. 3—OPERATING MECHANISM FOR 110-VOLT, 4-AMP LAMP. FIG. 4—OPERATING MECHANISM FOR 220-VOLT, 3.5-AMP LAMP.

When a cold quartz lamp is started it requires a rather high current owing to the small drop of potential at the low pressure, and the whole cross-section of the luminous tubes of the burner is filled with the pale bluish-green light. But presently, as the lamp warms up, the appearance changes. The light recedes from the walls and, with increasing vapor pressure, becomes concentrated in the center of the tube in a thin dazzling path. The current value drops steadily at first, then becomes constant, and the appearance of the light assumes a whiter color with a visible gain of red and orange rays as the lamp attains its temperature of operation. The change in the lamp current

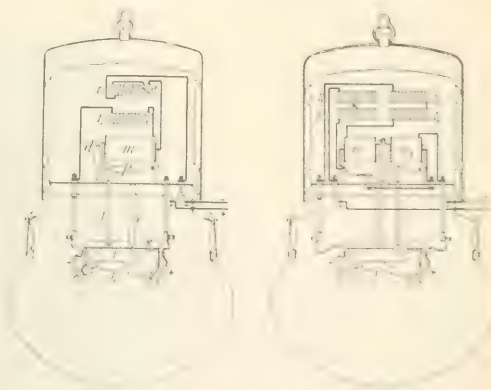


FIG. 5—CURRENT-VOLTAGE CHARACTERISTICS OF 110-VOLT, 4-AMP LAMP. FIG. 6—CURRENT-VOLTAGE CHARACTERISTICS OF 220-VOLT, 3.5-AMP LAMP.

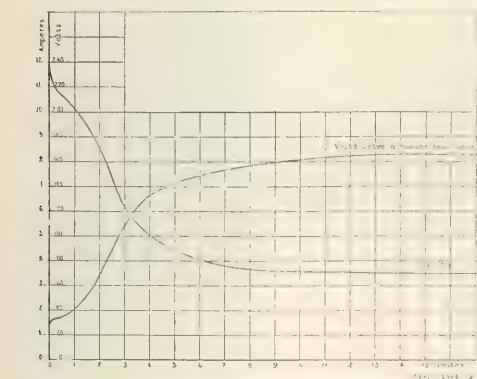


FIG. 2—STARTING CHARACTERISTICS OF QUARTZ LAMP

rays. The latter at the higher vapor temperatures are much more numerous.

A vacuum container for the direct-current quartz lamp is shown in Fig. 1. The tube  $t$  carries the luminous vapor and terminates at the positive end in an enlargement  $p$  and at the negative end in the lateral tube  $n$ . Mercury in each enlargement forms the two electrodes, which receive the

and the voltage of a 220-volt, 3.5-amp lamp with reference to time after starting is shown in Fig. 2. The essential parts of a commercial quartz lamp outfit are a series resistor for regulating the burner potential and making the lamp adaptable to a wider range of supply voltage, a series inductor for steadying the arc, a glass globe to prevent too rapid a dissipation of heat from the burner and to absorb



the ultra-violet rays, and, if the lamp is to be automatic, a starting device.

The ultra-violet rays, in which the mercury arc is especially rich and which are readily transmitted by quartz, may be considered injurious to the eyes at close range. The most actinic of these rays—that is, those with the shortest wave length—are absorbed by passing through a few inches of air, and all are completely absorbed in common glass, so that a surrounding globe of clear glass affords protection from these rays. When a quartz lamp is used for the purpose of the generation and utilization of ultra-violet rays, no glass should be inserted in the path and the lamp should be placed as close as possible to the exposed object.

The two types of quartz lamps which are to be described are for multiple connection on direct-current lines of 110 volts and 220 volts. From alternating-current supply circuits they may be operated through the medium of a rectifier. The 110-volt, 4-amp quartz lamp is shown in Figs. 3 and 5. The burner is securely held in an aluminum support *s*, to which a white enameled reflector *r* is fastened. The holder with its T-shaped backbone is pivoted in a support *c* and by means of the tilting lever *l* is linked to the movable iron armature of an electromagnet *m*. In order to avoid sudden shocks to the movable parts, a dashpot *d* is connected to the armature. A small movable permanent magnet *p* is shown suspended above the armature. This magnet automatically locks the tilting device when the polarity at the lamp terminals is reversed and so protects the burner against being ruined by a reversal of polarity. Two small resistance coils, *r<sub>1</sub>* and *r<sub>2</sub>*, which are equipped with a fuse wire *f* and a sliding contact for regulation, complete the auxiliary apparatus. The ventilated canopy, the insulated hanger and the ring holding the glass globe are very similar to those used with arc lamps.

The burner, magnet and resistor are all connected in series. The burner in its position of rest is so inclined that the two mercury electrodes are in contact. When the line switch is turned on the short-circuit current magnetizes the solenoid *m*. This actuates the movable armature, and through it the burners are turned on their pivots until the contact between the two mercury electrodes is broken and

The 220-volt, 3.5-amp lamp shown in Figs. 4, 6 and 7 has a similar burner and is in general appearance much like the lamp described above, but its mechanism is different. The operating position of the quartz burner *C* (Fig. 5) is identical with its position of rest. For starting the two electrodes are brought in contact by the movable armature of a shunt magnet *m<sub>s</sub>*. At the moment of the short-circuit between the electrodes the series induction coil *m*, operating an automatic cut-out *i*, is energized and interrupts the circuit of the shunt magnet, so that the burner drops back to its original position and the arc is started. This auxiliary is also provided with an automatic locking device for protection against reverse of polarity. Four series resistance coils, *r<sub>1</sub>*, *r<sub>2</sub>*, *r<sub>3</sub>* and *r<sub>4</sub>*, the first two of which are equipped with the sliding contacts, complete the mechanism.

### Service Switch and Fuse Box

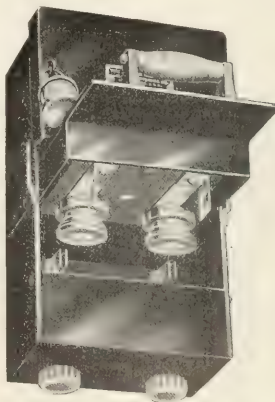
The accompanying illustrations show a type of switch and fuse box which the Palmer Electric & Manufacturing Company has placed on the market. The box has been designed particularly for use as a sealable service cut-out for the control of low-potential circuits but may be used for any purpose to which a switch and fuse may be applied. When the box is opened for inspection or in order to replace a fuse all exposed parts may be handled at will. The fuses and the parts upon which they are mounted do not become a part of the circuit until the box is tightly closed.

The illustration shows the box with the switch in an open position, the fuses being exposed for inspection or replacement. A simple lock which is operated by the action of opening and closing the box holds the switch and fuse-carrying members in the position indicated so that they do not have to be held open by hand while the fuses are being replaced. As the service wires are connected to the terminals at the upper end of the box, which is sealed, it is apparent that all of the parts of the box that normally carry current are dead when the switch is open, and in consequence the live parts of the switch are not accessible without breaking the seal.

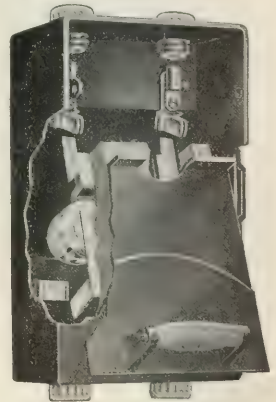
The box may be mounted with the service chamber at



FIG. 7—220-VOLT, 3.5 AMP LAMP



SERVICE SWITCH AND FUSE BOX



the arc started. As long as energy is supplied to the lamp the burner is held in its running position by the magnet. The fuse wire *f* will withstand the heavy current during the starting period, but will within one minute be fused by the additional heat generated in the resistance spool *r<sub>1</sub>*, if for any reason the mechanism should stick and the short-circuited burner continue to receive energy.

either the top or the bottom without change in any of its arrangements to comply with the National Code requirements relative to the fuse protecting the switch. The fact that the fuse contacts are dead when the box is open, it is claimed, will greatly lessen the possibility of accident to the operator such as might otherwise result from flashes and short-circuits.

### Switch for Remote Control

In order to render it suitable for installation at points where it may not receive a great amount of attention, the remote-control switch shown in Fig. 1 has been substantially constructed and built with few operating parts. The switch is a self-contained unit, carrying laminated copper brushes at the main contacts, which are so constructed that each

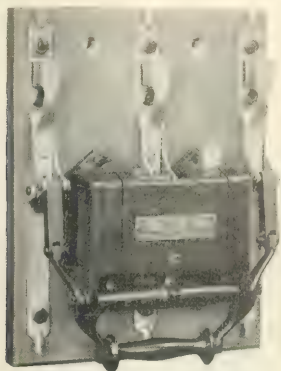


FIG. 1—100-AMP, 250-VOLT ALTERNATING-CURRENT OR DIRECT-CURRENT REMOTE-CONTROL SWITCH

lamination makes end-on contact. On closing, these contacts "wipe in," thus insuring bright surfaces. The auxiliary contact on which the arc breaks are made of carbon blocks.

The switch is operated by a double-coil solenoid which is controlled by a special double push-button switch. The normal position of the latter is the open one, and it remains closed only when held by the operator. To open or close the switch the corresponding push-button is pushed. A push-button switch is furnished with each remote-control switch and must always be used, as the solenoid coils are not designed to conduct their excitation current continuously. The cores of the operating solenoids are connected directly to the operating lever, which in turn is connected to the poles of the switch through a toggle mechanism. When a coil of the solenoid is energized its core moves the operating lever up or down, forcing the switch closed or open, this depending upon which coil is energized. A handle by which the switch may be opened by hand is provided and may be seen at the lower part of the switch in the illustration.



FIG. 2—CARBON-BREAK PUSH-BUTTON SWITCH

The switch is made single, double or triple pole, single throw for service on alternating-current and direct-current circuits for potentials of 110, 125, 220 and 250 volts, and can be furnished up to 300-amp rating. The standard finish of all the live parts of the switch is polished copper, while that of the mechanism is marine. This switch is manufactured by the General Electric Company.

### Three-Circuit Cord Switch

There are many electric heating devices now on the market which are designed to operate at several temperatures. It has been found that such devices as electric water urns, chafing dishes, heating pads, frying pans, table stoves, tailors' irons, etc., may be advantageously operated at three different temperatures, namely, low, medium and high. For the convenient control of these devices the Cutler-Hammer Manufacturing Company of Milwaukee has augmented its line of cord switches by the addition of a three-circuit brass-shell type as shown in the accompanying illustration. This switch may be placed on the cord in any convenient location for operation.

There are two push-bars, each having a light and black



THREE-CIRCUIT SWITCH

button, which operate twin mechanisms so arranged that the pushing of one light button gives low temperature, while the other operated alone gives medium temperature. The shell is marked so that the operator may know which button to press for low and which for medium temperature. To obtain the highest temperature both buttons are pushed. The operation is positive and quick, and one hand only is needed for the manipulation of the push-buttons. As can be seen from the illustration, two-conductor cord is required to connect to the socket or receptacle and three conductor cord is needed to connect the switch to the heating devices. The brass shell is finished in polished nickel. The rating of the new three-circuit switch is 6 amp 125 volts, 3 amp 250 volts.

### Balancer Sets for Electric Projector Circuits

It is interesting to note the progress in modern lighting and the different spectacular effects obtained through the use of the large electric search-lanterns. As a notable instance the Singer Tower in New York City, which at night gives the soft touch of carefully planned and concentrated illumination to the twinkle of the thousands of individual lights from the surrounding office buildings, may be cited.



BALANCER SET FOR SINGER BUILDING

The electrical energy from the Singer Building power plant is furnished at 250 volts, direct current. In order to economize in the use of copper for all lighting circuits two 70-kw balancer sets, one of which is illustrated herewith, were installed. One of these sets is idle at all times except when shifting the load from one set to the other. Each set consists of two 35-kw, 125-volt compound-wound, com-

mutating-pole generators, running at 1300 r.p.m. These generators are of special construction, being built with steel frames, laminated pole pieces and wrought-iron commutating-pole pieces. They are light in weight and operate noiselessly, giving satisfactory commutation up to 25 per cent overload.

The field coils of the two machines are connected in series across the 250-volt mains. The voltage regulation maintained by these sets is so close that one does not notice an appreciable falling off in the illumination, even with the load so unbalanced as to give 580 amp in the neutral wire, which represents a rare condition.

The tower lighting itself is also operated on a three-wire system, and although the amount of unbalanced load is much smaller than that of the office lighting system, the balancing set is of the same size and rating in order that the three sets may be interchangeable. The tower lighting is accomplished by means of 18-in. projectors operating at 35 amp each and showing an average apparent candle-power of approximately 6,000,000. These are supplemented by 30-in. projectors having an approximate apparent candle-power of between 50,000,000 and 60,000,000 each. The balancer sets for this installation were manufactured by the Diehl Manufacturing Company of Elizabethhoort, N. J.

### Double-Arm Exploring Mirror

The accompanying illustration shows a device recently put on the market by the Leeds & Northrup Company, Philadelphia, Pa., for use in photometering arc lamps and other large illuminating units. Two large mirrors, each 18 in. by 22 in., are so arranged that the light rays from the lamp under test are reflected from them to the screen of the photometer sight box. The arms supporting these mirrors are counterweighted and mounted on a common axis so that the mirrors may be rotated about a common center to any desired angle, the degree of rotation being measured by a small graduated scale. The height of the center of rotation of the mirrors is adjustable and may be changed to correspond to the height of the photometric axis of any pho-



DOUBLE-ARM EXPLORING MIRROR

tometer which is employed in measurement. In using the device the mirrors are placed symmetrically about the lamp at equal distances on either side of a vertical axis and the light reflected by them is compared to a standard through any common type of photometer. In this manner the average value of the candle-power in that plane is readily obtained.

### Dry Storage Battery

The Cook Railway Signal Company, Denver, Col., is marketing a dry secondary battery invented by its electrical engineer, Mr. N. Fallek. It is claimed that a complete departure in manufacturing methods has developed a different character of plate, through various combined chemical and electrolytic treatment baths after the first form-

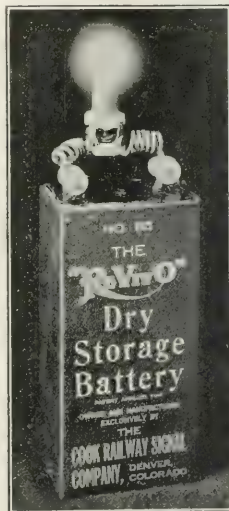


FIG. 1—2-VOLT, 20-AMP-HOUR CELL

ing processes. The plates are spaced by their head frames are then surrounded with a moist element in lead or rubber jars, no separators being employed, and with terminals added and a compound filler provided at the top, the unit is ready for use. Among the particular advantages claimed for the battery are freedom from spilling of electrolyte, evaporation or warping. The latter condition is attributed to the mechanical construction employed as well as to the protection afforded by the element action against sulphating. Compactness of construction is said to be characteristic of the battery, and this is claimed to reduce the internal resistance and to limit the injury by heating. The recuperative powers and plate life, according to the



FIG. 2—BROKEN PARTS OF CELL HELD WITH ROPE STILL ACTIVE

manufacturer, are unusually good. It is said that batteries of the type described have been employed successfully in aeroplane work. Tests and comparative data on weights, resistances and performance curves are not available for publication at this writing; but the manufacturer states that after exhaustive tests have been finished information of this character will be compiled and given to the trade.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Annual Report of Allgemeine Elektrizitäts-Gesellschaft.**—The magnitude of the operations of the Allgemeine Elektrizitäts-Gesellschaft, of Berlin, in 1912 greatly exceeded the expectations the company had entertained for that year. Much of the increase in orders received is ascribed by the company to the extension of its organization to all parts of the civilized world and to the larger demand for electrical equipment resulting from the rapidly broadening application of central-station service in large industrial territories. In order to meet the heavy demands for equipment the company found it necessary during the year to make extensive additions to its manufacturing facilities. The company has issued  $4\frac{1}{2}$  per cent debentures to the amount of about \$6,000,000, and proposes to increase its original capital by issuing new shares with a nominal value of \$5,000,000. A dividend of 14 per cent was declared as a result of the year's operations. Inasmuch as deliveries at the Brunnenstrasse factories fell behind the orders received, there is now ample work on hand to keep the facilities of the additional factory buildings to be erected in the next few months fully occupied for a considerable time to come. During the year the output of machines and transformers from the Berlin factory increased from 2,385,869 hp in the preceding year to 2,529,000 hp. The machinery constructed include three-phase generator units, with outputs up to 15,000 hp for hydroelectric plants, generators up to 4500 kw for connection to gas and Diesel engines and numerous rolling-mill drivers, particularly for reversing rolls. A new development during the year was the electrical equipment of submarine boats with special motors and switchgear. A number of single-phase locomotives with necessary controlling apparatus were also constructed. Transformers up to 15,000 kw at voltages ranging as high as 110,000 were built in large numbers by the company and improvement in the design of oil switches for heavy outputs also became necessary through the increasing size of central stations. A new line of direct-current motors from which the company expects much success was developed during the year. The prices obtained by the turbine factory showed a slight improvement over those in 1911. The output in steam turbines in 1912 aggregated 735,648 hp, as compared with 441,467 hp in the preceding year. Much progress was made in the development of high speed, three-phase units. The largest turbine unit constructed was of 20,000 kva rated output. Two units rated at 18,000 kva and one at 12,500 kva were also constructed. The output of the arc-lamp and clock factory was practically the same as in the preceding year. Flaming arc lamps, the report says, are rapidly increasing in favor and are having a steadily increasing demand, notwithstanding the competition offered by high candle-power metallic filament lamps. The company states that the quartz-mercury lamp manufactured in Hanau with the co-operation of the Allgemeine Elektrizitäts-Gesellschaft has increased appreciably in importance. A large increase was also made in the manufacture of switches, heavy installation material, meters, fans and electromagnetic instruments. The possibilities of the electric-heating field have been realized more fully by the company than in the past, and special attention was given during the year to the manufacture of electric heating and cooking apparatus for domestic and industrial purposes. The company's output of this class of equipment increased more than 75 per cent in 1912 over that in 1911. Insulators for potentials as high as 100,000 volts were made in the porcelain factory during the year. A large number of experiments with a view to introducing ozone into various branches of industry were conducted at the Frankfort factory. All departments of the Oberspreewerke cable works were so busy, as was the case in 1911, that the orders were made possible of execution only through the employment of two and three shifts. The

prices for insulated wire remained at a low point during the year, although some improvement was made over the quotations of 1911. The use of enameled wire as a substitute for cotton-covered and silk-covered wire showed marked increase. The heat-resisting and insulating properties of the company's special insulating material, tenacite, were further improved during the year. An appreciable reduction was made in the cost of manufacturing drawn filaments as well as a decided increase in their breaking strength. The output of carbon filament lamps has naturally shown a material decrease under prevailing conditions. The number of employees in the company's vehicle branch increased to more than 2000, and the output showed a gain of 50 per cent over that in 1911. Including work done in 1912, the company had installed motor-drive equipment for 385 rolling mills by the end of that year. The volume of business in mining equipment reached large proportions, and the volume of electrically operated hoists and elevators manufactured was the highest on record. Equipment for street railway systems continued to have a large demand during the year. The company had 70,162 employees on its pay rolls at the end of its fiscal year.

**Detroit Insulated Wire Employees Shared 1912 Profits.**—Following the custom which it inaugurated some years ago, the Detroit Insulated Wire Company, of Detroit, Mich., distributed a generous percentage of its 1912 profits among its employees. The amount which each received was based upon the length, continuity and value of his or her service. Hourly rate employees who had been with the company one year or more received, in accordance with the practice in preceding years, 2 per cent of their total wages since entering the continuous employment of the company. On this basis, for example, an employee with a record of five years of steady employment received 10 per cent of the average yearly wage. All monthly rate employees who had been with the company one year or more received 1 per cent of all salaries earned since entering continuous employment with the company. In announcing the bonus to the employees the company said in part: "We are presenting this to you because we believe it pays to reward faithful and steady workers so long as results and earnings make it possible. We hope that our combined efforts may continue to yield results that will permit this distribution for many years. As heretofore, the rule is that any employee discharged for cause or who has left for any reason (other than sickness, leave of absence or temporary lay-off), even though re-employing after a short time, loses credit for previous employment and will receive this bonus based only on the time of continuous employment since re-entering our employ. Our business is highly competitive and the profits per dollar of business are very small. To earn any money we are all obliged to work hard and steadily. This cannot be accomplished with employees coming and going, therefore we are aiming to induce our employees to remain with us steadily." The company does not guarantee to the employees, however, continuation of similar distributions from year to year.

**Crocker-Wheeler President Discusses Growth of the Electrical Trade.**—Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Company, said recently of the electrical manufacturing business in 1912: "The volume of business in electrical machinery this year will closely approach \$300,000,000. This is a moderate estimate because it embraces an increase of only 20 per cent, the total in 1909, according to the latest census report, having been \$243,000,000. The business of one company I know of has increased by a far greater percentage not only in volume but in variety. I am glad to say that with the spread of better knowledge

of electricity has come a demand for higher standards in apparatus and much more severe acceptance tests than formerly. In years gone by we have had machines 'inspected' and accepted by men who were as innocent of all knowledge of electrical machinery as a baby is of the uses of radium. Proof of the more general and discriminating interest in electrical machinery is found in the greater variety of machinery which is required. Our business in large alternating-current machinery, turbo-generators and transformers now rivals our output of direct-current machinery. As I have pointed out before, the volume of the electrical business in this country is an excellent index of the total volume of business. Practically all manufacturing plants have adopted electric drive for their machine tools."

**Turbine Equipment for Steel Mills.**—The Carnegie Steel Company has placed an order with the General Electric Company for two turbine units, one of which, a 5475-kva high-pressure condensing unit, will be installed at the Edgar Thompson works at Braddock, Pa., and the other, a 3750-kva mixed-pressure unit, is for the Homestead works at Munhall, Pa. In connection with the smaller unit, the Carnegie company has placed an order with the Rateau Steam Regenerator Company, 90 West Street, New York, for two regenerators which will receive the intermittent exhaust from several mill engines in the plate mill, varying from practically zero to a maximum of 300,000 lb. per hour, and will deliver a constant flow at the rate of 130,000 lb. per hour to the turbine. The latter will be equipped with a Rateau mixed-pressure governor. Both turbines will drive alternators which are to deliver three-phase, 25-cycle energy at 6600 volts. The Inland Steel Company, at Indiana Harbor, Ind., has placed an order for two Rateau regenerators, which will receive the exhaust from the engines in a blooming-mill and a bar-mill, with a maximum discharge of 485,000 lb. per hour and deliver a constant flow at the rate of 155,000 lb. per hour to two low-pressure turbines, each rated at 2000 kw. These will drive alternators.

**Cedar Rapids Manufacturing & Power Company's Re-funding Plan.**—Stockholders of the Cedar Rapids Manufacturing & Power Company, of Montreal, were scheduled to hold a special meeting on Jan. 3 to vote upon a proposition to redeem any part of an authorized issue of \$10,000,000 bonds and also to issue new bonds to the amount of \$15,000,000. In November last the directors of the company received authority to increase its capital from \$10,000,000 to \$15,000,000 and the meeting was for the purpose of considering what form the increase should take. The present capitalization of the company consists of \$10,000,000 authorized stock, of which \$8,000,000 is outstanding, and \$1,500,000 first-mortgage forty-year sinking-fund 5 per cent gold bonds due Jan. 1, 1952. This is a part of an authorized issue of \$10,000,000, of which \$5,000,000, including the \$1,500,000 now outstanding, are issuable forthwith. The balance is reserved for constructions or acquisitions, improvements, etc.

**Alabama Traction, Light & Power Company Orders Equipment.**—Contracts for power-station equipment amounting to approximately \$300,000 have been placed with the Westinghouse Electric & Manufacturing Company by the Alabama Traction, Light & Power Company, which, as previously noted in these columns, controls important water-power rights in the State of Alabama capable of developing several hundred thousand horse-power. The order just placed is for the initial equipment of the company's plant at Lock 12 on the Coosa River. It calls for four 13,500-kva, 6600-volt, 60-cycle, three-phase, vertical-type generators for operation at 100 r.p.m. With each is a direct-connected exciter. In addition to this equipment the contract includes twenty 4500-kva, single-phase, 6600-volt to 110,000-volt transformers.

**Arkansas Hydroelectric Plans.**—Control of the Garland Power & Development Company, which controls water-power sites on the Ouachita River, about 45 miles from Little Rock, has been acquired by interests associated with the Little Rock (Ark.) Railway & Electric Company. New officers have been chosen for the Garland company as follows: President, C. C. Kavanaugh; vice-president and treasurer, W. M. Kavanaugh, and secretary, D. H. Cantrell, all of Little Rock. The Garland company has been considering the construction of hydroelectric developments

with an aggregate rating of 28,000 hp on the Ouachita River. The plan provides for distribution of energy within a 100-mile radius of Little Rock, from the first station, to rice planters in the neighboring counties.

**William P. Bonbright & Company Reincorporate.**—William P. Bonbright & Company, 14 Wall Street, New York, investment bankers and dealers in public-utility securities, have filed articles of incorporation under the name of William P. Bonbright & Company, Inc. The capital of the new company will be \$5,500,000 in 7 per cent preferred stock and 100,000 shares of common stock without par value. The object of the incorporation is to provide capital for the rapidly growing business. The partners are: William P. Bonbright, Irving W. Bonbright, William F. Fisher, Frederic C. Walcott, Starling W. Childs, Frederick W. Stehr, George R. Buckman, the Right Hon. Albert Lord Fairfax, Orlando B. Wilcox and A. C. Cassells.

**Hartford (Conn.) Electric Light Increases Its Capital.**—Directors of the Hartford (Conn.) Electric Light Company have voted to recommend to the stockholders an increase in the outstanding stock from \$3,000,000 to \$3,600,000. The authorized issue is \$5,000,000. Stockholders are to meet on Jan. 8 to vote upon the proposition, and if it is approved, they will obtain the right to subscribe for the new stock at the rate of one share of the new for each five shares of the old, payable in two instalments, one on Feb. 4 and the other on Aug. 5. The employees were given a dividend of 5 per cent on their annual salaries on Jan. 1.

**New Utility Company for Cincinnati.**—While no details have been made public it is understood that a new central-station company has been formed to compete with the Columbia Gas & Electric Company, which operates in Cincinnati. It is said that interests which were affiliated with the latter prior to its acquisition in July last by a syndicate headed by A. B. Leach & Company, of New York, are behind the new project and that the installation of the block-plant system will be promoted.

**Progress of Toledo Railways & Light Reorganization.**—The reorganization committee of the Toledo Railways & Light Company has announced that holders of over 75 per cent of the outstanding stock of the company have assented to the proposed plan for reorganization. More than 60 per cent of the holders of outstanding stock have paid the assessment of \$7.50 a share. The time for deposit of the stock has been extended to Jan. 4, 1913.

**Evansville (Ind.) Company Files Mortgage.**—The Evansville Public Utilities Company, which, as previously noted, is a consolidation of the Evansville Public Service Company, the Evansville Gas & Electric Light Company and the Evansville & Southern Indiana Traction Company, has filed a mortgage for \$10,000,000. The proceeds will be used to retire the securities of the old companies.

**Northern California Power Closes Large Contract.**—A contract has recently been made between the Northern California Power Company and the Oro Electric Corporation through which about 20,000 hp in electrical energy will be furnished to the Oro company. The latter will purchase this energy until the hydroelectric station which it is building on Yellow Creek is completed.

**Foreign Orders for Searchlights.**—The Carlisle & Finch Company, of Cincinnati, has just made a shipment of seventeen cases of searchlights to fill an export order from one foreign customer. The Greek torpedo boats that have comprised the naval arm of the Balkan allies were recently equipped with searchlights made by this company.

**To Operate in Venezuela.**—The Venezuela Electric Light Company has been organized under the laws of Ontario with a capitalization of \$1,500,000 to do an electric-service business in Venezuela. The company is a MacKenzie-Mann project and will utilize undeveloped water-power resources in the South American republic.

**Alaska Hydroelectric Plant Nearly Completed.**—The 5000-kw hydroelectric power station which is being built for the Alaska Gold Mining Company will be placed in operation very shortly. It is understood that the company will begin the construction of a 160-ft. dam next spring.

**Birmingham (Ala.) Railway & Light Financing.**—Stockholders of the Birmingham Railway & Light Company have authorized the issuance of \$400,000 of common stock. This



is to be subscribed for at par and payable in cash. The proceeds will be used for repairs to the traction properties.

**National Carbon's Earnings.**—Net earnings of the National Carbon Company for its fiscal year ended Dec. 31, 1912, were, it is understood, equal to the record results of 1910, when a balance of \$1,303,000 was shown for the stock.

**United Illuminating Company (Conn.) Plans Stock Increase.**—Stockholders of the United Illuminating Company, of New Haven, Conn., are to vote on Jan. 4 on increasing the authorized capital stock from \$2,000,000 to \$2,500,000.

#### NEW YORK METAL MARKET PRICES

	Dec. 23		Dec. 30	
	Bid.	Asked.	Bid.	Asked.
Copper:	17.00	17.37½	17.00	17.37½
Standard, spot	2	3 d	4	5 d
London, standard, spot	75	15 0	76	3 0
Prime Lake	17.60	16 17½	17.65	17 17½
Electrolytic	17.50	17.55	17.55	17.65
Casting	17.35	17.40	17.35	17.45
Copper wire, base	19.00	19.00	19.00	19.00
Lead	4.35	4.35	4.35	4.35
Nickel	45.00	45.00	45.00	45.00
Sheet zinc, f.o.b. smelter	9.00	9.00	9.00	9.00
Spelter, spot	7.35	7.35	7.35	7.35
Tin, spot	50.25	50.25	50.25	50.25
Aluminum:				
Prompt delivery	26.25	26.50	26.00	26.50
Future	26.50	26 37½	25.75	26.25

#### OLD METALS

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.50	8.50
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

#### COPPER EXPORTS IN DECEMBER

Total tons to	Dec. 24, 18,834	Dec. 31, 27,228
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#### INDUSTRIAL SECURITIES

Security.	Capital Stock Listed.	DIVIDEND.		QUOTATION.	
		Per Cent.	Period.	Dec. 24	Dec. 31
Allis-Chalmers, 2d assess. paid.	\$17,151,100			14*	11
Allis-Chalmers, pf., 2d assess. paid.	14,034,700			14*	11
Amalgamated Copper	153,887,900	1	Q	74	78
American Tel. & Tel.	334,712,300	2	Q	110	109
Electric Storage Battery, c.	16,074,425				
General Electric	77,726,700	1	Q	183	186
Mackay Cos., c.	41,380,400	14	Q	8*	8*
Mackay Cos., pf.	50,000,000	1	Q	74	78
Western Union Tel.	79,943,400	1	Q	41	41
Westinghouse E. & M., c.	31,685,300	1	Q	74	74
Westinghouse E. & M., pf.	3,998,700	11	Q	121½	114

\*Last price quoted.

## Personal

**Mr. John T. Whistler**, formerly of the Reclamation Service, gave a talk on "Some of Our Water Resources" at a recent meeting of the Oregon Society of Engineers.

**Mr. Weare Parsons** has been elected treasurer and general manager of the Springfield (Ohio) Light, Heat & Power Company, the reorganization of which was effected recently.

**Mr. H. C. Barber**, who was assistant chief engineer of the municipal hydroelectric system in Hamilton, Ont., has been appointed assistant manager of the Toronto Hydro-Electric System.

**Mr. J. H. Doherty** has resigned as contract agent of the Corning (N. Y.) Gas & Electric Company to become general manager of the Fulton (N. Y.) Light, Heat & Power Company.

**Mr. Clifton R. Hayes**, local manager of the Fitchburg (Mass.) Gas & Electric Light Company, has been elected president of the Fitchburg Board of Trade and Merchants' Association.

**Mr. J. Shields**, chief inspector of the Jackson City lines of the Michigan United Traction Company, has accepted the position of superintendent of the Manistee (Mich.) Light & Traction Company.

**Mr. W. R. Thompson**, formerly assistant chief engineer of H. M. Bylesby & Company, of Chicago, has been promoted to be manager of engineering and construction for the same organization.

**Mr. Lamar Lyndon**, consulting electrical engineer of New York and Atlanta, sailed for Europe recently to join his family at Brussels, Belgium. They will return to New York together about Jan. 15.

**Mr. George H. Morse** has been appointed consulting engineer of the Mutual Electric & Machine Company of Wheeling, W. Va. Mr. Morse was formerly professor of electrical engineering of the University of Nebraska.

**Mr. Joseph D. Evans**, who has been chief engineer of the Montreal (Que.) Tramways since June, 1911, severed his connection with that company on Jan. 1 to become construction manager of the Electric Bond & Share Company, New York City.

**Mr. John J. Swan**, formerly associated with the Chicago Pneumatic Tool Company, New York, as manager of the New York office and later as mechanical engineer in the compressor department, has become associated with the Oil Power Engineering Corporation, New York.

**Mr. Hugh T. Wrecks**, who for the past year has been acting as special agent on wires and cables for the Underwriters' Laboratories in Chicago, tendered his resignation, effective Jan. 1, in order to devote his entire time to the work of the Wire Inspection Bureau, of which he is secretary.

**Mr. William Dieterle** has resigned as motor-service contract agent of the Southern California Edison Company to join the organization of a large mining company. Mr. Dieterle has served the Los Angeles company as accountant, traveling auditor, motor-service development auditor, etc.

**Mr. L. H. Conklin**, past-president of the Pennsylvania Electric Association and secretary of the Warren (Pa.) Light & Power Company, has accepted an appointment as secretary of the transmission section of the National Electric Light Association. Mr. Conklin's headquarters are at Scranton, Pa.

**Mr. M. F. Dugan** has resigned his position with the Cumberland County Power & Light Company to accept a similar position with the Central Maine Power Company at Waterville, Me. Mr. Dugan was presented with a purse of money at a farewell banquet at the Falmouth Hotel, Portland, on Dec. 21.

**Prof. C. Francis Harding**, of the school of electrical engineering, Purdue University, Lafayette, Ind., has returned from Madison, Wis., where he was called for a conference with the engineering department of the State Railroad Commission in connection with the Milwaukee street-lighting investigation on which he was engaged during the past summer.

**Mr. W. R. Lloyd**, secretary of the State Tax Commission of Alabama, has resigned his position and has been associated with the Alabama Interstate Power Company, a corporation supported by English capital which has a number of hydroelectric developments under way on the Coosa and Tallapoosa rivers in Alabama about 40 miles from the city of Montgomery.

**Mr. James Bennett**, superintendent of the electrical department of the Canadian Fire Underwriters' Association of Montreal and the only Canadian member of the electrical committee of the National Fire Protection Association, has tendered his resignation, effective April 1, 1913, to accept the appointment of managing director of the Fire Prevention Company of Canada.

**Mr. James A. Fleet**, general superintendent of the Cumberland County Power & Light Company of Portland, Maine, was the recipient of a farewell banquet on Dec. 21, when he was presented with a leather traveling bag. As announced in the Dec. 7 issue, Mr. Fleet has resigned his position with the Cumberland company and will engage in similar work in the West.



## Construction

**SAFFORD, ARIZ.**—Preliminary steps have been taken by the Farmers' Association of Safford toward the installation of a central electric power station in Safford and the erection of transmission lines to irrigating pumping plants that are to be installed upon a large irrigation district that is to be formed near Safford.

**ATKINS, ARK.**—The Atkins Lumber Co. contemplates the installation of an electric-light plant to supply electricity for lighting the town.

**CABOT, ARK.**—W. M. Hudson is promoting the construction of light and water plants in Cabot.

**KENSETT, ARK.**—A proposition has been submitted to the City Council by U. S. Bratton, of Little Rock, representing a company which proposes to build a dam on the Red River near Hiber Springs and install a plant to supply electricity to all towns in this section. Mr. Bratton asked for a 25-year franchise and guaranteed to have power here within 18 months.

**McGEHEE, ARK.**—The Commissioners of the Water and Light Improvement District of the incorporated town of McGehee have awarded the general contract for construction of an electric-light plant and water-works system for the town of McGehee to T. C. Brooks & Sons, of Jackson, Mich., at \$23,638.

**ALAMEDA, CAL.**—Extensive improvements are contemplated to the municipal electric-light plant within the next six months which will include the purchase of two 300-hp water-tube boilers, one 1250-kva steam turbo-generator, two surface condensers, a 2000-hp closed heater, oil and feed pumps, feeder regulators (3000 kw) and an entire new switchboard with instruments; also the reconstruction of all feeder circuits. Joseph B. Kahn is superintendent.

**BANNING, CAL.**—The Southern California Edison Co. has been granted a franchise to furnish electricity for lighting the proposed Banning city limits. The plans provide for the erection of the electric system between Redlands and Banning during the next 90 days and will be extended to Coachella before spring.

**COPPERPOLIS, CAL.**—The Calaveras Copper Co. is planning to build an electric railroad connecting its mines in Copperopolis with a railroad leading into Stockton. The proposed road will be about 16 miles long and will cost about \$200,000. J. H. Trerise is superintendent of the company.

**COURTLAND, CAL.**—The Great Western Pwr. Co. has run a cable across the steamboat slough from Grand Island to Suter Island, and will erect a pole transmission line, 11 miles long, for distribution purposes. The line will be extended on to Ryer Island.

**DIXON, CAL.**—The Pacific Gas & El. Co., of San Francisco, is reported to have appropriated \$60,000 for improvements to its local system. A carload of pole brackets has been received and 30 tons of copper are on the way.

**ELSINORE, CAL.**—The Southern Sierras Pwr. Co., of San Bernardino, has purchased the plant and holdings of the Elsinore El. Lt. & Pwr. Co. Extensive additions and improvements will be made by the new owners and a 24-hour service established.

**LODI, CAL.**—The Western States Gas & El. Co. is planning to distribute electricity in and about Lodi. Work will soon begin on installation of the system. W. S. Butler, of Stockton, is general manager.

**LOS ANGELES, CAL.**—The Angels' Flight Ry. Co. has applied to the State Railroad Commission for permission to issue \$100,000 in bonds, the proceeds to be used for extensions, etc.

**LOS ANGELES, CAL.**—The City Council has authorized the Board of Public Works to advertise for 750 additional arc lamps for lighting the streets of the city. The budget provides for 500 additional arc lamps to be installed during the present fiscal year, but the gas and light committee asked 250 additional.

**MODESTO, CAL.**—The Modesto & Empire Trac. Co. is planning to install the new Edison's storage battery on the cars operating on its line between Modesto and Empire, a distance of 5 miles. L. L. Bennett is attorney for the company.

**MONROVIA, CAL.** The city of Monrovia is planning to extend the municipal street-lighting system in the near future.

**PASADENA, CAL.**—The city of Pasadena will install two electrically driven centrifugal pumps in the new sewer system on South Grand Ave. Van Nor Ornum, city engineer, is in charge of the work.

**PLACERVILLE, CAL.**—Ralph Kyburg contemplates the installation of a 50-kw hydroelectric plant at his summer resort at Riverton, near Placerville. Water from Plum Creek will be utilized to operate the plant.

**STOCKTON, CAL.**—Plans have been perfected to complete the equipment of the Tidewater & Southern R.R. for electrical operation between Stockton and Modesto by June, 1913. Byron A. Bearce is president.

**PUEBLO, COL.**—The Arkansas Valley Ry., Lt. & Pwr. Co. will extend its transmission lines through Holbrook Valley, giving the ranchers in the vicinity of Fowler electric light and power service.

**CANAAN, CONN.**—The Stone & Webster Corp., of Boston, Mass., has acquired the property of the Berkshire Pwr. Co., of Canaan, which supplies electricity to five towns in this vicinity. The Stone & Webster Corp. is preparing to build a large plant at Falls Village, a few miles south of Canaan, where it recently bought the water rights owned by

the New Haven R. R. Co. The corporation, it is said, will erect a transmission line to Torrington and other manufacturing towns in the Naugatuck Valley.

**NAUGATUCK, CONN.**—The G. I. R. Glove Co. is installing a new electric plant to supply the factories of the clothing department and druggists' supplies with electricity for lamps and motors. The building is being remodeled to make room for new machinery. The wires will be carried under Maple Street in the new conduit now being laid. When the new arrangements are completed the old boilers and engines will be taken out.

**SAYBROOK, CONN.**—The Shore Line El. Ry. Co. will apply to the next General Assembly for an amendment to its charter giving it the privilege of supplying electricity for lamps, heaters and motors in the towns through which its railway passes, excepting New Haven.

**SEYMOUR, CONN.**—The United El. Lt. & Wtr. Co., of Waterbury, has acquired the property of the Seymour El. Lt. Co., which hereafter will be operated as part of the former system. The new owners will make numerous improvements to the local plant, including the establishment of a 24-hour service. Transmission lines will be erected to connect the local system with the Waterbury and Naugatuck system. F. J. Lyon, superintendent of the Naugatuck division, will have charge of the Seymour plant.

**DELAWARE CITY, DEL.**—The power plant of the American Pwr. Co. in Delaware City was recently destroyed by fire, leaving the city without electrical service.

**WASHINGTON, D. C.**—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 21 for furnishing supplies to be delivered at the various navy yards and naval stations as follows: Washington, D. C., Schedule 5087—automobile ambulance; Schedule 5092—1500 ft. double-braided, rubber-covered conductor; 4000 ft. Sherardized steel conduit, miscellaneous electrical supplies and 35,000 ft. weatherproof copper; Schedule 5093—120 chestnut poles, 35 ft. long. Brooklyn, N. Y. Schedule 5097—20,000 lb. granular carbonate sodium. Applications for proposals should give the schedule desired by number.

**PALATKA, FLA.**—A committee has been appointed by the Board of Trade to make investigations relative to the installation of a municipal electric-light plant. J. H. Yelverton, Jr., W. P. Merriam and A. M. Leach are members of the committee.

**CHIPLEY, GA.**—Application has been made to the City Council by Messrs. Hall & Gotha for a franchise to construct and operate an electric-light plant in Chipley.

**LYONS, GA.**—Bonds to the amount of \$12,000 have been voted for extensions to municipal water and light systems.

**KELLOGG, IDAHO.**—The Bunker Hill & Sullivan Min. & Const. Co., Kellogg, expects to purchase within the next six months series arc rectifier system, transformers, lightning arresters, wire, meters, etc.; also heating, cooking and household supplies, etc. Walter C. Clark is superintendent of water and light department.

**KELLOGG, IDAHO.**—The Long Valley Lt. & Pwr. Co., of Kellogg, expects to erect within the next 18 months about 20 miles of transmission lines and to purchase one 300-kva, 2300-volt, three-phase generator (rope drive), one 500-hp waterwheel and governor, transformers, poles, insulators, lightning arresters, wire and meters; also arc and incandescent lamps and electrical supplies and appliances. Walter C. Clark is president.

**SALMON, IDAHO.**—The Lemhi Pwr. Co., Ltd., of Salmon, contemplates the construction of a power house and the erection of 12 miles of transmission lines within the next six months; also the purchase of three 56-in. turbines.

**EAST MOLINE, ILL.**—The City Council has instructed the water and light committee to investigate the cost of maintenance of a municipal lighting plant.

**PEKIN, ILL.**—The proposed ornamental street-lighting system for Court Street will consist of 90 ornamental lamp-posts, each carrying three-lamp or five-lamp clusters, maintained by underground wires. The cost of the system is estimated at about \$11,000. E. L. Conklin, president of the Commercial Club, is interested in the project.

**BICKNELL, IND.**—The City Council has granted the Bicknell Pub. Utilities Co. an electric-light franchise, under which the company agrees to furnish a 24-hour service. Contracts have been placed for all necessary equipment and apparatus. It is expected to have the plant completed within six months.

**CHURUBUSCO, IND.**—Frank T. Schultz, superintendent of the municipal electric-light plant in Columbia City, has applied to the City Council for a franchise to establish an electric-light plant in this city.

**FORT WAYNE, IND.**—The Home Tel. Co. has notified the Secretary of State of an increase of capital stock to the amount of \$250,000. The company is planning to make extensions and improvements to its system.

**GOSHEN, IND.**—The City Council is planning to install a new lighting system on Indiana Avenue, south of Lincoln Avenue, early in the spring.

**KENDALLVILLE, IND.**—Owing to the announcement that the Bell Tel. Co. would charge a toll between towns in Noble County, the merchants are arranging to organize a new company to erect and equip a new telephone system.

**FORT DODGE, IA.**—The Fort Dodge L. & Pwr. Co. recently installed a 300-hp Babcock & Wilcox Sterling boiler and has just put in a 25-kw steam-driven General Electric motor. Richard M. Park is general manager.

**MURRAY, IA.**—At a special election held recently the proposition to grant Gilbert Johnson an electric franchise was carried.

**NEVADA, IA.**—A deal has practically been closed for the sale of the property of the Nevada El. Co. to the Iowa El. & Pwr. Co., of Cedar Rapids. William G. Dows is president of the Cedar Rapids company.

**SUTHERLAND, IA.**—A proposition has been submitted to the Council to install an electric-light system in Sutherland, energy to be supplied from the plant of the Peterson Hydro-Electric Co., of Peterson.

**VALLEY JUNCTION, IA.**—The City Council is considering the proposition of establishing a municipal electric-light plant and water-works system. The cost of the proposed plants is estimated at about \$10,000.

**WINFIELD, IA.**—A franchise has been granted Orr Vangler, of Wapello, to install an electric-light plant here.

**CLAY CITY, KAN.**—The Public Works Commission expects to change the municipal street-lighting system from arc lamps to series incandescent lamps. C. F. Rasmussen is superintendent of the light and plant.

**DOWNS, KAN.**—The Downs El. Lt. & Pwr. Co. expects to erect within a few months a new power house complete and to purchase one 150-hp steam engine with boiler and all accessories and a 100-kw, two-phase 60-cycle, 2200-volt generator. C. A. Beckford is manager.

**GARDEN CITY, KAN.**—At an election held recently the proposition to issue \$40,000 in bonds for the installation of a municipal electric-light plant was carried. J. F. Crocker is city clerk.

**TURON, KAN.**—At an election held recently the proposition to install an electric-light plant and water-works system was carried.

**COVINGTON, KY.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 13 for a conduit and wiring system and lighting fixtures in the United States court house and post office at Covington, Ky., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian at Covington. Oscar Wenderoth is supervising architect.

**EMINENCE, KY.**—An ordinance has been introduced in the City Council authorizing the sale of an electric-lighting franchise. The Kentucky Utilities Co., of Louisville, has notified the City Council that it will bid on the franchise and if purchased by it will furnish a 24-hour service. The company also proposes to supply electrical service in New Castle and Pleasureville.

**HAZARD, KY.**—Arrangements have been made by E. A. Pollard and James Williams, of London, Ky., for the establishment of an electric-light plant in Hazard.

**LEITCHFIELD, KY.**—The Leitchfield El. Lt. & Pwr. Co. contemplates enlarging its plant and installing water-works equipment, to be operated in connection with its electric-light system.

**LOUISVILLE, KY.**—The Kentucky Paint & Glass Co., 314 East Market Street, Louisville, it is reported, will be in the market for motors for a plant manufacturing plant.

**PADUCAH, KY.**—Superintendent J. O. Keebler has submitted a report to the City Council requesting that an appropriation of \$1,500 for a generator for the municipal electric-light plant be included in the 1913 appropriation ordinance.

**DONALDSONVILLE, LA.**—Contracts, aggregating about \$41,000, have been awarded by the municipal light and water commission for machinery to be used in remodeling the municipal electric plant to the Diesel Engine Co., the Fort Wayne El. Co. and the Lawrence Machine Co. Plans are being prepared for the new power house and bids for erecting same will soon be called.

**LAFAYETTE, LA.**—The Louisiana Trac. & Pwr. Co. has purchased a site in Lafayette for its proposed power house for the operation of its electric railways in southwest Louisiana.

**BIDDEFORD, MAINE.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 30, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Biddeford. Drawings and specifications may be obtained at the above office or from the custodian of site at Biddeford.

**BALTIMORE, MD.**—The Consol. Gas, El. Lt. & Pwr. Co. will soon establish a new storage and distributing station in the eastern section of the city on Constitution Street, near Monument Street.

**BALTIMORE, MD.**—The Baltimore International Devel. Co., Munsey Building, Baltimore, it is reported, would like to correspond with manufacturers and contractors relative to the installation of an electric plant at a coal mine in southwest Texas. The company would like prices on boilers, engines, generators and equipment for 200 miles of transmission line, including poles, wires and insulators.

**MOUNT AIRY, MD.**—George W. Runkles and Emory Wagner are interested in a project to establish electric-light and ice plants and laundry here.

**BATTIE CREEK, MICH.**—In addition to the Grand Rapids Kalamazoo line, now under way, the Michigan & Chicago Ry. Co. contemplates buy-

ing another that will connect Battle Creek with Albion, south of the Lake. The other line is from Kalamazoo to Paw Paw, where it branches, one division continuing to Benton Harbor and the other to South Haven.

**BAY CITY, MICH.**—The Bay City El. Co. has estimated the cost of its local system at a cost of from \$150,000 to \$200,000. These improvements are being made by the city.

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**BELLEVIEW, MICH.**—The Belleview Improvement Co. has secured a franchise to install a street-lighting system in Belleview, Mich. The company will install a system of incandescent lamps.

**DETROIT, MICH.**—The Detroit Edison Co. is preparing the electrical code for the city of Detroit. The code is being prepared by the city engineer, Edward Gray is chief engineer.

**DETROIT, MICH.**—The Detroit Edison Co. is preparing the St. Clair Hotel permission to run electric wires through a conduit now extending across Monroe Avenue, for the purpose of furnishing electricity for lamps and motors to a number of business firms in that section.

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**RICH HILL, MO.**—The City Council has engaged Rollins & Westover, Midland Building, Kansas City, Mo., to prepare plans and estimates and supervise the construction of the municipal electric-light system in Rock Hill.

**WASHINGTON, MO.**—The Mississippi Pwr. Distributing Co. has purchased the property of the Tibbe El. Co. and the Franklin Independent Tel. Co., of Washington. Energy for operating the local system will be transmitted from the Keokuk dam.

**GREAT FALLS, MONT.**—The Great Falls Automatic Tel. Co. has been acquired by the Mountain States Tel. Co. (Bell system) and will be consolidated in the near future. Many improvements are contemplated.

**LIBBY, MONT.**—The Kootenai Pwr. Co., of Cœur d'Alene, Idaho, is contemplating the construction of a dam and electric power plant here, for which plans are being prepared. Paul D. Pratt, of Libby, is local representative.

**SCHUYLER, NEB.**—Improvements are contemplated to the municipal electric-light plant within the next 12 months, including the purchase of a 40-kw or 50-kw, 230-volt, three-wire direct-current generating unit, directly connected, and switchboard for same. E. A. Schmid is manager of the municipal electric-light and water-works plant.

**TECUMSEH, NEB.**—The city has recently enlarged the municipal electric-light plant and water-works. A new 150-hp boiler and shaker grate have been installed and new coal bins built. A new pump has also been installed, a well driven and transmission line erected to same. E. D. Charles is superintendent of water and light plant.

**WAYNE, NEB.**—The Mayor has been authorized to appoint a committee of five from among the citizens to act with the committee from the City Council in regard to plans for improvements to the municipal electric plant.

**CARSON CITY, NEV.**—Ira Winters, of Carson City, contemplates the installation of a large electrically driven pumping plant to irrigate his land (1000 acres) on Washoe Lake.

**EXETER, N. H.**—The Public Service Commission has granted the Exeter & Hampton El. Co. permission to operate an electric system in the town of Stratham.

**KEENE, N. H.**—The Public Service Commission has granted the petition of the Keene Gas & El. Co. and the Ashuelot Gas & El. Co. for authority to operate an electric system in the town of Westmoreland.

**ASBURY PARK, N. J.**—Plans are being considered by the Beach Commission for the installation of a new lighting system for the boardwalk and the beach front, to cost about \$10,000.

**CRANFORD, N. J.**—The Barrows-Stewart Co. has been awarded a contract by Thomas Barret to build a concrete dam across the Rahway River at Cranford. The water will be used to drive a turbine to generate electricity for lamps and motors for local use.

**KEYPORT, N. J.**—An ordinance authorizing the Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. to construct and operate plants in Matawan, Holmdel and Marlboro Township has been approved by the Board of Public Utilities.

**YARDVILLE, N. J.**—The Public Service El. Co. is planning to install an electric distributing system here.

**CLAYTON, N. M.**—The municipal electric-light and power plant, which was recently destroyed by fire, is to be rebuilt and equipped with modern machinery.

**CARTHAGE, N. Y.**—The village of Carthage has entered into a contract with the Carthage El. Lt. & Pwr. Co. for a period of five years. Under the new contract the company is to furnish 46 arc lamps and 16 40-watt tungsten lamps and also 84 60-watt tungsten lamps in the business section of State Street. The 84 lamps for the business district will be placed on ornamental standards. Work will begin on the installation of the ornamental lighting system as soon as possible next spring. The contract provides for placing wires underground on State Street.

**MARCELLUS, N. Y.**—The Marcellus Ltg. Co. is changing over the local system to utilize Niagara power. The substation and transmission line have been erected and transformers for 25-cycle system purchased. The company expects to purchase a new lighting outfit throughout; tungsten-mercury will be used. F. W. Knapp is interested in the company.

**MECHANICSVILLE, N. Y.**—The Halfmoon Lt., Ht. & Pwr. Co., of Mechanicville, is making arrangements to change its generating equipment. At present it is purchasing power from the Adirondack El. Pwr. Corp., receiving energy at 40 cycles and regenerating at 60 cycles. The company expects to do away with its motor-generator sets and connect up direct to 40 cycles, making its system 40 cycles throughout. On account of this change the company will be obliged to purchase a large amount of equipment, such as motors, transformers, regulators, etc. Appliances of all kinds will be purchased by the company for its show-room, including one power table. W. L. Howland is treasurer and general manager.

**NEW YORK, N. Y.**—Plans are being considered by the executive committee of the Broadway Association for the installation of a new street-lighting system on Broadway from Twenty-third Street to Times Square. It is proposed to do away with poles altogether and to have lamps suspended from brackets attached to buildings, to be placed at about 20 ft. to 30 ft. apart.

**NEW YORK, N. Y.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until

Jan. 25 for three electric passenger elevators in connection with the reconstruction of the United States barge office, New York, in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

**NEW YORK, N. Y.**—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 8 for furnishing materials and installing a complete electric-lighting system in the Church of the Good Shepherd, and for additions to the electrical equipment in the Roman Catholic church at the New York City Home for the Aged and Infirm, Blackwell's Island, N. Y. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen.

**RANDOLPH, N. Y.**—The Randolph El. Lt. & Pwr. Co. expects to purchase within the next four months transformers, etc., necessary to provide for day service. The company has recently installed two 150-hp water-tube boilers. J. W. Grace is manager.

**ROCHESTER, N. Y.**—Plans are being prepared by the Rochester Ry. & Lt. Co. for enlarging the boiler house of its power station 3, located just north of the Platt Street bridge. The plans provide for increasing the boiler capacity by 10,000 hp (12 boilers of 825 hp each) and the installation of automatic underfeed stokers.

**ROME, N. Y.**—For the purpose of demonstrating the various methods of lighting the business district of the city with ornamental lamps, a committee of the Chamber of Commerce and one from the Board of Public Works have secured several different styles of lamps and poles which will be tried out in various parts of the city. The Rome Gas, El. Lt. & Pwr. Co. will erect the lamps and have charge of them.

**HAMLET, N. C.**—The power plant of the shops of the Seaboard Air Line Ry. Co. in Hamlet was recently destroyed by a boiler explosion.

**FINDLAY, OHIO.**—The City Council has authorized the lighting committee of the Council to make investigations relative to the establishment of a municipal electric-light plant. The lighting contract with the Toledo, Bowling Green & Southern Trac. Co. will expire Dec. 3, 1913.

**XENIA, OHIO.**—The Public Service Commission has authorized the Dayton Lt. & Pwr. Co., of Dayton, to take over the property of the Xenia Gas & El. Co. The price paid for the plant was \$149,750. The Dayton company was also granted permission to issue capital stock to the amount of the sale price.

**CUSHING, OKLA.**—An electric-light plant is being installed here by H. Askin and Frank Overlees. It is understood that part of the material has been purchased.

**INGERSOLL, OKLA.**—B. F. Blue, clerk, writes that the town does not propose to install an ornamental street-lighting system as published in these columns in the issue of Dec. 21 but is preparing plans for the erection of a transmission line from Ingersoll to the municipal electric plant in Cherokee, a distance of 4 miles, to secure energy to operate the proposed electric-light system here.

**PONCA CITY, OKLA.**—The City Council has awarded the contract for erection of pole line, electric machinery, pumping station and installation of system to the Halstead Construction Co., of Phoenix, Ariz., for \$5,990, machinery to be supplied by J. Merkle & Co., of Kansas City, at \$3,950. When completed the light and water plants, which are owned by the city, will be placed under one management. V. A. Harding, of Kansas City, has been employed as superintendent.

**BAKER, ORE.**—The Eagle River El. Pwr. Co., of Baker, Ore., may possibly extend its transmission lines 12 or 15 miles to furnish electricity for mining and irrigating work within the next 12 months. J. K. Roming is manager.

**HERMISTON, ORE.**—The Hermiston Lt. & Pwr. Co. has been granted a franchise to extend its transmission lines into Echo, the work to be completed in 90 days. The company will also furnish electricity in Umatilla at once.

**WILLIAMS, ORE.**—The Williams Wtr. & El. Co. expects to purchase within the next three months boilers, engines, generators, pumps and condensers, etc. Luther Stover is interested in the company.

**FARRELL, PA.**—The Farrell Improvement Co. is contemplating the installation of an ornamental street-lighting system on Broadway and Haywood Street. It is proposed to erect ornamental standards carrying cluster lamps. Farrell has not a post office.

**FRANKLIN, PA.**—The Citizens' Lt. & Pwr. Co., of Johnstown, is contemplating increasing the output of its local power plant.

**NEW MILFORD, PA.**—The New Milford Lt. & Pwr. Co. expects to erect within the next nine months a new power house and to purchase one or two waterwheels and one waterwheel governor. Charles N. Wood is president and general manager.

**WHEATLAND, PA.**—The Council has approved the 10-year contract with the Shenango Valley El. Lt. Co., of Sharon, for street lighting at \$23 per lamp per year. The company was granted a franchise for commercial lighting in the town.

**FORK SHOALS, S. C.**—The Cedar Falls Lt. & Pwr. Co. is planning to improve and enlarge its hydroelectric plant here. The wood dam will be replaced by a masonry one and the output of the power plant increased by about 500 hp. The transmission lines will be extended so as to supply electricity to the Kotrine Mfg. Co. in Fork Shoals, also to Fountain Iron, Simpsonville and several other cities. Post office address, Fork Shoals (R. F. D., Fountain Inn, S. C.).



ORANGEBURG, S. C.—The Commissioners of Public Works have requested the City Council to issue bonds to move the municipal electric-light plant to a site on the western outskirts of the city on the Edisto River. The present location has become inadequate for the plant.

ROCK HILL, S. C.—Proposals will be received by the Public Works Commission of the city of Rock Hill until Jan. 21 for the construction of a water-works system. The work will consist of auxiliary and main pumping station, electrically driven pumps, 1,000,000-gal. filter plant and reservoir and about 5 miles of pipe line to the Catawba River. Plans and specifications are on file at the office of the superintendent at Rock Hill, and at the office of Gilbert White, engineer, Charlotte, N. C. Specifications and bidding sheet can be obtained on application to engineer. A complete set of plans will be mailed on receipt of \$5 to cover cost. J. B. Johnson is chairman.

LESTERVILLE, S. D.—The Board of Trustees has purchased the electric-light system of the Commercial Club, which will now be owned and operated by the municipality.

BAY CITY, TEX.—Robert McCormick, consulting engineer, of Kansas City, Mo., has been engaged by the Bay City Ice & Lt. Co. to prepare plans for the installation of a new 300-kw steam turbine and complete boiler equipment. The Bay City company recently passed to the control of the Emanuel syndicate, of Dayton, Ohio, which plans other improvements to the ice and electric service. W. C. Duncan is local manager.

BURNET, TEX.—A petition is being circulated asking the City Council to call an election to vote on the proposition to issue bonds for the installation of an electric-light plant, the amount not to exceed \$6,000.

HOUSTON, TEX.—The South Texas Trac. Co., recently organized in Houston, will construct an interurban electric railway between points in Harris County. A. E. Hall, C. H. Hall and John A. Woen, of Alvin; H. T. Arnold, of Houston, and Edward P. Allen, of St. Louis, Mo., are interested.

SAN SABA, TEX.—The San Saba El. Lt. Co. has been granted a 50-year franchise by the City Council to install and operate an electric-light plant here.

TEXARKANA, TEX.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 24 for an electric elevator for the United States court house in Texarkana, in accordance with drawings and specifications, copies of which may be obtained at the above office.

SALT LAKE CITY, UTAH.—The Utah Lt. & Ry. Co. has filed an application with the city recorder for an amendment to its franchise permitting it to extend its Warm Springs car line from Seventh North and Second West Streets to the Davis County line. The company contemplates extending the railway to East Bountiful some time this year.

BIG STONE GAP, VA.—The Powell Valley Lt. & Pwr. Co. has recently erected a concrete power house, 32 ft. by 84 ft., and has purchased one 200-kva General Electric generator, one 300-hp Brown Corliss engine and two 150-hp Heine Safety hoilers, one General Electric switchboard, complete, and a lighting system, consisting of 50 General Electric luminous arc lamps. J. H. Matthews is secretary and treasurer.

MARION, VA.—The Appalachian Pwr. Co., of Bluefield, W. Va., has purchased a site in Marion on which it proposes to erect a substation, storeroom and office.

PETERSBURG, VA.—The Common Council has awarded the contract for street lighting to the Virginia Ry. & Pwr. Co. of Richmond. The contract is for a period of five years, beginning April 15, and provides for the installation of 40 additional arc lamps on Sycamore Street, between Old and Oak Streets. The company will substitute ornamental poles for the ones now in use.

BUCKLEY, WASH.—The Council has granted P. H. Hebb, of Tacoma, a 50-year franchise to supply electricity in Buckley. Mr. Hebb owns power rights on the White River which he proposes to develop.

RAYMOND, WASH.—The Twin City El. Co. is planning to rebuild its entire lighting system in this city, work on which will begin in the near future. Several new distribution districts are being laid out for the service.

WALLA WALLA, WASH.—C. S. Walters, general manager of the Pacific Lt. & Pwr. Co., states that \$150,000 will be expended by the company in this valley for improvements to its system, including the construction of new tracks in Walla Walla and Milton, new cars, paving, reconstruction of substations, freight locomotive, sheds, etc. The company will also build a 10-mile extension to the interurban line out of Vincent, at a cost of about \$225,000.

CHARLESTOWN, W. VA.—The property of the Citizens' El. Co., of Charlestown, has been purchased by the Washington City Ry. Co.

BAYFIELD, WIS.—Improvements are contemplated to the municipal electric-light plant within the next six months which will include the purchase of one 120-kw, 60-cycle, 2300-volt alternating-current generator directly connected to high-speed engine; one 60-kw, 60-cycle, 2300-volt belted generator, new switchboard and one motor-driven triplex pump, about 200 gal. per minute capacity. F. M. Herriek is superintendent.

LITTLE CHUTE, WIS.—The Valley Mill & Mercantile Co. contemplates the installation of an electric-light plant.

CODY, WYO.—The Shoshone El. Lt. & Pwr. Co. expects to purchase within the next three months two carloads of Idaho cedar poles and 50 meters. D. A. Tinkcom is superintendent.

RAWLINS, WYO.—The Rawlins El. Lt. & Fuel Co. expects to erect within the next 12 months an elevated coal track to facilitate unloading coal and may possibly purchase a 500-hp surface condenser, 1 ton of wire, 75 meters and a small amount of miscellaneous supplies. Within the next six months the company expects to purchase about 50 ornamental lamp-posts and miscellaneous appliances. J. H. Jacobucci is manager.

NEW WESTMINSTER, B. C., CAN.—The Westminster Pwr. Co., recently organized, proposes to build large storage reservoirs on Brand Creek, Indian River, Young Lake and North Norton Lake, for the purpose of generating electricity to be transmitted to New Westminster, Vancouver and other towns and cities.

VICTORIA, B. C., CAN.—Sealed tenders will be received by W. Galt, city purchasing agent, until Jan. 27 for such general supplies, including cluster-lamp globes, tungsten lamps, carbons, Portland cement, brass goods, hydrants, lead pipe, etc., as may be required by the municipality. Plans and specifications may be obtained at the office of the city purchasing agent.

TRANSCONA, MAN., CAN.—Tenders will be received by P. E. Ryan, secretary of the Commissioners of the National Transcontinental Railway, at Ottawa, until Feb. 13, for furnishing machines, tools, appliances, motors, furnaces, cranes, etc., required for the equipment of the car department shops at Transcona, Man. Specifications may be obtained at the office of W. J. Press, mechanical engineer, Ottawa, Ont.

WINNIPEG, MAN., CAN.—Sealed tenders will be received at the office of M. Peterson, secretary board of control, Winnipeg, Man., addressed to Chairman Board of Control, until Jan. 24, for furnishing and installing in the terminal station three 2700-kw step-down transformers with oil and accessories complete. Plans and specifications may be obtained at the Civic Light and Power Department, 54 King Street, Winnipeg.

BRANTFORD, ONT., CAN.—The city of Brantford is contemplating the installation of an electrically driven pump (10,000,000-gal. capacity) at the water-works pumping station. H. F. Leonard is city clerk.

HAMILTON, ONT., CAN.—The Hydro-Electric Department of the City Council has received authority from the Hydro-Electric Power Commission of Ontario to construct a conduit system for underground wires in Hamilton, to cost \$600,000.

PARRY SOUND, ONT., CAN.—A by-law will soon be submitted to the ratepayers asking an appropriation of \$5,000 for the installation of a new lighting system. E. E. Armstrong is clerk.

SARNIA, ONT., CAN.—An application has been filed with the Secretary of State at Ottawa for an act to incorporate a railway company under the name of the Huron Lake Shore Ry. Co. to construct and operate an electric railway from Sarnia to Meaford through the counties of Lambton, Bruce and Grey. The company asks for general powers of a railway, including the right to transmit and distribute electricity.

WINDSOR, ONT., CAN.—The City Council has entered into a contract with the Ontario Hydro-Electric Commission for power generated at Niagara Falls to the amount of 2500 hp at \$48 per hp per year. The transmission lines are to be erected within 12 months.

WINDSOR, ONT., CAN.—The Windsor & Tecumseh Ry. Co. has been granted permission to build a 10-mile addition to its present system, to cost about \$250,000. The proposed line will extend from Tecumseh, the present terminal, to Belle River, and work on it will be started at once.

MONTREAL, QUE., CAN.—The lower house of the Legislature has passed a bill incorporating Mount Royal (the Canadian Northern Railway Company's model city) with an extensive franchise for 25 years to the Montreal Tramways Co. and a 15-year exclusive franchise to the Public Service Corp. to supply electricity for lamps and motors.

WADENA, SASK., CAN.—The contract for installing an electric light and power plant at Wadena has been awarded to the British Columbia Engineering Co., of Winnipeg, Man.

## New Industrial Companies

THE CANADIAN BRUTHEE ELECTRIC AUTOMOBILE & BATTERY COMPANY, of Montreal, Que., Can., has been incorporated with a capital stock of \$1,000,000 by G. H. Sedgewick, A. G. Ross and A. E. Langman.

THE ENGLE BATTERY COMPANY OF CANADA, LTD., of Quebec, Que., Can., has been incorporated by L. B. St. Laurent, Hector La Ferte and Antonin Galipeault, all of Quebec. The company is capitalized at \$100,000 and proposes for its principal business in electric power, mechanical engineering, and the manufacture of batteries, storage and other electrical equipment.

THE FERRANTI ELECTRICAL COMPANY OF CANADA, of Toronto, Ont., Can., has been incorporated with a capital stock of \$250,000 by A. Gilmour, C. H. Watson and R. B. Henderson.

THE INTERSTATE EQUIPMENT MANUFACTURING COMPANY, of Chicago, Ill., U. S. A., has been incorporated by H. H. Russell, Joseph W. Fay and H. C. Nelson. The company is capitalized at \$5,000 and proposes to manufacture and deal in electrical supplies and devices.

THE JACKSON EASTERN DISTRIBUTORS, INC., of New York, N. Y., has been incorporated with a capital stock of \$10,000 to manufac-

ture engines and motors. The incorporators are: Fred C. Riley, Leo M. Garahan, John P. Hilands, 2 Rector Street, New York. The company proposes to manufacture and deal in engines and motors.

**THE LA FRANCE ELECTRICAL CONSTRUCTION & SUPPLY COMPANY**, of Toledo, Ohio, has been incorporated with a capital stock of \$10,000 by Otto G. Knigge, Richard W. Kirkley, G. E. Smith and Frank H. Geer.

**THE SPLITDORF ELECTRICAL COMPANY**, of New York, N. Y., has been incorporated with a capital stock of \$25,000 to manufacture engines, motor generators, batteries, etc. The incorporators are: Carlos W. Curtiss, Oscar J. Rhode and Walter J. Murray.

**THE STAR BALL PLAYER COMPANY**, of Newark, N. J., has been incorporated by G. A. Swain, of Montclair; G. H. Litterer, of New Brunswick, and F. G. Lake, of Newark. The company is capitalized at \$125,000 and proposes to manufacture electrical and other indicators to show scores, records, news, etc.

**JOHN WENDT & COMPANY**, of Harrisburg, Pa., has been granted a charter with a capital stock of \$10,000 for the purpose of dealing in gas and electric fixtures. John Wendt is among the incorporators.

## New Incorporations

**LITTLE ROCK, ARK.**—The Arkansas El. Co. has been incorporated with a capital stock of \$20,000. The officers are: C. J. Dolis, president; J. H. Carmichael, vice-president; Nicholas Campbell, secretary and treasurer.

**WILMINGTON, DEL.**—The Eastern Mexico Pwr. & El. Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$300,000. Herbert E. Latter is among the incorporators.

**PORTLAND, MAINE.**—The Bellows Falls Pwr. Corp. has been incorporated with a capital stock of \$100,000 to construct and operate plants to generate power for lighting, heating and power purposes. A. F. Jones is president and A. A. Richards treasurer, both of Portland.

**ST. LOUIS, MO.**—The North Missouri Pwr. Co. has been incorporated with a capital stock of \$2,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are: John S. Lehmann, Harry C. Leehr and Frank H. Nottbusch.

**BELVIDERE, N. J.**—The Belvidere Delaware El. Lt. & Pwr. Co. has been incorporated with a capital stock of \$50,000 to operate electric light and power plants. The incorporators are: S. E. Boardman, H. G. Boardman, of Oxford Township, and J. M. Roseberry, of Belvidere.

**NEW YORK, N. Y.**—The Inter-Ocean Ry. Co. has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at \$5,000,000 and proposes to control railway, light, heat and power plants and to do a general transportation business. The incorporators are: Ludwig De Leopold, Paul J. Huesler and Walter E. O. Schaltz, all of New York.

**WINGATE, N. C.**—The Wingate Tel. Co. has been incorporated with a capital stock of \$10,000 by J. W. Bevins and others.

**WARREN, OHIO.**—The Twentieth Century El. Ltg. Co. has been incorporated with a capital stock of \$30,000 by Jay Buchwalter, G. W. Phelps, C. C. Chaffee, H. S. Shaw and M. A. Hood.

**PITTSBURGH, PA.**—The Baden El. Co. has been incorporated with a capital stock of \$5,000 by H. F. Kates, of Pittsburgh; H. C. Denison and W. A. Weiland, of Bellevue.

**SCRANTON, PA.**—The Ry., Lt. & Pwr. Co. has been granted a charter with a capital stock of \$10,000. The incorporators are: Frank J. Pryor, Jr.; Joseph M. Welsh and W. J. Mulholland, of Scranton.

**SEWARD, PA.**—The Seward El. Co. has been incorporated with a capital stock of \$5,000 by J. W. Blough, H. E. Thompson and R. C. Saylor, all of Johnstown.

**SNYDER, TEX.**—The Snyder Ice & Lt. Co. has been incorporated with a capital stock of \$25,000 by E. W. Clark and others.

**GREEN SPRING DEPOT, VA.**—The Watauga & Green Spring Tel. Co. has been incorporated with a capital stock of \$5,000. The officers are: W. T. McConnell, president; J. D. McChesney, vice-president, and Guy McConnell, secretary, of Abingdon, Va.

**ABBOTSFORD, WIS.**—Articles of incorporation have been filed for the Abbotsford El. Co. with a capital stock of \$10,000 by G. H. Baker, A. J. Young, F. A. Jackson, H. J. Campbell, F. B. Wing and J. A. Billings.

## Trade Publications

**ELECTRIC RADIATORS.**—Luminous "Aston" radiators form the subject of Publication No. 710, a copiously illustrated four-page folder on this product of Veritys, Limited, 28 King Street, Covent Garden, London, W. C., England.

**GAS-GENERATING SYSTEM.**—Bulletin No. 106 of the Power & Mining Machinery Company, Milwaukee, Wis., refers to the Loomis

Pettibone gas-generating system, illustrates and describes the operating characteristics of this system, and also shows pictures of a number of plants in which the system has been installed.

**FUEL ECONOMIZERS.**—The Green Fuel Economizer Company, Matteawan, N. Y., is issuing a forty-eight-page condensed catalog of its products. It is No. 145 and is entitled "What We Make." It refers briefly to standard and special fuel economizers, coverings for fuel economizers, mechanical-draft outfits, heating, ventilating and drying outfits, motor-driven and engine-driven fans, propeller fans, vertical and horizontal engines and other apparatus.

**MODERN ILLUMINATION.**—An attractive pamphlet with a cover bearing the title "Modern Illumination" has been issued by the Bryan-Marsh Electric Works of the General Electric Company. In it an effort is made to bring out some of the more important advantages of electric lighting as applied to shops, public buildings, offices, streets, etc. A chart is given to show that in workshops the rate of accidents during the month of December is nearly twice as great as during the month of July, owing to the lack of proper illumination. The booklet contains much information, presented in non-technical language, of interest to the wide public concerned in the question of correct illumination.

**WOOD PRESERVATION.**—"Some Facts About Treating Railroad Ties" is the title of a treatise by Mr. W. F. Goltra, recently published by the W. F. Goltra Tie Company, Cleveland, Ohio, of which the author is president. The results of many years of experience, study and research in this important subject are embodied in this pamphlet. Part I gives comprehensive descriptions of the various processes of wood preservation that are at present in use—the Bethell, Burnet, Rutgers and others. Part II is devoted to recent improved methods of treating ties and timbers which are the result of extended research and experience on the part of the author. The treatise carries out its suggestive title, in that facts are dealt with and not theories. The little book contains a number of articles that have appeared in the technical press, contributed by Mr. Goltra and others, in which the subject matter is considered from all angles. Valuable tables showing weight of ties, absorption of oil, a layout of a tie-preserving plant for treatment by the Goltra process and other diagrams of interest are given. The treatise is copyrighted. It is bound with heavy paper covers, contains 110 pages and costs \$1 per copy.

## Business Notes

**THE FEDERAL SIGN SYSTEM (ELECTRIC)** has moved its general sales offices from the Home Insurance Building to its new factory building at Lake and Desplaines Streets, Chicago, Ill.

**THE METROPOLITAN ELECTRICAL SUPPLY COMPANY**, New York City, has removed its electrical supply business from 436 West Broadway to 76 West Thirty-sixth Street, where larger quarters have been provided.

**THE AUTOMATIC VENTILATOR COMPANY** announces that Mr. H. E. Lavelle, formerly with the Standard Paint Company, will be its selling and mechanical representative in the Middle Western States shortly after the first of the year. Mr. Lavelle will make Indianapolis his headquarters.

**THE GOULDS MANUFACTURING COMPANY**, Seneca Falls, N. Y., announces that the Mine & Smelter Supply Company, Denver, Col., has been appointed agent for the Goulds line of triplex pumps. The territory will include the entire State of Colorado and adjacent counties in the States of Wyoming, New Mexico, South Dakota and Montana.

**THE W. K. PALMER COMPANY**, engineer, Kansas City, Mo., announces the removal of its offices from quarters occupied for the past eight and one-half years to 919 Baltimore Street, where increased facilities for engineering business in the lines of its specialties are available. The company requests bulletins and catalogs of manufacturers of lines of equipment in civil, mechanical and electrical engineering fields.

**THE WIRE INSPECTION BUREAU** of New York, through its secretary, Mr. H. T. Wrecks, reports a continually increasing demand for special inspection, tests and general engineering work on railway signal, fire-alarm and electric-light installations from railroads such as the Lackawanna, Missouri Pacific, Chicago, Milwaukee & St. Paul, Great Northern, Chicago & Western Indiana, from municipalities, especially those operating under the commission form of government, and from fire marshals' offices of various states; also, a similarly increasing demand for general inspection work by independent organizations on all kinds of electrical and transmission machinery and apparatus and rubber goods.

**THE INDEPENDENT ELECTRIC MANUFACTURING COMPANY**, Milwaukee, Wis., has completed a new factory and moved all the equipment and stock into the new quarters. The building is located on the south side of Milwaukee and is said to be one of the most complete and up-to-date factories for the manufacture of starting and controlling devices in the country. Special attention has been paid to the experimental and test rooms, the test room being equipped with motor-generator sets so that variations of direct-current voltage may be obtained for testing direct-current apparatus, and transformers have been installed for the different alternating-current voltages. The property on which the factory is built is located on the Kinnickinnic River, making it possible to ship and receive by water, as well as rail when necessary.

ANALYST: J. H. HARRIS, JR., S. W. RICH, S. W. SUTHERLAND.



NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Company, Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, H. H. McKinney, Next annual meeting, Duluth, Minn., Jan. 7-8.

OHIO ELECTRICAL LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Columbus, Jan. 21.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkeny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

PITTSBURGH ELECTRICAL BOOSTER CLUB. Recording Watt, George H. Criss, 1806 Union Bank Building, Pittsburgh, Pa. Meeting, first Monday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary, Philip S. Dodd, 29 West 39th Street, New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo., Jan. 28-30, 1913.

WESTERN SOCIETY OF ENGINEERS. Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

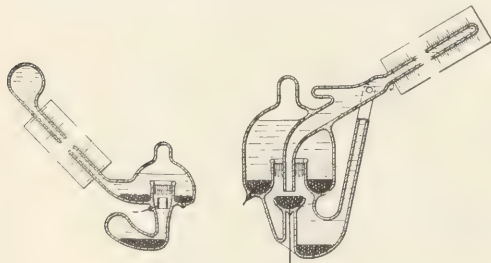
WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

## Weekly Record of Electrical Patents

### UNITED STATES PATENTS ISSUED DEC. 24, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,047,917. RAILWAY SIGNALING SYSTEM; C. J. Coleman, New York, N. Y. App. filed July 10, 1908. Automatic signals for steam or electric roads.
- 1,047,935. SWITCH HANDLE; M. Guett, Hartford, Conn. App. filed June 7, 1911. Rotary porcelain handle for snap switch.
- 1,047,954. MAGNETIC LIFTING APPLIANCE; G. Kröhne, Duisburg, Germany. App. filed Jan. 22, 1912. Plurality of linked magnets for lifting irregular bodies.
- 1,047,955. MEANS FOR REGULATING POLYPHASE COMMUTATOR MACHINES; J. L. LaCour, Vesterås, Sweden. App. filed Nov. 11, 1908. Special windings and adjustable transformers.
- 1,047,956. SYSTEM FOR AMPLIFYING ELECTRIC CURRENT VARIATIONS; C. D. Lindridge, Providence, R. I. App. filed Nov. 17, 1911. Negative and variable resistances for telephone transmission.
- 1,048,001. ATTACHMENT PLUG OR THE LIKE; J. C. Smith, Oak Park, Ill. App. filed March 29, 1911. Screw-shell anchorage and insulation.
- 1,048,003. MEANS FOR REGULATING ELECTRIC LAMPS; H. S. Stone, Boston, Mass. App. filed Jan. 21, 1911. Hand device for dentists, oculists, etc.



1,048,156.—Electrolytic Meter.

- 1,048,006. DYNAMO-ELECTRIC MACHINE; M. E. Thompson, Ridgway, Pa. App. filed June 23, 1910. Improvement on patent No. 591,024 to avoid leakage flux.
- 1,048,034. CONDENSER ARRANGEMENT; A. R. Bullock, Cleveland, Ohio. App. filed March 20, 1911. Series parallel.
- 1,048,066. GUARD FOR OVERHEAD TROLLEY WIRES; A. Gergely, Milwaukee, Wis. App. filed Aug. 9, 1912. Horizontally swinging lapped fingers constituting emergency supports.
- 1,048,119. ELECTRIC SWITCH; J. E. Wood, Dalton, Mass. App. filed Jan. 3, 1912. Lever switch with lock for automobiles, etc.
- 1,048,144. METALLURGICAL FURNACE; C. H. Fulton and W. A. Coursen, Rapid City, S. D. App. filed July 7, 1911. Cylindrical resistance type.
- 1,048,156. ELECTROLYTIC METER; H. S. Hatfield, Jena, Germany. App. filed May 4, 1912. Special measuring vessel filled by tilting the meter.

- 1,048,164. TROLLEY POLE; E. A. Hornbostel, Jr., Des Moines, Ia. App. filed April 18, 1906. Locked in case of derailment.
- 1,048,167. KEY SOCKET; H. Hubbell, Bridgeport, Conn. App. filed June 17, 1911. Contacts inclosed in two-piece porcelain.
- 1,048,168. KEY SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Mechanism carried by one part of a two-piece base.
- 1,048,172. ELECTRICAL SWITCHING AND TESTING DEVICE; M. R. Hutchison, Bronxville, N. Y. App. filed Oct. 21, 1905. Self-contained hand device.
- 1,048,176. TROLLEY AND SWITCH; T. P. Knowland, Jeffersonville, Ind. App. filed Dec. 28, 1908. Switching and replacing device.
- 1,048,200. ELECTRICAL SIGNALING SYSTEM; W. Noble, St. Louis, Mo. App. filed July 16, 1909. Contact-controlling mechanism for selective telegraphy, etc.
- 1,048,209. TELEGRAPH REPEATER; G. L. Rawdon, Cleveland, Ohio. App. filed Jan. 2, 1912. Time relay. Improvement on patent No. 914,877.
- 1,048,223. ELECTROMAGNETIC SEPARATOR; H. Stein, Cologne, Germany. App. filed Nov. 28, 1908. Serrated pole extensions.
- 1,048,231. METHOD OF MANUFACTURING CARBORUNDUM FILAMENTS; F. C. Thoms, Pittsburgh, Pa. App. filed Dec. 4, 1909. A carbon core is flashed in a vapor of silicon tetrachloride, hydrogen and ethylene.
- 1,048,253. TELEPHONE TRANSMITTER; D. H. Wilson, Chicago, Ill. App. filed Dec. 30, 1904. Two opposing diaphragms.
- 1,048,260. TROLLEY GUARD; G. Zeller, Issaquah, Wash. App. filed May 29, 1912. Retaining clamp.
- 1,048,277. THERMOSTAT; D. E. Belden, Auburn, N. Y. App. filed June 24, 1911. With temperature-adjustment feature for regulating house temperature, etc.
- 1,048,279. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed April 19, 1912. Retaining device.
- 1,048,314. TROLLEY HEAD; O. N. Iverson, Hills, Minn. App. filed April 23, 1912. Tension and replacing device.
- 1,048,349. TEMPERATURE ALARM; C. F. Rumold, J. P. Faulkner and J. W. Dinsmore, Berea, Ky. App. filed June 30, 1911. Induction coil and permanent magnet.
- 1,048,366. ELECTROMAGNETIC SWITCH; J. C. Smith, Louisville, Ky. App. filed July 31, 1911. Brake and arc extinction.
- 1,048,390. INSULATOR; F. Brown, Laketon, Mich. App. filed Sept. 9, 1911. Two-part conical pin type.
- 1,048,394. DEVICE FOR CLOSING OR CAPPING VESSELS AND SIMILAR ARTICLES; M. Dickinson, Brighton, England. App. filed Aug. 2, 1912. Disinfecting telephone transmitter device.
- 1,048,419. CONTROLLER; A. J. Loguin, West Allis, Wis. App. filed March 27, 1911. Protective starting device.
- 1,048,424. FLUID PRESSURE GOVERNOR; J. F. Menningen, West Allis, Wis. App. filed May 20, 1909. Quick make-and-break switch.
- 1,048,432. MOTOR-CONTROL SYSTEM; J. C. Smith, Louisville, Ky. App. filed July 31, 1911. Dynamic braking.
- 1,048,436. ELECTRIC CURRENT TRANSFORMER; E. C. Westcott, Sacramento, Cal. App. filed Dec. 4, 1911. Closed tank containing oil-submerged winding.
- 1,048,439. ELECTRICALLY ACTUATED RAILWAY SWITCH; J. H. Baker, Henderson, Ill. App. filed Oct. 31, 1910. May be thrown from a signal station, engine cab or car, or manually.
- 1,048,443. TELEPHONY OR TELEGRAPHY; S. G. Brown, London, England. App. filed Dec. 28, 1908. Amplifying signals.
- 1,048,450. CURRENT-CONTROLLING APPARATUS; E. L. Gale, Sr., Yonkers, N. Y. App. filed May 1, 1905. Automatic starting and stopping of elevators, etc.

# Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD AND ELECTRICAL ENGINEERING

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No. 2

## Growing Electrical Exports

The figures of the Department of Commerce and Labor for the export trade of October continue to show the upward trend of electrical development in this branch of our foreign business. The total exports of electrical goods in that month reached an amount not less than \$2,078,501, as compared with \$1,434,650 in the preceding year for the same month. This is a gain of about 40 per cent. The interesting fact is that it lies concealed in that tantalizing bunch of "all other," which jumped from \$786,718 to \$1,295,368. The total figures for the ten months ending October are also interesting, as they run as follows: 1910, \$14,031,971; 1911, \$15,590,757, and 1912, \$18,755,000. It will be seen at once that gains in foreign trade are cumulative and almost compounding, and equal the rapid advances that are going on in the industry considered purely from the domestic standpoint. All of this gives a new and acute interest to the tariff changes that may occur under our new political régime with the incoming of a new Congress and a new President pledged to "tariff reform." Personally and collectively we are heartily in favor of anything and everything that will reduce the "high cost of living" and will assist at the same time in the development of our foreign trade through export and interchange, but we are nowise envious of those whose intimate duty and responsibility it is during the next few years to adjust and solve all these intricate problems. One of our New Year pledges might well be to help them.

## Lucid Rate Schedules

How thoroughly awake the well-managed public-utility companies are to the importance of their relations with the public is made evident by the fact that so many of them have a responsible officer in direct charge of such relations. These officers are responsible for the courteous treatment of their patrons at all times and under all conditions. The obvious phases of such work are the adjustment of disputed bills, alleged meter errors, failure to make prompt installation or removal of service connections, correcting the causes of poor service, and the like. There might be included in this list the matter of handling new or prospective customers with proper consideration and tact, making clear what the service will cost and how the bills will be rendered. Above all, there should never be placed in the hands of the non-technical consumer without careful personal explanation a schedule of rates or data in relation thereto which is not on its face reasonably self-evident. An example of unintelligible data placed in the hands of a new consumer without any explanation whatever was given under the title "Rate Schedules from the Customer's Standpoint" on page 49 of

last week's issue. Matters of this kind should not be handled by correspondence, but instead by personal visit on the part of a solicitor. Clearly enough the work of the solicitor is lessened if the rate schedules are simple and easily grasped by the lay mind, in contrast with some of the complicated schedules which are not as much as the target for, at times, defective schedules which require the solicitor to avoid pitfalls which may invite the customer's criticism or arouse his distrust. The thing first desired is the simplest form of schedule which is equitable, and the second thing is a clean-cut explanation of it in simple language.

## The Reader's Viewpoint

Few are the electrical problems on which there is not room for difference of opinion. Exhausted subjects are equally rare. When readers disagree with opinions or statements of fact in the *Electrical World*, or when they can amplify such statements—add their own experience to that of others—they are invited to write a "letter to the editors." Communications of this kind are welcomed, because the *Electrical World* aims to be a mouthpiece, a medium of expression, for every man who has something worth while to say on electrical topics. And there is no other forum where what is said reaches a larger or more interested audience. This is another reason why this invitation to correspondents should be accepted—freely and often.

## Oil-Engine Characteristics

The report by Messrs. Potter and Carlson of tests on an internal-combustion engine using heavy oil, on page 105 of this issue, is a very timely contribution to the literature of prime movers. At the present time the increase naturally to be expected in the price of gasoline in response to the enormously increased demand of the last few years is already taking place. In the ordinary course of refining petroleum only a small percentage of the products of fractional distillation come within the limits of density which generally used to be assigned to gasoline and kindred products, therefore, the demand for these products has been very strongly felt. Although the production of the lighter hydro-carbons has been increased by "cracking" the heavier product, it is still true that the demand for gasoline is relatively increasing while that for the oils of the kerosene class is relatively diminishing. It is, therefore, extremely desirable to utilize if possible for electrical generating purposes the heavier oils, as has been done with a considerable degree of success in the Diesel and similar engines. From a thermodynamic standpoint these have given excellent results, working at very high pressure and

high compression. Yet from these very characteristics they are high in first cost and have not appealed to the ordinary user of moderate amounts of electricity.

The particularly interesting feature of the test described is that the engine used was a very simple four-stroke-cycle, single-cylinder machine and operating at moderate pressure on fuel oil of the density of very heavy kerosene. The engine was of 75-hp rating with a 16-in. by 24-in. cylinder and ordinary make-and-break ignition worked with an auxiliary water spray and operated at a barometric pressure about 3 in. below normal, corresponding to an elevation of 2850 ft. This last condition, owing to decreased density of the charge, implied lower output on a given working condition, so that the mechanical efficiency must have been slightly reduced. The test was made with a Prony brake under carefully regulated conditions and the results proved to be highly interesting. The engine was started either by compressed air or by priming with gasoline, and when in operation the fuel oil was vaporized in a special coil outside the engine heated by the exhaust. At approximately full load and a mean effective pressure of 75.9 lb. per square inch, the engine under a three-hour test operated on 1.01 lb. of oil per brake-hp-hour. Bearing in mind the fact that at normal barometric pressure the output would have been increased by somewhat more than 10 per cent without an equivalent change in the mechanical efficiency, it is clear that this machine would actually produce a brake-hp-hour on somewhat less than 1 lb. of fuel, the corresponding half-load consumption per brake-hp-hour being about 1.25 lb. The thermal efficiency was 14.62 per cent at full load and 11.7 per cent at half load.

As to general operation, the experimenters report excellent performance, although the record taken of the explosion pressures indicates that the governor was not working as steadily as might have been the case. The thermal value of the fuel oil is approximately 17,000 heat units per pound, which is not at all exceptionally high. This sort of performance for a very simple engine of the low-pressure class is highly satisfactory, showing that for stationary use even in units of very moderate size the heavier fuel oils can be employed economically. In the present state of the gasoline market this is an important matter, particularly since an expensive type of engine need not be installed for the utilization of the heavier oils as fuel.

From the standpoint of the electrical engineer the tests are instructive as showing, first, that under ordinary conditions of loading the cost of operation of even so effective a unit as this rises to a point where electric energy can easily remain a competitor, and, second, that prime movers of this kind operated at full load, as they would be in an auxiliary electric plant for emergency service, can be worked economically. The weak point of all explosion engines is their loss of economy when operated at the low and variable loads which are most common in general industrial service. Such loads can well be carried by the electric motor. Electric distribution, therefore, has little to fear from the improvements in internal-combustion engines and is likely to gain more than it loses by itself being able to utilize the improved prime movers under conditions of maximum efficiency.

## A Notable Swedish Enterprise

One of the largest transmission plants thus far installed has recently been placed in service at Trollhättan, in Sweden. It is a government enterprise utilizing as its storage basin Lake Vänern, the third largest lake in Europe, with an area of 2150 sq. miles. The outlet of this great body of water, the Göta River, is normally, as might be expected, a comparatively steady stream, the minimum flow being about one-third the maximum. With the regulation possible to be applied on the lake the minimum flow can be considerably increased and the possible output will rise to not less than 200,000 hp. Approximately half this amount is the output planned for the present installation. The hydraulic situation seems to be a very favorable one, for the canal required for its development is only seven-eighths of a mile long from intake to forebay. The equipment of the initial plant consists of eight 10,000-hp turbines, six of which are already in operation and the others under construction. These turbines are double-runner units of the Francis type, working under 108-ft. head, each directly coupled to a 11,000-kva generator. With the gates wide open the turbines will deliver 25 per cent over their normal rating. It is interesting to note that the efficiency of these turbine units rises at full load to 87 per cent, while that of the generators rated on 80 per cent power-factor reaches 90 per cent.

The general station design is not out of the ordinary, but some details of equipment are of special interest. The stators are inclosed and the rotors are equipped with fans which draw air from the outside and force it through the stators and thence into outlet flues. These flues are arranged to discharge heated air into the racks throughout the winter, to decrease the danger of clogging from ice. Three exciters, directly driven from waterwheels operating in conjunction with a battery of 1000 kw-hr. storage capacity, take care of the energy needed for excitation. In connection with the exciting system use is made of a booster coupled to the shaft of each machine unit, which abolishes the need for main-field regulators, the whole regulation being accomplished by varying the booster-field magnetism.

The large generators deliver energy at 25 cycles, a frequency most unusual in European installations. Its chief reason for being is found in the fact that the Trollhättan plant will very probably be used to supply energy for railroad electrification. The probability of electrification of the Swedish government railroads, which has been greatly favored, was borne in mind in designing the generators, which have a single-phase rating of 6500 kw at 85 per cent power-factor and can conveniently be used for the railway work. Energy is taken from the generators through lead-covered cables passing to the switch house by way of a tunnel and fed to duplicate low-tension busbars. The dangers that lie between the generator terminals and the switchboard were not altogether forgotten, each generator being equipped with an automatic oil circuit-breaker in the generator house itself, a precaution far too often neglected in modern plants with isolated switch galleries.

The present transmission emf is very moderate, only 50,000 volts, inasmuch as the main transmission lines to the city of Gothenburg and to Skara are only a little more



than 40 miles in length. Both of these lines are arranged with duplicate circuits. The supports are of flexible steel frames designed to yield and relieve the strain instead of breaking in an attempt to support it. Two strain towers per mile are used to limit the action of distributed strains, the normal spacing of the flexible towers being about 600 ft. The strain towers anchor the wire on pin-type insulators, while the flexible towers are equipped with suspension insulators. A grounded steel cable serves to decrease the danger from lightning. Altogether the Trollhättan plan is a very notable enterprise both in size and in its probable economic effect on manufacturing and railway operation.

### Artificial Telegraph and Telephone Lines

There are two well-recognized types of artificial line on which the transmission of electric waves or impulses can be studied in the laboratory. One of these is built of successive lumps of series impedance and shunt admittance. The other is built with distributed series impedance and shunt admittance. The first type may therefore be described as "lumpy" and the second as "smooth." Lumpy lines have the advantage of being simple, compact and relatively inexpensive. Smooth lines have the advantage of more nearly representing the electrical conditions along actual conducting circuits, overhead, under ground or under water.

The first artificial lines described in electrotechnical literature seem to have been constructed by Cromwell Varley, of Varley-Loop fame, in 1862, for duplex telegraph purposes, and were of the lumpy type, containing only series resistance and shunt capacity admittance. Smooth lines of the same electric character were introduced by Muirhead in 1875. Pupin introduced the additional element of series magnetic reactance into artificial lines, both of the smooth and lumpy types, about 1890. In smooth artificial lines containing series magnetic reactance the coils containing the latter must be wound so as to form layer by layer one of the plates of a condenser. This calls for the careful insulation of every meter of the wire entering into the coils. In recent years artificial energy transmission lines, both smooth and lumpy, have been described in our columns in some detail. The smooth lines are particularly well adapted for oscillographing impulses and transient electric phenomena. The lumpy lines exercise certain selective influences on the propagation of impulses, so that high-frequency and steep-fronted waves are subject to deformation in transmission. How much deformation occurs depends upon the number and the size of the lumps forming the line. In the steady alternating-current state, however, it is an easy matter to correct for the effects of lumpiness to any desired degree of precision. That is, the behavior of any given lumpy line under steady alternating currents is easy to determine, although the behavior under sudden impulses of any assigned wave-form may be difficult to ascertain.

In the *Elektrotechnische Zeitschrift* Herr Karl Willy Wagner has recently described an interesting new form of lumpy artificial line, constructed like a single-section telephone switchboard and containing fifty line sections in all. The novel feature of this line is that each line section has its capacitance and resistance adjustable in four steps, so

that the series impedance, as well as the shunt admittance, of each line section can be altered in a variety of steps, with the aid of small fixed switches grouped conveniently for that purpose on the face of the switchboard. Not only can the line length be adjusted at will by altering the number of line sections in series, but the electrical constants of each line section can also be adjusted within a certain range by setting all the switches conformably. In this way the line can be made to resemble either a submarine cable, an energy-transmission cable or an overhead line, etc., at will. The only apparent disadvantage accruing in this form of variable-constant artificial line is the large number of switch contacts which are introduced semi-permanently into the circuit, some of which may become imperfect after a time.

Nearly all of the experimental work on the new artificial line as reported in the article referred to has been devoted to the oscillographic study of transient impulses. In this branch of the line has only a limited degree of precision, owing to its lumpiness as well as to its range of variation in constants, due to imperfect penetration or to variable hysteresis at high frequencies. However, by keeping the fundamental rate of oscillation below the natural rate of oscillation of each line element taken separately, the discrepancies due to these disturbing influences have been kept within relatively small limits, and the oscillographic records obtained are of great importance as showing very clearly the ordinary switching-in and switching-out phenomena at the ends of an energy-transmission line.

Of still greater interest are the reflected disturbances at the junctions of sections differing in surge impedance as well as the effects on transmission or reflection caused by loads inserted in the line. It is here that the lumpiness of the line tends most to distort the oscillographic records. Nevertheless, the general results are of great practical qualitative significance and support the existing theory of the subject.

The number of experiments that can be made with such an artificial line is so great and they give so much practical information that we believe every important electrotechnical laboratory will have to be equipped sooner or later with such apparatus. Whether it should be of this multiple-constant type is even to be discussed. Where qualitative or first approximation quantitative results only are sought, then it would seem that this multiple-constant type, with switching devices, might be most advantageous both in construction and test cost. Where, however, accurate quantitative research is sought for the greatest practicable precision of measurements, it is probable that single-constant lines are preferable, which can be made only in fixed form, being constructed for each type. This means one artificial energy transmission line, one artificial telephone cable, one artificial telephone line, etc.; but it eliminates all the semi-permanent switching contacts and enables careful measurements to be made of each line at the frequencies which naturally pertain to it. However, these are questions that relate only to constructional detail. The main consideration is for every electrical engineering student to use and become familiar with the behavior of properly constructed artificial lines in the laboratory before he undertakes to learn the operation of such lines in industrial practice.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Electrification Plans of Chicago, Milwaukee & Puget Sound Railroad

As announced elsewhere in this issue, the Great Falls Power Company, of Montana, has secured from the federal authorities for a term of fifty years the grant of a right-of-way across the public domain for a 150-mile transmission line. This grant is conditional upon the sale of a large amount of energy to the Chicago, Milwaukee & Puget Sound Railroad for the electrification of 450 miles of its main line, from Harlowton, Mont., to Avery, Idaho. The announcement of the grant to the power company, just made public by the Department of the Interior, has been confirmed by President A. J. Earling of the railroad company, who expects the electrification project to be in operation within three years.

Although the details have not been arranged, yet the electrification plans provide for handling all traffic by electric locomotives, of which from fifty to a hundred will be required. The plans for the equipment and overhead construction are being completed rapidly, the intention being to begin the work of installation within eighteen months.

A contract has been signed with the Montana Power Company, which controls the Montana Power Transmission Company, the Madison River Power Company and the Thompson Falls Power Company. Energy at 110,000 volts and at 60,000 volts will be fed to the railroad company at eight different points on its right-of-way, the minimum requirement for power being 25,000 kw and the maximum for the present 50,000 kw. References to the plans now announced were made on pages 1116 and 1117 of our issue dated Nov. 23, 1912, and the plans of the Montana Power Company were outlined on page 1339 of our issue of Dec. 21, 1912. Five stations of the Montana Power Transmission Company, three stations of the Great Falls Power Company and the station of the Thompson Falls Power Company will supply the load. The Thompson Falls Power Company is now constructing a 50,000-hp hydroelectric station at Thompson Falls, Mont., and the Great Falls Power Company has also under construction a 130,000-hp hydroelectric development on the Great Falls of the Missouri, at Great Falls, Mont. In addition the latter company has in operation at Rainbow Falls a 21,000-kw station and at Black Eagle Falls a 10,000-hp development. The Montana Power Transmission Company has the following stations in operation: Madison River Development No. 1 (3,000 hp), Madison River Development No. 2 (12,000 hp), Big Hole Development (5,000 hp), Canyon Ferry Station (12,000 hp), and a station at Hauser Lake (25,000 hp).

### Rewards by American Museum of Safety

At the annual exercises of the American Museum of Safety, to be held in the Engineering Societies Building, New York City, on Thursday evening, Jan. 23, the Rathenau medal will be awarded to Mr. Thomas A. Edison for the "best device or process in the electrical industry for safeguarding industrial life and health." This medal was placed at the disposal of the Museum of Safety by the Allgemeine Elektrizitäts Gesellschaft. The *Scientific American* medal will be awarded to the Draeger Oxygen Apparatus Company for the "most efficient safety device invented dur-

ing the last three years and shown at the Museum's exhibit hall." The Travelers' Insurance medal will be awarded to the New York Edison Company as being that "American employer who has done the most for the protection of the lives and limbs of workmen." The Louis Livingston Seaman medal will be awarded to the National Cash Register Company for "progress and achievement in the promotion of hygiene and sanitation and the mitigation of occupational disease."

### Society for Electrical Development, Inc.

Final approval of the complete plan under which the Society for Electrical Development, Inc., proposes to conduct a broad co-operative movement for the benefit of the entire electrical industry, as has been outlined in these columns, and authorization of the announcements which are to be sent out, containing a complete description of the movement and covering the election of officers, will be the business before the society's organization committee at its next meeting, to be held in New York on Jan. 14.

The society expects to obtain sufficient funds through its financial plans to enable it to maintain a working capital of \$200,000. As reported, the various central station, jobbing, contracting and manufacturing interests represented by the members of the organization committee have pledged approximately \$125,000 for the work of organization.

In view of this support and the indorsement of the plan by the interests represented by the committee, a list of whose members appeared in the *Electrical World* for Sept. 7, 1912, those associated with the movement feel that the industry at large will regard the plan in a favorable light and that the balance needed to bring the funds up to \$200,000 will be readily pledged by those eligible for membership in the society.

### High-Tension Transmission on Canal Zone

A committee has been appointed to review the plans for the proposed high-tension transmission line across the Isthmus of Panama, to consider the various features of the telephone and telegraph cables, the possible disturbance to signal systems, the probability of the future electrification of the Panama Railroad, and to make recommendations relative to the best and most economical construction to be employed for all the different electrical conductors, all phases of the matter being taken into consideration, including protection to electrical lines, and safeguard against any possible attempts to cut communication in time of war. The committee consists of Mr. Edward Schildhauer, Lieutenant L. Mears, Captain W. H. Rhodes, Mr. C. F. Bleakley, Mr. W. H. Fenley and Mr. W. R. McCann.

### Commercial Cable Company Cuts Rates

The Commercial Cable Company announced on Jan. 1 that its rate of 12½ cents a word for deferred plain language messages had been cut to 9 cents, applicable to the same territory as that covered by the reduction in cable rates recently announced by the Western Union cable lines. A new rate of 9 cents a word for special deferred messages of four words each was also announced.

## Output of Large Generating Systems

The accompanying table gives information relative to the outputs, peak loads and load-factors of the central stations in Chicago, New York, Philadelphia, Boston and Brooklyn for the year just closed. The Commonwealth Edison system still has the highest peak load and the largest output of the central-station systems, owing to its great railway load. The New York Edison Company has recently taken over the load of the Third Avenue Railroad Company, approximating 28,000 kw, but too late to make any impression on the yearly output. In this connection the output

DATA ON LARGE GENERATING SYSTEMS

System	Peak Load in Kw	Date of Peak Load	Yearly Output in Kw-hr.	Yearly Load Factor of System, per Cent
Commonwealth Edison..	233,000	Dec. 11	799,000,000	43-44
New York Edison*.	189,726 210,813	Dec. 20 Dec. 23	513,926,429 1,191,296,064	30.8 133.4
Philadelphia Electricf...	65,489	Dec. 23	183,969,655	32
Boston Edison	60,143	Dec. 18	161,702,955	60.7
Brooklyn Edison.....	42,500	Dec. 17	125,770,000	33.7

\*Exclusive of service to railroads.

†Including railroad load estimated for entire year.

‡Philadelphia only.

of the Niagara Falls Power Company and the Canadian Niagara Power Company, which virtually comprise a single system, the stations being operated in parallel, is of interest. The peak load on that system occurred on March 8 and was 115,900 kw. The output for the year, however, was 868,392,750 kw-hr. and the load-factor of the system (ratio of yearly average to highest peak in year) was 82.29 per cent, making it in point of the output the largest system in the world. The figures, however, do not reflect natural conditions at Niagara Falls. During most of the year the output of each of the plants was rigidly limited by the restrictions of the Burton act, and during a large part of the year a part of the Buffalo load was supplied from the plant of the Toronto Power Company at Niagara Falls, Ont.

## American Economic Association Discusses Government Regulation of Prices

At the closing session of the Boston meeting of the American Economic Association, Professor J. M. Clark, of Amherst College, read a paper on "Governmental Price Regulation." Professor Clark declared that the country does not yet know as much about price regulation as many optimists suppose; and far from being the simplest way of handling the trusts, this method, he said, if carried through to the end, might unsettle our economic foundations in a way now little suspected. The simplicity of price regulation, in his opinion, is a most deceptive aspect. The Interstate Commerce Commission has not yet solved satisfactorily the problem of regulating the general level of railway charges, which is admittedly a difficult problem. Professor Clark pointed out the difficulty of meeting the fact that prices which will give reasonable earnings to some producers might spell ruin to others less efficient. Another serious difficulty, and perhaps the greatest one, is the necessity of regulating the quality of goods sold, as well as the prices. And it will be impossible to regulate the price of things which the trusts sell without regulating also the price of the things which they buy, wherever they become monopolistic in their buying. He declared that the prevention of discrimination and the revision of the patent system form the backbone of the program of those who would avoid the necessity of price regulation by restoring competition.

## French Decision in Wireless Telegraph Patent Case

The validity of the Marconi patent for tuning in wireless telegraphy was recently upheld by a decision of the French court rendering a judgment in favor of the Marconi interests against the Compagnie Générale Radio-Télégraphique and the Société Française Radio-Électrique. An injunction was issued prohibiting further infringement, the infringing apparatus was ordered confiscated, and costs and damages were awarded to the Marconi company. The validity of the British patent for the same invention was upheld by the High Court of Chancery in England about a year ago in a suit brought by the Marconi company against the British Radio Telegraph & Telephone Company.

The American patent for this invention, which is owned by the Marconi Wireless Telegraph Company of America, is the basis of litigation now pending in the United States courts against several other wireless companies.

## Water-Power Concession at Long Sault Rapids Declared Void

Attorney-General Carmody of New York sent to the State Senate on Jan. 1 an opinion to the effect that the law passed by the 1907 Legislature and signed by Governor Hughes granting a charter to the Long Sault Development Company is unconstitutional. The charter authorized the company to generate electric power at the Long Sault Rapids, in the St. Lawrence River, and provided for a minimum revenue to the State of \$50,000. The grant was attacked under the Dix administration on the ground that the natural waters belong to the State and should not be disposed of to private corporations. Legislation was sought last year which would deprive the company of its rights, with provision for compensation for any outlay; but this failed of passage, and in its place a resolution was adopted asking the Attorney-General for an opinion. The Development Company disposed of its interest in the grant to the so-called "Aluminum Trust" and capitalists of Pittsburgh, but no power has yet been developed on the site. The Attorney-General holds that the law of 1907 is unconstitutional because it contravenes the section providing that the Legislature shall pass no private privilege or franchise, and also that it violates the provision of the constitution requiring that the forest preserve shall be forever kept as wild forest lands and shall not be sold to or taken by any corporation.

## Massachusetts Electric Lighting Association

The annual meeting of the Massachusetts Electric Lighting Association was held at the Exchange Club, Boston, Mass., on Jan. 4, with President C. L. Edgar in the chair. About 125 of the leading central-station men in New England were present, and at the conclusion of the usual dinner a comprehensive address upon "Workmen's Compensation" was given by Mr. Herbert Wolfe, of New York. The speaker emphasized America's tardy recognition of the importance of the broad treatment of employees' accidents and illness and described the development of workmen's compensation in Germany since its inception. More than 9,000,000 employees are now protected in this manner. The latest liability laws in American states were reviewed and Mr. Wolfe accorded highest praise to the Massachusetts statutes as model legislation in this field. He contended that the cost of industrial accidents is as much a factor in production as is fire insurance, and that it should be met by the consumer. Careful application of principles is necessary to success. Mr. Magnus W. Alexander, of the General Electric Company, Lynn, Mass., a prominent framer of the Massachusetts statute, also spoke briefly, urging the utmost effort to reduce industrial accidents to a minimum. He



advocated employees' sharing a portion of the accident premium, so that in time the exercise of greater care will result in its being perceptibly reduced.

The following officers were elected: President, Mr. C. L. Edgar, Boston; vice-presidents, Messrs. C. F. Pritchard, Lynn, Mass., and R. W. Day, Springfield, Mass.; executive committee, the foregoing officers and Messrs. F. S. Pratt, A. E. Childs, A. B. Tenney and Philip Cabot, Boston; Mr. R. W. Rollins, Worcester, and Mr. J. W. Stevens, Greenfield, Mass. Mr. Everett W. Burdett, Boston, is secretary and general counsel.

### Supreme Court Interpretation of Sherman Law

The United States Supreme Court recently handed down a decision upholding the indictments against the men concerned in the so-called Patten cotton pool, which is generally regarded as having a far-reaching effect upon attempts to corner supplies of food products or commodities of any kind. The court did not pass upon the guilt of the defendants, but merely gave its judgment as to the applicability of the Sherman act assuming the facts in the case to have been correctly stated. Apparently this decision means that not only corners in cotton but any attempts on the part of speculators to advance the price of any commodity by withholding supplies from the market may be held as a violation of the Sherman law. Obviously this applies to wheat, corn, pig-iron, lard, copper or any other commodity that is being held off the market in an organized attempt to elevate the prices above what otherwise would be their ordinary level. It has been accepted as certain that the decision will discourage pooling operations in all the public commodity markets, but there are many who feel that the scope of the decision will be gaged better after the indicted cotton operators have been brought to trial and either convicted or acquitted. It is also believed that the present decision will have considerable bearing on the situation in Congress in reference to the proposed revision of the Sherman law.

### Federal Grant to Great Falls Power Company

What Secretary of the Interior Walter L. Fisher has declared to be the beginning of the electrification of all transcontinental railroads between the Rocky Mountains and the Pacific Coast was made by a right-of-way grant for a period of fifty years, given this week by the Interior Department to the Great Falls Power Company, of Montana, for a double-circuit transmission line 150 miles in length, by which the company will furnish energy to the Chicago, Milwaukee & Puget Sound Railway for the electrification of 450 miles of its main tracks between Harlowton, Mont., and Avery, Idaho. What is considered highly important is the fact that this step is to be taken under a grant which embodies the fundamental principles of water-power policy which Secretary Fisher has been advocating for the past two years. It demonstrates, in the opinion of Secretary Fisher, not only that the provisions for the protection of the public interests upon which the department insists do not prohibit water-power development, as has been claimed by its opponents, but that the greatest development which has yet taken place in the practical application of electricity can be and is being taken under these very provisions. The grant just issued provides for compensation to the federal government, very small at first, but subject to periodical readjustment every ten years. It provides for regulation of the rates and service, uniform accounting and complete publicity of books and records, the sale of energy to the United States and to the State within which the transmission lines are located, and to municipal corporations in such State, at as low a rate as that given to any other purchaser for a like use under similar conditions. The company is forbidden to claim

any earning value for the grant or any selling value should the public take over the company's works at any time. The compensation or rentals fixed for each decade must be reasonable, and the company has the right to contest in the courts any rental it believes to be unreasonable, but the burden of proof on this point rests on the company.

This transmission line is already in operation, having been built under a revocable permit issued in 1909. At that time no better right could be given for any power development, but the agricultural appropriation act of March 4, 1911, authorizing the making of fifty-year grants for transmission, telegraph and telephone lines, provides that the grants are to be made under general rules and regulations to be fixed by the Secretary of the Interior. The act provides that old lines already constructed can have the benefit of the statute on like "terms and conditions" as new lines, and, in view of the importance of this application to travelers and shippers by rail, and in further view of the fact that only transmission lines, not water-power sites proper, are involved, Secretary Fisher has felt justified in ruling that he has the power to impose specific terms and conditions under this statute. The power company desired the more permanent right obtainable under this new law because it has agreed to sell a large amount of energy to the Chicago, Milwaukee & Puget Sound Railway Company for electrifying 450 miles of railroad. The latter project was mentioned on page 1339 of our issue of Dec. 21, 1912. The installation of the new system will involve the expenditure by the railroad of many million dollars, and the railroad company was unwilling to invest so large a sum while the power company's rights were revocable in the discretion of the government. Therefore Secretary Fisher's grant is conditioned upon the power company's entering into and performing its obligations under a contract to supply electricity for the motive power of the railroad. The demands of the railroad under this contract with the power company must be supplied by a new hydroelectric plant at Great Falls, which will be of twice the capacity of the present plant at Rainbow Falls.

The amount of the rental for the first ten years will be nominal as compared with the magnitude of the power company's operations, and Secretary Fisher's idea is that it should remain at a very low figure so long as the prices exacted of energy consumers are reasonable. It is not his purpose to use rental charges of this character as a source of general revenue in lieu of federal taxation, but if at the end of any ten-year period it should appear that the company was charging consumers unduly high prices and thus increasing its profits beyond the standard of a reasonable and generous return upon its investment, the government could then increase the rental charge. Secretary Fisher considers that the fact that his successor will have the power to do this will, of itself and without the exercise of that power, exert a constant pressure upon the company, inducing it to make its price reasonable even if the state authorities should neglect to enforce effective regulation on their own initiative.

### Annual Report of the Commissioner of Patents

The annual report of the Commissioner of Patents for the fiscal year ended June 30, 1912, has recently been transmitted to Congress. The report shows that there were 69,236 applications for patents for inventions and a total of 79,747 applications for patents, trade-marks, labels and prints. On July 1, 1912, there were 21,059 applications awaiting action on the part of the Patent Office. During the year 19,634 patents expired. During the past five years the number of patents granted annually has not varied to a substantial degree. The number of patents granted during 1912 was 34,220, while the total number of patents, trade-marks, labels and prints was 47,067.

The total receipts of the office from all sources during the fiscal year were \$2,094,060, and the expenditures were \$2,025,912. The net surplus for the year, amounting to \$68,047, brought the accumulated surplus up to a total of \$7,132,073. The total number of applications of all kinds, including disclaimers and appeals, was 81,459, or 5076 more than for the year preceding. The commissioner pointed out that the increased receipts of the office reflect the marked prosperity of the country. The condition of the Patent Office is reported as fairly good considering the severe handicaps of insufficient force, inadequate salaries and lack of sufficient room and proper equipment with which to carry on the work. During the fiscal year there were 1642 interferences declared, of which 1241 were disposed of before final hearing, 239 were heard and 54 are awaiting decision. The total number of appeals disposed of in interference cases, including *ex parte* appeals, was 837.

The commissioner renewed his recommendation to establish the Patent Office as an independent bureau. Once again he called the attention of Congress to the disgraceful condition of the Patent Office quarters in respect to overcrowding and the serious fire risk. The commissioner's report was submitted in advance of the report of the President's Commission on Economy and Efficiency, which has since completed an investigation of the Patent Office, and therefore contains no discussion of the features covered by this investigation. An abstract of the report of the Economy and Efficiency Commission was presented in our issue of Dec. 14, 1912, page 1250.

### Recommendation of Governors on Public Utilities

In the recent political campaign a number of platforms adopted by political parties had to do with the regulation of public-service corporations. It is therefore natural that many of the governors should suggest legislation along this line, especially in those states where public-utility regulations are not yet in force. Brief abstracts of some of the utterances of governors relative to such legislation are given below.

#### CONNECTICUT

Governor Simeon E. Baldwin in his message to the General Assembly of Connecticut said that the results attained by the Public Utilities Commission have fully justified the expectations of those who contributed to its creation. One of them has been a steady influence for good exercised upon the corporations within its jurisdiction in a quiet and semi-official manner, though seldom coming before the public eye.

#### PENNSYLVANIA

As is probably well known, Pennsylvania at present possesses no public service commission, and in his message to the General Assembly Governor John K. Tener urged the early passage of a sane, sound, comprehensive and effective public-utilities law, framed along substantially the same lines as that drafted by Attorney-General Bell, which failed of passage at the last session of the General Assembly. He said that there is unquestionably a universal demand for the enactment of such a statute, and while he anticipated that several bills concerning the subject would be introduced, he urged that early reference of such proposed legislation to an active committee be accorded, and that, if necessary, the committee report a new and composite bill which shall contain the best provisions embodied in any or all of the bills suggested and culled from the field of such legislation in other states.

#### RHODE ISLAND

In his inaugural message Governor Aram J. Pothier of Rhode Island said that recent events (indictment of the

presidents of the New Haven and Grand Trunk Railroad systems) demonstrated in an emphatic manner the importance to the public of a state department exercising the functions contemplated when the Public Utilities Commission was created last year. The efficiency of such regulation should be maintained, the Governor said, by vesting sufficient power and authority in the commission to enable it to achieve the results for which it was created. The rates charged for the service rendered by the various utilities are now matters of record with the commission, but with no authority to inspect their securities or to make a physical valuation of their properties the commission finds it difficult to determine whether or not the rates charged are just or such as would be warranted to insure a fair return on the capital invested. In the opinion of Governor Pothier provision for such physical valuation of the property of all public utilities operated in the State and also for the inspection of their securities by the commission should be made by an amendment to the present law. The commission also should have the power of prescribing proper and uniform accounting methods and of requiring from all companies under its jurisdiction reports of operating expenses and financial and other data. It appears that no provision is made in the Rhode Island law for the appointment of experienced men to act as inspectors of the equipment of steam and electric railways and of the gas and electricity supplied for public consumption. Until such systematic inspection is afforded, the Governor said, the quality of service rendered the public will continue to depend largely upon the utility furnishing it. The most important need, however, in his estimation is some provision for the physical valuation of utilities and the inspection of their securities, and he recommended to the General Assembly the enactment of an amendment to the present law containing such provision.

#### MICHIGAN

Governor W. N. Ferris in his message to the Legislature of Michigan made certain recommendations with respect to a public utilities commission. The State now has a railroad commission which has the power to fix the rates and regulate the practice of railroad, telephone and power companies. The Governor recommended the enlargement of the powers of this commission to cover all public-utility corporations of the State, and inasmuch as there can be no intelligent fixing of charges without a knowledge of the real value of the properties, he also recommended that the commission be authorized to make physical valuations of all such properties as it may deem advisable in order that the rates fixed may net a reasonable return on the actual cash invested.

#### MASSACHUSETTS

In his address to the two branches of the Legislature Governor Eugene N. Foss confined himself to a discussion of what he considered to be the supreme issue, the struggle between the people and the transportation monopoly for control of the government. He said that the commission should not aspire to control railroads beyond its borders but should exercise fully its real power to regulate. With regard to the railroad situation the Governor said that, as a practical issue, public ownership of railroads may soon be the only policy left and that those who believe that public ownership of public property and public performance of the public service of railroad transportation are socialistic and otherwise undesirable need not look to the present masters of the railroad system to defeat the proposal of government ownership. Most of them desire it and have been plying their trade in bonds and stocks on their properties in order, if occasion comes, to unload upon the government. The only way to postpone national ownership of railroads and to retain in the commonwealth the power to regulate its transportation system, Governor Foss maintained, is to assert that power at once and to apply it with-



out delay. He therefore renewed his recommendation that a powerful public service commission be created armed with mandatory authority over the public service so far as Massachusetts is able to control this.

### The Silver Voltmeter—Part III

By E. B. ROSA, G. W. VINAL AND A. S. McDANIEL

The second series of quantitative experiments was begun in December, 1909, after several months spent in the qualitative work described in Part II (*Electrical World*, Dec. 14, 1912, page 1262). As a result of the preceding work the authors had discarded the filter-paper voltmeter as an instrument of precision and had turned their attention to the problems related to the porous-cup form and the purification and testing of the electrolyte. The apparatus and methods employed were similar to those previously described.

During this period of the work the small porous-cup voltmeter was found to be the most convenient and reliable form to use as a standard. With the purest salt available the deposits were adherent and white, always non-striated, and crystalline as seen under the microscope. As a test of the reproducibility of this small porous-cup form, there were tabulated fifty-four deposits, made in pairs (except two sets of three each), in each pair the electrolyte and other conditions being made as nearly identical as possible. The average deviation of each value from the mean of each group of two or three cups was found to be one part in 100,000. That is, when the variations in the electrolyte and the measurement of current and time are eliminated so that it is simply a question of how nearly two similar voltmeters agree with one another—the variations being produced by loss of silver in washing the deposit, fluctuation in moisture or impurity in the deposit, and errors in weighing the cups—the average deviation of individual values from the mean shown by two or three cups is only 0.001 per cent.

Comparison of the large porous-cup voltmeter with the smaller size showed consistently a heavier deposit in the former by about five parts in 100,000, and the siphon form, which required a very large volume of electrolyte, gave a still greater excess. It was at length discovered that this excess of deposit in the larger sizes was roughly proportional to the volume of the electrolyte and the authors have called this the "volume effect." It seemed probable that this was due to traces of impurity which had not been eliminated from the electrolyte, and this suspicion led to an extended investigation of the purifying and testing of silver nitrate. As a result of this work, electrolyte was prepared which satisfied all the criteria for purity and brought the large sizes of voltmeters into agreement with the small porous-cup voltmeter, thus justifying its previous use as a standard form. The effect of slight contamination of the electrolyte in this small size must have been almost negligible, as the results obtained with it have been amply justified by subsequent work. As the experiments progressed the "volume effect" was found to be a very useful indication of the purity of the electrolyte, revealing the presence of impurities too small in amount to affect visibly the crystalline structure of the silver deposit. It is not claimed that this phenomenon of heavier deposits in large voltmeters is a new discovery, for it was observed in the work of Lord Rayleigh nearly thirty years ago and has been ascribed to various causes, but the authors do believe that its significance has not been appreciated before nor the correct explanation for it given.

Using the mean of forty-four of the most reliable determinations made in the small porous-cup form of voltmeter during the period from December, 1909, to April, 1910, the authors have obtained for the Weston normal cell at 20 deg. C., on the present basis, the value 1.01827, volts.

This is very close to the value recorded in the first series of measurements and is probably more reliable.

Several determinations were made in which two voltmeters maintained at 50 deg. C. by external heating coils during the passage of the current were compared with two similar voltmeters at room temperature (about 20 deg. C.). The results indicate that there is no temperature coefficient, a fact which Kohlrausch and Weber have also shown in a different way. It is believed that the reason other observers have found increased deposits in voltmeters at higher temperatures is because the chemical activity of impurities in their electrolyte would naturally increase with the rise in temperature.

Two gold dishes, similar in design to the smaller platinum dishes previously used, were purchased for comparison. By tabulating the differences in deposit between the gold and platinum cathodes in each case where no other differences in the voltmeter existed, it was found as a result of twenty-nine comparisons that the deposits in the gold dishes were lighter by 1.4 parts in 100,000, which may be regarded as indicating the substantial agreement between the two materials.

Some further work was done with the Poggendorff form, but the results were not encouraging. Hence attention was directed chiefly to the forms that had proved more reliable and to the purification and testing of the electrolyte in anticipation of the co-operative work with the English, French and German national laboratories, begun at Washington April 1, 1910.

The most difficult problems connected with the preparation of silver nitrate for use in the voltmeter are concerned with the exclusion or removal of reducing impurities and colloidal silver, on the one hand, and of uncombined acid and base on the other. The tests that have been developed for determining the acidity of the solution are for the purpose of determining the uncombined acid or base rather than the absolute hydrogen-ion concentration.

The usual methods of testing the neutrality of salts do not apply to silver nitrate. Thus, toward litmus a silver-nitrate solution will react as alkaline, even after the addition of one part in 100,000 of nitric acid. A similar solution will react acid toward methyl orange after the addition of alkali, provided the silver is not completely precipitated. Other indicators also were tried. If the silver be precipitated from the silver nitrate solution by a neutral KCl solution and the AgCl precipitate filtered off on asbestos, the filtrate will show a neutral reaction toward the various indicators if the original  $\text{AgNO}_3$  contained no uncombined acid or base. By using iodoesine as an indicator so little as one part in 1,000,000 of nitric acid (or alkali) added to the original  $\text{AgNO}_3$  can be detected in the filtrate by titration with ( $\text{N}/1000$ )  $\text{HNO}_3$  or  $\text{NaOH}$ . The results have been expressed in terms of parts per million of the nitric acid.

For the detection of reducing impurities (principally cellulose hydrates from filter paper), and of colloidal silver, a titration test with ( $\text{N}/1000$ )  $\text{KMnO}_4$  solution has proved very valuable. The slightly acidified crystals of silver nitrate are fused as will be described for purifying the salt, and then dissolved in water to form a 66 per cent solution. Ten cubic centimeters of this solution is acidified by adding 1 cu. cm of concentrated nitric acid (free from nitrous acid) and the  $\text{N}/1000$  potassium permanganate solution added in 0.5 cu. cm portions until the pink color persists for five minutes or more. The number of cubic centimeters thus required the authors have called the "permanganate number" of the silver nitrate. In test cases this has been found to be proportional to the amounts of oxycelluloses previously added to the silver nitrate and very minute traces can thus readily be detected. It is not claimed that the organic material is necessarily oxidized completely, but nevertheless the method is much more sensitive than any method of direct combustion would prove under the circum-



stances, as well as being more expeditious. By titrating these concentrated solutions of silver nitrate less than 0.001 per cent of colloidal silver may be detected, a result that is of particular value in showing when over-fusion of the salt has occurred in its preparation.

The water used was twice distilled in block tin and was kept in bottles of especially prepared resistant glass. Samples were frequently tested for conductivity and alkalinity. These values were, on the average, about  $1.3 \times 10^{-6}$  reciprocal ohms and 0.6 parts in 1,000,000 respectively. The water in the stills was boiled by steam under pressure, thereby avoiding the possibility of contamination by  $\text{CO}_2$ , which may greatly increase the deposit in the voltameter.

For purifying the silver nitrate for use in the voltameter it is convenient to start with the best chemically pure salt obtainable from the manufacturing chemists. If this salt is repeatedly recrystallized from neutral solution, the resulting product shows a tendency to become basic, which under certain conditions gives rise to the volume effect in the voltameter. To avoid this condition it is necessary that the last mother-liquor should be acid to the extent of from 0.1 to 1 per cent of the water present, depending on the efficiency of the draining. In the present work a porcelain centrifuge has been employed and the crystallization carried out in porcelain, quartz and platinum vessels without any significant differences in the final product. It is best that the preliminary recrystallizations should be made from strongly acid solutions, as this increases the yield of crystals owing to the less solubility of the  $\text{AgNO}_3$ , and decreases the number of crystallizations required to satisfy the permanganate test.

Salt yielding the same result in the voltameter has also been prepared by recrystallization from strongly acid solution and subsequent fusion. The fusion appears to break up the more resistant impurities contained, and in some cases these come to the surface and may be readily removed by washing the surface of the fused cake as suggested by Mr. F. E. Smith. The fusion also furnishes a ready means of controlling the amount of acid in the final product, but especial precautions must be taken to avoid decomposition. Whether the silver nitrate is decomposed by heat when fused seems to depend less on the temperature than upon the amount of acid retained by the melted salt. As soon as the last trace of acid is expelled the salt begins to decompose into silver oxide and colloidal metallic silver, as shown by the tests with iodosine and potassium permanganate respectively. By removing the salt from the furnace as soon as the last trace of solid material has melted it is found that a small amount of acid (one or two parts in 100,000 of the solid salt) is retained. This is sufficient to prevent decomposition and in a 10 per cent solution is negligible in the voltameter.

Salt prepared in this way, which is satisfactory for the voltameter, is invariably of a beautiful pearl white and is never darkened, as noted by some earlier observers. The reasons why the salt, when recrystallized and fused according to the well-known researches of Richards and Forbes, although well suited for their purposes of atomic weight determinations, is not suitable for use in the voltameter can be given adequately only in the complete paper to be published in a *Bulletin* of the Bureau of Standards. It must suffice here to say that the authors have carefully followed their procedure and found the product unsuited for the voltameter—first, because of the slight decomposition resulting from the prolonged fusion, and second, because of the basicity formed from the repeated recrystallizations from neutral solutions.

In the fourth and last paper of this series the results subsequent to the work of the International Technical Committee will be given. These include experiments, made with the highest precision, to determine the value of the Weston normal cell, and also a discussion of the action of acid and base in the voltameter.

## Public Service Commission News

### NEW YORK COMMISSION

The Public Service Commission of the Second District has directed the Granville Electric & Gas Company to reduce its present residence electric lighting rate from 15 cents per kw-hr. so that for like service the rates shall not exceed the company's present residential commercial rate, which are on the basis of 13 cents per kw-hr. for the first 30 kw-hr., 12 cents for the next 30 kw-hr., 11 cents for the next 30 kw-hr., and all in excess of this 8 cents per kw-hr., with a discount of 10 per cent for payment within fifteen days. The commission holds that the evidence as presented in the case discloses discrimination between residence and business lighting. The opinion further states: "No reason appears why the company should maintain a higher rate for house service, and accordingly its 15-cent rate for residences should be reduced to 13 cents per kw-hr. It should also reduce its residence rate for larger quantities to correspond with its business rates. This ruling applies only to the facts and conditions shown in this case, and may or may not be applicable in other cases, being dependent upon the particular facts appearing herein."

### MASSACHUSETTS COMMISSION

An exhaustive report recommending the closer control of holding companies has been submitted to the Massachusetts Legislature by the special commission appointed to investigate the status of voluntary associations. Among the parties to the commission were the members of the Board of Gas and Electric Light Commissioners and the Railroad Commission. The joint commission recommends the passage of five bills for the further regulation of holding companies. The first bill provides that no business corporation shall hereafter purchase or hold, directly or indirectly, more than 10 per cent of the stock of a Massachusetts public-service corporation. The second bill gives the Railroad and Gas and Electric Light commissions all books, accounts, contracts, etc., of any voluntary association holding the stock of a Massachusetts public utility, and an important section provides that the act shall not be construed as requiring or instituting either board in taking into consideration the total capital stock of the holding company or trustees in fixing the rates charged by or the service furnished by subsidiary companies.

A third bill provides that no person, partnership or association owning or controlling public-utility shares shall hereafter use any name or title which, in the opinion of the commissioners having regulative authority, might lead the public to believe that such owners or controllers of shares were in themselves, or were conducting the business of, a public-service corporation. A fourth bill provides a penalty of fine or imprisonment for any trustee of a holding company who fails to file a copy of the trust agreement or such association with the commissioners of corporations. The fifth bill provides for the annual publication of all declarations of trust and amendments or additions thereto which have been filed with the corporation commissioner. This publication is also to contain such information as may be transmitted by the Gas and Electric Light or Railroad commissions in regard to such companies.

In the course of its report the special commission has pointed out that there are in Massachusetts several voluntary associations and the commission is created for the purpose of holding public-service securities. Of these, eight concern railroads, three utilities and seven concern gas or electric companies. Most of these have shares outstanding in public considerably in excess of the shares of the subsidiary companies, the properties being in some cases wholly secured physically. In at least two instances public service corporations are associated with ordi-

nary trading corporations, from which the former purchase materials, supplies or services. The report reviews the established policy of the State not to allow the issuance of securities in excess of actual requirements by public-service corporations, and points out that such securities are issued only under the authority of the commissions having regulative powers. While authority is generally given to gas companies to engage in the supply of electricity, a purpose to forbid the merging of gas and electric companies expressly appears in the recent acts authorizing the consolidation of gas companies and electric companies respectively. A similar hostility also exists with regard to the merging of street railways with railroads. In the general laws authorizing consolidations they are confined to properties actually connected or operating in adjoining municipalities and are subject to the approval of the supervising commission.

The commission points out that the policy of the State is to keep the authorized capital stock as low as the market and other conditions warrant, to prevent the capitalization of surpluses accumulated out of earnings, to withhold authority to consolidate public services different in character and to limit consolidations to properties capable of becoming integral parts of one enlarged system. It is intended to create and preserve a status favorable to low rates and good service by rigid restrictions upon the issue of securities and by authorizing direct interference with rates and service. While discouraging competition between companies engaged in the same business, it plainly proposes to preserve such degree of competition as may result from the independent operation of railroads and street railways and of gas and electric light companies serving the same communities. The holding-company plan invites the taking of a heavy toll from the public, and may prevent or delay the normal advantages which might accrue to the public from the voluntary action of the subsidiary companies in the reduction of rates and improvement of service. When such a relation includes a trading company dealing in supplies or materials, the result may be a loss of that freedom of contract hitherto regarded as of inestimable value. It appears to the commission that any action toward regulation of holding companies by the supervising boards might tend to give a deceptive value to the shares of voluntary associations now outstanding and might still further mislead the investing public. The report points out that, while the prime purpose of laws for the public supervision of public utilities is to protect the consumer rather than the investor, the interests of both will be conserved by requiring from these holding companies such information as may be necessary in the public interest or for the successful regulation of their subsidiaries, and by compelling them to adopt such name as may clearly distinguish them from the operating companies which they control.

#### WISCONSIN COMMISSION

The Wisconsin Railroad Commission has granted the application of the municipal electric light and water plant of Arcadia for an increase in rates on the ground that increase in operating expenses due to the rehabilitation of the plant and increase in salaries, with an accompanying decrease of 33 per cent in output occasioned by the general introduction of tungsten lamps, has reduced the net revenues to an unreasonably low figure. The present rates consist of a meter rate of 5 cents per kw-hr. for commercial lighting and 6 cents per kw-hr. for street lighting. The rate of 7 cents, as requested by the petitioner, was considered insufficient and the following schedule was ordered: Primary rate, 11 cents per kw-hr. for the first thirty hours' use a month of the active connected load; secondary rate, 8 cents per kw-hr. for the next sixty hours' use; excess rate, 6 cents. In residences the active load is to be taken as 60 per cent of the total connected load when the total connected load is equal to or less than 500 watts; when the

installation exceeds this value, 33 $\frac{1}{3}$  per cent of the excess is to be taken as active. In stores, banks, business and professional offices, etc., 70 per cent of the connected load up to 2.5 kw is to be regarded as active, as well as 55 per cent of the load in excess of this value. In county and State buildings, schools, churches, factories, etc., 55 per cent of the total connected load is to be active. The minimum bill was increased from 50 cents to 75 cents, and the rate for street lighting was fixed at \$4.25 per 60-cp tungsten per annum, plus a charge of 5 cents per kw-hr. for energy consumed.

The electric light plant at Chetek has been authorized to increase its rates for commercial lighting by about 16 per cent, exclusive of the excess rate, the latter being increased 100 per cent.

The commission, on its own motion, has investigated the rates and regulations of the municipal electric light and water plant at Evansville and has ordered the utility board to establish the following schedule for commercial lighting: Primary rate, 11 cents net for the first ninety hours' use per quarter of the active connected load; secondary rate, 7 cents net for the next 180 hours' use per quarter; excess rate, 5 cents. The consumers are to be divided into classes according to the percentage of active connected load in a manner similar to that obtaining at Arcadia, noted above. The rate for motor service was decreased from a flat rate of 6 cents per kw-hr. to a rate of 5 cents per kw-hr. for the first ninety hours' use per month, all in excess being charged at the rate of 4 cents per kw-hr.

#### OHIO COMMISSION

The Public Service Commission of Ohio has ordered the Middletown Gas & Electric Company to amend its long-hour lighting and breakdown lighting rate and to substitute instead two rates, one relative to long-hour lighting, to be the same as that now in force, and the other relative to breakdown service, to be as follows: A minimum charge of \$3 a month per kva of demand and all energy consumed during any month to be charged according to the following scale: Up to 150 kw-hr., 10 cents a kw-hr.; from 151 to 300 kw-hr., 9 cents a kw-hr.; from 301 to 600 kw-hr., 8 cents a kw-hr., and for all energy above 600 kw-hr., 7 cents. Where the account is paid by the tenth day of the succeeding month a discount of 10 per cent must be allowed and the minimum charge is to apply in payment for energy used. The company is also required upon the written request of any customer to make a re-measurement of the demand without charge, though this need not be done more than four times a year. The order becomes effective Feb. 1, 1913.

#### OREGON COMMISSION

On Dec. 27 and 28 the Railroad Commission of Oregon held preliminary meetings with the various utility corporations of that State, conferring with representatives of electric power and light and street-railway systems the first day and with the delegates from gas, telephone and telegraph companies the second day. As a result of the meetings committees were appointed representing the various utilities, which will draw up proposed rules and regulations governing various services, together with proposed accounting systems and uniform classifications of accounts. These will be submitted to the Railroad Commission in the shape of reports and the Railroad Commission will then hold public hearings on the proposed rules and accounting systems. It is expected that the rules and regulations adopted by the Oregon commission will be very similar to those adopted by the Washington commission. The Railroad Commission of Oregon has already issued its instructions relative to filing of tariffs, and a number of companies have already filed their rate schedules.

#### WASHINGTON COMMISSION

The Public Service Commission of Washington has published its standard classification of property, construction



and operating accounts for power, light and water companies and also for street railways, and it is expected that a classification will soon be issued for gas companies. The classification adopted by the Washington commission was prepared by representatives of the Northwest Electric Light and Power Association. The classification adopted is based quite largely on the Wisconsin classification but also contains features from the National Electric Light Association classification. After it was recommended by the Northwest association the Washington commission held a public hearing and made a few changes and then published the classification as an order of the commission. The gas-company classification of accounts is being held up temporarily, but it is expected that it will soon be published.

#### NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has ordered the Public Service Gas Company to reduce its rates in the Passaic division from \$1.10 to 90 cents per 1000 cu. ft. and has recommended that the company make the same rate throughout all of the other divisions of the State. The board also recommended that the company's schedule of quantitative discounts be readjusted in accordance with the new rate. The board's decision in this matter makes no allowance for "good will" but recognizes "going concern value" as entering into the base upon which the utility is entitled to earn a fair return.

## Current News and Notes

**EXPORTS OF TELEPHONE EQUIPMENT.**—Telephones have been separately listed in the export statistics of the United States only since the middle of 1911, but sufficient data have already been obtained to justify the statement that the telephone exports of 1912 amounted to more than \$1,000,000 in value.

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**PARIS TO WASHINGTON BY "WIRELESS."**—The new United States Navy radio-telegraph station at Arlington, near Washington, D. C., recently picked up a wireless time signal from the Eiffel Tower station of the French government at Paris. In addition to the signal, the word "Eiffel" was distinctly received before communication was broken. The distance from Paris to Washington is nearly 4000 miles.

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**LOSS OF SHAWNEE (OKLA.) OFFICES BY FIRE.**—Fire which gutted the Pottawatomie Building at Shawnee, Okla., Dec. 26, destroyed the offices, salesroom and storeroom of the Shawnee Gas & Electric Company, which occupied the greater part of the first floor. The company was able to save all its important books and records, according to Mr. F. W. Caldwell, general manager, and promptly opened up a new office across the street at 113 North Broadway. The loss is well covered by insurance.

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**TWENTY-FIVE-CYCLE EQUIPMENT TO BE USED ON THE CANAL ZONE.**—The Balboa electric plant on the Canal Zone has been closed as a generating station and the Balboa territory will be supplied from Miraflores. Twenty-five-cycle, three-phase equipment will replace the 60-cycle apparatus now in use in the Ancon district, and henceforth all alternating-current motor and lighting installations on the Zone will be operated by 25-cycle energy. The cranes on the pier at Balboa and the overhead crane in the Balboa shops will be operated from the Balboa plant by a motor-generator set. Otherwise, the Balboa station will be used solely as a distributing center.

\* \* \*

**GERMAN, BRITISH AND AMERICAN ELECTRICAL EXPORTS.**—During 1911 the total value of electrical goods exported from Germany amounted to \$52,558,000 and that of imports

to \$114,300,000, a rise from \$7,050,450. The exports of electrical machinery and appliances from the United States during 1911 were worth in round figures about \$19,329,000, as against \$16,547,300 in 1910. The exports from Great Britain for 1911 comprised \$13,720,000 worth of electrical goods and apparatus, \$8,714,500 worth of electrical machinery and \$254,500 of electrical porcelain ware, a total of \$22,689,000. The imports under these classifications were valued at \$69,800,000, \$1,114,000 and \$104,000, a total of \$71,018,000. For 1910 the British total exports were \$28,440,000 and the imports \$11,121,285.

\* \* \*

**COOKING BY ELECTRICITY.**—At a meeting of the Swedish Technological Society at Stockholm on Dec. 14, 1912, Dr. Alfred Ekström delivered a lecture on "Cooking by Electricity." Demonstrations were made with a new electric stove somewhat similar to the Copenhagen stove made in this country, but containing a number of improvements patented by Dr. Ekström. From extensive experiments in a household of twelve persons, the speaker concluded that cooking and baking by electricity on this stove was 35 per cent cheaper than on a wood stove. Identical meals were cooked, in each way, under equal conditions, and the cost was figured in both cases with electricity and wood at market price, that is 2.75 cents per kw. hr. for electricity and \$10 per cord of 128 cu. ft. for hard wood.

\* \* \*

**GREATER CHICAGO TERMINAL PLAN INVOLVES ELECTRIFICATION.**—At a luncheon of the City Club of Chicago on Jan. 4 Mr. Jarvis Hunt, architect, explained his plan for a joint passenger and freight terminal for the through route business of all the railroads entering Chicago. The "Greater Chicago Terminal Plan," as Mr. Hunt calls it, provides for a new channel for the South Branch of the Chicago River 175 ft. east of Canal Street, the terminal to be bounded by West Twelfth Street, South State Street, Archer Avenue and the new channel of the river. It is arranged for a loop rather than a stub-end terminal, the incoming and outgoing traffic to be entirely separate. The ultimate capacity would be 600 trains an hour. The speaker said that unquestionably such a terminal would be accompanied by electrification of the trackage leading to it. Railroads coming in from the south, west and north respectively would be combined in a few great terminal arteries, and these could be electrified with comparative economy.

\* \* \*

**DEPARTMENT OF ELECTRICITY SECURES INCREASED APPROPRIATION.**—By a recent decision of the Supreme Court of Illinois, the city of Chicago at the time of making up its annual budget faced a reduction in its expenditure of approximately 20 per cent. Until reduced legislation could be obtained from the Legislature it was necessary for the city authorities to practise the greatest economy. Temporarily the city officials from the Mayor down, were necessary to accept a 20 per cent reduction in salaries. In this situation it is interesting to note that the Department of Electricity, which has charge of the city street lighting, received an appropriation even larger than that of last year. The amount set aside for this department a year ago was about \$1,480,000, while the figure included in this year's budget is \$1,675,000. This will enable the Department of Electricity to carry out its contract with the Sanitary District for increased electric street lighting. An effort was made in the City Council to reduce the item for supplies for the Department of Electricity from the \$300,000 which was asked to the \$200,000 of last year. Mr. Ray Palmer, the city electrician explained, however, that without this increased appropriation it would probably be necessary to discontinue the operation of a portion of the increased street arc-lighting service next summer. The aldermen felt that the need of better street lighting was so urgent in Chicago that the increased appropriation should be allowed.



**THE "BATHTUB" CASE.**—The retrial of the criminal anti-trust suit against the so-called "Bathtub Trust" will be commenced early next month in Detroit. In the first trial the jury disagreed and the government delayed retrial until the Supreme Court decided the issues involved in the civil case. The decision of the Supreme Court was reported very fully in our columns on Nov. 30, 1912, page 1131. That decision ordered the dissolution of the combination of sixteen corporations and sixty-four individuals, manufacturers of enameled ironware.

\* \* \*

**WATER SUPPLY OF THE ST. LAWRENCE RIVER.**—Water Supply Paper No. 304, issued by the United States Geological Survey, comprising part of a series dealing with the surface water supply of the United States, is entitled "Part IV. St. Lawrence River Basin." This was prepared under the direction of Mr. M. O. Leighton by Mr. C. C. Covert and Mr. R. H. Bolster. The publication is devoted mainly to the presentation of stream-flow measurements made during the calendar year 1911 upon streams tributary to the Great Lakes and the St. Lawrence River.

\* \* \*

**LECTURES ON INDUSTRIAL HYGIENE.**—The public health education committee of the New York County Medical Society will give a series of lectures on alternate Wednesday evenings and Thursday afternoons from Jan. 8 to March 27, 1913, in which are included three lectures on industrial hygiene. These will be given Wednesday, Feb. 19, at 8:15 p. m., and include one on "The Benefits of Accident and Disease Prevention Among Working People," by Mr. Arthur Williams; another on "Industrial Hygiene and Lighting," by Mr. L. B. Marks, and a third on "Safety Appliances and Prevention of Accidents," by Dr. William H. Tolman, of the American Museum of Safety. The lectures are to be held at 14 West Forty-third Street, New York, and are open to the public.

\* \* \*

**LARGE SINGLE-CYLINDER INTERNAL-COMBUSTION ENGINE.**—According to a recent announcement, a German firm is now prepared to furnish an internal-combustion engine of a type in which 4000 hp can be generated in one cylinder. The announcement has reference to a marine type of engine using oil fuel, but undoubtedly the advances in design which have made possible such large single-cylinder units are applicable also to stationary practice. At the present time the limit of output in single-cylinder units is in the vicinity of 300 hp to 400 hp. The new unit is said to be of the two-cycle double-acting type. It has been known for some time that several German firms have been very active in developing high-power internal-combustion engines for use with oil fuel, but it has been very difficult to obtain authentic information regarding what has been accomplished. Competition from the Diesel type of engine and the extensive preparations under way or completed by many manufacturers for turning out large engines of this type have been undoubtedly a potential factor in stimulating the efforts of the German builders to develop successful oil engines in large units.

\* \* \*

#### SOCIETY MEETINGS

**MEETING OF OPERATING ENGINEERS.**—At a meeting of the Institute of Operating Engineers to be held at 8 p. m. on Jan. 25, in the Engineering Societies Building, New York, Mr. Arthur K. Ohmes will deliver a lecture on heating and ventilation.

\* \* \*

**WOOD PRESERVERS' CONVENTION.**—The ninth annual meeting of the American Wood Preservers' Association will be held in the Hotel Sherman, Chicago, on Jan. 21-23. A number of papers relating to wood preservation will be presented and discussed. According to the program, the treatment of poles and cross-arms will come up on the afternoon of Jan. 22.

**ELECTRIC CLUB OF CHICAGO.**—At the meeting of the Electric Club of Chicago held on Jan. 2 a committee was appointed to nominate officers for the ensuing year, action to be taken on these nominations at the election to be held on Feb. 6. This committee consists of Messrs. F. S. Hickok, D. W. Roper and H. A. Mott.

\* \* \*

**MEETING OF NEW YORK COMPANIES' SECTION, N. E. L. A.**—At the next meeting of the New York Companies' Section, N. E. L. A., Jan. 20, President F. M. Tait of the N. E. L. A. will be speaker, his topic being "Association Affairs." Mr. W. J. Burns, the noted detective, is also scheduled to relate some of his famous experiences.

\* \* \*

**JANUARY MEETING OF CHICAGO SECTION OF THE INSTITUTE.**—A paper on "The Principles of Regulation and Methods by Which Public Utility Laws Are Enforced" will be read by Mr. Halford Ericson, a member of the Railroad Commission of Wisconsin, before the Chicago Section of the American Institute of Electrical Engineers on Jan. 27, in the rooms of the Western Society of Engineers.

\* \* \*

**SONS OF JOVE AT NEW YORK.**—At the Wednesday noon luncheon of the Sons of Jove, Hotel Imperial, New York, Jan. 8, Mr. George F. Parker, manager of the New York Electrical Show, addressed the 100 members present. Mr. Frank M. Tait, president of the Dayton Electric Lighting Company, of Dayton, Ohio, and president of the National Electric Light Association, is to be the guest of the club at its next meeting, Jan. 22.

\* \* \*

**PREPARATION FOR INSPECTORS' CONVENTION AT ST. LOUIS.**—St. Louis electrical men are preparing to entertain the Western Association of Electrical Inspectors when that association holds its annual convention in St. Louis on Jan. 28 to 30. The St. Louis League of Electrical Interests will give a dinner in honor of the inspectors on Jan. 28, and there will be a rejuvenation of the Jovian Order on Jan. 29. Mr. W. J. Canada, of Denver, is president of the Western Association of Electrical Inspectors, and Mr. W. S. Boyd, of Chicago, is the secretary. Mr. James H. Fenton is the chairman of the St. Louis committee of arrangements.

\* \* \*

**PHILADELPHIA N. E. L. A. SECTION ACTIVITIES.**—At a meeting of the commercial branch of the Philadelphia Electric Company Section, N. E. L. A., Dec. 30, Mr. C. J. Russell discussed the definition and importance of various central-station factors. Mr. J. W. Howell, of Harrison, N. J., addressed the regular section meeting of Dec. 16 on the subject of incandescent lamp development. New apparatus and devices were also exhibited. At the accounting meeting of Dec. 12 Mr. Gershom Smith, Washington, D. C., took for a subject the relation of team play to modern business efficiency. Protective devices for meter installations was the topic of the December session of the meter-department branch, held earlier in the month, when a paper by Mr. G. R. Smith, of Brooklyn, N. Y., was read.

\* \* \*

**CHICAGO ASSOCIATION OF COMMERCE COMMITTEES.**—In the new ways and means committee of the Chicago Association of Commerce the sub-committee on electrical goods, fixtures and wires consists of Mr. J. A. Bannan, of the Thordarson Electric Manufacturing Company, chairman; Mr. Louis A. Schwab, Monarch Electric & Wire Company, vice-chairman, and Messrs. H. L. Grant, Western Electric Company; J. W. Bolte, Bolte & Weyer Company, and Frank Horton, Moran & Hastings Company. The sub-committee on public utilities consists of Mr. A. R. Bone, Chicago Telephone Company, chairman; Mr. Britton I. Budd, Chicago Elevated Railways, vice-chairman, and Messrs. George B. Foster, Commonwealth Edison Company; John Fitzpatrick, Western Union Telegraph Company, and Henry N. Foster, Chicago Telephone Company.

## Hydroelectric Plant at Trollhättan, Sweden

**100,000-hp generating station built by the Swedish government for supplying energy at low rates for municipal purposes and ultimately for traction**

ONE of the largest water-power developments in Europe has recently been carried through by the Swedish government at Trollhättan, a well-known tourist resort, which for years has attracted thousands of visitors from all over the world by the beauty of its scenery. The water-power possibilities of the locality have long been recognized, but it was only after many years of litigation that the right of the government to utilize the waterfalls at that place was finally settled by the courts. A short description of the project was given in the *Electrical World* in the issue of Aug. 11, 1910.

The Trollhättan falls, which are among the largest in Sweden, are located on the Göta River, about 40 miles from Gothenburg. This river is the only outlet of Lake Vänern, the largest lake of the country and the third in size in Europe. Its area is 2150 sq. miles. The stream flow in the river varies between a minimum of 11,500 cu. ft. per second and a maximum of 32,000 cu. ft. per second. With the proposed regulation of Lake Vänern, the water level can readily be raised and the minimum flow materially increased, and it is estimated that in this way not less than 200,000 hp may be obtained. A

view of the Göta River looking down stream from the last of the chain of falls is shown in Fig. 1.

With an available head of 108 ft. and a flow of about 9000 cu. ft. of water per second, which is the amount for which the present installation was planned, approximately 100,000 hp can be developed. The completed generating equipment now in operation comprises three-fourths of this amount. The bulk of this power is transmitted to Gothenburg, the leading city on the west coast and the second largest city in Sweden, while the remainder is either transmitted to various other cities or is utilized by the different manufacturing establishments in the immediate vicinity. It is the intention to use a large amount of power of the future development for railroad electrifications and for electric reduction of iron ore.

The regulating dam is constructed across the river about 400 ft. below the water intake to the power canal. This dam is built on firm rocks and is provided with four openings separated by granite piers. The two center openings each have a width of 65 ft. and may be closed by means of bear-trap or roller gates, while the other openings in the

dam are closed by six ordinary sluiceways which can be drawn up or let down as desired. Both the bear-trap gates and the sluiceways are geared to electric motors and can be operated either electrically or by hand power.

The intake from the river to the power canal consists of six openings, each about 40 ft. wide, separated by granite pieces of 6.5 ft. thickness. A floating ice guard, built of strong timber and fitted with a screen, is placed in front of the openings.

The power canal, which is about 4250 ft. long, is partly blasted in the solid rock and the remaining portion constructed of concrete. The intake and the first 1150 ft. of

the canal have a section permitting a stream flow of 12,500 cu. ft. per second, while the remainder allows a flow of only 9000 cu. ft. per second. With the regulation of Lake Vänern and the contemplated increase in the development decided upon, the present ship canal may be utilized as a power canal, the old ship canal then being abandoned for the use now made of it and superseded by a larger one. A canal permitting a stream flow of 3500 cu. ft. per second will then be built connecting this old ship canal with the power station and



FIG. 1—VIEW OF LOWER FALLS AT TROLLHÄTTAN WITH SITE OF PRESENT PLANT TO THE LEFT

also with the present power canal. Provision has already been made for such a branch, and a gate has been installed having a width of 56 ft. and a height of 30 ft.

The distributing reservoir is located close to the power station and was blasted in the rock. On the two short sides of this reservoir there are provided overflow outlets to prevent an inundation of the power station in case a number of the waterwheel governors should simultaneously be closed. A handsome building, shown in Fig. 3, is provided for housing the gates and guards for the penstock inlets. Each turbine unit is supplied by a separate penstock which emerges from a separate chamber in the gatehouse and is provided with sluiceways and ice guards, the former being provided either for manual operation or for electric remote control from the control house. There are eight penstocks for the main turbines, each having a diameter of 14 ft. and three for the exciter turbines with a diameter of 4 ft. The penstocks have a length of about 200 ft. and the larger ones are installed in separate blasted tunnels, the space between the steel tubes and the tunnel walls being filled with cement. The three smaller pipes are, on the other hand, placed in a

common tunnel. Fig. 3 shows a view of the power house in the foreground and the gatehouse on top of the hill.

#### TURBINES

The turbines, generators and exciters form the equipment of the power station, while the transformers and the switching equipment are located in a separate building at

easily accessible by means of vertical pits. All the bearings are water-cooled and are fitted with thermometers, at a convenient place outside the turbine casings, for indicating the bearing temperatures. The wheels have a diameter of 6 ft. on the inlet side and are made of cast steel securely fastened to the shaft.

A special feature in connection with the design of these



FIG. 2—DISTRIBUTING RESERVOIR AND GATEHOUSE

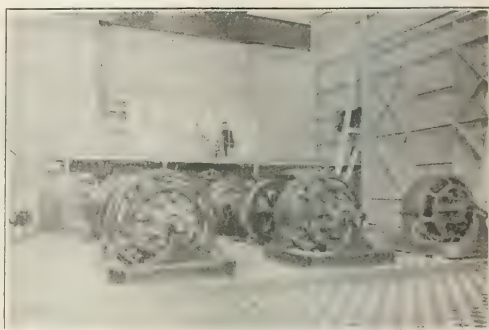


FIG. 4—INTERIOR OF EXCITER ROOM

some distance from the generating station. The ultimate equipment will consist of eight generating units and three exciter units. Six generators and all the exciters are now in operation, while the remaining two generating units are under construction. Each of the turbines has a normal capacity of 10,000 hp at 187.5 r.p.m., with an overload capacity of 12,500 hp measured at the coupling. The main turbines are of the horizontal double-runner Francis type, inclosed in a cylindrical steel casing directly connecting

turbines is the ease with which the guide blades can be independently removed. These blades are of steel, cast in one piece with their respective shafts, and in order to remove them it is necessary only to remove the section of the box belonging to the blade in question and then to uncouple the connection between the crank and the regulator. All parts of the regulating mechanism have been located outside the turbine casing so as to insure the greatest possible reliability and durability, at the same time providing for



FIG. 3—GENERATING STATION IN FOREGROUND AND GATEHOUSE ON HILL

with the penstock as shown in Fig. 6. Almost all parts of the turbines, especially those exposed to the severest strains, are made of steel. The smallest interior diameter of the casing is 16.5 ft., the largest 18 ft., and the thickness of the material is about 15/16 in. The shaft is made of nickel steel in three parts with forged couplings bolted together. Three bearings with ring lubrication are provided and made

an easy lubrication and inspection of the journals during operation.

The turbine governors and the oil pumps are belt-driven from the turbine shafts. The governors are also equipped with motors so that they may be controlled from the operating switchboard. Hydraulic brakes are installed for bringing the turbines to a standstill, and these brakes are so



arranged that they can be operated from the starting platforms. The turbines have proved to be very efficient and actual tests have shown a full-load efficiency of 87 per cent, deducting for the losses due to the pipe friction.

#### GENERATORS AND EXCITERS

The alternating-current generators are rated at 11,000 kva or 9000 kw at about 80 per cent power-factor. They are of the three-phase, 25-cycle type operating at 187.5 r.p.m. and delivering energy at from 10,000 volts to 11,000 volts. The design is also such that the generators will be able to deliver 6500-kw single-phase energy at 11,000 volts and 85 per cent power-factor, the reason for this being that a considerable future single-phase load is anticipated from railroad electrifications. The efficiency at 9000 kw, 80 per cent power-factor is 96 per cent, the regulation 21 per cent,

to its weight the frame and poles are split in three sections, at right angles to the shaft, and these parts are substantially bolted together. The shafts have been bored through their length and the core taken out to ascertain that the material used was absolutely free from any defects. The design of the rotor is furthermore such as to withstand a speed 85 per cent beyond normal. The stators are divided into two sections only and are of an entirely inclosed construction, as shown in Fig. 5. The rotor is equipped with fans which take air from the outside through inlet channels in the floor and force it through the stator and thence through outlet channels to the outside. The generators can, however, readily be changed to the ordinary open type by simply removing the inner part of the end shields.

Many advantages have been found in the inclosed type of generator construction; for instance, cold air is obtained



FIG. 5—INTERIOR VIEW OF MAIN GENERATING ROOM

and the guaranteed maximum temperature rise 45 deg. C. above the room temperature.

When delivering 11,000 kva, 11,000 volts, at 80 per cent power-factor the generators require a field current of 285 amp. This energy for field excitation is obtained from three 220-volt exciters driven by waterwheels and from a small direct-current booster generator mounted on the shaft of each alternator and connected with each field circuit. These boosters are designed so that the voltage across the generator field can be varied from 0 volt to 300 volts. No rheostats are used in the main field circuits for regulation of field current because this is entirely accomplished by regulation of the booster field current, which is supplied from the 220-volt system. A portable electrically operated field rheostat is kept in reserve and can be readily connected to the circuit in case of failure of a booster.

The main generators are of a very substantial construction, the rotor being of cast steel, the poles solid and cast with the frame, the pole faces only being laminated. Owing

to its weight the frame and poles are split in three sections, at right angles to the shaft, and these parts are substantially bolted together. The shafts have been bored through their length and the core taken out to ascertain that the material used was absolutely free from any defects. The design of the rotor is furthermore such as to withstand a speed 85 per cent beyond normal. The stators are divided into two sections only and are of an entirely inclosed construction, as shown in Fig. 5. The rotor is equipped with fans which take air from the outside through inlet channels in the floor and force it through the stator and thence through outlet channels to the outside. The generators can, however, readily be changed to the ordinary open type by simply removing the inner part of the end shields.

Many advantages have been found in the inclosed type of generator construction; for instance, cold air is obtained for the ventilation, the warm air can be utilized for heating purposes and conducted to the most proper place for such use; the station need not be unnecessarily heated during the summer months, and noise is reduced to a minimum. Possibly the most novel scheme is the utilization of the heated air for heating the racks to prevent their clogging with ice during the winter months.

The stator windings are insulated with mica and the protecting rods are substantially supported outside the core so that they may be able to withstand the strains due to short circuits. The bearings are provided with ring lubrication and are water-cooled. The total weight of each complete unit is 220 tons, the weight of the rotor being about 75 tons.

Three waterwheel-driven exciters shown in Fig. 4, each having a capacity of 350 kw at from 220 to 300 volts and a speed of 410 r.p.m., furnish the energy necessary for excitation. The machines are of the commutating-pole type and are capable of developing 25 per cent overload. While

they are intended for a normal operation at 220 volts, they can deliver 300 volts when used for charging the storage battery which is installed in connection with the exciter system. This battery is rated 1000 kw-hr., 4800 amp-hr., at three hours' discharge. The efficiency of the exciter units at full load is 92.5 per cent.

#### TRANSFORMERS

The transformers are installed in the transformer and switch house, which is located about 1000 ft. from the generating station. One transformer bank, rated at 11,000 kva, is provided for each generator. The transformers are of the single-phase water-cooled type, having a maximum

boiler iron  $\frac{1}{2}$  in. thick with the seams welded. The tanks have been tested with a pressure of 10 atmospheres, and the design is such that they are absolutely air-tight and oil-tight. This makes it possible to dry the transformers under vacuum and also to prevent any damp air from entering when the volume of the oil decreases because of the cooling. A relief valve is provided which will permit the expansion

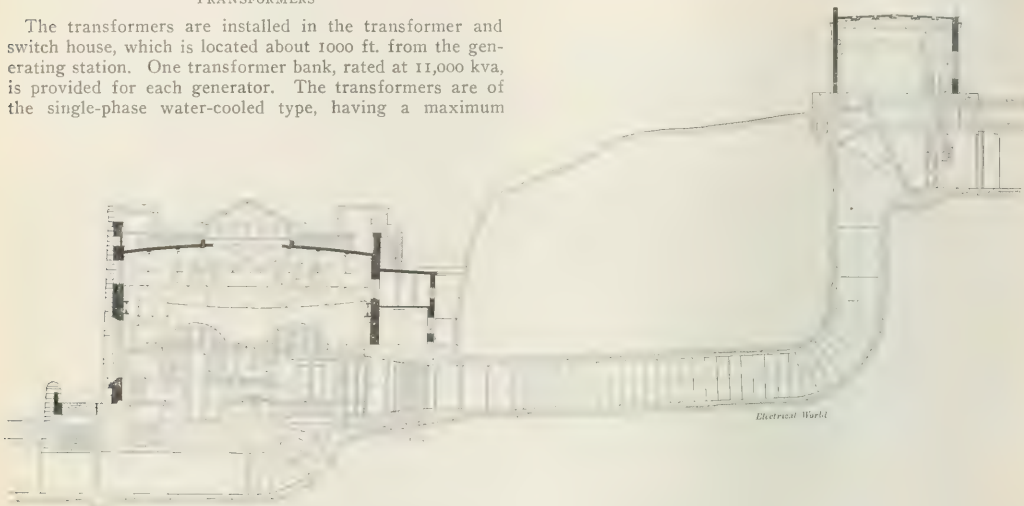


FIG. 6—CROSS-SECTION OF GATEHOUSE AND GENERATING STATION

rating of 3670 kva with a temperature rise not exceeding 60 deg. C. They are delta-connected on the low-tension side and star-connected on the high-tension side, the low-tension voltage being 10,000/11,000 volts and the high-tension voltage 50,000 volts between the phases. The guaranteed efficiency at 3000-kva unity power-factor was 98.5 per cent, and the insulation test consisted of an application

or contraction of the volume of the oil. The copper cooling coils circulate 14 gal. of cooling water per unit per minute. Each transformer is provided with a ratchet-driven wheel base as shown in the illustration and, besides this, with a very complete equipment of thermometers, gages and signal apparatus for recording the temperature and oil level in the transformers. The total weight of each unit is 31 tons, the

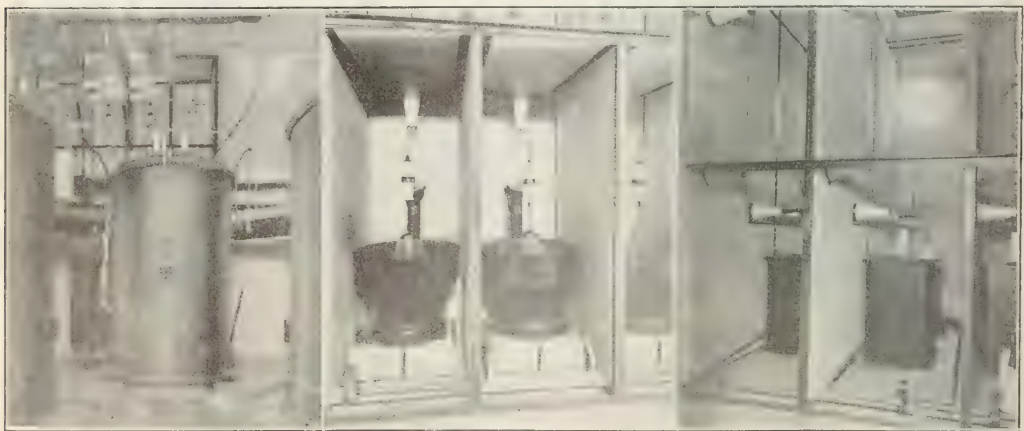


FIG. 7—3670-KVA TRANSFORMER

FIG. 8—WATER-JET LIGHTNING ARRESTER

FIG. 9—HORN-GAP LIGHTNING ARRESTER

of 100,000 volts between the high-tension winding and the core and of 20,000 volts between the low-tension winding and the core for a period of fifteen minutes each.

A view of the transformers is shown in Figs. 7 and 14. The core type is of especial interest, as this design of transformer has never been attempted in this country for such large sizes. The tanks are unusually substantial, being of

core and windings weighing 18 tons and the tank with oil 13 tons.

#### SWITCHES AND LIGHTNING ARRESTERS

Each generator is provided with an automatic oil circuit-breaker, which is located in the generating station. The connections from this switch to the switch house consist of four three-conductor, lead-covered cables for each unit,

a tunnel being provided through which the cables are run. In the switch house (Fig. 15) the cables are again united and connected through oil switches to two sets of low-tension busbars and to the step-up transformers. The local power is taken from these buses, which can be tied together, if desired, by means of a tie switch provided for this purpose. An automatic oil switch is provided on the high-

(Fig. 10), the different phases being inclosed in cells and compartments to minimize the danger of short-circuits and of accidentally coming in contact with the live parts of the system. The low-tension buses are made of copper bars and the high-tension buses of copper pipes, both being bare and mounted on substantial insulation. The buses are also provided with expansion joints to prevent insulator break-



FIG. 10—SWITCH COMPARTMENTS



FIG. 12—HIGH-TENSION BUSBAR STRUCTURE

tension side of each transformer group, this as well as the corresponding low-tension transformer switch being equipped with differential relays. A set of 50,000-volt transfer buses (Fig. 12) with transfer switches of the oil-break type are installed, and each of the four present outgoing 50,000-volt lines is equipped with automatic oil switches, as are also all local 10,000-volt circuits. The system of connections is very flexible, and it is possible for each generator, with or without voltage transformation, to supply energy for any number of outgoing lines and to operate independently of the other generators. In this manner the installation can be divided into several systems independent of each other, insuring an increased reliability and safety.

The outgoing lines are provided with choke coils and

ages due to expansions or contractions of the buses caused by temperature variations.

The two control switchboards are located in the center of the switch house. One board contains the instruments and control devices for the generator circuits, while the other is for the control of the transformer circuits and the outgoing lines. They are of marble and are made in accordance with the usual bench-type construction, as shown in Fig. 11. A separate deck containing a very complete equipment of signal apparatus is also provided, as shown in the illustration.

The design and the mounting of the oil switches are such that the oil tanks can easily be lowered, thus effecting a simple means of inspecting the contacts without dismount-



FIG. 11—CENTRAL SWITCHBOARD AND SIGNAL BOARD

double lightning protective devices. These consist of double horn-gap arresters with shunted oil resistors and series-connected water resistors, multigap and water-jet arresters, as shown in Fig. 8. Besides these, choke coils and horn-gap arresters are also inserted on the high-tension side of each transformer between each phase and the neutral point.

The switch structure is of the inclosed construction

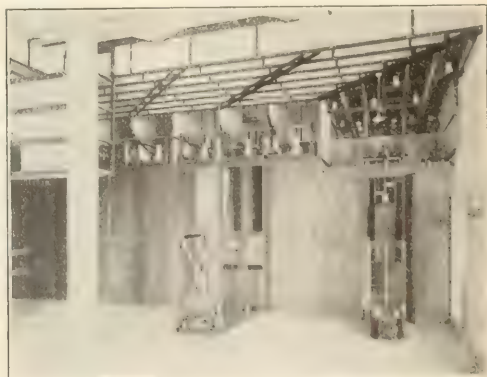


FIG. 13—OIL SWITCHES FOR 5600-VOLT CIRCUITS

ing the switch or emptying the oil. For the larger-type switches, as shown in Fig. 13, where the tanks are too heavy to permit being lifted by hand, a special truck is provided, which can be pushed in under the tank. It is provided with a table which can be raised or lowered either manually by a ratchet or, for the largest breakers, electrically by means of motor drive. When the tank has been



lowered and removed from the cell, the contacts are left exposed for examination. This construction is also of great advantage when oil is to be changed in that the tanks can be moved on the truck to the oil room and the filling done there.

Some of the switches are equipped with series resistors in each phase, arranged in such a manner that when closing the switch the potential is first limited to its half value. This eliminates current rushes, which otherwise take place, as, for example, when switching in a transformer bank, before the magnetic circuit has had time to be normally saturated. For this reason oil switches with series resistors are to be recommended especially for low frequencies where transformers with a relatively high saturation have been selected. Such switches are also of great value for holding down the voltage when switching in long transmission lines or extensive cable systems. All the resistances are mounted inside the switches and for the

FIG. 14—TRANSFORMER WITH SHELL REMOVED

largest sizes the arrangement is such that the resistance is connected in the circuit only during the time of operation

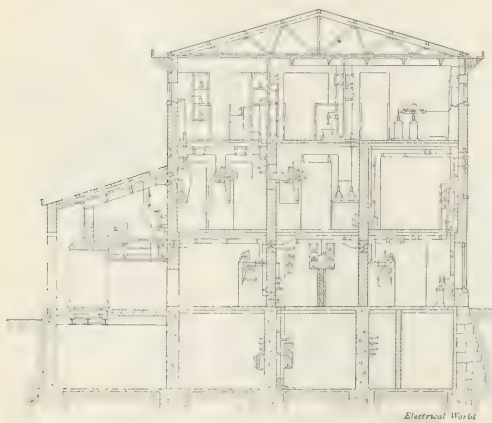


FIG. 15—SECTION AT SWITCH HOUSE

while it is entirely disconnected from the circuit whether the switch is normally in the closed or the open position.

#### TRANSMISSION LINES

The outgoing 50,000-volt transmission lines consist of a 41-mile double-circuit line to the city of Gothenburg; a 20-mile branch line from the town of Lilla Edet, on this

line, to the city of Alingsas, and a 45-mile double-circuit line from the power station at Trollhättan to the city of Skara, with a single circuit continuing for another 9 miles to the city of Sköfde. All the circuits are supported on steel towers of the flexible construction, approximately two strain towers being installed per mile.

The line to Gothenburg is of a very substantial construction, the tower to the left in Fig. 16 illustrating one of the strain towers for this line, while the flexible towers are of the A-frame construction. The normal span for this line is 600 ft., the six line conductors being of stranded copper of a size equivalent to No. 00 B. & S. The ground wire consists of a No. 0 steel cable supported on an upright extension of the towers. The strain towers have a normal height of 48 ft., weighing 6300 lb., while the flexible towers are 52 ft. high and weigh 3500 lb. each. The insulators on the strain towers are of the pin type and on the flexible towers of the suspension type. All the towers are provided with concrete foundations.

The lines between Trollhättan and the city of Skara and the line between Lilla Edet and the city of Alingsas employ a much lighter line construction. Both are of the double-circuit type, the span of the former being 550 ft. and that of the latter 600 ft. The conductors are equivalent to No. 2 B. & S. stranded copper cable and the ground wire consists of a No. 0 steel cable. The strain towers of both lines weigh 5000 lb. each and have a height of 48 ft. The



FIG. 16—TRANSMISSION LINES ENTERING SUBSTATION

flexible towers of the first line have a height of 47 ft., weighing 2200 lb., while for the second line they are 52 ft. high and weigh 2600 lb. Pin insulators have also been used on the strain towers and suspension insulators on the flexible towers on these lines. The design of a strain tower for these two lines is shown to the right in Fig. 16.

The line between the cities of Skara and Sköfde is only single-circuit and the construction is very light. The normal span is 450 ft. and the conductors are of hard-drawn copper equivalent to No. 5 B. & S. and the steel ground wire is also equivalent to No. 5 B. & S. The strain towers for this line are 41 ft. high and weigh 2600 lb., while the flexible towers are 47 ft. high and weigh 1300 lb. The insulators are of the pin type. For all the 10,000-volt local distributing lines wood or steel poles with pin insulators are exclusively used.

The engineering and design in connection with this development have been done by the government engineers under the supervision of Mr. Torsten Holmgren, who is now the chief engineer and general manager of the plant. The electrical equipment, with a few exceptions, has been furnished by the Allmänna Svenska Elektriska Aktiebolaget (the General Swedish Electrical Company), of Westeras, Sweden.

## The Planning of a Large Modern Steam Generating Station

During an address given at a joint meeting of engineering societies in Chicago on Dec. 23 Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, gave some interesting information about the considerations that influenced the location and design of the new Northwest station of the Commonwealth Edison Company, and also some facts about the equipment of this large and modern generating plant.

In determining the selection of a site for a modern steam generating station in a large city, the dominant factors are the ones involved in the economical handling and utilization of coal. The cost of the fuel exceeds all other operating costs combined, and as the consumption of fuel is in the ratio of two to three, depending upon whether the station is operating condensing or non-condensing, it appears that unless the coal consumption is to be increased 50 per cent the station must be located near an abundant supply of condensing water. This is the first specification for a steam power-station location.

If \$1.70 a ton be assumed as the average price of steam coal in Chicago f.o.b. cars and it is further assumed that 60 cents a ton be the cost of cartage from the railroad to the power station, it appears that unless the cost of fuel is to be increased very materially, the generating plant must be located adjacent to a railroad, and preferably on a railroad which brings the coal to the city. Therefore, the determining factor of second importance is that of railroad facilities.

Desirable power-house sites are hard to find in a large city. When a satisfactory location is found it is advisable to provide for a large installation. At the time the Northwest station in Chicago was to have been started (that is, the winter of 1911-12) the maximum load on the system was about 200,000 kw, while the indication was that for a number of years the future increase would be at about the average rate of 15 per cent. Accordingly acreage sufficient to accommodate two generating stations of 120,000 kw each was sought, although it was not the intention to install machinery of this rating at the beginning.

### ACREAGE REQUIRED FOR 240,000-KW PLANT

The next step was to consider what acreage is required to accommodate a generating equipment of 240,000 kw. Experience has shown that such a power house supplying a diversified metropolitan load will at some seasons of the year be operated at a load-factor of 50 per cent. For a 240,000-kw installation this will require a daily coal supply of something over 4000 tons, or about 100 carloads. To make a moderate allowance for the uncertainties of freight traffic over a distance of 200 miles, provision should be made for storing on the property at least three days' supply of loaded cars and one day's output of empty cars, amounting altogether to 400 cars, and this will require 4 miles of storage tracks. Further, to protect its customers, an electric-service company should have on hand a reserve of at least ninety days' supply of coal. For the generating station or stations under consideration this would amount to about 350,000 tons.

The 240,000-kw station, or two 120,000-kw stations, together with storage tracks, storage coal piles and switch tracks, will require about 50 acres of ground, but after allowing for convenient spacing, parking and recreation grounds it will be found that the total space required for such a plant and all that goes with it is not less than 75 acres, the greater part of which is for receiving, storing and handling coal. Thus ample acreage is the third important factor in determining the location of the generating station under consideration.

The fourth consideration is a factor which in the earlier days of the electric-service industry was put first, and that

is the nearness of the generating station to the center of the load.

Taking into account these four factors, Mr. Abbott exhibited a map to show why the site of the Northwest station on the North Branch of the Chicago River, in the neighborhood of California Avenue and Roscoe Street, was selected as the best that could be obtained. This site consists of one tract of 55 acres and another of 40 acres. These two tracts are separated by streets and dwelling houses, but are connected by the company's private elevated electric railway built on a right-of-way which was purchased. On the eastern side—the one bordering the river—it is planned to erect eventually two power stations. One of these is now partly built, the initial equipment of two 20,000-kw units being in operation. It may be remarked here that the Northwest station has been described in several articles published in the *Electrical World*, the latest being that by Prof. H. H. Norris in the issue of Oct. 5, 1912.

The speaker described the station, stating that about two-thirds of the first station has been completed, although only one-third of the equipment has been installed. He devoted considerable attention to the coal-handling equipment. If the incoming coal cars have drop bottoms, the unloading is done quickly by opening the drops. If a car does not have a drop bottom, it is unloaded at a cost of 2 cents a ton by a 2-yd. clamshell bucket operated from an overhead crane. In its passage through the boiler house the coal is handled on five different levers and in nine operations, but at no point is it necessary to use manual labor.

Two types of boilers are used at the Northwest station, one with a vertical pass for the hot gases and one with a horizontal gas pass. The purpose of using the two types is to give them a thorough test to determine which is the better, with the idea of insuring practically perfect, therefore practically smokeless, combustion.

Each boiler should be able to generate 30,000 lb. of steam an hour, and this will require a rate of coal burning of 4500 lb. an hour under each boiler. This means that in each second of time 300 cu. ft. of air passes through the grate. With sixty boilers, all running at the maximum rate, the amount of air entering the grates each minute would be over 1,000,000 cu. ft. To avoid unpleasant drafts of cold air in winter provision is made to admit air directly under the grates from the train-shed below.

The 20,000-kw vertical turbo-generators at the Northwest station are spaced 44 ft. apart, whereas the 12,000-kw units at Fisk Street are on 41-ft. centers. The steam turbines are six-stage machines and each one has 7392 buckets. The outside diameter of the sixth wheel is 13 ft. 2 in. and it has a peripheral velocity of over 500 ft. a second, or about 6 miles a minute. The guaranteed steam consumption, with steam at 250 lb. pressure and 100 deg. superheat, is 14 lb. per kw-hr. at loads of 10,000 kw and 20,000 kw, and 13.45 lb. at a load of 15,000 kw.

### COMPARISON OF STEAM TURBINES AND RECIPROCATING ENGINES

Mr. Abbott devoted considerable time to an explanation of why the steam turbine is more efficient than reciprocating engines, and he gave curves showing a comparison of the expansions between steam cylinders and steam turbines from 175 lb. absolute pressure to 2.5 lb. absolute pressure. With the increased ratio of expansion which is obtained in the turbine the importance of low vacuums is much greater with the turbine than with the engine. Steam can be expanded from 200 lb. down to, say, 50 lb. pressure more economically in a steam cylinder than it can through the blades of the first stages of a turbine; but the loss through the low-pressure cylinder in the compound engine is so great that the combined efficiency of all the stages of the steam turbine is much better than is the combined efficiency of the two or more cylinders of a compound reciprocating engine.



In the 20,000-kw units at Northwest station the weight of the steam end of the turbine is 200 tons and of the generator 230 tons, making a total weight of 430 tons, of which 100 tons is in the revolving elements.

The generator mounted above the turbine is of the revolving-field type and generates 25-cycle, three-phase current at a pressure of 4500 volts, which is stepped up by transformers to 9000 volts. The revolving field has four poles and weighs 52 tons. The armature is star-wound and has a continuous rating of 2570 amp per phase.

Forced ventilation is used for the generator. Although the efficiency of the machine is high, yet because of the large amount of energy transformed the heat evolved by each generator is equal to that resulting from the perfect combustion each hour of 270 lb. of coal of the quality used in the boiler room.

At the Northwest station the additional reactance needed in the generator circuits to prevent surging is introduced by the auto-transformers, which raise the emf from the machine voltage of 4500 to the system voltage of 9000. These transformers are installed in a separate building.

In conclusion Mr. Abbott said: "The generating station just described is the most modern in existence and was designed by engineers who have been engaged all their lives in designing power houses and power-house equipment. No expense was spared to make this installation the last word in the art of converting the energy of coal into electrical energy. The station was designed for six units, two of which were to be included in the first installation and the remaining four to follow soon thereafter, so that the station when completed would contain a symmetrical, up-to-date equipment of the largest size and highest efficiency; but—alas for the best-laid plans!—between the time that the plans were finished and the completion of the initial equipment as great strides were made in the art as had been made during any period of equal length in its history. The Northwest station is doing all that was expected of it, but within a little more than a year from the time it was put into service its equipment will be eclipsed by an installation at Fisk Street of larger and more efficient boilers and larger and more efficient turbines. The indications now are that the equipment which will be installed at the Northwest station in the future will be of an entirely different type from that now in use there, and we may even hope that it will show as great an improvement over the newer Fisk Street turbines as those are expected to do over the machines we have discussed to-night."

### Discussion

Mr. Bion J. Arnold spoke of the Northwest station as a great engineering achievement. Chicago has led in central-station design because of the broad conception exhibited in the management of its electric-service utilities, the engineering talent of the company and the ability of the consulting engineers. Mr. Arnold referred to the increase in thermal efficiency of power stations, which he said had now reached about 10 per cent in the case of modern 10,000-kw units. In one New York station with reciprocating engines and low-pressure exhaust-steam turbines this figure has reached something over 11 per cent, and very likely the Northwest station will do as well. Another feature of the Northwest station praised by Mr. Arnold is its simplicity. The speaker made the interesting statement that the New York Edison Company is now contemplating taking over one or both of the generating stations of the New York Central Railroad used for supplying electricity to its New York City terminal, the arrangement being that the railroad company shall buy its electrical energy from the electric-service company, the latter operating the existing generating stations of the railroad company.

Mr. G. T. Seely, assistant general manager of the Chicago Elevated Railways, commented on the fact that the protected third-rail used in the Commonwealth Edison Com-

pany's private elevated railway is the only contact rail of that type of which use is made in this part of the country.

One gentleman asked what precautions had been taken to protect the very large storage piles of coal from spontaneous combustion. Mr. Abbott said that he knew of nothing that would absolutely prevent all danger of spontaneous combustion of coal in large storage piles unless it be the use of coal in large sizes. Screenings in large piles are almost sure to take fire in warm weather, and this is a contingency that must be anticipated and guarded against.

## Demagnetization and Recovery of Permanent Magnets

By SHIRO SANO

It is a well-known fact that a permanent magnet loses considerable of its attractive force when it receives a mechanical blow. However, it is not quite so well known that the magnet may recover its magnetic force, fully or partly at least, according to its magnetic conditions, when it is given a certain mechanical treatment.

The writer has performed a series of experiments with a view to ascertaining more or less quantitatively the effect of mechanical mistreatment upon the demagnetization of a

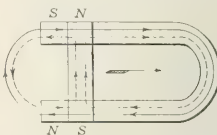


FIG. 1—FLUX DISTRIBUTION IN HORSESHOE MAGNET



FIG. 2—ARRANGEMENT FOR MEASURING MAGNETIC FLUX

permanent magnet and its recovery therefrom. A standard form of a horseshoe magnet, such as is used in the ordinary telephone signaling generator, was taken as the sample for experimentation. It was about 5 in. long,  $\frac{3}{4}$  in. wide,  $\frac{3}{8}$  in. thick, and the two legs were separated by  $1\frac{3}{4}$  in. and had a soft-iron armature or keeper 2.5 in. long,  $\frac{3}{4}$  in. wide and  $\frac{1}{8}$  in. thick.

The first experiment consisted in measuring the effect upon the magnetic force of the magnet of rubbing the armature on the surface of the magnet in the direction of the arrow-head, as shown in Fig. 1. This experiment was

TABLE 1—RESULTS OF TEST ON PERMANENT MAGNET

Number of Strokes	Galvanometer Throw	Per Cent Throw	Total Number of Strokes
0	64	100	0
1	48	75	1
1	40	62.5	2
1	39	60.9	3
4	35.5	55.5	7
6	34	53.1	13
10	33.5	52.3	23
30	33	51.6	33
30	32.5	50.8	63

performed in order to ascertain the effect produced in constructing the magnet generator where the magnets usually are magnetized first and then inserted in their place, during which process they are, incidentally, rubbed upon by the pole-pieces of the generator.

In order to measure the magnetic force of the magnet the apparatus shown in Fig. 2 was used. This consists of a coil made up of a bundle of fine wires inserted inside the horseshoe magnet. The two terminals of the coil are connected through a switch to a ballistic galvanometer. A quick withdrawal of the coil from inside the magnet will produce a throw on the ballistic galvanometer, thus giving a measure of the flux cut by the motion of the coil. The



throw of the galvanometer will, therefore, represent the magnetic force of the magnet. At first sight this may seem rather a crude way of measuring the flux, but experience shows that it is more reliable than it appears. The throw of the galvanometer was first measured with the magnet magnetized initially by a powerful magnetomotive force. The results of the first experiment are given in Table I.

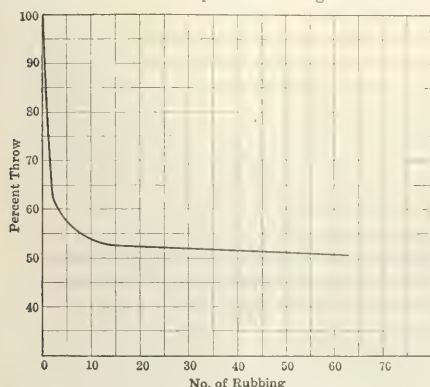


FIG. 3—CURVE SHOWING RESULTS OF TABLE I

By this table it is seen that the strength of the magnet is considerably lowered by rubbing it with the armature when the degree of magnetization is high, while it is not affected so much when the degree of magnetization is already lowered. Thus, in the first stroke, the magnetic force was lowered approximately 25 per cent, while from the thirty-third to the sixty-third stroke the percentage throw of the galvanometer decreases only from 51.6 to 50.8, a comparatively small amount.

The second experiment consisted in sliding the keeper upon the side of the magnet first in one direction and then in the opposite direction. The magnet was first subjected to the action of a very powerful mmf about 20,000 ampere-turns being applied to the whole magnetic circuit. The throw of the galvanometer was noted before any rubbing was done and after each positive and negative stroke. By positive stroke is meant the sliding of the keeper in the

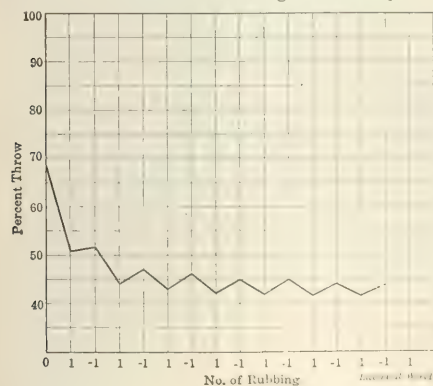


FIG. 4—CURVE SHOWING RESULTS OF TABLE II

direction shown by the arrow-head and by the negative in the opposite direction. The results are seen in Table II.

It will be noted that the first positive stroke decreased the throw of the galvanometer from 68 to 50.5, and the next negative stroke increased it to 51.5; that is, the negative stroke restored a very small amount of the magnetic force. From the sixth reading on, however, the recovery

of magnetic force due to negative rubbing was well-nigh complete.

To account for these phenomena the writer offers the following explanation: With the keeper in the position shown in Fig. 1, a pole of opposite polarity would be set up at each end. If we consider the keeper as an independent magnet, then the flux produced by it will be set up as shown in the dotted lines, whereas the main flux is directed as shown in full line. Evidently, toward the open end of the magnet the two fluxes are opposed to each other, while toward the closed end they assist each other. If, now, the keeper be moved in the direction shown, the oppositely directed fluxes produced by the keeper will extend gradually over all the magnet and will result in weakening it. If, on the other hand, the keeper be moved in the opposite direction, away from the closed end, the local flux, directed in the same sense as the main flux, will gradually extend over the whole length, while the oppositely directed flux will be eliminated.

The reason the demagnetization is so severe when the magnet is highly magnetized and rather feeble when the magnet has been demagnetized is because in the first case

TABLE II—RESULTS OF RESTORATIVE TEST

	NUMBER OF STROKE													
	0	1	-1	1	1	1	-1	-1	1	-1	1	-1	1	-1
Galvanometer throw...	68	50.5	51.5	44	47	44	47	44	47	44	47	44	47	44

the magnet is well saturated, and consequently a little decrease in flux will have a correspondingly great decrease in magnetizing force, while in the second case the magnet is not saturated, and hence a decrease in flux will cause a proportional decrease in the strength of the magnet. The answer to the question as to why the recovery of magnetic force is slight when the magnet is near saturation seems to be that a little decrease in flux by positive rubbing will correspond to a large decrease in strength, and when the magnetic force is enfeebled once for all, the negative rubbing, however repeated, cannot force the flux to return to a value near saturation.

## Fuel-Oil Engines

At the recent annual meeting of the American Society of Agricultural Engineers in Chicago, Prof. C. F. Hirshfeld, of Cornell University, delivered a scholarly address on "The Principles of Fuel-Oil Engines." Beginning with the fundamentals of vaporization, the speaker summarized the chemistry of fuel combustion in oil engines. He surveyed the latest researches in this rather complicated subject and as a practical conclusion laid great stress on the importance of fine spraying in any fuel-oil engine. This fine spraying may bring difficulties of its own in its train, and Prof. Hirshfeld devoted considerable time to a consideration of the use of water vapor as a corrective, particularly in the case of kerosene engines. The peculiar phenomena observed upon mixing kerosene and water in internal-combustion engines were discussed at some length. One interesting observation made was that the Diesel engine is nothing but an internal-retort engine working without water. The speaker thinks there is no question that the Diesel engine is the most nearly perfect type of oil engine in existence.

Mr. John A. Secor, of the M. Rumely Company, discussed the paper. He spoke of the growing scarcity of gasoline as a fuel for internal-combustion engines. Fortunately, however, kerosene is available, and in many respects it is an ideal fuel. Mr. Secor thought the Diesel engine unreliable, at least for agricultural work.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Electricity for Farms in the Blue Grass

The farm as a user of central-station energy is being uncovered by the Kentucky Utilities Company, of Lexington, which operates in a large part of the Blue Grass section of the State. It has secured franchises for stringing its wires in a number of counties adjoining Fayette, which contains Lexington, and is preparing to go after farm business in earnest. Not only is the company securing contracts for lighting residences and barns but it is also wiring farm property so as to enable agricultural machinery, of which the modern farm has a large array, to be operated electrically. A number of farmers had already bought gasoline engines with which to generate power for their corn shredders, feed choppers and the other equipment in their barns, and the opportunity to substitute the more satisfactory, convenient and economical service of the central station is being embraced with enthusiasm. Among the large estates which have contracted with the Kentucky Utilities Company for service for the purposes indicated is that of Clarence Lebus, president of the Burley Tobacco Society and one of the leading figures in Kentucky agriculture.

## Reduction of Rates in St. Louis

Following its reduction of rates effective on Dec. 1, 1912, the Union Electric Light & Power Company of St. Louis sent a circular letter to its commercial customers asking them to fill out an inclosed card if they wished to take advantage of the new commercial rate schedule provided that the net rate accruing thereunder was not higher than under the existing contract. During the month of December about 7000 responses were received. In about 90 per cent of the cases so far reported the consumer has been materially benefited by the new rates. The matter has been handled in this way because there are several different schedules, and the customer's consumption is taken for a year and figured on the basis of the various schedules to ascertain which is the most beneficial to him. The company announces that it will continue its policy of rate reductions from time to time as conditions warrant, and patrons will always have the benefit of these reductions regardless of existing agreements.

## Stimulating Popular Interest in Ornamental Lighting

Since the Bay City (Tex.) central station was acquired by the Emanuel syndicate of Dayton, Ohio, several months ago, efforts have been directed toward improving the local standard of street illumination. To this end the local manager, Mr. W. C. Duncan, recently succeeded in getting the Business Men's League of Bay City to hold a banquet to boost the installation of a new system of ornamental tungsten-post lighting. In the banquet room, as the accompanying illustration shows, the central-station company erected one of the five-lamp standards which it proposed to install in the downtown section, and this actual demonstration created the greatest interest among the leading citizens of the community who were present at the meeting. Enthusiastic speeches were made, and the next evening the City Council took the matter up for discussion.

Later the Bay City company scored another popular hit by transferring this sample post from the banquet room to the interior of the post office. This building is owned by a man who rented the room to the government seven years ago, when rents were low, on a ten-year lease, to be heated, lighted and kept in repairs for the sum of \$200 per year. Buildings are now renting on each side of the post



BANQUET ARRANGED TO STIMULATE ORNAMENTAL LIGHTING

office for \$50 to \$60 a month. Consequently the owner does not feel like spending more money in improvements. The public as a whole was suffering, as it was almost impossible to see the combination on one's lock box by the aid of the two 2-cp lamps which were depended upon for lighting the space, 25 ft. by 80 ft. The sample post lamps now furnish a degree of illumination over the entire lock-box area that is brilliant by comparison with the former conditions, and this public-spirited movement of the utility company has occasioned some very complimentary comments from the townspeople.

## Liability of Superintendent for Death of Inexperienced Lineman

A lawsuit that is attracting some attention among electrical men was tried in the Circuit Court at Peoria, Ill., last month. The action was brought by John Zaitz, as administrator of Edward Zaitz, against Frank Z. Ames, as superintendent of Edward Zaitz while employed as a lineman by the Minonk Electric Light & Power Company, of Minonk, Ill., of which Mr. Ames, the defendant, was superintendent at the time of the accident. It was asserted on the part of the plaintiff that Zaitz was young and inexperienced and knew nothing of the danger of working on the line, which carried wires charged with a voltage dangerous to human life. As superintendent of the company, it was alleged that Mr. Ames ordered young Zaitz to ascend a pole and do some repair work in proximity to the high-potential wires. Further, the plaintiff declared, Ames knew of the danger and did not inform Zaitz. In neglecting to do so it was charged that the superintendent was guilty of negligence and carelessness, and that by reason thereof Zaitz, while doing the work he was directed



to do, came in contact with the primary wires of the overhead circuit, which was carrying a current having an emf of over 2000 volts, and was killed. The administrator sued for damages to the amount of \$10,000.

On the part of the defendant it was contended that Zaitz had been told by the construction superintendent a few days before the accident of the danger of coming in contact with the primary wires. Evidence was given to show that at the time when the accident happened Zaitz had climbed the pole of his own motion, although another lineman had started to do the work. The work to be done was merely the attaching of some secondary wires to brackets 18 in. or 20 in. below the primary wires. After the young man had attached one wire to a bracket on one side of the pole he shifted his position to the other side, waiting, apparently, until another secondary wire should be passed up to him. While waiting he apparently raised his hands and heedlessly placed them in contact with the primary wires over his head. He was seen immediately after the shock with his hands extended above him and swinging back, hanging by his belt and spurs.

Notwithstanding the evidence introduced by the defense, the jury found a verdict for the plaintiff, allowing the administrator \$2,000 for the benefit of the next of kin of the decedent. No immediate judgment was entered on the verdict. A motion for new trial has been filed, and if it is not allowed the case will be taken to the Appellate Court. The case was hotly contested, Weil & Bartley appearing for the plaintiff, and Winslow Evans for the defendant.

### Making a Central-Station Sales Agent of the Contractor

A simple co-operative plan has recently been developed by the Edison Electric Illuminating Company of Brooklyn through which it has added more than thirty of the electrical contractors in that city to its selling force without incurring any appreciable expense for their services.

The salient features of the plan are that the company acquires from the contractor the privilege to paint the words



FIG. 1—STORE OF HEBREW CONTRACTOR ACTING AS CENTRAL-STATION AGENT

"Edison Light, Heat and Power Applications Received" upon the contractor's window as shown in the accompanying illustrations, explains its contracts to the contractor, authorizes him to take applications for its service and renders him any and all assistance he desires in getting new customers for it. Applications for practically all classes of service may be taken by the contractor. In exceptional

cases, involving contracts for extensive motor-service or lighting requirements, the company's representatives give the prospective customer such information as the contractor is unable to furnish, or conduct all negotiations if desirable, upon receipt of a notice from the contractor.

In return for this privilege, which also results in increased installation for the contractor, the company fur-

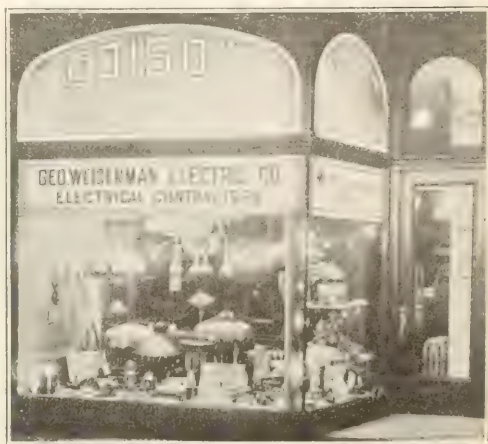


FIG. 2—ATTRACTIVE DISPLAY IN CONTRACTOR'S SHOW WINDOWS

nishes window lighting for the contractor from dusk to midnight without charge, the turning on and off of the supply being done at an outside switch by the company.

In this way the company has secured a number of desirable branch offices in several of the important business sections of the city. The plan has been so successful that it will be extended within a short time so that similar branches will be available in all parts of the city. Only financially responsible and progressive contractors are made parties to this plan. The only other conditions imposed by the company are that the contractor install an attractive plate-glass front if one is not already in place and remove all references to any other lines of business he may carry on.

The lettering is plainly visible both day and night and presents an excellent advertisement of the company's business to pedestrians and passengers in surface cars.

The Brooklyn company is planning to install in the windows of contractors acting as its agents attractive displays of apparatus that is sold and installed by the latter, the idea being to render all the assistance in its power to make the windows attractive and ultimately to increase its revenues from the sale of energy. These displays will be changed periodically, probably once a month.

### Central-Station Service for Louisville Newspapers

The efficacy and economy of central-station service has been again demonstrated in the case of the Louisville *Courier-Journal* and the Louisville *Times*, Colonel Henry Watterson's famous newspapers, which have moved into a handsome new home at Third and Green Streets in the Kentucky city. They formerly occupied space in a large building at Fourth and Green Streets, using for lighting and motors electricity produced by their own generators. When the matter of equipping the new building came up, however, it was decided to depend chiefly on central-station service, retaining the connections with the plant in the old building, which is still in commission, for emergency purposes only. The Kentucky Electric Company was given the contract and is supplying all of the energy.



## Electric Mine Pumps Pay Own Cost in Fifteen Months

Mine-water trouble at the Vindicator and Golden Cycle shafts, on the east side of the Cripple Creek (Col.) mining district, has now been overcome by the installation of electric pumps in the latter shaft. The water is lifted to the 100-ft. level, and then flows through the Cycle into Wilson Creek, at a reduced cost compared with that of steam pumps. The electric pumps consist of two sets of 175-hp, 30-cycle, 2300-volt motors, driving triplex pumps at the 1000-ft. level, each pump lifting 400 gal. per minute. The motors are of the two-speed type. On a twenty-four-hour basis the units will have an 85 per cent load-factor. It is expected that the new pumps will pay their cost in fifteen months. The pumps are installed 1600 ft. underground and are running without any trouble. Recently they were covered with 150 ft. of water, owing to a faulty connection in the discharge pipe. A test gave an over-all efficiency for these pumps of 83.8 per cent, comparing the electric input at the surface with the water discharged at the surface. On the showing made by these pumps it is expected that additional drainage in the Cripple Creek district will be done by electrical energy.

## Prompt-Service Methods in Minneapolis

In order to facilitate prompt-service connections the Minneapolis General Electric Company has prepared a reply postal card which is handed or mailed to each new customer when the contract is made. The portion of the card addressed to the customer bears the following message:

"Your application for electric service has been received. We desire to connect service and meter for you as quickly as possible. Before the meter can be installed it is necessary that your wiring and fixture contractors obtain an inspection of the wiring and fixtures from the city building inspector's department. Switches and cabinet boxes should be completed to secure their approval. Service wires are extended to the premises at our expense. If service is not given promptly after the above requirements are complied with, please detach and mail the attached card to the company, and it will receive immediate attention."

The card addressed to the company contains the following: "Premises No. — are ready for your service, having been properly inspected and accepted. We should like to have your service installed by next — night. If house is not open, key can be found at No. —. Yours truly, —."

## Development of a Modern Central-Station Generating Plant

In 1902, when the Ashley Street generating station in St. Louis was designed and partly built, the plant was planned for a total output of 12,000 kw in reciprocating-steam-engine-driven units. This equipment took up about two-thirds of the engine-room space provided, and there was one deck of twenty-eight Scotch marine boilers. Before the station was entirely completed, the company owning it was reorganized, and the property was purchased by the Union Electric Light & Power Company, its present owner. The remaining one-third of the engine-room floor area was utilized for the installation of four 5000-kw vertical turbo-generators, this row of machines taking up an area about 72 ft. in length over all and about 36 ft. wide.

With the advancement of the art, the 5000-kw units came to be regarded as uneconomical and practically obsolete in a very few years. They were removed and 12,000-kw units were installed in their place; that is to say, the steam rotors and the electrical generators were replaced, the foundations and all auxiliaries remaining unchanged. In

1904 two 2000-kw vertical units were installed. These were later replaced by two 4000-kw horizontal units. The auxiliaries and condensers for these smaller units were also used in the installation of the larger units.

Mr. John Hunter, chief engineer of power plants for the Union Electric Light & Power Company, who has been in charge of the work during this interesting transition period, is of the opinion that the installation of turbo-generator units represents the greatest amount of power developed anywhere in an engine-room area of equal size.

The maximum rating of the Ashley Street station is now about 70,000 kw, and the maximum load carried is about 55,000 kw.

To meet the demand for additional steam-raising equipment, it was necessary to install a second deck of boilers. The newer boilers are of the water-tube type, of 500 hp normal rating each, with over-load rating of 75 per cent. Later the marine boilers were removed to make room for more water-tube boilers, as the load on the station increased. The plant is so designed that reserve coal is carried in overhead bunkers to the extent of a ten-day supply. Coal is raised to these bunkers by tower hoists with a lift of 132 ft. This plant has a unique distinction in the fact that delivery of all coal from the bunkers and the collection of ashes in the basement is done by gravity. The ashes are raised by small cars to the top of the building, where large bins are provided. Storage capacity is provided for ashes to the amount of about ten carloads.

## Miniature "White-Way" Lighting in Central-Station Window

In connection with the recent inauguration of an extensive installation of "white-way" lighting at Lynn, Mass., the Lynn Gas & Electric Company equipped its main display window with ten miniature 110-volt inclosed-arc lamps mounted on miniature ornamental standards, the lamps being placed against an attractively painted background of a parkway scene. A number of electric heating devices were shown at the front of the window, and a display of the national colors completed the effect. The miniature lamps were operated first on the same night that the city's full-size display was placed in service, and the window attracted much local comment. Incidentally, a temperance campaign was in full swing during the period in which the ornamental lighting was started, and effective use of an electric sign was made by the anti-saloon interests in one of the most important squares of the city. The sign carried the "slogan" "Make it six," thus advising the passing voter to add another "dry" year to the five preceding the election.

## Static Due to Feather Duster Cause of Filament Breakage

In a certain Eastern school building complaint was made about the short life of the incandescent lamps furnished, many globes being found with their filaments broken and twisted to the sides of the glass. The lamps themselves, when tested in regular life racks, showed good average performances, so that a service test was finally determined upon for the purpose of studying the lamps under actual working conditions.

In twenty-six days, according to the New York Electrical Testing Laboratories, fifty-six lamps, or 29 per cent of the total, burned out. Thirteen new lamps were then put in one of the fixtures, and after being dusted in the regular manner with a feather duster, current was turned on and four of the lamps immediately burned out. Wiping with a slightly dampened cloth was substituted for the cleaning with the feather duster, and the abnormal breakage at once ceased.

# Wiring and Illumination

## Grounding Secondaries in Rocky Mountain Districts

A controversy concerning the effectiveness of methods proposed is delaying the grounding of secondaries in Pueblo, Col. The usual Byllesby method, employing driven pipes, is opposed by Mr. W. J. Canada, the engineer of the Rocky Mountain Fire Underwriters' Association, as being unreliable when used in dry soils for the protection of secondaries fed from heavily fused primaries. The Underwriters' Association is recommending water-main grounds, and these have been generally adopted in the Rocky Mountain district.

## Wood Poles in the Electrical Industry

The accompanying figures, showing the extent and classification of the wooden poles purchased in the electrical industry from 1907 to 1911, are taken from the report issued by the Bureau of the Census, which was prepared with the co-operation of the Forest Service. The compilation was made by Mr. J. E. Welchel, under the direction of Mr. W. M. Steuart, chief statistician for manufactures.

The total purchase of poles in 1911 was less than for 1910 and 1909 by 452,674 and 320,720 respectively, but exceeded the totals for 1908 and 1907 by 168,866 and 134,752 respectively. The decrease was confined to a falling off in purchases by telephone and telegraph companies and steam railroads, while a substantial increase in purchases was made by electric railroads and electric light and power companies. The decrease reported by the telephone and tele-

NUMBER AND KIND OF POLES PURCHASED IN THE ELECTRICAL INDUSTRY, 1907 TO 1911

	1911	1910	1909	1908	1907
Cedar.....	2,100,144	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut.....	693,496	677,517	608,066	516,049	630,282
Oak.....	199,590	265,290	236,842	170,102	7,480
Pine.....	161,690	184,677	179,586	176,730	188,900
Cypress.....	72,995	75,459	77,677	90,579	100,368
Juniper.....	27,847	20,042	43,581	42,317	38,923
Redwood.....	26,887	30,421	23,145	13,061	31,469
Douglas fir.....	24,833	56,732	24,877	19,542	15,919
Tamarack.....	23,543	30,964	29,889	24,123	13,884
Osage orange.....	21,101	23,221	21,491	18,109	5,962
Spruce.....	10,166	22,929	11,423	8,088	10,146
Locust.....	8,477	9,080	10,463	10,224	4,712
All other.....	47,258	42,845	31,871	29,422	89,254
Total.....	3,418,020	3,870,694	3,738,740	3,249,154	3,283,268

graph companies was not general, being confined in the main to states in which there was more than usual activity in the construction of lines during 1910. The increasing use of concrete and steel poles and towers also has a bearing on the demand for wooden poles, whose use they now restrict materially.

Of the total reported purchases in 1911, 2,402,724, or 70.3 per cent, were made by the telephone and telegraph companies; 787,649, or 23.0 per cent, by the electric railroad and central-station companies, and 227,647, or 6.7 per cent, by the steam railroads.

During the five-year period covered by the report the total purchase of poles was 17,559,876, of which cedar contributed 11,281,152, or 64.2 per cent; chestnut, 3,125,403, or 17.8 per cent; oak, 938,874, or 5.3 per cent; pine, 798,862, or 4.5 per cent, and cypress, 417,087, or 2.4 per cent. While these five varieties have during each of the five years covered furnished 94.3 per cent of the total, the tendency is now to substitute less expensive woods. With a decrease in the number of poles reported from all woods in 1911 as compared with 1910 of only 11.7 per cent, the loss in cedar was 13.6 per cent, in oak 24.8 per cent, in pine 12.4

per cent, and in cypress 3.3 per cent. A slight gain was made by chestnut, of 2.4 per cent. In all, thirty-five different species of timber contributed to the total pole purchases in 1911.

In 1911 636,364 poles were reported as having had some kind of preservative treatment. This number exceeded the total for 1907 by 206,305, that for 1908 by 312,116, and that for 1909 by 79,873, but was less than the number reported as having been treated in 1910 by 168,169. The principal woods treated in 1911 were cedar, yellow pine and chestnut.

## "White-Way" Lighting at Lynn, Mass.

An extensive installation of "white-way" magnetite-arc lighting was inaugurated at Lynn, Mass., on Dec. 9, the occasion being marked by an automobile parade and a celebration in which local public officials and commercial organizations took part. Elaborate decorations were installed throughout the business district, and many visitors from other parts of New England were present to witness the transformation of the downtown streets, for it is declared that no city in the world possesses public illumination equaling that of the Lynn business district. The lamps were



FIG. 1.—MARKET STREET, LYNN, MASS.

switched on after a prearranged period of about three hours' darkness, and it is estimated that upward of 60,000 people were on the streets when the circuits were closed.

The Lynn installation is of particular interest because it includes both main and side streets and because of the exhaustive study given to local conditions by the manufacturers' designing engineer, Mr. C. A. B. Halvorson, Jr., under whose direction the lamps were located with the special object of providing uniform illumination throughout the business district. Contrary to common practice in "white-way" lighting, the Lynn installation is being operated as a part of the regular city street lighting. The city pays at the rate of \$70 per lamp per year for service until midnight, and \$82.40 per lamp-year where all-night service is maintained. Energy for the operation of the system is supplied by the Lynn Gas & Electric Company. The lighting equipment itself was purchased and presented to the city by the local Board of Trade and retailers' association, the merchants having been assessed \$2 per front foot to meet this installation cost.

At present the installation comprises 152 6.6-amp direct-current General Electric luminous-arc lamps mounted on specially designed columns and equipped with medium alabaster globes. The lamps consume about 515 watts each at the arc and in general design are similar to the well-known New Haven units described in the *Electrical World* of Dec. 23, 1911, page 1525. An improvement, however, introduced since the latter pioneer installation was completed, is the redesign of the working mechanism to make it fit into a compartment 3 in. smaller in diameter, thus enabling the lines of the pole and its surmounting equipment to be



made more attractive from the artistic standpoint. The standard posts carry the arcs 14.5 ft. above the street. In one or two instances, however, the importance of adequate distribution in a public square led to the installation of the units in pairs, with the arcs elevated 28 ft. above the street. The poles were built by the Lundin Electric & Machine Company, of Boston, Mass., and were designed for this in-



FIG. 2—CITY HALL SQUARE

stallation by Prof. E. J. A. Duquesne, of Harvard University, chairman of the art commission of the Republic of France.

The standards are in general mounted upon concrete foundations 3 ft. deep, 2 ft. square at the top and 3 ft. square at the bottom. Four  $\frac{3}{4}$ -in. anchor bolts are used to secure each post. The spacing varies from 70 ft. to 250 ft., the lamps usually being staggered on opposite sides of the thoroughfare, so that the interval between units along the street is virtually halved when taking the street as a whole into account. About 50,000 ft. of No. 6 B. & S. cable was installed in connection with the underground feeds. The arcs are operated in two circuits from 75-lamp, double-tube rectifiers located at the generating plant of the Lynn Gas & Electric Company and supplied with energy from the 2300-volt buses of the station through constant-current transformers. Each standard is equipped with a Lundin positive cut-out switch of the series type, which short-circuits the lamp and also cuts its mechanism dead from the external lines when thrown by hand. The top of the post fixture is about 16 ft. 8 in. above the street.



FIG. 3—ORNAMENTAL POST NEAR PUBLIC LIBRARY

The Lynn installation extends in general from City Hall Square throughout the district lying between Broad Street, Market Street and Central Avenue. There is also a notable illumination of cross streets and prominent thoroughfares leading from Central Square, which is occupied by the principal steam railroad and trolley facilities reaching the city. The accompanying illustration of the lighting of Monroe

Street (Fig. 4) typifies the scope of the cross thoroughfare illumination adopted. This street is about 30 ft. wide, and the lamps are spaced 130 ft. apart in the region shown, or 65 ft. apart considering both sides of the roadway. In a length of 600 ft. there are eleven lamps. On Market Street, the principal business thoroughfare of the city, there are thirty-seven lamps in a total length of 1700 ft. Here the



FIG. 4—MONROE STREET, A CROSS-TOWN THOROUGHFARE

width of the roadway varies from about 40 ft. to 100 ft. On the four cross streets between Central Square, Liberty Square and City Hall Square thirty-three lamps are installed. All-night lighting is provided for these sections as well as for portions of the main thoroughfares. A number of lamps on ornamental posts have also been placed in the parkways of the city, and the residential district will shortly be equipped with improved lighting facilities. As yet no photometric measurements have been made on the streets, but the designers planned to obtain an average illumination of at least 3 ft.-candles throughout the territory covered by the "white-way" installation.

### American and European Wiring Practice

By A. H. BERNHARD

The writer of the present article has had about eight years' experience in electrical contracting work in Europe, mainly on the French and Italian Riviera, and thinks that consulting and operating engineers as well as wiring contractors may be able to find some European methods worth adopting and incorporating in the wiring practice of this country.

The first striking difference between American and European—especially French—practice is that concealed wiring is quite rare outside of the United States. There are three reasons for this—the customer has been educated to seek a very cheap installation, he rarely considers wiring a house before it is entirely completed, and, as the "furred" construction of buildings is unknown in France, it is necessary to channel the brick or stone walls and the hollow tile partitions for all concealed conduit work.

In order to give a clear insight into French wiring practice, the several systems of wiring used in France will be described, beginning with the system most used, which is unquestionably the flexible-cord system.

#### FLEXIBLE-CORD SYSTEM

In an apartment house installation, for instance, the rooms are wired by the flexible-cord system in about the following manner: In the center of the ceiling of each room a rosette with counterweight cord adjuster is placed, and a flexible cord is run along the ceiling from the rosette to one of the walls of the room, and then down the wall to a conveniently placed snap switch containing an open fuse-wire cut-out.



The flexible cord generally used for circuits of this kind, feeding not more than three or four 50-watt lamps, is a two-conductor twisted cord, each conductor being equivalent to a copper wire having a diameter of 0.9 mm (No. 18 wire). In order to make this cord very cheaply and at the same time small in diameter and flexible, so as to negotiate the pulleys of the counterweight adjuster, the insulation is generally composed as follows: one serving of cotton yarn, two thin unvulcanized Para rubber tapes wound in reverse directions, another serving of cotton yarn, and finally a braid of either mercerized cotton or linen or silk, these braids being furnished in innumerable standard colors and art shades, so as to harmonize with the tints of the wall paper or other room decorations.

The twisted flexible cords are slipped over small porcelain wiring knobs placed every three or four feet. A thin, round varnished wooden block is often placed between the rosette and the ceiling and between the snap switch and the wall, so as to avoid direct contact of the flexible cord with those surfaces.

From the snap switch a similar flexible cord is run up the wall toward the ceiling and out through a hole in the partition into the hall, where it is tapped into either a flexible cord main or a main composed of rubber-covered wire run in wooden molding.

As will be evident, the main idea is low cost. And it must certainly be a surprise to engineers accustomed to the rigid requirements of the National Electrical Code to know that these cheap jobs really give very little trouble. In fact, the writer has never known an actual fire to be started by a short-circuit caused by this seemingly unsafe type of wiring.

It will be noted that practically every lamp so installed is a drop lamp, and by far the greater part of these are equipped with the very convenient counterweight type of cord adjuster, which allows the lamp to be used at any height and at any lateral displacement in the room. For instance, in the case of bedrooms, reading in bed is easily provided for by driving a nail into the wall over the head of the bed and hooking the lamp-cord on it. Such a scheme is considered hazardous in this country, but not in the European countries under consideration.

#### SNAP SWITCHES

Another point to be noted is that almost every lamp is controlled by a snap switch placed on the wall of the room beside the door, so as to be convenient on entering. This is not true of the majority of the installations which are made in the United States.

Most snap switches of European make are "junk" compared to those of American make, and, furthermore, the writer has always found that the practice of using open-wire fuses in snap switches is very troublesome as well as unsatisfactory, the American system of centralizing cut-outs on panels and using only one fuse for each 660 watts of connected lamps being, in his opinion, a much better one from every point of view.

#### BAYONET SOCKETS

The writer also knows of no more diabolical invention in the electrical line than the "bayonet-catch" socket, which is used almost exclusively in France and England and to a much less extent in other European countries. This type of socket and lamp base has just two advantages—very low first-cost and ease of snapping the lamp in and out of the socket by a quarter-turn of the lamp bulb. In all other respects the American screw base is far superior, and it is preferred in Germany, Italy and other European countries outside of British and French influence. The writer has seen so many short-circuits, shocks and fallen lamps and reflectors, due to the use of the bayonet-catch socket, that he is convinced of the grave defects of this construction.

#### COST OF SYSTEM

It might be stated that a fair average price for flexible-cord work in France is about 15 francs (\$3) a lamp (one lamp to a room), each lamp being installed as above described, mains being run either in flexible cord or in molding, including meter-board, main cut-out for open fuses, all wiring, snap switches, rosettes, counterweight cord adjusters, bayonet-catch sockets, flat, opal or enameled-iron reflectors and carbon-filament lamps. The price given is for jobs of from six to ten lamps, using a fair quality of French material. On larger jobs even lower prices can be obtained.

Of course, the substitution of American sockets and switches for those of French make and the use of prismatic-glass shades and tungsten lamps would change the cost considerably, but it still would remain much below the cost of any other system of wiring.

#### Armored Cable Versus Conduit Systems

Conduit systems have long occupied an almost exclusive field whenever overhead lines were to be placed underground, no other underground method being available. Armored cable, however, is beginning to get a foothold, not as a direct substitute for the conduit system but rather in a field of its own which covers one particular phase of underground systems. This field includes the smaller cities, suburban districts, parks, private residences and manufacturing plants where the buildings are spread over a considerable area. The tungsten lamps in the New York City parks, for instance, are fed with energy through armored cable laid in the ground. Installations of this sort where the service rendered is comparatively small do not warrant a large expenditure to increase the fixed charges. The following figures recently submitted by the Simplex Electrical Company of Boston show the cost of the lead-covered cable in ducts and also of the armored cable laid directly in the ground:

##### COST OF LEAD-COVERED CABLE LAID IN DUCTS

1000 ft. No. 6 three-conductor, rubber insulated, lead-covered cable (600-volt service).....	\$175
1000 ft. conduit.....	55
Cost of laying, including cost of two manholes and drawing in and splicing cable.....	450
	<hr/> \$680

##### COST OF STEEL-TAPED CABLE LAID IN GROUND

1000 ft. No. 6 three-conductor, rubber-insulated, lead-covered, steel-taped cable (600-volt service).....	\$240
Cost of laying.....	50

The figures do not include the cost of relaying the pavement. This, while approximately the same in either case, will be somewhat more for the conduit installation than for the armored cable, because the trench for the ducts would need to be wider and deeper in order to have the ducts far enough underground.

As noted in the table, the difference in cost is mainly due to the much larger expenditure needed for the installation of the duct system. The armored cable itself costs only a nominal sum more than the regular lead-covered cable and its installation is very simple, consisting merely of laying this ready-made cable conduit system directly in a shallow trench and replacing the earth over the cable. The construction of conduit system with its necessary manholes requires plans from which to work and expert superintendence during its construction. In addition to this the cost which is involved by drawing the lead cable into the ducts must be taken into consideration.

### Recent Telephone Patents

A patent granted to Mr. E. Neuhold, of Friedenau, Germany, relates to the arrangement of release magnets in a complete automatic trunking system of the Strowger type. According to this invention the circuits of the release magnets are so arranged that all are completely under the control of the calling subscriber, irrespective of whether any of the selectors have failed in action. It will thus be seen that in case of failure there is no disabling of the calling line due to inability to release a connection wholly or partially set up.

Mr. H. P. Claussen has obtained a patent describing a machine-ringing trunk circuit. The ringing key at the "B" end has a magnetic lock which retains it in the operated position until released by the response of the called party. The trunk is especially designed to meet the requirements of a particular switchboard system and provides for the usual operating conditions. This patent is assigned to the Stromberg-Carlson Company.

In a patent granted to Mr. C. C. Bradbury, of Chicago, there is described a rather simple circuit arrangement for a common-battery switchboard. The answering jacks and answering plugs are constructed upon the three-wire basis and the calling plugs and multiple jacks upon the two-wire basis. By this means the usual bridged cut-off relay of the two-wire system may be made of very high resistance, as the circuit of the supervisory relays is completed through the extra spring in the answering jack. This circuit is shown in the illustration. This patent is assigned to the Kellogg Switchboard & Supply Company.

A patent has been granted to Mr. E. R. Corwin, of Chicago, and assigned by him to the Corwin Telephone Manufacturing Company, covering a telephone exchange system. This is a common-battery system of the two-wire type and a very simple arrangement. No line relay is provided, the line lamps being directly connected. A cut-off relay responds to the insertion of the plug, the control of the former being secured through the adjustment of non-inductive resistances.

### AUXILIARY TELEPHONE APPLIANCES

Mr. C. H. North, of Cleveland, Ohio, is the inventor of a party-line ringing key designed to reduce the number of contacts to a minimum. The key has a push-button for each of the four selections. Each button controls an individual selective current key and in addition engages the plunger of a common master key. The master key is a straight ringing key, the energy supply to which is controlled by the push-button depressed and is operated by a cam which extends into the path of all four buttons and is rocked by any one of them. The button last depressed is locked down by a sliding latch which is driven by a cam.

Mr. E. G. Eidam, of Rochester, N. Y., has obtained a patent for a switching key in which the improvement lies in the details of construction. The frame is made up of sheet-metal punchings pressed into shape.

The telephone may serve as a means of communication between a tug and a barge in tow. A conducting hawser will serve as one side of the circuit and the water for the return. Mr. R. H. Lindal, of Gloucester City, N. J., has obtained a patent for such a system, employing a hawser containing a spiral conductor.

A railway telephone instrument forms the subject of a patent granted to Mr. A. D. T. Libby, of Elyria, Ohio. This instrument is designed to be mounted along the right-of-way, and signaling is accomplished through a lamp. Three sides of the box carry red lenses which are exposed to this light. Telephone apparatus is mounted upon a hinged transverse partition which is fitted with holes at the proper height for allowing the light free exit.

Mr. W. D. Miller, of Butler, Pa., is the inventor of a receiver supporting arm. This is a telescoping arm and is mounted horizontally at the correct height to accommodate

the ear. The telephone circuits are switched by a cam engaged by the end of the telescoping arm. The condition of the circuit depends upon whether the receiver is pulled out or pushed back into the position of disuse.

## Letters to the Editors

### Low-Frequency Lamp Flicker

*To the Editors of the Electrical World:*

SIR:—In reference to Mr. C. F. Lorenz's interesting article on page 1146 of your issue of Nov. 30, 1912, and with particular reference to your editorial comment thereon, I should like to point out that while the thermal capacity of the lamp filament has a good deal to do with the degree of flicker shown on 25-cycle circuits, there is another factor which we have observed to enter into the question, namely, the rigidity of the filament and its consequent resistance to mechanical vibration. While a thick filament incidentally has a high thermal capacity, thereby giving a "flywheel" or heat-storage effect and diminishing the influence of the no-current points, it is the rigidity of the heavy filament which plays a part in making such a lamp physiologically preferable when operated on low-frequency circuits. This may be demonstrated among carbon lamps of the same batch. On shaking these it will be observed that the filaments of some oscillate more readily and continuously than others, owing to accidental details of construction in the turns of filament. Putting the lamps in circuit it at once becomes evident that the lamp which shows less tendency to oscillation will show less flicker when used on a low-frequency circuit. From this it appears that there is a mechanical vibration induced by the low-frequency current which, for some filaments, greatly enhances the flicker due to the lighting effects of the current.

We are designating a rigid-filament, non-vibratory, flickerless lamp to be of high "physiological efficiency," as differentiated from watt-per-candle or mechanical efficiency

H. J. GLAUBITZ,

General Manager Electrical Department.

London, Ont.

### The Jobber and the Manufacturer

*To the Editors of the Electrical World:*

SIR:—In the Nov. 30 issue a transformer manufacturer is quoted as follows: "The greatest drawback in our field is the inability of the supply-house salesman to compete with the technical experts such as those which two or three of the largest manufacturers maintain. The remedy points to direct representation, which will eventually eliminate the jobber."

I should like to point out that it is not the inability of the supply-house salesman to compete with the technical experts that has changed much of the volume of the transformer business direct to the manufacturer, but the syndication of the electric-light plants which has consolidated their purchases and given the manufacturers an excuse to take their orders direct. I do not think it can be controverted that some of the manufacturers themselves have been mainly responsible for this syndication and consolidation, although their names may not appear directly in regard to the transaction.

I believe the statement is an injustice to the jobbers and that it will be accepted as a fact and misunderstood, thus creating an undue influence against them, not only in transformers but also in other lines of material.

T. C. RINGGOLD,

General Sales Manager Central Electric Company,  
Chicago, Ill., Dec. 19, 1912.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Brake Test on a 75-hp Oil Engine

By A. A. POTTER AND W. W. CARLSON

While results of many tests on high-pressure oil engines like the Diesel and of medium-pressure, or semi-Diesel, types like the De La Vergne have appeared in print, there seems to be a dearth of data regarding the economy, by

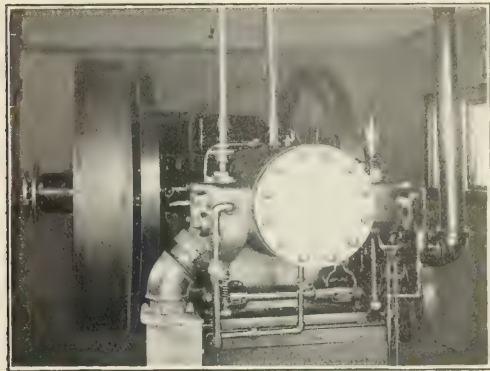


FIG. 1—VIEW OF OIL ENGINE WHICH WAS TESTED

actual brake tests, of low-pressure oil engines using low-grade fuel oils.

The superiority of the Diesel and semi-Diesel types lies mainly in the fuel economy and there is no question that for units exceeding 100 hp in rating one of these types should be chosen. In the case of power requirements under 100 hp either for the generation of electricity in small power plants or for pumping water the low-pressure types with electric ignition are preferable on account of lower first cost.

A brake test was carried on recently by the authors on a 16-in. by 24-in. horizontal, single-cylinder, low-pressure oil engine, of the four-stroke-cycle type, arranged with mechanically controlled vertical valves on opposite sides of the cylinder, and in which the compression pressure before ignition was about 60 lb. a square inch. Starting was accomplished either by compressed air or by turning back



FIG. 2—FULL-LOAD INDICATOR CARD—200-LB. SPRING

on compression by hand, after a charge of gasoline had been admitted into the cylinder from a glass charge cup over the inlet valve. The engine operated on Solar fuel oil, which was vaporized by the exhaust gases in a coil located entirely outside of the engine cylinder. Ignition of the charge was accomplished by means of a make-and-break igniter with a rotary contact piece. Cooling water was circulated by a rotary pump driven by a belt from

the engine crank shaft. A general view of the engine is shown in Fig. 1.

During operation water was injected with the fuel, and when properly proportioned the engine ran without noise. Improper regulation of the water spray produced pounding due to pre-ignition of the charge. After continuous operation for several days on Solar oil the inside of the cylinder was examined and found free from any deposit.

The engine was guaranteed by the maker to deliver 75 hp at an elevation of 2800 ft. above sea level when operating at a piston speed of 750 ft. a minute and with a temperature rise of the jacket water of about 120 deg. Fahr. The test was made at an elevation of 2850 ft., the average barometer reading being 26.95 in. During the test the engine was loaded by means of a Prony strap brake placed on a specially constructed, water-cooled pulley.

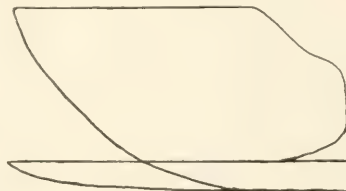


FIG. 3—LOOP CARD AT HALF LOAD—16-LB. SPRING

The various constants for the engine, brake and fuel are given in Table I. Table II shows the average results of the brake tests at full and partial loads, while Table III was calculated in order to show the heat distribution at the various loads per pound of fuel. Since, on account of the decreased density of the charge, the power of an internal combustion engine is decreased about 3.5 per cent for every 1000 ft. elevation, the same engine should develop at sea level about 84 brake hp.

The object of the test being to determine whether the engine would deliver 75 brake hp with a fuel consumption of 1.25 pint per brake hp-hr., the governor was adjusted for the correct piston speed at full load. The variation in speed from full load to the fractional loads was of no consequence in the case of the engine under test, as it was installed to carry a constant load. The running of the

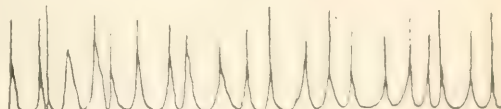


FIG. 4—CONTINUOUS EXPLOSION DIAGRAM AT FULL LOAD—200-LB. SPRING

engine was perfect and the speed fluctuations slight at all loads below full load.

In Fig. 2 is shown a characteristic indicator card taken during the full-load test with a 200-lb. spring, while Fig. 3 shows a loop card, taken with a 16-lb. spring and stop. The loop card is advantageous in showing the suction and exhaust phases of the cycle of operations and in revealing defects in the valve mechanism.



A continuous diagram of the explosion pressures obtained for a series of explosions is shown in Fig. 4. This type of diagram is obtained by advancing the paper drum of the indicator by hand while holding the pencil arm against

TABLE I—CONSTANTS

Cylinder diameter, in.....	16 1/4
Length of stroke, in.....	.24
Engine constant.....	0.0122
Brake arm, ft.....	4.057
Weight on brake at full load, lb.....	517.7
Brake constant.....	1 ÷ 1294
Kind of fuel.....	Solar oil
Specific gravity at 60 deg. Fahr.....	0.8145
Deg. Baumé.....	42.0
Lb. per gal.....	6.79
Heat units per lb., high.....	17,240
Heat units per lb., low.....	16,322
Heat units per gal.....	117,100

the paper on the drum. The variations in the explosion pressure are probably due to unsteadiness of the governor, producing somewhat uneven compression pressures during successive cycles.

TABLE II—DATA AND RESULTS

	NUMBER OF TEST		
	1	2	3
Duration of test, hours.....	3	1	1
Barometer, in.....	26.95	26.94	26.95
Speed of engine, r.p.m.....	183.5	201.2	202
Mean effective pressure.....	75.9	37.1	27.5
Indicated horse-power.....	85.6	45.5	34.0
Brake-horse-power:			
Maximum.....	76.0	40.1	20.3
Minimum.....	68.0	39.41	20
Average.....	73.5	39.70	20.2
Mechanical efficiency, per cent.....	85.8	87.4	59.4
Fuel used, total lb.....	222.75	50.1	42.5
Fuel used per i.h.p. per hour, lb.....	0.868	1.10	1.25
Fuel used per b.h.p. per hour, lb.....	1.010	1.26	2.10
Fuel used per b.h.p. per hour, pints.....	1.192	1.49	2.48
Heating value of fuel consumed:			
Per i.h.p. per hour, B.t.u.....	14,980	18,980	21,550
Per b.h.p. per hour, B.t.u.....	17,400	21,750	36,200
Temperature of cooling water, deg. Fahr.			
Inlet.....	82.25	79.0	84.25
Outlet.....	164.0	133.	125.5
Rise.....	81.75	54.0	41.25
Cooling water used per hour:			
Total, lb.....	1,775	2,868	2,712
Per b.h.p., lb.....	24.2	72.2	134.2
Thermal efficiency, per cent.....	14.62	11.7	7.0

The values for the heat distribution per pound of fuel at the various loads, as given in Table III, would indicate that too little jacket water was being supplied to the engine during the test.

TABLE III—HEAT DISTRIBUTION PER POUND OF FUEL

	NUMBER OF TEST					
	1		2		3	
	B.T.U.	Per Cent	B.T.U.	Per Cent	B.T.U.	Per Cent
Converted into indicated hp.....	2,935	17.0	2,315	13.4	2,036	11.30
Converted into brake-hp.....	2,520	14.26	2,020	11.7	1,210	7.01
Friction and losses.....	415	2.40	295	1.7	826	4.79
Losses in jacket water.....	1,955	11.32	3,090	17.9	2,635	15.28
Losses in exhaust, radiation, etc.,.....	12,350	71.68	11,835	68.9	12,569	73.42

The results of the tests and general operation indicate that a good make of gasoline engine with electric ignition, when provided with some form of auxiliary vaporizer which is usually nothing more than a coil placed in the

path of the exhaust, will run satisfactorily on oils as heavy as 40 deg. Baumé and will develop a brake-horse-power for an hour on about a pint of fuel.

Hub Expansion of Turbine Wheels at High Speeds

Unless proper precautions are taken, a high-speed turbine wheel expands at the hub a sufficient amount to cause an appreciable increase in the bore, making the wheel slightly loose upon the shaft and soon causing distress.

A paper on the subject of this increase under centrifugal stress, presented by Mr. Sanford A. Moss, West Lynn, Mass., before the American Society of Mechanical Engineers' meeting, New York, Dec. 4, 1912, gave a general discussion of stresses in a rotating wheel and outlined a mathematical method for computation of the increase in bore, checked by actual measurements at high speeds.

The increase of circumference of the bore is found to be proportional to the original circumference and the tangential stress and inverse as the modulus of elasticity. In the experiments the readings showed that the bore expanded at each speed an amount almost exactly equal to the computed values.

For a wheel with 12-in. bore and 30,000-lb. maximum stress, which is permissible with special grades of steel, this increase of bore comes out over 0.01 in., which gives an appreciable loosening of the shaft fit.

For an average case the hub bore expands about 0.6 of the amount of the force fit and for a force fit of 1 mill per inch of bore the radial stress is about 13,000 lb. per square inch and the effective tangential stress is about 27,000 lb. per square inch. For other amounts of force fit the stresses are in proportion.

For the average case above mentioned the pressure to force the hub on the shaft is about 1560 lb. per inch of bore and per inch of hub length for a force fit of 1 mill per inch of bore.

Carrying Capacities for Busbars

Kindly give data for figuring copper busbars for carrying from 5000 amp to 10,000 amp alternating current at low voltages. W. J.

The "Standard Handbook for Electrical Engineers" gives the following data on the carrying capacity, current density, etc., of busbars of various sections:

Size, Inches	Circular Mils	Amperes.	Amperes per Square Inch.
1 x 1	318,310	433	1732
1 1/2 x 1 1/2	397,290	530	1696
1 3/4 x 1 3/4	477,465	626	1669
2 x 2	556,400	725	1657
2 1/2 x 2 1/2	596,830	676	1442
3 x 3	716,200	578	1418
3 1/2 x 3 1/2	835,600	916	1395
2 x 3	954,930	1035	1380
2 1/2 x 2 1/2	1,074,300	1154	1367
2 3/4 x 2 3/4	1,591,550	1500	1200
2 1/2 x 3	1,989,440	1715	1097
2 x 3	1,273,240	1222	1222

By combining the necessary number of such flat sections, leaving spacer blocks and air spaces between the bars, a composite conductor of the required carrying capacity can be built up. In designing solid conductors of such large carrying capacities, the surface area or perimeter of the section may become the controlling factor rather than the actual area of cross-section. Care must be taken, however, that the temperature rise at the center of the section shall not become excessive.

Round sections will be least advantageous for larger buses, because such circular shapes present the least perimeter per unit of cross-sectional area. For round sections hollow tubes would be preferable as securing the greatest ratio of outside surface per unit of cross-section.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Single-Phase Motor with pole-Changing Windings.*—J. S. NICHOLSON AND B. P. HAIGH.—A new type of single-phase commutator motor, the invention of one of the authors, recently installed in the James Watt Engineering laboratories of the University of Glasgow. The principles involved in the use of pole-changing windings in commu-

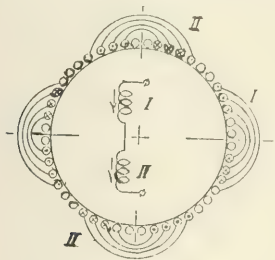


FIG. 1—MOTOR WITH POLE-CHANGING WINDINGS

tator motors are discussed: (1) The compensated series motor. (2) The repulsion motor. Pole-changing stator and pole-changing armature windings and the commutation of the machines are then considered. A typical stator winding for eight and four poles is shown in Figs 1 and 2 and consists essentially of two sets of coils, I, I, and II, II. In Fig. 1 the directions of current in these are such that the winding has eight poles, the conductors being arranged in eight groups, alternatively positive and negative, occupying in this instance four of the six slots of each pole-pitch. On reversing the direction of the current in coils II, II, as shown in Fig. 2, the winding gives four poles, each having eight active slots arranged in two groups of four,

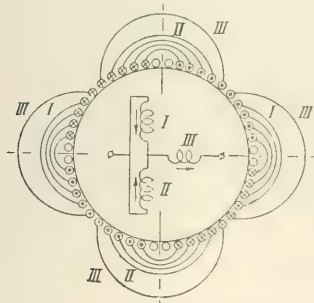


FIG. 2—POLE-CHANGING WINDINGS

separated by groups of two empty slots. As the presence of these latter inactive slots would be undesirable in a stator winding intended for compensating the ampere-turns of the armature, an extra set of coils, III, III, may be added so as to complete four uniform groups of conductors while still leaving four groups of slots in the neutral zones unwound. The three sets of coils are preferably connected so that coils I and II are in series when employed for eight

poles and in parallel with one another (but in series with the extra coils, III) when used for four poles. An improved design is shown in Fig. 3, serving not only as an eight-pole field winding, but also as an additional four-pole main winding according to the directions of current in the component coils 1, 2, 3 and 4. When these are coupled in the two pairs, 1, 2, 3, 4, which may be connected in series, as in Fig. 3a, or singly, or in parallel, an eight-pole field

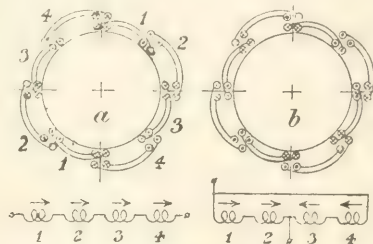


FIG. 3—IMPROVED ARRANGEMENT

is produced covering nearly five-sixths of the total pole area at uniform density. By reversing the currents in coils 3 and 4, while those in coils 1 and 2 remain unchanged, as shown in Fig. 3b, the directions of the currents in four of the eight groups of slots are such as to fulfil the purpose of the extra main winding (III, Fig. 2), while the directions of current in the remaining four groups are such as to neutralize one another, leaving these slots inactive so far as external magnetomotive forces are concerned, although subject to copper losses and magnetic leakage. The use of the extra main winding, or of the reconnected field winding, not only improves the overload range of the motor by reducing the stray fluxes but also increases its output in proportion to the voltage induced in the active conductors of the additional winding. The author then takes up pole-changing armature windings. A comparison is made between the relative outputs of the types of machines discussed and a table is given comparing these with the normal repulsion motor. Control connections are illustrated, and finally some details and tests of an experimental motor are given.—*London Electrician*, Dec. 13 and 20, 1912.

*Three-Phase Commutator Motors.*—A note on a recent British patent (No. 16,790, Dec. 12, 1912) of the Siemens-Schuckertwerke G. M. B. H. To overcome the commutation difficulties with these motors when of large size, and to avoid the replacement of a large motor by smaller ones in purely series connection, whereby the rotors are connected in mesh, the motors are provided with double brush sets, two sets to each phase. By this means the rotor and stator windings of all the motors may then be connected in series. Speed variation may be obtained by shifting the brush sets of each phase. Taking two motors, they may be mechanically coupled, the brush gear of each being mechanically connected to insure the equal distribution of the load. Alternatively, the lead connecting the brushes of the two machines may be connected to a point on the secondary of the transformer. The motors need not then be mechanically connected, and the brushes may be displaced by different amounts.—*London Elec. Eng'g*, Dec. 19, 1912.

**Armature Reaction in Lap-Wound Machines.**—W. LULORS.—The conclusion of his mathematical article. The circulating currents in a lap-wound armature due to unequal pole strengths are usually supposed to produce an armature reaction largely tending to remedy inequalities in the magnetic field. The author shows that only in the case of the four-pole machines is this counterbalancing true. This is in agreement with the fact well known in practice that the four-pole lap-wound machine is far superior to those having more poles. —*London Electrician*, Dec. 20, 1912.

#### Lamps and Lighting

**Tungsten Drawn Filaments.**—A note on a recent British patent (No. 18,467, Dec. 12, 1912) of W. D. Coolidge. With dense, coarse powdered tungsten of high purity is mixed between 1 per cent and 5 per cent by weight of the oxides of the rare earths. The mixture is compressed hydraulically. The sticks so produced are heated in a hydrogen tube furnace up to above 1200 deg. C. They are then brought to a very intense white heat by the passage of an alternating electric current in a reducing atmosphere. A previous heating in a vacuum for about half an hour may be given. The removal of impurities is facilitated by the porous nature of the sticks due to the added substances. The size of the sticks may be about  $\frac{1}{4}$  in. square and 6 in. long. They would not be subjected to the full current at first, but about 1400 amp for fifteen minutes, then 1700 amp for fifteen minutes. After this the current would be brought to zero by a reduction of 200 amp each minute. —*London Elec. Eng'g*, Dec. 19, 1912.

**Electrodes for Flame-Arc Lamps.**—A note on a recent British patent (No. 27,620, Dec. 12, 1912) of the British-Thomson-Houston Company and the General Electric Company of this country. To prevent the formation of a non-conducting layer of slag on electrodes containing varying amounts of titanium or titanium carbide, from 2 to 3 per cent of cuprous material is added. —*London Elec. Eng'g*, Dec. 19, 1912.

**Illumination.**—A THOMÄLEN.—A mathematical article in which the author describes a method for determining the average illumination of rectangular surfaces by calculating exactly the space angles which are obtained by Höghner's division of the quadrant. —*Elek. Zeit.*, Dec. 19, 1912.

#### Generation, Transmission and Distribution

**Electric Machinery in Steel Works.**—J. ARTHUR SYKES.—The author points out that the conditions under which machinery is worked in steel works are very severe. Consequently more than usual care must be taken in the selection of plant. It is also necessary to pay particular attention to details, such as the prevention of the accumulation of dust in machines, the maintenance of insulation, etc. As far as possible the plant should be standardized, in order to avoid the necessity of a large number of reserve units, and the arrangement should be such that a breakdown can be remedied with the least possible delay. Breakdowns in cranes are often due to lack of efficient brakes, leading to the running away of motors. Resistor units and their connections are also a frequent source of trouble unless suitably designed. —*London Electrician*, Dec. 13, 1912.

**Electrically Driven Rolling Mills.**—A list of 203 electrically driven rolling mills in Europe with brief data on equipment and system. There are also a description of the electrical plant for driving the reversing rolling mill at the Skinningrove Iron Works, and an article by J. J. Fasola on the direct application of the single-winding Sandycroft-Hunt three-phase cascade motor to rolling-mill work. —*London Electrician*, Dec. 13, 1912.

**Electric Non-Reversing Mills.**—S. H. ECKMANN.—After some general remarks on the relative economy of steam and electrically operated mills, the author considers the claims of the reheating furnace with waste heat boiler and steam rolling mill versus the regenerative reheating fur-

nace and electrically driven mill. Different methods of obtaining variable-speed drives are outlined. Improved efficiency and increased output are obtainable by the use of automatic slip regulators. Notes are given on the compounding of direct-current mill motors and a new system is outlined of equalizing a group of mill motors. In addition to the usual shunt field  $Sh$  and series field  $S$  each motor (Fig. 4) has a third field winding,  $E$ , through which flows the total current of the whole group of motors. Any increase of the total current therefore immediately causes all the individual motor currents to decrease and thus discharges, or reduces the rates of charging, all flywheels connected to the system. Motors that happen to be running on light load when a heavy current occurs somewhere in the system may even reverse their current and regenerate into the line, thus easing the demand from the power house. In the same way any decrease of the line current will cause all motors to increase their currents and thus charge their flywheels or reduce their rates of discharge. The illustration shows a special case, where part of the

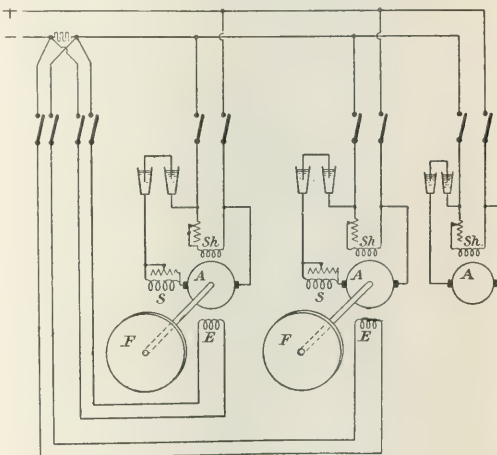


FIG. 4—FLYWHEEL GENERATOR SYSTEM

motors belonging to the system are not equipped with a flywheel at all and where, therefore, the load fluctuations caused by them are smoothed down by the flywheels coupled to the other motors of the system. —*London Electrician*, Dec. 13, 1912.

**Peat.**—J. TEICHMUELLER.—A continuation of his very long paper read before the German Association of Electrical Engineers on the use of peat in electrical engineering with special reference to the power plant in Ostfriesland utilizing the peat deposit of the Wiesmoor. The plant is a turbo-generator plant, the peat being utilized as fuel for the boilers. Under these conditions with peat dried in the air, but not completely free from moisture, 2.5 kg (55 lb.) of peat produces 1 kw-hr. under ordinary conditions of service, or 400 kg (880 lb.) produces 1 ton of peat. The price of the peat being \$1.25 per ton, the cost of fuel is about 0.3 cent per kw-hr., which compares well with the results obtained in other German plants where bituminous coal is used for firing. Still better results can be obtained with peat if it is used in a gas producer with gas engines operating according to the Frank-Caro process, with recovery of ammonium sulphate as a by-product. This system is in use in a plant which supplies energy to the city of Osnabrück. In this case 2 kg (4.4 lb.) of peat is consumed per kw-hr. The author gives details of the transmission-line construction. The paper is to be concluded. —*Elek. Zeit.*, Dec. 19, 1912.



**Wind Motors.**—W. A. P. TURNBULL.—An illustrated description of a new type of wind motor for generator driving which was exhibited at the Sydney Agricultural Show. The special feature is the method of speed regulation. This is shown diagrammatically in Fig. 5, in which *a* is a plan and *b* an elevation of the apparatus. The wind wheel *X* runs on shaft *D*, which is rigidly connected to casting *Z*, which is pivoted at *F* on the supporting tower. The center line of shaft *D* is to one side of the center line of the pivot and tail apparatus. The tail of the mill *T* is free to turn horizontally on a fulcrum *Y* rigidly supported from the casting *Z* through frame *L*. The other end of the tail arm is, however, restrained in its movement by a weight *W*, to which it is attached by a rope running over a pulley *P* carried on the framework. The regulation is automatic. When the wind is blowing in the direction shown by the arrow *K*, the wind-wheel tends to turn out of the wind in the direction shown by the arrow *O*. The wind, however, tends to keep the tail *T* in the direction of the wind. If *W* were made extremely heavy, the tail would act as though rigidly connected to *Z*, and the regulation would be unstable. The weight, however, is so adjusted that the resultant of the two parallel forces acting at each end of the tail at right angles thereto, and which takes effect on *Z* through the pivot *Y*, balances the turning movement of the main wheel

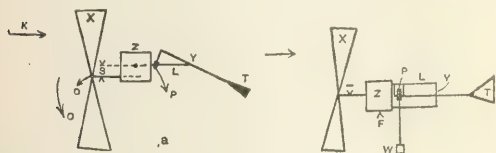


FIG. 5.—DIAGRAMMATIC VIEW OF WIND MOTORS

about the vertical axis of *F* in such a manner that the wind-wheel turns out of the wind or into the wind according to whether the wind velocity rises or falls. The wheel then revolves at practically constant speed over and above a maximum wind velocity—generally fixed at from 10 to 15 miles per hour. No matter what hurricane is blowing, the speed of the wind-wheel does not exceed this maximum, turning right out of the wind momentarily when the gusts are very severe but maintaining the constant speed.—*London Elec. Review*, Dec. 20, 1912.

**French Water Powers.**—Some notes on the rapid development of water-powers in France. The greatest project is the development of the water-power of the Rhone River, where a power plant of 240,000 kw is being erected. The largest part of the energy is to be transmitted at 120,000 volts to Paris, the distance being 430 km (260 miles). The principal hydroelectric companies of France have combined and formed a syndicate. The total rating of the water-power plants represented in this syndicate is now 575,000 hp, of which one half is sold for lighting and industrial purposes and the other half is used in electrochemical and electrometallurgical plants. The total rating of the water-powers available in France is estimated at 5,000,000 hp with a low-water level of 10,000,000 hp with average water level. A great deal therefore remains to be done to utilize this power. Much is expected from the electrification of railways and many of the French railway companies make experiments, but so far only 10,000 hp is utilized for electric traction on trunk railroads in France.—*Elek. Zeit.*, Dec. 19, 1912.

#### Traction

**Electrification of London Railways.**—An article on some electrification schemes of the London & Northwestern Railway and the London and Southwestern Railway. The former will electrify 79 miles of track, the latter 73 miles. Both are adopting the continuous-current system at 600

volts pressure, the former with third and fourth rails, and both companies will have their own power stations.—*London Elec. Review*, Dec. 12, 1912.

**Berlin.**—A continuation of the memorial of the Railway Department of the government concerning the electric operation of the Berlin City, Loop (Ring) and Suburban railways. Data are given on the changes in the design of the steam locomotives which would become necessary with the intended greater rapidity of succession of trains in case steam traction was used. Comparative figures are given on the use of electric and steam traction. The first installation is considerably cheaper for electric traction (about \$1,470,000 against \$2,000,000 for steam traction), while the cost of operation is practically the same in both cases.—*Elek. Zeit.*, Dec. 19, 1912.

#### Installations, Systems and Appliances

**Scrapping Plant at London.**—A note stating that four 3500-kw reciprocating engines and generators at the Greenwich power station are to be replaced by four 8000-kw turbo-generators, the total equipment rating being thus increased from 34,000 kw to 52,000 kw, although the reciprocating plant was put down only ten years ago and was far from having completed its useful life. The work will be carried out in two stages, two sets at a time. The reciprocating sets together cost about \$595,000, whereas the cost of replacing them, including the provision of an overhead crane and making certain alterations, will be about \$1,135,000. The book value of the present plant when discarded will be about \$375,000. On the other hand, the saving in fuel with coal at \$2.75 per ton is estimated at \$57,150 for the first two turbines, and this is sufficient to meet the debt charges on the first portion of the new plant.—*London Electrician*, Dec. 13, 1912.

**Safety Device for Electrical Machinery for Coal Mine.**—D. BOWAN and W. E. FRENCH.—The composition of fire-damp is considered, and the results of experiments on the ignition temperatures of different gases are given. The velocities of inflammation of a gas under constant volume are discussed and pressure curves are given. Experiments with safety devices and the phenomenon of "after-burning" with gauze-protected apparatus are explained. The details of a number of flame-proof devices for mining work are criticised. Oil protection is dealt with and some oil-immersed machinery of British manufacture reviewed in detail. Gauze, plate, labyrinth and tube protection are further discussed.—*London Electrician*, Dec. 20, 1912.

#### Electrophysics and Magnetism

**Gravitation.**—JUN ISHIWARA.—A paper on the theory of relativity with consideration of gravitation. The author starts from the fundamental equations of the electromagnetic theory, assuming the velocity of light not to be constant, and shows how on this basis it is possible to derive Abraham's gravitation formulas and also the result that the gravity of a system is proportional to its energy. In the fundamental equations of electromagnetic phenomena as well as in the equations of the field of gravitation the square root of the velocity of light is an item of particular importance.—*Phys. Zeit.*, Dec. 15.

**Electric Constriction.**—E. F. NORTHRUP.—An article describing a curious manifestation of electric constriction showing pressure forces in a liquid carrying a current, due to the pinch effect.—*Met. and Chem. Eng'g*, January, 1913.

#### Electrochemistry and Batteries

**The Electric Furnace in the Production of Iron from Ore.**—D. A. LYON.—An illustrated article pointing out that the use of the electric furnace in the production of iron from ore while restricted to certain countries with special conditions has now entirely passed the experimental stage in view of the fact that commercial iron-ore-reduction furnaces are running in California and Scandinavia. Com-

parison is given of details of the practice in California and Scandinavia, especially with reference to reduction in shaft, to gas circulation and use of calcined limestone. The author indicates the lines along which the electric furnace will probably be improved and its efficiency raised. He concludes that the electric iron-ore-reduction furnace is meeting the requirements in those localities where it has been introduced, and that it will no doubt find extended application in those countries where the conditions are favorable to its introduction, namely, where electrical energy is comparatively cheap and where coke and charcoal are comparatively high. Inasmuch as the cost of electrical energy is largely the governing factor in determining its adoption, and as the cost of electrical energy is constantly decreasing, we may expect to find an extended application of the electric reduction furnace in the future.—*Met. and Chem. Eng'g*, January, 1913.

**Induction Furnace.**—J. HARDEN.—After some general remarks on induction furnaces, the author gives a survey of the conditions obtaining in various steel-producing countries. It is rather in the production of special classes of steel than of steel such as is used in armor plate, and of which the specification is not so exacting, that the induction furnace will find its place. In the production of high-grade steels the cost of electric energy is not very important so long as the resulting product is good. The characteristics of the induction furnace render it particularly applicable to this class of work. In conclusion, details are given of the construction of induction furnaces and of the way in which it has been found necessary to make the furnace linings.—*London Electrician*, Dec. 13, 1912.

#### Units, Measurements and Instruments

**Measurement of Temperature by Electric Means.**—C. B. THWING.—An article discussing critically the general principles and the limitations of simple thermocouples, reduction pyrometers with thermocouple and electric resistor pyrometers. In selecting pyrometers the temperature range is one of the first considerations. For temperatures with a maximum range above 1500 deg. C. (2732 deg. Fahr.) the radiation type is the only one of the three which is available. The lower limit for this type of instrument is ordinarily about 500 deg. C. (932 deg. Fahr.). Where the upper limit is 150 deg. C. choice may be had between the radiation and the platinum thermocouple. Where the upper range is 1200 deg. C. (2192 deg. Fahr.) the chrome-nickel thermocouple, the platinum thermocouple and the radiation type may all be used. For temperatures up to 1000 deg. C. (1832 deg. Fahr.) the iron-constantan thermocouple and the nickel resistor could be employed, with the choice probably in favor of the resistor type. The form and size of the thermocouple or resistor bulb are also determined by circumstances. Where large heat areas are under consideration, with slow changes of temperature, the thermocouple may be of large cross-section and thoroughly protected with iron or refractory tubes. Where the bodies to be measured are small and the temperature fluctuations are very rapid the thermocouple must be made smaller. For example, if the transformation point of a number of specimens of steel is to be determined, it is desirable that the specimens be small, with a small opening into which a very small thermocouple is inserted. The same considerations which make the thermocouple small would determine the choice of the thermocouple as against the resistor bulb, since the former can be made almost infinitesimally small and will respond with corresponding quickness to the temperature of the inclosing body. Where thermocouples are used the greatest consideration must be given to the matter of cold-end variation, and in the installation the most complete precaution must be taken in the matter of wiring to make sure that all joints are permanently made. In the case of resistor thermometers the failure to get good results is often due to the failure to protect the lead wires

from moisture or from abrasion.—*Met. and Chem. Eng'g*, January, 1913.

**Thermal Emf of Tungsten and Molybdenum.**—E. F. NORTHROP.—An article on the determination of the thermal emf of tungsten and molybdenum. A diagram giving the emf as a function of the temperature shows that this curve reaches a maximum at 530 deg. C. and comes back to zero at 1060 deg. C. The author recommends that many samples of tungsten and molybdenum be tested. If they all have a neutral point at 1060 deg. C., a thermocouple of these metals would serve in a very convenient way to fix this temperature. A couple or a resistor thermometer to be tested would be put in the same electric oven with the tungsten-molybdenum couple and the temperature raised until the latter showed zero emf. The temperature would then be 1060 deg. C.—*Met. and Chem. Eng'g*, January, 1913.

#### Telegraphy, Telephony and Signals

**Telegraph Currents.**—K. W. WAGNER.—A conclusion of his paper, illustrated by numerous diagrams, on a new artificial telegraph line for investigating phenomena of telegraphy. Since the transient phenomena or short natural lines are very often so quick that they cannot be determined directly by means of the oscillograph, the artificial line of the author is so designed as to change all the time constants in a certain ratio; the transient phenomena in the artificial line are then retarded in the same ratio, but are otherwise not changed or distorted. In the second part of the paper the author gives several oscillograms which have been taken with the artificial line to investigate several problems in practice. One of these is the use of alternating-current signals for telegraphy. It has been claimed that this system permits transmission to a greater distance, but this is a mistake since an alternating-current signal consisting of a number of impulses and reversals changes while being transmitted over a long line into one single broadened and flattened impulse. Other subjects discussed are the current at the distant end with different lengths of line, the connection in series of lines of different characteristics, and the use of protective devices against abnormally high voltages.—*Elek. Zeit.*, Dec. 19, 1912.

## Book Review

CALCULS TECHNIQUES ET ÉCONOMIQUES DES LIGNES DE TRANSPORT ET DE DISTRIBUTION D'ÉNERGIE ÉLECTRIQUE. First part. By C. Le Roy. Paris: A. Hermann & Sons. 172 pages, 52 illus. Price, 6 francs.

A very practically presented elementary textbook on the design of electric conductors for the transmission of energy. The design includes a discussion of the heating, efficiency, economy and pressure regulation of the conductors. Various practical examples are examined, numerically, from an engineer's point of view. The nine chapters of the work relate to the following subjects: Considerations determining the choice of the size of conductors; conditions for safety of operation; conditions for satisfactory service; conditions for good economy; design of distributing conductors; resistance of wires; design of lines with reference solely to their resistance, inductance, reactance and impedance; design of transmission and distribution lines taking their reactance into account. It is unfortunate that a distinct difference of terminology exists between the French and English languages in regard to inductance and reactance. What is called inductance in English is sometimes described as "self" in French and what is called reactance in English is then described as inductance in French. This serious discrepancy in terms should soon receive international consideration and elimination in order to facilitate interchange of ideas among engineers of different nations.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Showcase Lighting

In selecting a showcase lighting system several important points should be considered. The illumination of the interior of the case should be approximately double that of the general illumination of the store; the light should be of such an intensity and quality that the goods are shown in their true color and style; the temperature of the interior of the case



FIG. 1—SHOWCASE REFLECTOR

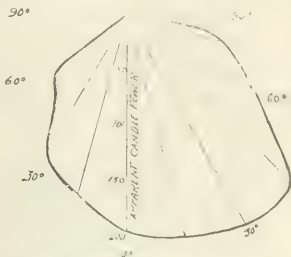


FIG. 2—DISTRIBUTION DIAGRAM

must not be raised to any appreciable extent, and any increase, however small, should be evenly distributed, as a plate glass which is warm in spots is liable to crack when cold drafts strike it. Moreover, the lighting unit should be neat and inconspicuous and permit of easy and thorough cleaning of the case.

The Linolite lamp, it is claimed, meets these conditions very satisfactorily. This lamp is approximately 1 ft. long and 1 in. in diameter. The tungsten metal filament is concentric to the tube and extends its entire length. The interior glass area of the lamp is 31 sq. in., as against 17 sq. in. for the ordinary "bung-hole" type of lamp and 24 sq. in. for the ordinary incandescent lamp of the same rating.



FIG. 3—SHOWCASE LIGHTED WITH LINOLITE LAMPS

This large glass area is said to insure low temperature and long life. On account of its shape the lamp also adapts itself to a very small reflector.

The illustrations show the application of the Linolite system of showcase lighting in the store of Lipman, Wolf & Company, Portland, Ore., where over 3000 ft. of Linolite is in use. Fig. 1 shows a reflector 2.5 in. deep and

2 in. high, which distributes the light as shown in Fig. 2. The art case in Fig. 3 are 30 in. deep and 32 in. high and are equipped with four Linolite lamps for each 8 ft. of frontage, while the wallcases are 24 in. deep and 36 in. wide with three lamps to each case. The art exhibit is



FIG. 4—STATUARY EXHIBIT ILLUMINATED BY LINOLITE LAMPS

shown in Fig. 4. The depth from the posts to the back of the case is 3 ft. 6 in. and from the ceiling to the counter 5 ft. 6 in. The Linolite lamps used in the specially designed wallcase reflector are rated at 35 watts. The installation was made by the H. W. Johns-Manville Company, New York.

### Oil-Engine Operation at Paullina, Ia.

Paullina, Ia., a town of 1000 population, installed a 50-hp oil-engine generating equipment about two years ago. The



OIL-ENGINE PLANT, PAULLINA, IA.

plant comprises a two-cylinder horizontal Mietz & Weiss oil engine, operating at 275 r.p.m., directly coupled to a 30-kw, 110/200-volt direct-current generator by means of a flexible coupling. Besides supplying lighting for the business and residential sections, a moving picture show and 140 tungsten street lamps are operated from the equipment. In the business section a number of five-lamp tungsten



standards are employed. The plant, with pole line, equipment, etc., was installed complete by the Interstate Electric & Manufacturing Company.

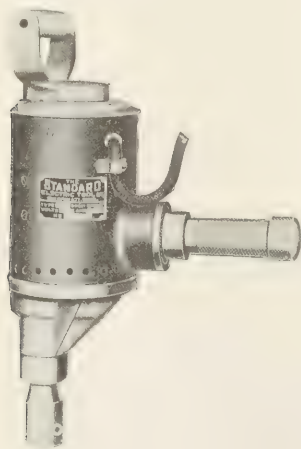
From the annual report of the town officials the following figures are taken for the cost of operation of the plant from April 1, 1911, to March 31, 1912, during which period the income from lighting service was \$3,793.95. This is exclusive of street lighting, for which no charge was made: Salary for superintendent of public works, \$1,320; repairs for plant, including miscellaneous supplies, etc., \$65.58; fuel for plant, \$339.63; lubricating oil for plant, \$43.98; outlay for plant during year, \$1,769.19.

The above figures do not include, of course, charges for capital invested in the plant, depreciation, taxes, etc. In addition to the difference of \$2,024.76 shown in favor of plant income over the items of outlay tabulated, it is estimated that the street lighting furnished would have cost \$1,500.

The oil-engine equipment has proved very economical to operate and has given extremely satisfactory service, including many long record runs without trouble or shut-down. For pumping its water supply the town of Paullina recently purchased from the manufacturer, August Metz, 87 Elizabeth Street, New York, an additional 18-hp oil engine of the same type.

### Portable Electric Drills

The Standard Electric Tool Company of Cincinnati, Ohio, has placed upon the market a line of portable electric drills in four sizes, namely,  $\frac{1}{4}$  in.,  $\frac{5}{16}$  in.,  $\frac{1}{2}$  in. and  $\frac{3}{4}$  in. The drill motors will operate with either alternating or direct current and, it is stated, will give equal satisfaction on low-frequency circuits or on 60-cycle mains. This



PORTABLE ELECTRIC DRILL

versatility has been brought about through the use of series-commutating type motors of special design. High power, absence of tendency to run hot and an improved method of forced ventilation are the features claimed for these drills. The motors have been so designed that they will not race under light load, consequently twist drills are less frequently burned and no damage results if the tool runs idle.

A switch placed in the handle of the drill gives to the operator full control of the apparatus at all times. All armature spindles and the gears in the two largest sizes run in ball bearings. The gears are made of chrome-nickel steel, case-hardened, and are supported on both ends and incased in grease.

### Insulated Wire

The Underwriters' tests are much more severe on the smaller sizes of 1911 code wire than on the larger sizes, and where the same quality of insulation is used throughout it is considered the best practice to increase the voltage tests more on the larger sizes of wire. The Simplex Electrical Company, 201 Devonshire Street, Boston, Mass., claims that all of its 1911 code wire "Simcore" is subjected to the following tests for one minute:

Size, B. & S.	Required by Underwriters, Volts	Applied to Each Length of "Simcore," Volts
14 to 8	1500	2000
6 to 2	2000	3000
1 to 0000	2500	5000
225,000 to 500,000	3000	6000
525,000 and larger	3500	7000

From the above it will be noted that the voltage tests applied are much in excess of those required by the Underwriters, being in the larger sizes as much as 100 per cent more.

### Storage-Battery Industrial Trucks

By ADRIAN D. STEVENSON

The genesis of the electric truck is found in the necessity of some automatic device that would not only supplant the cumbersome hand truck but also in certain cases afford a cheap substitute for industrial railways, locomotive cranes and trolley cranes.

A simple industrial electric truck is built in sizes and capacities suitable for moving loads on piers, in freight sheds, warehouses and industrial establishments generally. Its clearance and radius of action permit it to pass through congested places, and it goes forward or backward with ease and facility and is capable of ascending gradients of 25 per cent. On piers and in railway terminals it can deliver its load on the deck of a vessel or within a freight car; in a warehouse or store it can carry its load from floor to floor wherever wanted with a degree of celerity otherwise impossible; in the factory it carries materials di-

#### WEEK'S RECORD OF STORAGE-BATTERY TRUCK HAULING TRAILERS

Number of packages handled.....	7570
Average weight per package, lb.....	230
Total weight handled, tons.....	900
Average distance packages were moved, ft.....	900
Percentage of time machine was working.....	80
Number of packages delivered per working minute.....	3
Number of different jobs worked on.....	30
Heaviest single load drawn, tons.....	12.5
Cost of operator, interest, depreciation and energy.....	\$24.00
Cost of moving one package 900 ft., cents.....	0.33
Cost of moving one ton (nine packages) 900 ft., cents.....	3

rectly to the place where needed and at the precise time when needed, something impossible with moving apparatus working on a fixed track, and at the same times does it more quickly and more economically than it can be done with hand trucks. The capacity of these trucks is usually 2000 lb., that having been found the limit for trucks with the widest range of action. The larger sizes must of necessity take up more room and as the size increases the greater clearances are required. The size and style suitable for a particular business always depend on the working conditions. For the great majority of cases, however, the truck of 2000 lb. capacity is ample. Few hand trucks are required to carry this much, and when they do they require several men to pull them. The speed upon the

level is 7 miles per hour and their radius is 25 miles on a single charge of the battery. By changing batteries a twenty-four-hour service may be maintained. One of these trucks is capable of doing fifteen times as much work as one-man and a hand truck can do in a given time. The operation of such a truck is sufficiently simple to permit of the usual labor employed for hand trucks. The power required for a full charge of the battery averages 6 kw.

It must be obvious that the adoption of this device is of great benefit to the central station. There is hardly a city but where hundreds of these vehicles can be used. One element is of particular moment, and that is the possibility of doing away with the greater part of the elevator equipment, as these trucks are readily capable of using an incline which is equally quick and saves the elevator expense. The advantages over conveyor systems are that the radius of the truck is unlimited and the investment much less. Furthermore, the system of using motor trucks is capable of unlimited expansion without regard to the existing equipment. This is not true of conveyor systems, and the chance for expansion is always limited in case of trainways.

The storage-battery crane truck is one application of the motor truck. Its function is somewhat different. This



FIG. 1—ELECTRIC TRUCK SHOWING DRIVER'S STAND

truck finds its use in the loading and unloading of freight and also in shifting packages where the weights are less than 1 ton and where the use of locomotive or trolley cranes would not be practicable. The tractive effort of the crane motor is sufficient to pull a number of trailers. Its drawbar pull is 2000 lb. on wood-block paving, which is the equivalent of a 5-ton locomotive on rails. It is sufficient to move loaded freight cars and readily to handle loads of from 5 tons to 8 tons on trailers. Where hauls are short the hoists carry the package on the hook to the place where it is wanted, thus combining lifting, carrying and dropping in practically one effort. Owing to its short wheelbase and its clearance, the radius of action thus afforded is greater than that of any other device. The following examples taken from actual practice over an extended period will give an idea of what can be expected of the storage-battery crane truck:

By the pick-up-and-carry method sixty 800-lb. barrels of plumbago were removed 300 ft. in an hour and only one helper was used; 150 300-lb. boxes of rubber were loaded into a box car 75 ft. distant in fifty minutes. On the preceding page the record of an average week's work performed by a storage-battery truck in hauling trailers is given in tabular form.

Having thus outlined the function of the storage-battery truck, attention may be called to the magnitude of its field

and its possibilities with reference to establishing a high degree of efficiency in the handling of free-flowing freight and merchandise generally. First on the list in matter of importance is the railway freight terminal.

The freight terminal presents a peculiar situation. Located usually and necessarily in a congested portion of a city, the opportunities for expansion are decidedly limited.



FIG. 2—A QUICK MEANS OF MOVING HEAVY BARRELS

With the present methods of handling freight the increase in business is met either by purchasing additional real estate or by suffering delay and congestion. The present value of freight terminals is based purely on ground-floor area. The upper area is valueless. It would therefore seem that the ultimate relief is to be found in the utilization of upper floors. The motor truck becomes a primary factor in the utilization of space heretofore useless, as it can readily ascend permanent or moving inclines or can be used in connection with elevators, whichever the situation may call for.

From information gathered from the Interstate Commerce Reports and various papers bearing on the subject, the cost of handling freight amounts to 60 per cent of the



FIG. 3—TRUCK IN OPERATION

total cost of transportation. That is, for every dollar spent on the transportation of freight 40 cents goes for handling. If, therefore, this cost of handling can be reduced by the introduction and use of motor trucks it would seem that a very desirable result had been accomplished.

The trucks illustrated in this article are made by the General Vehicle Company, Long Island City, N. Y.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Personnel of New J. G. White & Company Subsidiaries.**—The plan of the officers and directors of J. G. White & Company, Inc., to segregate the latter's engineering and operating departments through the formation of two new corporations, one to be known as The J. G. White Engineering Corporation and the other as The J. G. White Management Corporation, as was described in these columns Nov. 23, has been approved and officers and directors for the two new companies have been elected. The directors of The J. G. White Engineering Corporation are as follows: Harry Bronner, of Hallgarten & Company; James Brown, of Brown Brothers & Company; F. Q. Brown, of Redmond & Company; Douglas Campbell, of Campbell, Harding & Pratt; George C. Clark, Jr., of Clark, Dodge & Company; Bayard Dominick, Jr., of Dominick & Dominick; A. G. Hodenpyl, of Hodenpyl, Hardy & Company; T. W. Lamont, of J. P. Morgan & Company; Captain Marion McMillin, of Emerson McMillin & Company; J. H. Pardee, president The J. G. White Management Corporation; E. N. Potter, of Potter, Choate & Prentice; Frederic H. Reed, vice-president J. G. White & Company, Inc.; Charles H. Sabin, vice-president Guaranty Trust Company; Frederic Strauss, of J. & W. Seligman & Company; Moses Taylor, of Kean, Taylor & Company; George H. Walbridge, of Bonbright & Company; E. N. Chilson and C. E. Bailey. The officers are: J. G. White, chairman finance committee; Gano Dunn, president; E. G. Williams, A. S. Crane, H. A. Lardner, vice-presidents; H. S. Collette, secretary, and R. B. Marchant, treasurer. The directors of The J. G. White Management Corporation are as follows: Cecil Barret, of Spencer Trask & Company; F. Q. Brown, of Redmond & Company; P. M. Chandler, of Chandler Brothers & Company, Philadelphia; Arthur Coppell, of Maitland, Coppell & Company; Gano Dunn, president The J. G. White Engineering Corporation; George E. Hardy, of Hodenpyl, Hardy & Company; R. G. Hutchins, Jr., vice-president National Bank of Commerce; R. L. Montgomery, of Montgomery, Clothier & Tyler, Philadelphia; John T. Pratt, of Campbell, Harding & Pratt; Frederic Strauss, of J. & W. Seligman & Company; H. R. Tobey, of N. W. Halsey & Company, and J. G. White, president J. G. White & Company, Inc. The officers are: J. H. Pardee, president; F. H. Reed and S. L. Selden, vice-presidents, and T. W. Moffat, secretary and treasurer. The business of the Management company was established some years ago as a department to supervise the operation of properties in which J. G. White & Company, Inc., was interested. This department, which has now been formed into a separate company, was, on Dec. 31, 1912, acting as operating and consulting manager of public utility and railroad properties in the United States, Nicaragua and the Philippine Islands, including the Manila Electric Railroad & Lighting Corporation and subsidiaries; the Helena (Mont.) Light & Railway Company; the Eastern Pennsylvania Railways Company, of Pottsville, Pa., and subsidiaries; the United Light & Railways Company and subsidiaries; the Associated Gas & Electric Company and subsidiaries; the Augusta-Aiken (Ga.) Railway & Electric Corporation and subsidiaries; the Pacific Railroad of Nicaragua; the Kentucky Public Service Company and subsidiaries, and other properties. The parent organization, J. G. White & Company, Inc., controls the new companies and will continue as an active financing and owning company.

**1912 Copper Production Was Largest on Record.**—Statistics and estimates received by the United States Geological Survey indicate that the copper output in this country in 1912 exceeded that of any previous year in the history of the industry. The smelter output, based upon returns for eleven months and estimates for the month of Decem-

ber, was 1,249,000,000 lb. in 1912, against 1,097,232,749 lb. in 1911. The average quoted price of electrolytic copper for the year showed a marked increase over that for 1911. The average for 1912 was about 16 cents per lb., as compared with 12.5 cents per lb. for 1911. The year opened with copper at about 14 cents per lb., but from June on the monthly average did not fall below 17 cents. Figures published by the Copper Producers' Association show a production of refined copper amounting to about 1,570,000,000 lb. in 1912, as against 1,433,875,026 lb. in 1911. Stocks of refined copper held in the United States on Jan. 1, 1913, were 105,312,582 lb., as compared with 89,785,000 lb. on Jan. 1, 1912.

**Activities of Siemens & Halske A. G.**—Owing to the increasing business of the Siemens companies in Canada, the Siemens Company of Canada, Ltd., has been formed with principal offices in the Transportation Building, Montreal, and Mr. Arthur S. Herbert as general manager. Branch offices have been opened in 305 Standard Bank Building, Toronto, and in the McArthur Building, Winnipeg. The Siemens & Halske A. G. reports increasing orders for automatic and semi-automatic telephones for private and public purposes abroad. The company recently received an order for two exchanges for Rome of 2000 subscribers each. Many factories and hotels, the company says, are installing automatic telephones. Since 1909 the Siemens & Halske A. G. has installed 70,007 automatic and semi-automatic telephones in various European communities for public and private use.

**Utah Power & Light Increases Its Holdings.**—The electrical properties of the Utah-Idaho Sugar Company, including a 7000-kw generating station on Bear River near Collinston, Utah, have been sold to the recently organized Utah Power & Light Company for \$600,000. The purchasers are planning to develop energy on a large scale along the Bear River and have several hundred men engaged on construction work in that territory. The properties of the San Juan Water & Power Company, of Durango, Col., which has a power station at Tacoma, about 20 miles from Durango, have also been acquired by the Utah Power & Light Company. The latter has obtained options on the Delta Electric Light & Power Company, of Delta, Col., and on the electric-service properties at Montrose and Ouray, Cal.

**Large Demand for Heating Appliances.**—Mr. Roger Williams, of the New York office of the Simplex Electric Heating Company, said this week to a representative of the *Electrical World* that in October, November and December last he sold over 50 per cent more electric-heating appliances than he did in the corresponding period of 1911. A stock received at the end of September, 1912, and amounting to more than 50 per cent in excess of that sold in the last quarter of 1911, was sold before the close of October, so that the volume of business in November and December added to this made a total considerably ahead of that in the last three months of 1911. Toasters and chafing dishes were in greatest demand, he said, with that for the former predominating.

**General Electric's 1912 Gross Exceeded \$100,000,000.**—It is learned from an authoritative source that the business of the General Electric Company in the fiscal year ended Dec. 31, 1912, was the largest in the history of the company. Gross earnings amounted to approximately \$102,300,000, which compares with \$70,383,854 in 1911.

**New York Edison's Showrooms Busy.**—During the week ended Dec. 21, 1912, 119 orders for electric appliances were received at the various showrooms of the New York Edison Company. These amounted to a total of \$936 and called for appliances aggregating 41 kw in rating.



**Large Gain in New Incorporations Last Year.**—Not in six years have incorporations been made on such a large scale as was the case in 1912. According to compilation by the *Journal of Commerce*, New York, the new companies organized in the Eastern States in 1912, representing a capital of \$1,000,000 or more, as well as increases in capital, aggregated \$2,295,172,000, which is \$457,740,600 in excess of the 1911 total. Adding capital represented by incorporations in states other than those in the East increased the total to \$2,647,271,000. Counting in companies in all the states with a capital of \$100,000 and over, but less than \$1,000,000, the grand total for the year was \$3,288,245,000, as against \$2,906,001,850 in 1911 and \$2,869,073,742 in 1910. Among the largest incorporations of the year in the Eastern States were the \$70,000,000 Tennessee Railway, Light & Power Company, the \$50,000,000 Continental Public Service Company, the \$53,000,000 Chicago Utilities Company, the \$40,000,000 American Public Utilities Company, the \$40,000,000 Puget Sound Traction, Light & Power Company, and the \$30,000,000 Havana Electric Railway, Light & Power Company.

**New Allis-Chalmers Company to Begin Operations Soon.**—The reorganization committee of the Allis-Chalmers Company hopes to have all details of the reorganization completed and to have the new company in operation early in March. The members of the executive committee and most of the principal officers of the new company, which is to be formed after the foreclosure sale to be held on Feb. 3, will be Milwaukee men. Payment of the third assessment, in accordance with the reorganization plan, is due on Jan. 15. The date for the final payment will probably be set a short time before the new company begins operations, so as to provide additional working capital for it.

**Commonwealth Power, Railway & Light's Common Dividend.**—Directors of the Commonwealth Power, Railway & Light Company, which operates in Michigan, have declared an initial dividend of 1 per cent on the company's \$12,000,000 common stock. This is payable May 1 to stock of record April 10. The regular quarterly dividend of 1½ per cent on the \$6,000,000 preferred stock was also declared. This is payable Feb. 1 to stock of record Jan. 14. As was stated Dec. 28, the action on the common stock was anticipated by a majority of the stockholders in view of the substantial gains that were made last year in the earnings of the company.

**Brazilian Traction, Light & Power Gains.**—Increases in both gross and net earnings continue to be made by the Brazilian Traction, Light & Power Company, which was formed last summer, as noted in these columns, through consolidation of the Rio de Janeiro Tramways, Light & Power Company, the Sao Paulo Tramways, Light & Power Company and the Sao Paulo Electric Company. The November gross was \$1,773,623, as compared with \$1,770,187 in October and with \$1,691,298 in September. Net earnings in November were \$1,006,271, and those in October and September were \$1,004,329 and \$953,901 respectively.

**Pennsylvania Utilities Merged.**—The Allegheny County Light Company, the Monongahela Light & Power Company, the Southern Heat, Light & Power Company, the Ohio Valley Electric Company and the Oakmont & Verona Light, Heat & Power Company, all owned by the Philadelphia Company, of Pittsburgh, have been merged with the Duquesne Light Company, which is controlled by the same interests. The Duquesne company, as noted in these columns Dec. 28, recently increased its capital stock to \$25,000,000 in connection with this merger.

**Northern California Power Company to Make Improvements.**—It is stated that about \$225,000 will be spent this year by the Northern California Power Company of San Francisco upon improvements and extensions to its system in Shasta County. Among the work that will be done are the building of a reservoir on Dry Burney Creek and the installation of equipment to double the present ratings of the power stations at Kilarc and South Cow Creek.

**Kings County (N. Y.) Electric Light & Power Financing.**—The directors of the Kings County (N. Y.) Electric Light & Power Company have authorized the issuance of \$4,000,000 capital stock. When this is delivered to the holders of the \$4,000,000 convertible debentures exchangeable

at par for stock from March 1 next, there will be \$14,000,000 stock outstanding. Through this conversion dividends will be increased by \$320,000 and interest will be decreased by \$240,000, making a net increase in charges of \$80,000.

**New Haven Company to Issue New Stock.**—The stockholders of the United Illuminating Company, New Haven, Conn., have voted to authorize the directors to increase the capitalization of the company from \$2,000,000 to \$2,500,000. The present outstanding stock issue is \$1,800,000. This will be increased to \$2,100,000 by issuing \$300,000 of new stock. The proceeds are to be used for improvements to the company's stations in New Haven and Bridgeport, Conn.

**Cedar Rapids Manufacturing & Power Refunding Plan Approved.**—The stockholders of the Cedar Rapids Manufacturing & Power Company, of Montreal, have approved the refunding plan to which reference was made in these columns last week. This provides for retiring the present authorized issue of \$10,000,000 bonds and replacing these with a new issue of \$15,000,000 first-mortgage forty-year 5 per cent bonds to be issued from time to time as required for the needs of the company.

**Employees Strike in California Construction Camp.**—More than 2000 of the men employed by Stone & Webster in constructing the hydroelectric developments for the Pacific Light & Power Company near Fresno, Cal., have gone on strike and, it is said, have seized the company's stores at their construction camp, 25 miles from that place. It is also reported that most of the men are members of the Industrial Workers of the World.

**Anticipates a Good Year.**—In a brief New Year's review published in a daily newspaper Mr. James W. Johnson, district manager in Chicago for the General Electric Company, said that he thought that the prospects for the year 1913, so far as the sale of electrical apparatus and supplies is concerned, would compare favorably with last year unless action by the new Congress on tariff revision affects general business unfavorably.

**More Companies Added to West Penn System.**—Effective Jan. 1, the Washington (Pa.) Electric Light & Power Company, the Canonsburg (Pa.) Electric Light, Heat & Power Company, the Citizens' Electric Light, Heat & Power Company, of McDonald, Pa., and the Waynesburg (Pa.) Electric Light & Power Company were merged with the West Penn Traction Company.

**Southwestern Telegraph & Telephone Plans.**—The Southwestern Telegraph & Telephone Company expects to spend about \$4,500,000 in Texas this year in increasing its facilities. During the first ten months of 1912 the company spent about \$40,000 on additional real estate and \$2,500,000 on exchanges, including switchboards and other equipment, and about \$700,000 on toll lines.

**New England Telephone Earnings Increased in 1912.**—Gross receipts of the New England Telephone Company in its fiscal year ended Dec. 31, 1912, were slightly in excess of \$16,000,000, as compared with \$14,705,448 in 1911 and \$13,630,922 in 1910.

**Standard Underground Cable Declares Extra Dividend.**—The Standard Underground Cable Company has declared a quarterly dividend of 3 per cent and an extra dividend of 3 per cent. These were payable Jan. 10.

## December Statement of Copper Producers' Association

The producers' association in the Copper Producers' Association, issued Jan. 8, compares with the November statement as follows:

	November	December
Stocks and bonds owned	105,312,782	86,164,059
Unpaid stock on order	—	—
Production	1,141,180,101	1,141,180,101
Domestic sales	55,906,550	55,906,550
Foreign deliveries	65,713,796	65,713,796
Total sales	121,620,346	121,620,346
Stocks and bonds owned	105,312,782	86,164,059

## Electric Securities

Security.	Outstanding.	S—Semi-annually.		A—Annually		DIVIDEND.		LAST QUOTATION.	
		Per Cent.		Period.		Per Cent.		Period.	
		Period.		Bid		Asked		Period.	
Adirondack Electric Power, c.	\$9,500,000			19½	21				
Adirondack Elec. Power, pt.	2,500,000			61½	63				
Amer. Gas & Electric (\$50), c.	2,500,000			81	85				
Amer. Gas & Electric (\$50), pt.	1,537,500			45	47				
Amer. Light & Traction, c.	10,395,400			Q	400	410			
Amer. Light & Traction, pt.	11,236,200			Q	108	110			
Amer. Power & Light, c.	5,631,400			66	68				
Amer. Pwr. & Lt., 6% cum. pt.	5,631,400			83	85				
Amer. Pwr. & Lt., opt. cum. pt.	1,604,000			13	15				
Amer. Pwr. & Lt., 6% notes, 21.....	2,199,100			3	S	98½	100		
Appalachian Power, c.	6,000,000			25	26				
Appalachian Power, pt.	2,180,000			75	76½				
Arizona Power, c.	3,000,000			12	13				
Arizona Power, pt.	850,000			50	55				
Asheville Light & Power, 1st s. l. 5s, 42.....	1,100,000			23	S	93	96		
Augusta-Aiken Railway & Electric, 1st 5s, 35.....	2,588,000			23	S	90	94		
Augusta-Aiken Ry. & Elec., c.	2,250,000			23	23				
Augusta-Aiken Ry. & Elec., pt.	1,500,000			13	Q	75	85		
Augusta Railway & Electric 1st 5s, 40.....	967,000			23	S	100	....		
Butte Elec. & Pwr., 1st 5s, '51.	4,283,000			23	S	95	97½		
Central Maine Power, 1st 5s.....	2,502,000			5	A	97	99		
Cities Power & Light, c.	5,499,430			4	M	110	112		
Cities Service, pt.	10,195,360			4	M	86½	87		
Columbus Railway Gas & Electric 1st 5s, 36.....	2,454,000			23	S	93	95		
Columbus Ry., G. & Elec., c.	2,000,000				60				
Columbus Ry., G. & Elec., pt.	840,000			13	Q	85	95		
Commonwealth Edison, cap. stock	32,964,800			7	A	145	....		
Consolidated Gas, Electric & Power (Baltimore), 4½s.....	11,564,000			23	S	87	87½		
Consumers Pwr. (Mich.), 5s, '36.	10,088,000			23	S	95½	97½		
Consumers Power (Minn.), 1st 5s, '29.....	9,528,000			23	S	89	92		
Dallas Elec. Corp., 5s, '22.....	3,659,000			23	S	95½	97½		
Denver Gas & El. Lt., c.	7,001,300			4	M	220	....		
Denver Gas & El. Lt., gen. 5s	6,000,300			4	S	93	95		
Empire District Electric, 5s.....	1,925,000			23	S	84	86		
Edison El. Ill. of Boston, cap. stock.....	15,603,700			23	Q	239	....		
Federal Light & Traction, c.	1,750,000				33	36			
Federal Light & Traction, pt.	2,500,000			13	Q	82½	85		
Gas & Electric Securities, c.	1,000,000				135	150			
Gas & Electric Securities, pt.	1,000,000			7	A	92	96		
Harwood Electric, 5s, '39.....	1,000,000			23	S	100½	101½		
Kings County El. Lt. & Pwr.	10,000,000			2	Q	140	....		
Niagara Falls Power, 5s, '32.....	10,000,000			23	S	101½	102½		
Northern Ohio Railway & Light, 4½s, '35.....	17,541,000			23	S	86	87½		
Northern States Power, c.	5,975,000			13	Q	23½	24½		
Northern States Power, pt.	5,886,700			13	Q	84	86		
Pacific Gas & Electric, c.	31,908,750			13	Q	62½	63		
Pacific Gas & Electric, pt.	10,000,000			13	Q	91½	91½		
Philadelphia Electric (\$25)....	24,987,750			13	Q	22½	....		
Portland General Electric, 5s	8,000,000			23	S	100	102		
Republic Railway & Light, c.	5,200,000				24	27			
Republic Railway & Light, pt.	6,360,000			13	Q	79	81		
St. Joseph's R., L., H. & P., 5s	4,647,000			23	S	99	100		
Seattle Electric Co., com. 5s, '29	7,417,000			23	S	97	97		
Southern Calif. Edison, 5s, '39.	9,975,000			23	S	96	98		
Southern Power, 5s.....	4,000,000			23	S	69½	101		
Standard Gas & Elec. (\$50), c.	9,313,150				\$21½	\$23			
Standard G. & E. (\$50), pt.	10,977,950			2	Q	\$50	\$51		
Tennessee Electric, c.	20,000,000				22½	24			
Tennessee R., L. & Pwr., pt.	10,250,000			13	Q	76½	77½		
Tri-City Railway & Light, c.	9,000,000				55	....			
Tri-City Railway & Light, pt.	2,826,200			13	Q	90	93		
Tri-City Ry. & Lt., 5s, '23.....	8,207,000			23	S	97	98		
Western Power, 6% notes.....	14,670,000				A	24	27		
Western Power, 6% notes.....	6,000,000				A	51	53		

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent.		Dec. 31	
		Period		Jan. 8	
Allis-Chalmers, 2d assess. paid	\$17,151,100			1½	1½*
Allis-Chalmers, pt., 2d assess. paid	14,034,700			5	5*
Amalgamated Copper.....	153,887,900			78½	77½
American Tel. & Tel.....	334,712,300			139½	139½
Electric Storage Battery, c.	16,074,425			53½	53½
General Electric.....	77,726,700			186	185
Mackay Cos., c.....	41,580,400			84*	84
Mackay Cos., pt.....	50,000,000			66½	68
Western Union Tel.....	79,943,400			75½	75
Westinghouse E. & M., c.	31,685,300			79½	78
Westinghouse E. & M., pt.	3,998,700			121½	121½*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Commodity	Dec. 30		Jan. 7	
	Bid.	Asked.	Bid.	Asked.
Copper	17.00	17.37½	17.00	17.37½
Standard, spot	£ s d	£ s d	£ s d	£ s d
London, standard, spot	76	76	76	76
Prim. Lake	17.65	17.75	17.65	17.75
Electrolytic	17.55	17.65	17.55	17.65
Casting	17.35	17.45	17.35	17.45
Copper wire, base	19.00	19.00	19.00	19.00
Lead	4.35	4.35	4.35	4.35
Nickel	45.00	45.00	45.00	45.00
Sheet zinc, f.o.b. smelter.....	9.00	9.00	9.00	9.00
Spelter, spot	7.35	7.35	7.35	7.35
Tin, spot	50.62½	50.62½	50.20	50.20
Aluminum				
Prompt delivery	26.00	26.50	26.00	26.50
Future	25.75	26.25	25.75	26.25

## OLD METALS

Heavy copper and wire.....	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.50	8.50
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

## COPPER EXPORTS IN JANUARY

Total tons to	Jan. 9, 3,159
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## Personal

Mr. A. A. Anderson has resigned as general manager of the Springfield (Ill.) Light, Heat & Power Company.

Mr. W. D. Matthews has been elected vice-president of the Canadian General Electric Company in place of the late H. P. Dwight.

Mr. J. R. McKee, chairman of the sales committee of the General Electric Company for a number of years, has been elected a vice-president of the company.

Mr. Clarence H. Mackay, president of the Postal Telegraph & Cable Company, has been elected president of the California Society of New York for 1913.

Mr. R. A. Ross, consulting engineer of Montreal, Que., has been engaged by the city of Calgary, Alberta, to report on the local power and lighting situation.

Mr. R. M. Searle, vice-president of the Rochester (N. Y.) Railway & Light Company, was elected president of the Chamber of Commerce of Rochester at its recent meeting.

Mr. Robert G. Griswold, for some time on the engineering staff of the Denver (Col.) Gas & Electric Light Company, has been transferred to the New York office of H. L. Doherty & Company.

Mr. S. N. Ford, president of the Mansfield (Ohio) Railway, Light & Power Company, was appointed receiver of the company on Dec. 30. The property was ordered to be sold within four months.

Mr. Charles O. Bancroft has resigned as president of the Cumberland County Power & Light Company of Portland, Maine, because of ill health, and Mr. W. M. Bradley has been elected to fill the vacancy.

Mr. Herbert Senger, assistant general manager of the Port Jervis (N. Y.) Light & Power Company, has resigned and joined the staff of the Consolidated Gas Purification & Chemical Company, New York.

**Dr. G. W. Pierce**, of the Department of Physics, Harvard University, on Jan. 4 addressed the New England Wireless Society in the Jefferson Physical Laboratory at Harvard on "Resonance in Receiving Circuits."

**Mr. O. B. Young**, a Boston attorney, formerly connected with Messrs. Stone & Webster, has been elected a vice-president of the General Electric Company to fill the vacancy left by the late Hinsdill Parsons.

**Mr. Walter G. Clarke**, consulting engineer, of New York, has been on the Pacific Coast during the last month investigating a number of important water-powers. He is expected to return to New York next week.

**Mr. A. D. Furlong**, formerly general superintendent and electrical engineer of the Springfield (Ill.) Light, Heat & Power Company, has been appointed general manager of the properties in place of Mr. A. A. Anderson, resigned.

**Dr. Milton W. Franklin**, who is in charge of the ozone laboratory of the General Electric Company at Schenectady, delivered an address on the production of ozone and oxygen at the Massachusetts Institute of Technology, Boston, Jan. 7.

**Mr. C. S. Morgan**, formerly manager of the new-business department of the Plattsburg (N. Y.) Gas & Electric Company, has been appointed general manager of the Lincoln (Ill.) Gas Company, succeeding Mr. H. S. Bramwell, resigned.

**Mr. C. O. Poole**, consulting engineer, of Los Angeles, Cal., recently underwent an operation for appendicitis. According to late reports he is now greatly improved in health, and the physicians express confidence in his ultimate recovery.

**Mr. Sidney W. Ashe**, of the General Electric Company, Harrison, N. J., delivered an illustrated lecture on "Some Fundamental Principles of Light Generation and Distribution" before the meeting of the Schenectady Section of the A. I. E. E. on Jan. 7.

**Mr. T. I. Jones**, general sales agent of the Edison Electric Illuminating Company of Brooklyn, is scheduled to deliver an illustrated address on the business of the Brooklyn Edison company before the Brooklyn Section of the N. E. L. A. on Jan. 13.

**Mr. J. D. Maxwell** has resigned as electrical engineer of the Spartanburg (S. C.) Railway, Gas & Electric Company to become connected with the Anderson Electric Carriage Company, which manufactures the "Detroit" electric vehicle. Mr. Maxwell will be attached to the Philadelphia office of the company.

**Mr. Joseph M. Bricker** has tendered his resignation as manager of the Somerset (Pa.) Electric Light, Heat & Power Company, effective Feb. 1. He will remain with the concern, however, as "secretary-treasurer," a position he has held since the organization of the company over twenty-one years ago.

**Mr. M. Anderson** has severed his connection with the Commonwealth Power Company of Jackson, Mich., and accepted the position of general manager of the People's Gas & Electric Company of Mason City, Ia., succeeding Mr. A. W. Zahm, whose resignation was announced in these columns on Nov. 16, 1912.

**Mr. William H. Blood, Jr.**, past-president of the National Electric Light Association and of the Electric Vehicle Association of America, addressed the members of the Electrical Engineering Society of the Massachusetts Institute of Technology in Boston on Jan. 4. Mr. Blood's topic was "Suggestions for the Young Engineer."

**Mr. C. S. Sergeant**, vice-president of the Boston (Mass.) Elevated Railway Company, assumed the duties of head of the bureau of elevated and subway construction on Jan. 1, relinquishing the supervision of operation to Mr. Matthew C. Brush, second vice-president, and to Mr. C. H. Hile, who has been made chief of the bureau of maintenance.

**Mr. P. P. Crafts**, who for about eight years has been general manager of the Iowa & Illinois Railway Company, Clinton, Ia., has been made assistant to the chairman of the executive committee of interests which control the railway, electric and gas systems of a number of cities in Iowa, Illinois, Michigan, Indiana and Tennessee.

**Mr. George Harvey Jones**, of the Commonwealth Edison Company of Chicago, addressed the Electrical League of Southern California at its weekly luncheon at the Angelus Hotel, Los Angeles, on Dec. 31. His topic was "The Power Engineer and His Work."

**Mr. Wallace P. Mercer**, manager of the Delphos (Ohio) Electric Light & Power Company and of the Van Wert (Ohio) Public Service Company, will in future also have general supervision over a number of stations in various states controlled by the same financial interests. Mr. Mercer will take over part of the work of President E. W. Lathrop.

**Mr. W. J. Canada**, engineer of the Rocky Mountain Fire Underwriters' Association, was presented with a C. L. Guinand stop-watch for use in fire-engine and pump tests by the Commissioners of the city of Pueblo, Col., at a recent meeting. The gift was in appreciation of Mr. Canada's services as chairman, without compensation, of the Pueblo Board of Electrical Engineer Examiners.

**Mr. L. A. McArthur**, assistant general manager of the Pacific Power & Light Company, Portland, Ore., was awarded a prize of \$25 in gold for the best popular name for the Portland, Eugene & Eastern Railway Company, which is constructing 340 miles of electric interurban transportation lines through the Willamette Valley. The name "Web-foot Route" has been officially adopted by the company.

**Mr. H. W. Fuller**, whose transfer from Bluefield, W. Va., to Louisville, Ky., was announced in these columns on Dec. 7, at a recent meeting of the directorate of the Louisville (Ky.) Gas Company and its subsidiary, the Louisville Lighting Company, was elected to the office of vice-president in both utilities. Mr. Fuller will act as chief aide to General George H. Harries, president of the two corporations.

**Mr. W. P. Naser**, formerly manager of the electrical departments of the H. W. Johns-Manville Company's New Orleans and Texas branches, has resigned and accepted the post of sales manager of the Cravens Electric Company, Chicago. Prior to his connection with the H. W. Johns-Manville Company, Mr. Naser was employed in the British and American works of the Westinghouse Electric & Manufacturing Company.

**Mr. James W. Dunbar**, of New Albany, Ind., has been made general manager of the United Gas & Electric Company of that city, succeeding Mr. Martin J. Insull, of Chicago, who, however, retains the management of the railway and interurban systems. Mr. Dunbar was secretary of the Western Gas Association for a number of years during his position as superintendent of the old gas, light and coke company of New Albany.

**Mr. R. G. Bonner**, manager of the Louisville (Ky.) branch of the Westinghouse Electric & Manufacturing Company, has resigned his position, to become, now business manager of the electric utility in Elyria, Ohio, owned by Henry L. Doherty & Company. Mr. Bonner is well known in the Ohio Valley electrical field, having been connected with the Westinghouse interests in that section for a number of years. He is succeeded by Mr. J. C. McClendon, who has been his assistant for about one year.

**Mr. H. C. Alvord**, formerly manager of the new-business department of the Metropolitan Electric Railway of Reading, Pa., has severed his connection with the company to accept the position of manager of the Queens Electric Company, a local electrical contracting concern. Mr. Alvord was formerly in the employ of the New York & Queens Electric Light & Power Company, the Edison Electric Illuminating Company of Brooklyn, and the Montreal Light, Heat & Power Company.

**Mr. C. O. Mailloux**, who is now visiting Europe in his official capacity as president of the United States committee of the International Electrotechnical Commission and vice-president on international arrangements for the International Electrical Congress and Exposition in 1913, was the moving spirit in the founding of the *Electrical World* in 1883 and served as its first editor. He was a charter member of the American Institute of Electrical Engineers, having signed the "call" for its organization in 1883. Mr.



Mailloux has always maintained an active interest in the Institute and has been elected a manager three times and a vice-president twice. He served as a delegate of the Institute to the congress in Paris in 1900, London in 1906, Marseilles in 1908 and Turin in 1911.

**Mr. E. G. Connette**, since May, 1912, vice-president of the International Railway Company, Buffalo, N. Y., has been elected president of the company to succeed Mr. Thomas Penny, resigned. Prior to his election as vice-president of the International Railway Company, Mr. Connette was transportation engineer for the Public Service Commission of the First District of New York. He is well known in electric railway circles and has taken an active part in the affairs of the national and state railway associations.

**Mr. A. Hussey**, who for the past six years has been in charge of construction and maintenance of all transmission facilities for the New York Central & Hudson River Railroad, electrical division, New York, has been appointed acting superintendent of distribution of the Edison Electric Illuminating Company of Brooklyn as successor to Mr. J. W. Lafferty, whose resignation was announced in these columns Dec. 14. Prior to his connection with the New York Central, Mr. Hussey was with the Cataract Power & Conduit Company of Buffalo, N. Y., where he served eight years.

**Mr. Hugo Reisinger**, of New York, the well-known importer of arc-lamp electrodes, has been appointed privy counselor to the Prince Regent of Bavaria, who in 1910 also decorated him with the Star of the Commander's Cross of the Order of St. Michael. This latter honor was conferred on Mr. Reisinger for his work in promoting art exhibitions in Germany and the United States. Mr. Reisinger is a patron of art and possesses one of the finest collections of modern paintings in the country. He is an honorary fellow for life of the New York Museum of Art and the Copley Society of Boston. Columbia University conferred on him the honorary degree of master of arts in 1911.

**Mr. Joseph D. Evans**, whose appointment as construction manager of the Electric Bond & Share Company, New York, was noted in the *Electrical World* Jan. 4, 1913, was educated at the schools of Lowell, Mass., where he was born, and was graduated as a civil engineer from the Massachusetts Institute of Technology. He went south to do work in the engineering department of the proposed Nicaraguan canal and was subsequently associated with the United States government engineers in the preparation of the original estimates for the Panama Canal. He next engaged in steam-railway construction in the republic of Ecuador. After this Mr. Evans engaged in electric railway work in Pennsylvania, Massachusetts and Connecticut and a little later was appointed general superintendent of construction of the Great Northern Power Company at Duluth, Minn. Subsequently he represented J. G. White & Company in the construction of the Buffalo, Lockport & Rochester Railway, which operates an electric railway between Rochester and Lockport. He was then appointed by J. G. White & Company resident engineer of the Canadian Light & Power Company, and on the completion of the plant at St. Timothée he accepted the position of chief engineer of the Montreal Tramways. Mr. Evans will have charge of plants under construction in Utah and Idaho by the Electric Bond & Share Company.

**Mr. Frederic Nicholls**, who has held the most prominent place in Canadian electrical manufacturing for many decades, has been elected president of the Canadian General Electric Company, succeeding Mr. W. R. Brock, who has been made honorary president and chairman of the board. Mr. Nicholls was born in England on Nov. 23, 1856. He received his education at Stuttgart and in 1874 crossed the Atlantic for Canada. His early connection with Dominion politics and journalism are matters of Canadian history. In the electrical world he is best known as an active pioneer whose faith in electricity and its application in Canada is unbounded. His was the moving spirit in the organization of the first incandescent lighting system in Canada, and his was the domineering personality which maintained the Canadian General Electric Company as one of the most independent and influential of the electrical manufacturing companies in the Dominion. He was keenly interested in the promotion of the first street railway system and in the

first interurban railway system of the Dominion. To him also belongs the credit for the building of the hydroelectric system of the Electrical Development Company of Ontario, Ltd., at Niagara Falls, Ont., and the 85-mile transmission line to Toronto. Until recently, when he began gradually to curtail his numerous responsibilities in order to conserve his energies in the interests of purely Canadian work, Mr. Nicholls was associated with other Canadians in the Brazilian utilities at Sao Paulo and Rio de Janeiro. Mr. Nicholls was president of the National Electric Light Association in 1896-7.

**Mr. Walter Farrington Wells** has been appointed general manager of the Edison Electric Illuminating Company of Brooklyn as successor to Mr. W. W. Freeman, who re-



WALTER WELLS

signed some time ago to become vice-president and general manager of the Alabama Interstate Power Company, Birmingham, Ala. Mr. Wells, who is well known in the industry, was born in Rahway, N. J., Jan. 10, 1870, and received his technical education at Rutgers College. After leaving college he became associated with the Brooklyn Edison company, occupying successively positions as draftsman, foreman and assistant electrician and in June, 1894, was appointed electrical superintendent.

In April, 1897, he accepted the position of assistant general manager of the then Manhattan Electric Light Company with full charge of technical departments. This position he held until 1900, when the company was merged with the New York Edison Company, and he then was made a district superintendent. In June, 1899, he was appointed superintendent of the old Mount Morris Electric Light Company and continued to act as such for about a year. When the Edison company made its first installation of rotary converters, etc., for 6600-volt transmission the direction of the work was assigned to Mr. Wells and he also co-operated in the preparation of the plans and superintended the installation of the electrical plant of Waterside Station No. 1. When the station was completed Mr. Wells was appointed superintendent in general charge of its operation. Upon the death of Mr. E. A. Leslie, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, the position of general superintendent was created and Mr. Wells was appointed to discharge its duties. Mr. Wells held this position until recently, when he was appointed acting general manager and finally general manager. Mr. Wells has contributed several papers on subjects connected with the operation of large generating systems to the transactions of the Association of Edison Illuminating Companies and to the National Electric Light Association. He is a fellow of the American Institute of Electrical Engineers and of its power station committee. He is also general chairman of the technical committee of the National Electric Light Association and chairman of the committee on steam turbines of the Association of Edison Illuminating Companies.

## Obituary

**Mr. John J. Lowthaire**, a salesman connected with the foreign department of the General Electric Company, 30 Church Street, New York City, dropped dead in his office on Dec. 28. Mr. Lowthaire was married and lived with his wife and one child in Richmond Hill, L. I.

**Samuel Barclay Charters, Jr.**, assistant professor of electrical engineering at Leland Stanford Junior University, died at the home of his father in Pittsburgh, Pa., Dec. 29. Mr. Charters represented the city of Los Angeles on the commission having in charge the construction of the municipal aqueduct and power plants. A wife and son survive him.

## Construction

**FAYETTEVILLE, ARK.**—The project of the Fayetteville Pwr. & El. Co. has been purchased by W. R. Felker, of Rogers, who, it is understood, represents Kansas City interests. The consideration is said to have been \$135,000.

**HELENA, ARK.**—The installation of an ornamental street-lighting system in the business district is under consideration.

**CORNING, CAL.**—The Sacramento Valley El. Ry. Co. contemplates extending its railway to Paskenta, a distance of 24 miles.

**ESCONDIDO, CAL.**—The Escondido L. & Pwr. Co. has applied to the State Railroad Commission for authority to issue and sell at par 49,500 shares of capital stock, the proceeds to be used for the construction of a hydroelectric power plant.

**HOLTVILLE, CAL.**—The Holton Pwr. Co. contemplates improvements and extensions to its system, for which bonds to the amount of \$150,000 have been issued.

**LOS ANGELES, CAL.**—Bids will be received until Jan. 31 by the Board of Public Works for 253 steel towers for 110,000-volt transmission line. Forms, etc., may be obtained on application to the Los Angeles Aqueduct Board.

**MADERA, CAL.**—J. S. Harker, president of the Mountain Progressive Club, is promoting the construction of an electric railway from Madera to Yosemite Valley. To secure power for the proposed railway it is proposed to store the waste waters of the North Fork watersheds to be utilized to drive a hydroelectric power plant.

**POMONA, CAL.**—The City Council has passed an ordinance providing for extending the electric-lighting system on several streets. The street-lighting service is furnished by the Southern California Edison Co. Frank Balfour is local manager.

**REDLANDS, CAL.**—Bids will be received by R. Warner Thomas, City Clerk, until Feb. 5 for construction of an electric power plant for the municipal water system. The plant will require a maximum of 600 hp; bids to be taken on steam, gasoline and crude-oil engines. F. E. Trask, Union Oil Building, Los Angeles, is consulting engineer.

**SACRAMENTO, CAL.**—The residents of South Oak Park are preparing a petition to present to the City Commissioners asking for the installation of arc lamps on Palmetto Avenue.

**SACRAMENTO, CAL.**—Bids will be received by E. F. Pfund, County Clerk, at the office of the Board of County Supervisors, 910 Sixth Street, Sacramento, until Jan. 21 for furnishing and installing lighting fixtures in the Court House Building in Sacramento, in accordance with the amended plans and specifications prepared by R. A. Herald, architect, which may be seen at the office of the architect, 430 Forum Building, Sacramento.

**SAN DIEGO, CAL.**—Bonds to the amount of \$35,000 have been voted by the San Ysidro Irrigation District, comprising the Little Landers Colony, the proceeds to be used for the installation of a new electric pumping plant and about 4 miles of steel, iron and concrete pipe.

**SAN LUIS OBISPO, CAL.**—The Coalinga Wtr. & El. Co., of Coalinga, has applied to the State Railroad Commission for permission to construct and operate an electric light and power system in San Luis Obispo, Monterey and Santa Barbara Counties.

**SIERRA VILLE, CAL.**—The Mountain Development Co. is preparing to install a 2500-hp hydroelectric power plant on Berry Creek, near Sattley. The plans call for the construction of several dams near the head waters of Berry Creek to conserve the annual flood waters for power purposes. The power generated at the plant will be used for pumping water for irrigation purposes. W. O. Peck is interested in the project.

**STOCKTON, CAL.**—The City Council has accepted the bid of the Western States Gas & El. Co. for lighting the streets of the city with 475 arc lamps.

**STOCKTON, CAL.**—The Oro El. Corp., of Oroville, has been granted a 50-year franchise to operate in Stockton. The company has obtained 3500 applications for service in the city limits of Stockton and will now apply to the State Railroad Commission for permission to build and operate distributing systems in and around Stockton.

**WILMINGTON, CAL.**—The Pacific El. Ry. Co., of Los Angeles, is planning to build local car lines to some of the carbon tracks recently put on the market.

**YREKA, CAL.**—The California Oregon Pwr. Co. is canvassing the ranchers living between its substation on the Bryant Ranch in Scott Valley and Callahan, a distance of about 14 miles, for the purpose of securing subscribers to take electricity for lamps and motors. If sufficient patronage is secured a transmission line will be erected to supply electricity in that district.

**DELTA, COL.**—Negotiations have been completed for the sale of the Delta El. L. & Pwr. Co. to the Utah Pwr. & Lt. Co. for \$75,000. The absorption of the Delta plant is the first step in the efforts of the Colorado-Utah Pwr. Co. to establish a continuous chain of power plants on the western slope from Telluride to Grand Junction. It is understood that options will soon be made on plants at Montrose and Ouray. Energy for operating the local system will be supplied from the central station in Telluride and a 24-hour service will be established. J. E. Shue, manager of the local plant, will be retained.

**NEW HAVEN, CONN.**—The Connecticut Co. contemplates extensions to its system in Norwalk, South Norwalk, New Britain, Berlin and Ansonia for which franchises will be asked; also construction of a line from Bridgeport to Nichols. The company asks for a revival of rights to build northward from Milford to the tracks of the New Haven & Derby Railroad.

**NEW MILFORD, CONN.**—The property of the New Milford El. Co. has been purchased by a company, recently organized, which proposes to erect a large mill here. Energy generated by the plant will be used to operate the new mill. The new company has announced that it will continue to furnish electric service to the town but will secure electricity from the Bulls Bridge plant, north of the village, serving it through a local substation to be erected.

**WASHINGTON, D. C.**—A report from an American committee states that a foreign firm, the U. S. G. Co., has secured a contract for the installation of electric power for various purposes. The power plants and repair shops are now under construction and the company is now in the market for power-house machinery, steel cables, wire, batteries, generators, electric meters, glass insulators, tools and implements of all kinds, as well as all sorts of electrical appliances, such as wires, trans., transformers, etc. For further information address No. 10,138, Bureau of Manufacturers, Department of Commerce and Labor.

**WASHINGTON, D. C.**—Proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until 1 p. m. on the following supplies: Item 1—10,000 feet cable, type 215; (2) 1200 ft. 150-pair, paper-insulated, lead-sheathed and armored cable; (3) 5000 ft. phosphor-bronze antenna cord; (4) 10,000 ft. cable, type 214; (5) 3000 ft. cable, type 308; (6) 10,000 ft. cable, type 401; (7) 2000 ft. cable, type 408; (8) 30,000 ft. outside distributing wire, 45 mils; (9) 45,000 ft. pothead wire, 36 mils; (10) 25,000 ft. single braid wire, 51 mils; (11) 3000 ft. cable, type 321; (12) 2000 ft. cable, type 324; (13) 50,000 ft. one-pair, rubber-insulated, lead-sheathed, cylindrical, braided, green, groundable type or Standard Green Arm (type 251) cable. Further information may be obtained on application to W. L. Clarke, captain Signal Corps, U. S. A., Washington, D. C.

**ST. AUGUSTINE, FLA.**—Arrangements are being made to incorporate the Jacksonville & St. Augustine Public Service Co. for the purpose of building a power plant to furnish electricity for lamps, heaters and motors. It is proposed to manufacture byproducts from the use of yellow pine as fuel, including tar, charcoal and pine oil, etc. The company will be capitalized at \$2,000,000. William F. Ellis, of Chicago, Ill., is consulting engineer; A. W. Corbett, president; John D. Andreu, vice-president; D. L. Dunham, secretary, and A. E. Baya, treasurer.

**ROME, GA.**—The City Council has engaged Solomon & Norcross, consulting engineers, of Atlanta, to prepare plans and estimates of the cost of establishing a municipal electric light and power plant.

**BRUNEAU, IDAHO.**—The Great Shoshone & Twin Falls Wtr. wr. Co., of Twin Falls, contemplates building a power plant in Bruneau. It is understood that work will start at once.

**AMHOV, ILL.**—The City Council has ordered that a contract with the Illinois Northern Utilities Co. for the terms of which 17 ornamental standards carrying incandescent electric lights will be placed on the principal streets and public squares, be put in force. The standards will be replaced by incandescent lamps attached to a neck posts 11 feet high.

**ASHMORE, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has decided to erect a power plant at Ashmore. The plant will be installed with French electricity in Ashmore, Oakland and Macomb.

**BLOOMINGTON, ILL.**—Superintendent S. S. Noble, of the municipal electric system, has recommended to the City Council the purchase of a 200-kw electric generator for the central plant plant.

**BUSHNELL, ILL.**—A committee composed of John M. Brant, M. N. P. H. Co., W. C. H. Co., S. N. Co. and C. C. Co. has been organized to secure a franchise for the installation of a power plant in Bushnell. The Pub. Ser. Co., of Mattoon, is asking for a 50-year franchise.

**CENTRALIA, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, proposes to organize the East Side El. Ry. Co., for a 20-year franchise to construct and operate an electric railway on Locust Street, Saline Street and Washington Street.

**CLINTON, ILL.**—The Clinton El. Co. has been organized and plans for the installation of a power plant in Clinton. The plant will be installed with French electricity in Clinton, Oakland and Macomb.

**DELAWARE, ILL.**—The Delaware El. Co. has been organized and plans for the installation of a power plant in Delaware. The plant will be installed with French electricity in Delaware, Oakland and Macomb.

**FRANKLIN, ILL.**—The Franklin El. Co. has been organized and plans for the installation of a power plant in Franklin. The plant will be installed with French electricity in Franklin, Oakland and Macomb.

**FREEDPORT, ILL.**—The Freedport El. Co. has been organized and plans for the installation of a power plant in Freedport. The plant will be installed with French electricity in Freedport, Oakland and Macomb.

**JERSEYVILLE, ILL.**—Steps have been taken to organize a new electric-light company. Judge H. W. Pogue and others are interested in the project.



**LINCOLN, ILL.**—The Board of Supervisors of Logan County has voted an appropriation of \$1,350 for the purpose of installing sixteen ornamental lamps about the square. The city agrees to furnish electricity and maintain the lamps for 15 years. Merchants have agreed to erect similar lamps on opposite side of the four streets.

**OHIO, ILL.**—The Illinois Northern Utilities Co. of Chicago is reported to have purchased the property of the Ohio El. Co.

**PEORIA, ILL.**—The residents of Hamilton Boulevard have started a project for the installation of an ornamental lighting system on that thoroughfare.

**PEORIA, ILL.**—The Peoria Gas & El. Co. has absorbed the electric plants at Roanoke, Eureka and Metamore, Ill., owned by the Eureka Electric System, and has assumed control of same.

**ROCKFORD, ILL.**—Business men on Fourteenth Avenue have decided to hold a meeting to interest property holders in a project for installing an ornamental lighting system on that thoroughfare.

**SHEFFIELD, ILL.**—The Kewanee El. Lt. & Pwr. Co., of Kewanee, is said to be negotiating for the purchase of the local plant owned by the Sheffield El. Lt. Co. The Kewanee company is asking for a 25-year franchise in Sheffield.

**SPRINGFIELD, ILL.**—The extension of the ornamental street lighting to several more streets is under consideration. Willis J. Spaulding is City Commissioner.

**SPRING VALLEY, ILL.**—Arrangements are being made for lighting the 3-mile strip of country road between Cherry and Arlington, and it is expected it is successful, it is expected that the road from Cherry to Ladd will be lighted in the same manner. A contract is now pending between the Commissioners of Westfield Township and the Spring Valley Gas & El. Co. for lighting the road between Cherry and Arlington.

**STERLING, ILL.**—The Illinois Northern Utilities Co., of Chicago, is reported to have offered \$75,000 for the Griswold wire plant, which has excellent water-power facilities. The wire company is in the hands of a receiver.

**WALNUT, ILL.**—The Illinois Northern Utilities Co., of Chicago, Ill., is reported to have purchased the local electric-light plant.

**WAVERLY, ILL.**—The local electric light plant, owned by H. J. Rodgers, has been purchased by the Central Illinois Pub. Serv. Co., of Mattoon, Ill.

**WYOMING, ILL.**—The Ideal Club is raising funds to install ornamental lamps in Central Park.

**EVANSVILLE, IND.**—The Evansville Gas & El. Lt. Co. and the Evansville Public Ser. Co. have consolidated under the name of the Evansville Pub. Ser. Co. The new company is capitalized at \$1,350,000, and the directors are B. C. Cobb, W. H. Barthold, A. C. Blinn, F. J. Haas, F. W. Cook, S. W. Cook and Henry Marshall.

**INDIANAPOLIS, IND.**—The Terre Haute, Indianapolis & Eastern Trac. Co. is reported to have contracted with the Vandalia Coal Co., the Coal Bluff Mining Co. and the Western Indiana Mining Co. to supply electrical energy for mining purposes, to be supplied by transmission lines for which the company has secured franchises over most of the public highways in Vigo County.

**MARION IND.**—The Marion Lt. & Htg. Co., of Marion, the Jonesboro Lt. & Wtr. Co., of Jonesboro, and the Upland El. Co. have been consolidated and will be known as the Marion Ltg. & Htg. Co. The new company is capitalized at \$1,600,000, and will furnish electricity for lamps and motors and steam heat in the towns and cities named. The directors are H. L. Finley, F. P. Hunter and M. B. Smythe.

**MIDDLEBURY, ILL.**—Pidgeon Brothers are contemplating the installation of an electric-light plant in connection with their flour mill. The generating equipment will be driven by two Curtis waterwheels, one 25 in. and the other 35 in., which now are used to operate the flour and feed mill. Three-phase, 60-cycle system will be used, but generating machinery has not yet been decided upon. Work will begin on the proposed work early in the spring.

**MONTICELLO, IND.**—The capital stock of the Monticello Tel. Co. has been increased from \$30,000 to \$60,000.

**SOUTH BEND, IND.**—The Indiana & Michigan El. Co. has increased its capital stock to \$3,500,000. The company proposes to make extensive improvements to its plant.

**WALKERTON, IND.**—The Board of Trustees of the municipal electric-light plant expects to purchase two boilers and an engine and alternator for the municipal electric plant in the spring. A. L. Freyer is superintendent.

**DALLAS, IA.**—The Consolidated Coal Co., 139 West Van Buren Street, Chicago, Ill., is preparing plans for the construction of an electric power plant, about 2 miles south of Dallas, to supply electricity to operate a coal mine. The equipment, contracts for which have been let, will include two 300-hp Oil City water-tube boilers, two stokers, made manufactured by the Illinois Stoker Co., coal-conveying equipment, made by the Webster Mfg. Co., one 600-kw General Electric steam turbine, one 1600-kw General Electric 2300-volt, 60-cycle alternating-current generator and three 25-kw General Electric transformers. Carl Scholz, of Chicago, Ill., is vice-president of the company and P. P. Reeves, of Dallas, Ia., is engineer in charge of the work.

**MARCUS, IA.**—K. C. Gaynor, of Sioux City, recently granted a franchise, will install an electric-light plant in Marcus. The equip-

ment will include a 35-kw alternating-current generator, 12 transformers, 200 poles and 100 meters. A complete stock of electrical supplies will be carried.

**MUSCATINE, IA.**—The City Council is considering plans submitted by B. C. Blackwell for substituting electric lamps for gas lamps and extending the arc-lamp lighting district.

**WEBSTER CITY, IA.**—Arrangements are being made to install an ornamental street lighting system in the business district, for which funds have been subscribed by the merchants. R. J. Mullins is superintendent of the municipal electric plant.

**BLUE MOUND, KAN.**—A special election has been called for Jan. 20 to vote on the proposition of issuing \$6,000 in bonds, the proceeds to be used to take over the property of the Blue Mound El. Lt. Co. and to enlarge and improve the same. If the proposition carries, improvements will be made to the plant and street-lighting system and a 24-hour service established.

**CANTON, KAN.**—The city of Canton is planning to install an electric-light plant to cost from \$10,000 to \$12,000. A storage-battery system is being considered. As yet no contracts have been awarded. The city has not yet engaged an engineer. T. N. Frantz is city clerk.

**CEDAR POINT, KAN.**—C. B. Avis, city clerk, writes that an election will probably not be held before spring to vote on the proposition to issue bonds for the installation of an electric-light plant.

**DE SOTO, KAN.**—Plans are being considered for the construction of a municipal electric-light plant, to cost about \$4,500. Bids will soon be received for construction of plant. Jerome Runyon, of De Soto, is engineer in charge.

**HORTON, KAN.**—The city is contemplating the purchase of General Electric transformers, wire and meters for the municipal electric-light plant. W. W. Wood is superintendent.

**SCOTT, KAN.**—At an election held Dec. 31 the proposition to issue bonds for \$40,000 for the construction of an electric-light plant and water-works system was carried. O. D. Card is city clerk.

**HARDINSBURG, KY.**—Preparations are being made by William T. Halliday, of Chicago, Ill., for the installation of an electric light plant here. Application has been made for a franchise.

**WINCHESTER, KY.**—An agreement has practically been reached between the City Council and the Winchester Ry., Lt. & Ice Co. for the renewal of the street-lighting contract. Under the agreement the company is to replace the present arc lamps (17 in number) with 400-cp tungsten lamps and to install 10 additional lamps of 100 cp; also to furnish electricity for lighting the city hall and pumping station free of charge.

**FRANKLINTON, LA.**—The Franklinton El. Lt. & Pwr. Co. is rebuilding its plant recently destroyed by fire. Contracts for machinery have been let and it is expected to have the plant in operation by Feb. 1. M. M. Magee is president.

**ANNAPOLIS, MD.**—The Annapolis Public Utilities Co., recently incorporated, has entered into a contract with the Washington, Baltimore & Annapolis El. Ry. Co. for energy for street and residential lighting in the city of Annapolis. Contracts have already been awarded for transformers, etc. It is understood that the Annapolis company proposes to erect a gas plant here.

**GARDNER, MASS.**—The Selectmen have granted the Gardner Electric Light Company permission to lay underground wires on Pearl Street from Green to James Street.

**NEW BEDFORD, MASS.**—The Board of Aldermen has refused to grant the Southern Massachusetts Pwr. Co., of Fall River, a franchise to supply electricity in New Bedford.

**ANN ARBOR, MICH.**—The contract for construction of the power, heating and lighting plant for the University of Michigan has been awarded to James Stewart & Co., of Chicago. Shirley W. Smith is secretary of the university.

**DETROIT, MICH.**—The Banner Laundering Co. has purchased a 130-kw generator from the Crocker-Wheeler Co. and is planning to install additional equipment in its plant.

**DETROIT, MICH.**—The Acme White Lead & Color Works have made arrangements to secure part of their power from the Detroit Edison Co. They will continue to use steam and gas engines.

**FORD CITY, MICH.**—The Eastern Michigan Edison Co. is making an appraisal of the electric-light equipment in Ford City with a view of purchasing same and furnishing electricity here. Electrical service is now supplied from the plant of the Michigan Alkali Co. Post office address is Waukegan, Mich.

**IRONWOOD, MICH.**—The Ironwood & Bessemer Ry. & El. Lt. Co. has increased its capital stock from \$700,000 to \$900,000.

**SAGINAW, MICH.**—The Michigan State Tel. Co. contemplates extensive improvements to its system in Saginaw during 1913, which will involve an expenditure of about \$195,000. The plans provide for an addition to its present office building and extensions to the underground conduit system, also to lay two and perhaps three more cables across the river to take care of the West Side business.

**BOYD, MINN.**—We are informed that bids will be received until Jan. 22 for the installation of a municipal electric-light plant in Boyd. Earl D. Jackson, Capital Bank Building, St. Paul, is consulting engineer.

**HASTINGS, MINN.**—Proposals will be received by the State Board of



electrical transmission, including the country roads from the Columbia River to various points at Portland.

**PORTLAND, ORE.**—The Electric Engineering Corp., 46 First Street, Portland, has secured contract for installing a 1000-kw hydroelectric development on Wind River, Washington, to supply electricity for logging purposes. The company, it is said, would like to receive prices on material and equipment needed for the project.

**ASHLAND, PA.**—The Edison El. Ilg. Co., of Ashland, expects to erect within the next eight months 5 miles of new transmission lines into the surrounding territory and to purchase one 300-hp boiler and copper wire and other supplies for line extensions. The company has just installed a 50-lamp General Electric magnetite arc-lamp system. R. D. Heaton is president and general manager and M. E. Russell, secretary.

**LEBANON, PA.**—Eight Lebanon County electric companies have been consolidated under the name of the Lebanon Valley El. Lt. Co., of Lebanon, with a capital stock of \$80,000. The companies merged are the West Lebanon El. Lt. Co., capitalized at \$5,000; Swatara El. Lt. Co., \$25,000; Hebron El. Lt. Co., \$5,000; Palmyra El. Lt. Co., \$20,000; Lebanon El. Lt. Co., \$10,000; Myerstown El. Lt. Co., \$5,000; Mill Creek Township El. Lt. Co., \$5,000, and Jackson Township El. Lt. Co., \$5,000. It is said that a large power development is planned. The officers of the company are: Joseph B. Weaver, president; Henry Weaver, vice-president; Daniel Weaver, treasurer, and Raymond S. Bickler, secretary, all of Lebanon.

**MIDLAND, PA.**—The Tri-State Ry. & El. Co., of East Liverpool, Ohio, will soon begin work on the construction of a power plant near Midland, Pa., to cost about \$2,000,000. The company has obtained control of several mines near the proposed site, to insure fuel. The J. G. White Engineering Co., 43 Exchange Place, New York, N. Y., will have charge of the work. W. R. W. Griffin is general manager.

**POTTSVILLE, PA.**—The Eastern Pennsylvania Ry. Co. is planning to build a new substation at Frackville. Work has been started on the erection of a high-tension line from Pottsville to Frackville to feed the substation.

**NEWPORT, R. I.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 8 for furnishing and installing a direct-current switchboard and station wiring at the naval torpedo station, Newport, R. I., estimated cost \$11,500. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. H. R. Stanford is chief of bureau.

**PROVIDENCE, R. I.**—City Sergeant T. Frederick Chase, custodian of the City Hall, has recommended to the City Council an appropriation to improve the lighting facilities in the building.

**SIOUX FALLS, S. D.**—Proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Feb. 3 for the installation of an electric passenger elevator and hydraulic lift in the United States Post Office and Court House at Sioux Falls, S. D., in accordance with drawings and specifications, copies of which may be obtained at this office. O. Wenderoth is Supervising Architect.

**YANKTON, S. D.**—Sealed proposals will be received at the office of John W. Summers, City Auditor, until January 29 for furnishing material, equipment and constructing water-works system for the city of Yankton, as follows: Division 1—Brick pumping station, equipped with two electrically driven centrifugal turbine or volute pumps of 300 gal. per minute capacity; one centrifugal, turbine or volute booster pump of 1000 gal. per minute capacity, belt-connected to a 60-hp distillate or fuel oil engine; remote control and automatic starter for service pumps and all necessary piping, valves and equipment. Division 2—One ingot iron tank, 400,000 gal. capacity, erected on steel tower 30 ft. high; foundations, two valves and valve chamber complete. Division 3—Trenching, laying and finishing complete the distribution system, consisting of laying 6-in., 8-in., 10-in. and 12-in. wood or cast-iron pipe, valves, 567 service connections, 44 fire hydrants, 28,310 lb. of special castings for wood pipe, or 34,424 lb. of special castings for cast-iron pipe. Plans and specifications may be seen and blank forms of proposals, which must be used, may be secured at the office of the city auditor. Plans and specifications may be secured from the engineers upon payment of \$15, which will be refunded upon return of same. Proposals for each division must be made on separate blanks.

**ELIZABETHTOWN, TENN.**—The Watauga Pwr. Co., contemplates extensive additions and improvements to its system, for which bonds to the amount of \$300,000 will be issued.

**JACKSON, TENN.**—The Jackson Ry. & Lt. Co. contemplates extending its railway up Porter Street to Winter's Grove.

**KNOXVILLE, TENN.**—The Knoxville Ry. & Lt. Co. has been granted a franchise by the Knox County Court to construct and operate lines over the Kingston turnpike. The company proposes to extend its lines to the Eastern Hospital for the Insane, 5 miles west of the city.

**SEVIERVILLE, TENN.**—Preparations are being made for the installation of an electric-light plant in Sevierville. Material for the plant has already been purchased. D. R. Shearer, consulting engineer, of Knoxville, has charge of the engineering work. Clyde McMahn is president of the company.

**DALLAS, TEX.**—The Hobson El. Co. has amended its charter increasing its capital stock from \$196,000 to \$350,000 and changing its name to the Southwest General El. Co.

**DALLAS, TEX.**—The Stone & Webster Engineering Corp., of Bos-

ton, Mass., expects to begin work on construction of its proposed electric railway, which is to run between Dallas and Terrell, a distance of about 30 miles, about March 1.

**EAGLE PASS, TEX.**—The Texas Lt. & Pwr. Co., which controls the International El. Co. and the Eagle Pass Wtr. Co., is making arrangements to furnish the Indio Ranch (consisting of about 3000 acres) with energy to operate pumps for irrigation purposes. The transmission line, it is stated, will eventually be extended to Carrizo Springs and Cometa County, and eventually up the Rio Grande as far as Los Moras.

**GRANBURY, TEX.**—The proposition to issue bonds for the installation of an electric-light plant will soon be submitted to the voters.

**ITALY, TEX.**—The Texas Pwr. & Lt. Co., of Dallas, has purchased the electric plant of the Italy Wtr. Co. and has been granted a 50-year franchise to operate an electric-light system here.

**SEADRIFF, TEX.**—The construction of an electric-light plant, water-works system and ice plant in Seadrift is under consideration. V. V. Elick and E. Salzer, of Granger, are interested in the project.

**WACO, TEX.**—The Southern Trac. Co. is preparing to make important improvements to the local street railway system. It is proposed to extend the railway and double-track portions of the system. The company is also preparing to begin at an early date the erection of a large central power station.

**WAXAHACHIE, TEX.**—The installation of a municipal electric-light plant in Waxahachie is under consideration.

**OGDEN, UTAH.**—Preparations are being made by the Utah Lt. & Ry. Co. for the erection of a transmission line to connect the southern Idaho plants with the Salt Lake City system. The proposed route will follow the shores of the lake.

**SALT LAKE CITY, UTAH.**—The County Commissioners have granted the petition of the Utah Lt. & Ry. Co. asking for an amendment to the charter purchased from the Telluride Pwr. Co. authorizing the extension of its transmission line along the Butterfield Canyon road from Lake T. Harman.

**SALT LAKE CITY, UTAH.**—The Utah Pwr. & Lt. Co. has purchased the electric plant of the Utah-Idaho Sugar Co. on Bear River, near Colinston. The Utah Pwr. & Lt. Co. proposes to increase the supply of the water in the river next summer by impounding water in Bear Lake; it also proposes to develop water-power along the Bear River to generate electricity. Contract has been made for 22,000 kw additional at the Grace plant. A new plant will be built at Onedia with an output of 24,000 kw. D. C. Jackling is president of the power company and P. B. Sawyer vice-president and general manager.

**ALEXANDRIA, VA.**—The Washington-Virginia Ry. Co., of Washington, D. C., contemplates the construction of a new substation in Alexandria.

**NATIONAL SOLDIERS' HOME, VA.**—Proposals will be received at the office of treasurer, Southern branch of National Home for Disabled Soldiers, National Soldiers' Home, Va., until Feb. 5 for furnishing material and labor for repairs to electric transmission lines, installing electrically driven sewerage pump in building No. 18 and repairs to flooring to general mess hall and also hospital dining room. F. E. Skinner is treasurer.

**CENTRALIA, WASH.**—The City Commissioners are considering the proposition of supplying electricity for lamps and motors to Fords Prairie, west of Centralia, the service to be supplied from the municipal electric light plant.

**SEATTLE, WASH.**—The Puget Sound Trac., Lt. & Pwr. Co. has been granted permission to rebuild the cable railway on Madison Street. The railway will be equipped for electrical operation. The Stone & Webster Management Association, of Boston, Mass., is general manager.

**VANCOUVER, WASH.**—The Northwestern El. Co., of Portland, Ore., has applied to the City Council for a franchise to operate a street railway and light and power system in this city.

**WAPATO, WASH.**—Plans are being prepared by the Pacific Pwr. & Lt. Co. for increasing its present hydroelectric generating system at Naches, Wash., by 5000 hp. Work will begin at once under the direction of D. F. McGee, chief engineer, of Portland, Ore.

**WINLOCK, WASH.**—The City Council has granted the Independent El. Co. a franchise to erect and operate transmission lines for the distribution of electricity for lamps, heaters and motors in Winlock for a period of 50 years.

**WHEELING, W. VA.**—The Wheeling El. Co. has applied to the Board of Commissioners of the county of Ohio for a franchise to erect, maintain and operate transmission lines on the river road from the northern corporation line of the city of Wheeling to the southern line of Brooke County for the distribution of electricity for lamps, heaters and motors. John B. Garden is manager.

**NEW WESTMINSTER, B. C., CAN.**—The British Columbia El. Ry. Co. is preparing plans for a large electric transmission project, which includes the erection of a distribution station on the corner of Edmonds Avenue, Burnaby, B. C.

**DAUPHIN, MAN., CAN.**—The Town Council has decided to install a new plant with three times the output of the present plant. The erection of cluster lamps on the main thoroughfares is under consideration.

**EUREKA, N. S., CAN.**—The Nova Scotia Knitting Co. is installing an electric-lighting system in its mills. The company will also furnish electricity for lighting the town.

**STEMACKE, N. S., CAN.**—G. R. Marshall, of Stemacke, has recently installed a lighting system in Stemacke. The electric generating equipment is operated in connection with his mill. Mr. Marshall has also purchased the electric plant of Logan & Co. in Shubenacadie and is lighting that town. Electricity is supplied by the local plant, transmitted over a 4-mile single-phase transmission line.

**TRENTON, N. S., CAN.**—The Town Council has awarded a contract to the Pictou County El. Co., of Stellarton, for lighting the streets of the town. The contract calls for the installation of 100 60-watt tungsten lamps.

**AURORA, ONT., CAN.**—The Council has passed a by-law authorizing the purchase of the equipment of the Aurora El. Lt. Co.

**BOBCAYGEON, ONT., CAN.**—The municipal electric-light plant was recently destroyed by fire, causing a loss of about \$5,000.

**DRYDEN, ONT., CAN.**—A by-law has been introduced to the Council advocating taking over the electric-lighting system of the Dryden Timber & Pwr. Co., to be owned and operated by the municipality.

**NIAGARA FALLS, ONT., CAN.**—The Niagara Falls Queen Victoria Park Commission has given the Ontario Pwr. Co. permission to enlarge its power house and install two additional units of 13,500 hp each, including turbines, generators, governors, switchboard, penstock, etc.

**OWEN SOUND, ONT., CAN.**—A by-law will be submitted to the ratepayers to authorize the issue of the \$50,000 debentures to meet an overdraft and to cover needed extensions at the municipal electric-light plant. It is suggested that automatic stokers be installed and a low-pressure steam turbine to operate by exhaust steam.

**ST. CATHARINES, ONT., CAN.**—The City Council has reconsidered its refusal to negotiate with the Hydro-Electric Power Commission and will ask the commission to submit an estimate on the cost of furnishing 2000 hp.

**STRATFORD, ONT., CAN.**—A new transmission line from Stratford to Sebringville is under consideration, for which plans and estimates will soon be prepared.

**MONTREAL, QUE., CAN.**—Plans have been submitted to the Board of Control by Superintendent Parent of the City Light Department for the location of ornamental lamp standards on St. Catherine Street from Papineau to Atwater Avenue. The plans provide for 142 standards.

**ROSTHERN, SASK., CAN.**—A by-law authorizing an appropriation of funds for the installation of an electric-light plant will be submitted to the ratepayers.

**YELLOW GRASS, SASK., CAN.**—The town of Yellow Grass is contemplating the installation of an electric-light and power plant.

**TAMPAICO, TAMAUULIPAS, MEX.**—The Tampico El. Lt. Pwr. & Trac. Co. has begun work on construction of the new electric railway to La Barra, a distance of 6 miles. A new power house is being erected, which will be equipped with machinery to develop 3000 hp. All transmission lines will be placed underground where streets are asphalted and overhead elsewhere. The company will also install a new street-lighting system consisting of 270 magnetics lamps. On the place 64 ornamental electrolights, each carrying five lamp globes, will be erected. It is expected to have the lighting system completed by Aug. 1, 1913.

## New Industrial Companies

**THE ATTIX ELECTRICAL ENGINEERING COMPANY**, of Brooklyn, N. Y., has been incorporated by Frederick Van Note, T. Attix and C. Buchard Smith, 391 Fulton Street, Brooklyn, N. Y. The company is capitalized at \$20,000 and proposes to do a general contracting business.

**THE AUTOMATIC MUSIC COMPANY**, of Brooklyn, N. Y., has been incorporated by Lina Strauss, Faust de Scio and Abram Ellenbogen, 63 Wall Street, New York, N. Y. The company is capitalized at \$25,000 and proposes to manufacture and deal in automatic electric player pianos and organs.

**THE G. A. BAUER COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$10,000 to do a general electrical manufacturing and machinery business. The incorporators are Peter Hansen, Gustav A. Bauer and Henry C. Kinne.

**THE CENTRAL WELDING & MANUFACTURING COMPANY**, of St. Louis, Mo., has been incorporated with a capital stock of \$30,000 by Adolph P. Erker, Hugo Wedemeyer, Robert Bausch and Eugene B. Dyer. The company proposes to manufacture gas-welding apparatus and deal in electrical supplies, gas accessories, etc.

**THE ELECTRIC GENERATOR & ACCUMULATOR COMPANY**, of Chicago, Ill., has been incorporated by Philip L. Knoedler, Frederick W. McKenna, Charles B. Askew, Monroe Mitchell and James M. Smitzer. The company is capitalized at \$15,000 and proposes to manufacture and deal in electrical apparatus.

**THE ELECTRICAL DEVELOPMENT COMPANY**, of New Orleans, La., has been incorporated with a capital stock of \$10,000 to deal in electrical goods and appliances, patents, etc. The officers are Lyman C. Reed, president, and Charles B. Murphy, secretary.

## New Incorporations

**PAYETTEVILLE, ARK.**—The Fayetteville Gas & L. Co. has been incorporated with a capital stock of \$200,000. The officers are: George D. Locke, president; F. F. Freeman, vice-president; W. B. Felker, secretary, and J. S. Decker, treasurer.

**SAN DIEGO, CAL.**—The Escondido El. & Pwr. Co. has been incorporated with a capital stock of \$50,000. The officers are: G. A. Thomas, E. G. Logan, W. W. Prior, Mercedith Conway and C. S. Palmeter.

**WILMINGTON, DEL.**—The Municipal Public Service Corporation has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$2,500,000. The incorporators are: H. R. Ewart, C. L. Leake and H. W. Deane.

**BRANSON, ILL.**—The Branson Tel. Co. has been incorporated with a capital stock of \$7,000 by J. S. Haller, E. D. Blinn, Jr., and R. O. Haller.

**PORTLAND, MAINE.**—The Portland Water Gas & El. Co. has been incorporated with a capital stock of \$5,000,000 for the purpose of generating, distributing and selling light, heat and power, etc. A. F. Jones is president and T. L. Crockett, treasurer, both of Portland.

**ST. LOUIS, MO.**—The Iron County El. Lt. & Pwr. Co. has been incorporated with a capital stock of \$10,000 by W. T. McCaskey, S. F. Senger, James P. Paterson, John C. Murphy and O. M. Selig.

**NORTH WESTERN, N. Y.**—The Northwestern Rural Tel. Co. has been incorporated with a capital stock of \$100,000 by D. E. Dinterlock, Sarah Dinterlock and Alice E. Dinterlock, all of North Western.

## Trade Publications

**COPPER-CLAD WIRE.**—The Duplex Metals Company, Chester, Pa., has added another to its series of leaflets relating to copper-clad wire, one of which is its copper-clad wire.

**ELECTRICAL HOUSE GOODS.**—Partrick, Carter & Wilkins, Philadelphia, Pa., is sending out Catalog No. 26, which refers to annunciators and electrical house goods. Each device is briefly described and illustrated.

**MOTORS.**—"Westinghouse Motors, Their Serviceability to All Who Use Machinery," is the subject of a sixteen-page illustrated booklet issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

**CHAIN-BELT MIXER.**—A large, striking photograph of the chain-belt mixer manufactured by the Chain Belt Company, Milwaukee, Wis., is conspicuously shown in the calendar for 1913 which this company is sending out.

**TURBINES.**—A six-page advance booklet on the Connecticut turbine has been issued by the Connecticut Turbine Manufacturing Company, New London, Conn. These turbines are manufactured in sizes from 25 hp to 500 hp for any speed.

**AUTOMOBILE LIGHTING BATTERIES.**—Recent leaflets have been sent out by the Cleveland Electric Storage Battery Company, 14 Market Street, St. Louis, Mo., relating to its storage and automobile lighting batteries and another containing a general table of lighting and ignition specialties.

## Business Notes

**THE NEW PROCESS GEAR CORPORATION.**—The new company, the New Process Gear Corporation, of Syracuse, N. Y.

**THE KORTING & MATTHESEN COMPANY.**—The new company, the Korting & Matthessen Company, of New York, N. Y.

**THE CULLENHAMMER MANUFACTURING COMPANY.**—The new company, the Cullenhammer Manufacturing Company, of New York, N. Y.

**THE WHEELER CONDENSER & ENGINEERING COMPANY.**—The new company, the Wheeler Condenser & Engineering Company, of New York, N. Y.

**THE INTERNATIONAL STEEL MAKING WORKS.**—The new company, the International Steel Making Works, of New York, N. Y.

**HESS-BRIGHT MANUFACTURING COMPANY.**—The interests of Mr. Henry Hess in the Hess-Bright Manufacturing Company, of Philadelphia, have been acquired by the Deutsche Waffen und Munitionsfabriken, of Berlin, Germany, the makers of the D. W. F. ball bearings.

**MR. MORRIS FOX.**—Mr. Morris Fox, of New York, N. Y., has been elected to the position of president of the Wisconsin Electrical Association, for the sale of Byllesby securities in the State of Wisconsin. Mr. Fox, who graduated from the School of Commerce at the University at Wisconsin, class of 1908, has been connected with Byllesby & Company for about six years.



# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 31, 1912

- 1,048,496. BRACE FOR CROSS-ARMS OF TELEGRAPH AND TELEPHONE POLES; Isaac Cline, Huntington, Ind. App. filed Feb. 7, 1912. This device is a metal cross-arm brace for erection.
- 1,048,500. CONVERTER; George W. Conrad and Harry E. Conrad, Nanty Glo, Pa. App. filed April 20, 1912. Mechanical rectifier having oscillating moving part, with actuating coils and blow magnets.
- 1,048,505. GALVANIC BATTERY; Ehen G. Dodge, South Orange, N. J. App. filed Feb. 19, 1912. The negative element, having a depolarizing oxide, is subdivided into tablets held by framework.
- 1,048,507. AUTOMATIC ELECTRIC AIR BRAKE; Edward H. Dewson, New York, N. Y., and Walter V. Turner, Edgewood, N. A. App. filed April 12, 1909. Breaking of train wires automatically applies pneumatic car brakes.
- 1,048,548. SYSTEM FOR CONTROLLING ELECTROMOTORS; Christian Krämer, Frankfurt-on-the-Main, Germany. App. filed March 11, 1910. Automatically controlled field-circuit means for compensating for generator remanence.
- 1,048,557. CONVEYANCE AND SIGNALING APPLIANCE THEREFOR; Ray H. Manson, Elyria, Ohio. App. filed Sept. 18, 1911. Push-button with resistance contact, for mounting on automobile steering wheel.
- 1,048,561. SELECTIVE SIGNALING SYSTEM; Judson McFell, Chicago, Ill. App. filed June 18, 1909. Selectors arranged for successive operation controlled by line impulses.
- 1,048,574. BATTERY TERMINAL; Roger M. Newbold, Chicago, Ill. App. filed Feb. 14, 1912. Threaded-stud lug connection for storage batteries.
- 1,048,581. CARBON ELECTRODE FOR ELECTRIC FURNACES; Berthold Redlich, Ratibor, Germany. App. filed Feb. 19, 1912. Electrode has conical metallic core to increase conductivity.
- 1,048,587. WIRE HOLDER FOR INSULATORS; Anthony J. Riefer and David E. Mays, Pittsburgh, Pa. App. filed March 29, 1912. The clamp band carries a grip socket with hasp lock.
- 1,048,588. POLE CHANGER; Charles H. Roth, Chicago, Ill. App. filed May 5, 1911. Oscillating arm makes contacts with a bank of lugs.
- 1,048,603. HYDROELECTRIC SMELTING FURNACE; Antonio Tommasini, New York, N. Y. App. filed Aug. 1, 1912. Hydrogen supplied to hearth is heated electrically to melt ore charge.
- 1,048,636. TROLLEY-LINE CLAMP; Cletus N. Allarding, Mansfield, Ohio. App. filed Dec. 7, 1910. The clamping members, arranged with lugs and apertures, from journal sockets.
- 1,048,639. TELEGRAPH SYSTEM; William E. Athearn, Brooklyn, N. Y. App. filed Feb. 19, 1912. For main-office and sub-office use, the transmission instruments are operable independently of the signals.
- 1,048,642. APPARATUS FOR WELDING BY ELECTRICITY; William D. Bartlett, Cleveland, Ohio. App. filed April 24, 1911. Means for clamping the welding jaw firmly in position.
- 1,048,645. RHEOSTAT; Willie M. Bowles and Charley O. Allen, Shawnee, Okla. App. filed May 10, 1911. Screw adjusts compression of carbon blocks.
- 1,048,646. INSULATOR FOR RAIL JOINTS; Bancroft G. Braine, New York, N. Y. App. filed July 20, 1912. Insulating end post with rail section.
- 1,048,656. TROLLEY-WIRE HANGER; John Christensen, Evans City, Pa. App. filed Sept. 18, 1911. Split washer grips wire-clamping ears.
- 1,048,661. TROLLEY POLE; Robert M. Craig, Paterson, N. J. App. filed May 28, 1912. Wheel is mounted on ball bearings.
- 1,048,670. CONTACT FOR ELECTROMAGNETIC MECHANISM; Reginald A. Essenden, Washington, D. C. App. filed March 16, 1906. Spherical plunger with contacts on pivoted and resilient arms.
- 1,048,706. BRACKET FOR CURRENT-CONDUCTING WIRES; Arie Kleinhesselink, Orange City, Ia. App. filed Aug. 12, 1912. Bracket pin with notch for second wire.
- 1,048,732. TROLLEY; Jozef Piotrowski, Uniontown, Pa. App. filed March 8, 1912. Ball-pivot mounting of trolley wheel.
- 1,048,736. INSULATING CLEAT; Benjamin Richards, Canton, Mass. App. filed May 28, 1910. Angle cleat with insulating head screw.
- 1,048,742. TROLLEY; Theodore Scherba, Pittsburgh, Pa. App. filed April 17, 1912. Hard stem swiveled in pole-end socket.
- 1,048,762. METHOD OF COOLING VAPOR ELECTRIC APPARATUS; Percy H. Thomas, East Orange, N. J. App. filed March 23, 1904. Spectrum of light-giving vapor is supplemented by that of permanent gas.
- 1,048,773. ELECTRIC BATTERY; Frederick L. White, Lakewood, Ohio. App. filed March 29, 1912. Kerosene-oil lining between positive electrode and mix.
- 1,048,798. ELECTRICALLY OPERATED ATTACHMENT FOR PIANOS; John L. Black, Hamilton, Ohio. App. filed Feb. 23, 1911. Electromagnetic hammers for drums, bells, etc.
- 1,048,809. WIRE-BENDING PLIERS; Robert F. Coleman, Philadelphia, Pa. App. filed Aug. 21, 1912. Anvils carried on jaws co-act with central bar anvils.
- 1,048,817. GYROSTATIC MECHANISM; Emil Falcke, Dresden, Germany. App. filed Oct. 26, 1910. If energy supply is interrupted, gyrostatis motor becomes generator to energize controlling apparatus.
- 1,048,819. ALTERNATING-CURRENT RECTIFIER; Charles F. Fayer, New York, N. Y. App. filed March 22, 1912. Commutating contacts are cup-shaped for spark diversion.
- 1,048,824. MAGNETIC SEPARATOR; De Nise A. Griffiths, Chicago, Ill. App. filed May 3, 1909. Scraper arms are yieldably mounted on magnetic drum.
- 1,048,832. INTERRUPTER FOR IGNITION MACHINES; Otto Heins, Edgewater, N. J. App. filed May 26, 1911. Cam-rotations period of ignition.
- 1,048,847. FUSE SWITCHES; Arthur V. A. McHarg, New York, N. Y. App. filed June 27, 1912. Fuse is de-energized when in position for removal or insertion.
- 1,048,849. WIRELESS BREAK KEY; Grier P. Mobley, San Antonio, Tex. App. filed July 10, 1911; app. renewed Nov. 19, 1912. Back contact for connection to receiving apparatus.
- 1,048,850. INSULATOR; John W. Moore, Carey, Ohio. App. filed April 6, 1912. Two-part knob, with V-notches and aligning fingers.
- 1,048,856. PROTECTIVE CASING FOR ELECTRIC METERS; Thomas E. Murray, New York, N. Y. App. filed Jan. 25, 1912. Case telescopes to give access to connections.
- 1,048,857. ELECTRIC CUT-OUT; Thomas E. Murray, New York, N. Y. App. filed May 31, 1912. Cup-shaped contacts and insulating plug.
- 1,048,858. ELECTRIC BATH CABINET; Thomas E. Murray, New York, N. Y. App. filed Sept. 16, 1912. Folding cabinet with lamps in non-collapseable tubes.
- 1,048,859. ELECTRIC FUSE; Thomas E. Murray, Jr., New York, N. Y. App. filed April 22, 1912. Refractory insulating material protects ends.
- 1,048,880. TRAIN-CONTROLLING DEVICE; August W. Reiling, Fort Wayne, Ind. App. filed Feb. 6, 1911. Electromagnet disconnects slumt winding.
- 1,048,903. CURRENT DISTRIBUTOR AND TIMER; James M. Smith, Philadelphia, Pa. App. filed Jan. 13, 1909. Cylindrical contacts and depressions.
- 1,048,913. ELECTRIC BELL; Harve Reed Stuart, Springfield, Ohio, and Frederic Schaefer, Pittsburgh, Pa. App. filed Feb. 20, 1912. Alternating-current bell with polarized cores and circuit closer.
- 1,048,928. STRETCHER FOR CABLES, WIRES, ETC.; Frederick John Aster, Rock Island, Ill., and Adolphus William Malone, Davenport, Ia. App. filed Aug. 24, 1912. Toggle-wedge grip for wire.
- 1,048,930. ELECTRIC PYROMETER; Henry Earl Beighle, East Cleveland, Ohio. App. filed June 15, 1908. Thermo-sensitive resistance in Wheatstone bridge combination.
- 1,048,978. SIGNAL DEVICE; Maurice Levison, Chicago, Ill. App. filed Aug. 28, 1907. Call may be established and released independently of generator set.
- 1,048,980. SYSTEM OF MULTIPLE AND SIMULTANEOUS TELEGRAPHY; Ferdinando Lori, Padua, Italy. App. filed Jan. 13, 1906. Mechanically and electrically tuned arrangement of vibrating wires, condensers and transformer secondaries.
- 1,048,985. SYSTEM OF ELECTRICAL DISTRIBUTION; Louis C. Marburg, Milwaukee, Wis. App. filed Jan. 7, 1910. Control of fly-wheel generator set.
- 1,048,987. ELECTRICALLY OPERATED ALARM CLOCK; Robert Maunthe, Denver, Col. App. filed Dec. 18, 1911. Contacts completed by clock mechanism.
- 1,048,992. INSULATOR; George A. Mead, Mansfield, Ohio. App. filed July 29, 1908. Body forms encircling open groove.
- 1,048,999. CONTROLLING MECHANISM FOR MOTORS; Charles R. Brann, Montclair, N. J. App. filed Aug. 7, 1908. Brake mechanism operable by relayive speeds.
- 1,049,000. SPEED CONTROL; Charles R. Pratt, Montclair, N. J. App. filed Sept. 7, 1910. Automatic controller for main motor.
- 1,049,004. SECONDARY CLOCK; Alfred L. Sohn, Los Angeles, Cal. App. filed Oct. 29, 1910. For winding and setting telegraph clocks.
- 1,049,005. INSULATING COMPOSITION AND PROCESS OF MAKING THE SAME; Charles P. Steinmetz, Schenectady, N. Y. App. filed July 29, 1911. Mixture of tale with magnesium silicate.
- 1,049,011. ELECTRICAL APPARATUS; Carl J. E. Waxbom, Columbus, Ohio. App. filed Jan. 26, 1911. Gas-proof motor casing with non-magnetic filling.
- 1,049,028. CONTROLLING DEVICE FOR ELECTRIC MOTORS; Paul H. Zimmer, Schenectady, N. Y. App. filed April 10, 1908. Two-way speed controller.
- 1,049,040. OHMMETER; Thomas William Bibb, Seattle, Wash. App. filed July 27, 1911. Adjustable galvanometer calibrated to read resistance in circuit.
- 1,049,043. ELECTRICAL MELTING AND SOLDERING APPARATUS; Willie M. Bowles and Charley O. Allen, Shawnee, Okla. App. filed May 6, 1911. Carbon stick and cup form arc electrodes.
- 1,049,044. TELEGRAPHY; Clarence M. Breedlove, Birmingham, Ala. App. filed Sept. 20, 1911. Local station circuit.
- 1,049,066. TELEGRAPH INSTRUMENT; William H. Engle, Port Costa, Cal. App. filed Feb. 21, 1912. Key with vibratory pendulum contactor.
- 1,049,070. ELECTRIC LAMP; Frank L. Fowler, Philadelphia, Pa. App. filed March 28, 1912. Grooved base to secure lamp in socket.
- 1,049,114. DYNAMO-ELECTRIC MACHINE; James Colquhoun Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed June 6, 1912. Single-ring armature with three terminals, outer two in series with field.
- 1,049,115. ELECTRICALLY OPERATED MOTOR VEHICLE; James C. Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed June 6, 1912. Wheel motors driven by motor-generator set.
- 1,049,132. WIRE-TERMINAL PLUG; Claude E. Mowrer, Ypsilanti, Mich. App. filed April 10, 1912. Pivoted jaw clamp, with lock.
- 1,049,139. TROLLEY-LINE CLAMP; Cletus N. Allarding, Mansfield, Ohio. App. filed Dec. 7, 1910. Clamp ear with swiveled head.
- 1,049,247. ELECTRICALLY OPERATED MOTOR VEHICLE; James C. Macfarlane and Henry Burge, Arc Works, Chelmsford, England. App. filed June 6, 1912. Pedal-operated controller affecting motor torque and braking.
- 1,049,253. SOUND-TRANSMITTING APPARATUS; Charles W. McGonigle, Algona, Wash. App. filed Feb. 5, 1912. Gang connection of transmitters to double diaphragm.
- 1,049,296. ELECTRIC SWITCH; Clifford E. Hain, Omaha, Neb. App. filed Feb. 29, 1912. Two electromagnets with common pole-piece and armature.
- 1,049,305. COMBINATION SWITCH AND SAFETY FUSE; James S. Johnston, Utica, N. Y. App. filed March 12, 1908. Axially telescoping switch parts.
- 1,049,308. FIRE-ALARM-BOX MECHANISM; Christian F. Klein and Edward A. Pyles, Baltimore, Md. App. filed March 27, 1911. Combination of department and local alarms.

# Electrical World

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## Regulation of Securities

The one dominant feature which appears in most of the messages of governors to the state legislatures is the insistence with which laws placing the promotion of corporations under public regulation are asked for. Ever since creation human nature has been endowed with a desire to amass fortune quickly and without labor, and all the swindling transactions that have gone on for years have prospered because of the gullibility of unsuspecting and inexperienced investors whose hard-earned cash has been exchanged for beautifully lithographed stock certificates worth oftentimes less than the cost of printing them. In those states possessing public service commissions having authority to supervise the issuance of stocks, bonds, etc., the government already exercises control and the utilities have no difficulty in disposing of securities thus vouched for. Reputable bankers throughout the country are offering such stocks and bonds to their patrons as safe investments, which also have the added advantage of paying an excellent return. In this respect, aside entirely from the power of the commissions to fix and regulate rates, the public service commission laws have been a boon to central-station companies, many of which have heretofore had to depend on the whims of local financiers for money with which to make extensions, etc. With the securities of other corporations placed under like regulation, a salutary influence should pervade the investment market.

## The Falling Copper Market

Falling prices in a freely competitive market indicate decreasing demand, increasing supply, or possibly both. When competition is limited or circumscribed, and prices accordingly are under the control of a comparatively small group of producers, price cutting is indicative as a rule of a falling off in business. This is the conclusion which seems justified by the recent drop of nearly a cent a pound in copper. The converse building up of prices under rising demands is usually a slow process, and the rise almost invariably continues until business is checked. Then comes a slump, which ordinarily takes place rather precipitously, because bona-fide buyers are proverbially conservative in a falling market, waiting until the bottom level is apparently struck. That a 19-cent base price for copper wire was unwarrantably high, all things considered, seems entirely evident, and therefore the drop comes as a relief. In the characteristic American eagerness to "whoop things up," regardless of whether the activity is fundamentally justified, is found one of the underlying causes of our typical cyclic variations in commodity prices. Perhaps the day is coming when we shall have a simpler or clearer index of prosperity as a whole, which will tend to suppress undue zeal in booming business at a rate not warranted by fundamental conditions.

## The New York Commissions

Leaving aside for the time being the question of whether the two Public Service Commissions in New York State ought, on the abstract merits of the case, to be consolidated, it seems entirely premature to take up now the matter of such consolidation. The commission for the First District is in the midst of a great piece of transportation engineering in connection with the new dual system for serving the people of Greater New York, and it should be left undisturbed to complete the gigantic task which it has already started. Disquieting rumors have been abroad for some weeks past, particularly in reference to the personnel of the commissions and the filling of vacancies which expiring terms of service will soon create. Governor Sulzer clearly has a chance to inspire public confidence in the new administration, and incidentally add to his own laurels, by his course in these matters which so closely affect the welfare of both the utility corporations and the people at large.

## One Way to Educate the Public

Even the small central station can follow with profit some plan like that now being carried out by the Edison Electric Illuminating Company of Boston, which offers gratis to local organizations the services of lecturers on electrical subjects. The Boston company's bureau was formed in response to the many requests for speakers received from local social, educational and religious bodies. Noting this, the management promptly showed its foresight by turning such a spontaneous demand into means for getting valuable publicity, charging the moderate expenses of the lecture service to advertising account. The results have been most gratifying, and a number of evening addresses have already been given in various parts of the great metropolitan and suburban district served by the company. As the company's offer becomes better known locally, it is expected that the bureau's usefulness will grow still greater. The smaller places the central-station manager will find equal opportunities to reach his constituents in a way that will be both educational and profitable. For the metropolitan company's staff of special lecturers he will, of course, have to substitute his own services or those of his commercial agent, if he has one. In either case there will be accomplished valuable missionary work in explaining some of the possibilities and problems of electric service to present and prospective consumers. To most of the population in the small town "the electric-light man" is a being of mystery, leagued with occult forces and measuring and merchandising an imponderable and somewhat suspicious commodity. In the course of an evening's friendly talk, however, the central-station man can explain something about the uses of the vague utility which courses over his wires.

telling how it is made in the power plant and suggesting new electrical applications for the home, the shop and the office.

A few simple experiments will go far toward dispelling much of the mystery of the central-station business, and opportunity should be given to have the questions of the public answered clearly and sufficiently. An exhibit of appliances and devices will help round out the domestic interest of the evening. Several of the large manufacturing companies also stand ready to loan moving-picture films in which demonstrations of apparatus are woven into attractive little household dramas. One central-station manager made his bow on the local rostrum by appearing semi-annually before the physics class at the high school. His talks proved so interesting that later he was asked to address the whole school. Meanwhile the young folks were taking home the ideas imparted, and already a direct influence was being felt by the local service in the demand for new appliances and improved lighting facilities, and even in a better understanding of the company's aims. Quick to learn, the physics pupils found they could read the meters in their own homes and those of neighbors, instilling both pride and confidence when the bills rendered later agreed with the amateur estimates. Soon the older people of the community began to request the central-station man to give some of his interesting talks at their church socials, literary societies, club meetings, etc., and now his name is a household word among the townspeople. It has taken a good deal of the manager's time and effort to be ready with an entertaining topic on each occasion, but in making this outlay he has built up a property of almost inestimable value in the friendly sympathy and understanding which the local public now has for his company's service.

### Energy for Railroad Electrification

One of the most hopeful signs pointing to railway electrification is the disposition to purchase energy for such purposes from transmission systems in existence or to be established, or even from central stations large enough to carry the load economically. If one runs back over the history of proposed railway electrification, it is unhappily self-evident that extremely little progress has been made toward the larger work, save for the substitution of electric motive power for steam on a few roads which had they been originally built a few years later than they were would have been electric from the first, and for the electrification of some tunnels and terminals practically under duress. The adoption of electric motive power in standard railway work has been confined to one or two instances, thus far of small magnitude. Upon analysis the causes which lie back of this record of apparent apathy will be found to be chiefly matters of finance entirely independent of any engineering phases of the problem. It is frankly admitted on all hands at the present time that electric traction on a large scale can be made a success and can be of great practical benefit to the roads concerned. It is well known, for example, that the electric locomotive is if anything more reliable than the steam locomotive, requiring fewer repairs and less attention. It is able to run with

safety more miles between inspections and can haul heavier loads at better speeds for the same strain on the track. Generally, too, the electric locomotive is a more powerful and reliable machine than even the best steam engine. It is equally true that the problem of distribution of electrical energy for a general trunk-line service has been pretty well cleared up and that there is no reason to hesitate about electrification on this account.

On the other hand, it is a well-nigh universal experience that railway men deep in the matters of practical management almost invariably shy at the idea of electric traction. On questioning one with this doubting mind it is generally found that the real reason for a lack of interest is the fact that his road cannot stand the expense of the change. Of course, it is known too well to need comment that most American railroads have been, first and last, very heavily capitalized, and that in pursuing the reckless policy of buying up competitors at any price many large systems have put themselves on the very last limit of their possible borrowing capacity. In short, few roads, even were they disposed to go into electric traction as a matter of obvious economy, are in a position to float the necessary securities on good terms. The present tendency toward the supply of energy for railway purposes from big transmission plants or central stations opens a way of relief which should have a very important influence on the extension of electric traction. The arrangements recently made by the St. Paul transcontinental line to electrify more than 400 miles of road, using energy to be purchased from the Great Falls Power Company of Montana, is a case in point. In this instance the great advantage of the electric locomotive for heavy-grade work will tell immensely in its favor, but, aside from this, the fact that the change can be made without compelling the road to assume the additional burden of generating the energy is a significant one. It means that the power development can be taken up and financed on its merits, with an insured market furnished by the railroad, while the railroad can go ahead with its electrification unhampered by the necessity of a heavy permanent investment in a power plant which it could not utilize to the best advantage solely on its own line.

There is no logical reason why a railroad desiring to use electrical energy should have to begin at the beginning and build a costly special plant for its service, any more than there is reason why, desiring coal, it should go to great trouble and expense in acquiring and developing coal mines. It can buy electrical energy in one case and coal in the other in many instances cheaper than it can possibly generate or mine. The great technical difficulty about a station supplying energy to a large railway electrification is that the load-factor is likely to be peculiarly bad. The railway load, with its sudden peaks and low average, can be handled much more economically in a station already carrying a huge miscellaneous output in which the relatively minor variations of the railway service sink and disappear. The gain in the matter of load-factor in a station operating both railway and miscellaneous load is enough in most cases to determine the economies of the question. Moreover, the railway load, when distributed over a considerable system, is a comparatively easy one to



handle because it has as a whole no large general peak, except in the case of purely suburban service. In any event it adds much more to the general load on the station than it does to the peak load as such, so that the net result is an improvement in the load-factor. Moreover, the diversity-factor of a large railway system is an advantageous one, so that the aggregate demand of the system for power is not excessive. For these reasons, and for the added one that a great plant operated either by water-power or by steam is able to generate energy very cheaply, a road desiring electrification should, if in a favorable locality, be able to buy energy at an advantageous figure without becoming involved in the expense incident to generation.

All through the Rocky Mountain country there is ample water-power for the electrification of all the transcontinental railroads without exceeding transmission distances now regarded as fairly conservative. As one draws into the Middle West water-powers are, to be sure, less plentiful but cheap coal takes their place and electrical energy can be and is produced in the great plants of that region at an astonishingly low figure. There is every reason, therefore, why a railroad interested in electrification should take up the task unburdened by the power-station end of the proposition. Freed from this, it should be able to undertake the organization of its distribution system and operating elements with more freedom than would otherwise be the case. We look to see extensive advances made in railroad electrification within the next decade. The great Western work to which reference has just been made is promised for completion within the next three years, and once the advantages of electrification are shown on so great a scale it is safe to say that the example will be followed in numerous other instances. The removal of the complexities of station organization and management, and the very large added first cost due thereto, will make the task of arranging electrification very much more simple than has heretofore been the case. These foregoing facts, as we have pointed out, should lead to very cheap energy supply, since the large transmission systems or central stations generate the necessary output for the railroad under more favorable load conditions than would be possible were the road operating its own power plant.

### Long-Distance Radio-Telegraphy

Long-distance radio signaling has passed out of the stage where a designer when he wished to rate an instrument merely "thought of a number" and wrote it down. With the establishing of reliable data relating to transmitter power delivery, signal intensity, distance and character of country separating the sender and the receiver, this branch has become a matter of engineering very nearly as exact as any other division of electrical science. The adoption of uniformly operating methods of generation and more rugged receivers—which are of surprising sensitiveness—together with high-musical sparks for penetration of atmospheric disturbances, has made long-distance wireless telegraphy fit for management on businesslike principles. The consistent work of the Marconi transatlantic stations at Glace Bay, Nova Scotia, and Clifden, Ireland; the pro-

posed series of British government plants linking the world, and the several transatlantic stations now in course of erection within a few hundred miles of New York, all join to indicate clearly that the dream of ten years ago is the fact of to-day. By the use of transmitters generating sustained streams of waves, working in connection with very delicate yet very stable receivers, and operating at the high speeds of automatic telegraphy, a new era of commercial radio communication seems likely to break upon us at any moment. With perhaps the assistance of multiplexing, the inherent economy of radio transmission due to its absence of investment in line wire or cable plant seems likely to make it a formidable rival of the older and more familiar methods of electrical transmission of intelligence.

A detailed description of the high-powered naval radio-telegraph plant recently completed at Fort Myer, near Arlington, Va., is given in an article by Messrs. D. H. Tuck and M. B. Hodgson, appearing in this issue. This station is the first very powerful government wireless equipment to be placed in service in the United States. Somewhat over two years ago the federal wireless officers directed their plans toward an extended chain of powerful radio-telegraph stations which would ultimately connect United States possessions throughout the Atlantic and Pacific and thus allow communication independent of cables or wire telegraphs. It was felt that a first step should be toward securing facilities for transmitting orders from Washington directly to naval vessels stationed within several thousand miles of that point. With this in view an investigation of available wireless apparatus was made, and thereafter a contract was awarded for the equipment with Fessenden instruments of a coastal station and two scout cruisers, the *Birmingham* and the *Salem*. The shore station was guaranteed capable of transmitting to the ships, by day or night, from an antenna 600 ft. high, over distances up to 3000 miles; while the ship outfits were to be able to reply over any space not greater than 1000 miles.

For preliminary trials the shore-station apparatus was installed at Brant Rock, Mass., where a 420-ft. tower was available. Early in 1910 the cruisers were sent to sea, the *Birmingham* crossing to Liberia and the *Salem* traveling southward. Communication was maintained for a number of days, the signals from shore becoming uncertain at a little over 2000 miles. The test was adjudged successful, nevertheless, from a consideration of the lower aerial height and reduced power imposed by the location selected for trial, and consequently the erection of the Arlington station was commenced. Delays through strikes held back the tower construction and the plant did not reach completion until a few months ago. The 100-kw transmitter was removed from Brant Rock and reinstalled, and a series of tests were begun, with the result that Arlington's piercing high-pitched whistling spark has already been heard in Nova Scotia, in the Canal Zone and on the Northern Pacific coast. A final test is to be made next month, in which the cruiser *Salem* is expected to receive from Arlington over more than 3000 miles, and upon its completion our government will be in possession of the first link in the group of installations, which are expected to be models of efficiency and certainty in operation.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Wisconsin Electrical Association Meeting

(By Telegraph)

The opening meeting of the fifth annual convention of the Wisconsin Electrical Association was held in Milwaukee on the morning of Jan. 15. A brief address was delivered by President Irving P. Lord, of Waupaca. A report submitted by the committee on taxation was discussed to some extent. Interest in this important subject is particularly keen at this time owing to the new income-tax law. A paper on the maintenance of arc lamps was read by Mr. L. H. Lathrop, of Menomonie.

The greater part of the morning session was devoted to the reading and discussion of a paper on "The Proposed Revision of the Standards of Electric Service Which Is Now Under Consideration by the Railroad Commission of Wisconsin," by Mr. J. N. Cadby, of the engineering staff of the commission. Mr. F. A. Vaughn, of Milwaukee, discussed the tentative rules of the commission relating to electric service. It was announced that a public hearing on the subject would be held at Madison next month. The Railroad Commission seeks the co-operation of the central-station men and had an exhibit at the convention. Several manufacturers and jobbers also made exhibits.

### Officers of Society for Electrical Development

A meeting of the Society for Electrical Development, Inc., was held on Jan. 14, 1913, at the Engineering Societies Building, New York City. At this meeting the work done by the organization committee was approved, as were also the by-laws of the society.

Immediately after the meeting of the society a further meeting was held of the board of directors, who were selected by the associations which they represent from the various branches of the industry. The complete board is as follows: Messrs. Henry L. Doherty, W. E. Robertson, A. C. Einstein, W. W. Low, J. E. Montague, Gerard Swope, W. H. Johnson, F. S. Price, J. F. Gilchrist, Roger Scudder, A. W. Burchard, Ernest Freeman, L. A. Osborne, E. McCleary, J. R. Crouse, P. N. Thorpe, B. M. Downs, J. R. Strong, W. A. Lyman and G. M. Sanborn.

The funds which have been advanced by the organization committee to carry out the organization work of the society were turned over, with all records of meetings of the organization committee, to the society, and officers of the society were elected as follows: President, Mr. Henry L. Doherty; vice-presidents, Messrs Ernest Freeman, A. W. Burchard, W. H. Johnson, J. R. Crouse and W. E. Robertson. The above, with Messrs. L. A. Osborne, Gerard Swope and J. R. Strong, compose the executive committee, on which will lie the heavier responsibilities of the further organization work of the society.

Appointments were also made of Mr. J. M. Wakeman as general manager and Mr. Philip S. Dodd as secretary-treasurer. Both Mr. Wakeman and Mr. Dodd are well known in the electrical industry and have a very intimate acquaintance with publicity problems of the kind involved in the present propaganda on behalf of electrical development.

The work of the society will be devoted to various lines of effort for the greater development of the electrical in-

dustry at large, and will be carried out along broad-gage lines aiming to increase in every way the uses of electricity, especially for lighting, heating and motor service.

It is a recognized fact that the time has come when it is not only possible, but practical, for the four different interested branches of the industry to co-operate in developing the entire business for the benefit of each and all. No one manufacturer, jobber, contractor, dealer or central station can carry out singly efficient educational work so well as it can be carried out by co-operative effort.

In the plans of Mr. J. Robert Crouse in 1905 to organize a Co-operative Electrical Development Association were embodied practically the same thoughts, ideas and plans which are expressed in the constitution of the Society for Electrical Development, Inc., and to the inspiration given at that time belongs the credit for the present society, which was outlined at the meeting held on Association Island Sept. 3, 1912, as noted in our issue dated Sept. 7, 1912.

The membership of the society, as stated in the by-laws, is open to every interest in the electrical industry, and the subscriptions, based upon a small percentage of the gross business, are so small individually that it is believed that the full co-operation of every concern in the electrical industry can be secured. In our issue dated Oct. 26, 1912, were outlined the plans for financing the society.

The society has the indorsement of the executive committee of the National Electrical Contractors' Association, the National Electrical Supply Jobbers' Association, the executive and public-policy committees of the National Electric Light Association, together with the support of a large number of manufacturers, both large and small. With such indorsement there can be very little question of its practicability and value to the industry at large.

### Midwinter Convention of the A. I. E. E.

Arrangements have been completed for the midwinter convention of the American Institute of Electrical Engineers, which will be held under the auspices of the standards committee in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, from Feb. 26 to Feb. 28. Papers for the convention have been secured with the object of providing data for the revision of the standardization rules. As will be noted, two of the papers have been prepared by sub-committees of the standards committee. These papers will be widely distributed prior to the convention in order to invite written discussions. Such discussions as are received before Feb. 10 will be printed for distribution at the convention. The other papers have been arranged in four groups as shown below.

#### SUB-COMMITTEE PAPERS

"Temperature and Electrical Insulation," by Dr. C. P. Steinmetz and Mr. B. G. Lamme, of the sub-committee on revision of rules; "Method of Rating Electrical Apparatus," by Messrs. W. L. Merrill, W. H. Powell and Charles Robbins, of the sub-committee on rating.

GROUP I—HEATING, HEAT MEASUREMENTS AND RATING BY HEAT

*Moving Machinery.*—"Notes on Internal Heating of Stator Coils," by Mr. R. B. Williamson; "Measurement of Temperature on Rotating Electric Machines," by Messrs.

L. W. Church, E. I. Chute and O. W. A. Oetting; "Method of Determining Temperature of Alternating-Current Generators and Motors and Room Temperature," by Messrs. H. G. Reist and T. S. Eden; "Thermocouples and Resistance Coils for the Determination of Local Temperatures in Electrical Machines," by Messrs. L. T. Robinson and J. A. Capp.

**Transformers.**—"Methods of Determining Temperature of Transformers and of Cooling Medium," by Messrs. S. E. Johannssen and G. W. Wade; "Methods of Measuring Temperature of Transformers," by Messrs. C. Fortescue and W. M. McConahey; "Correction of Transformer Temperature for Variation of Room Temperature, Taking Into Account Both Copper and Iron Losses," by Mr. C. Fortescue.

**Temperature Correction.**—"Temperature Rise of Stationary Induction Apparatus," by Messrs. J. J. Frank and W. O. Dwyer; "Effect of Room Temperature on Temperature Rise of Motors and Generators," by Messrs. M. W. Day and R. A. Beekman; "Effect of Air Temperature, Barometric Pressure and Humidity on the Temperature Rise of Electrical Apparatus," by Messrs. C. E. Skinner, L. W. Chubb and Phillips Thomas; "A Laboratory Investigation of Temperature Rise as a Function of Atmospheric Conditions," by Messrs. C. B. Blanchard and C. T. Anderson; "Laws of Heat Transmission in Electrical Machinery," by Mr. Irving Langmuir.

**Cable Heating.**—"Current Rating of Electric Cables," by Messrs. R. W. Atkinson and H. W. Fisher; "The Heating of Cables Carrying Current," by Mr. S. Dushman.

#### GROUP II—METHODS OF DETERMINING LOSSES IN APPARATUS

**Induction Motors.**—"Induction-Motor Load Losses," by Messrs. H. C. Reist and A. E. Averrett; "Stray Losses in Induction Motors," by Mr. A. M. Dudley; "Notes on Induction Motor Losses," by Mr. R. W. Davis.

**Transformers.**—"Losses in Transformers," by Mr. W. W. Lesis; "Stray Losses in Transformers," by Messrs. C. Fortescue and W. M. McConahey.

**Generators.**—"Determination of Load-Loss Correction Factors for Rotating Electric Machines," by Messrs. E. M. Olin and S. L. Henderson; "Load Losses of Alternating-Current Generators," by Messrs. W. J. Foster and E. Knowlton; "Notes on Stray Losses in Synchronous Machines," by Mr. F. K. Brainard; "Stray Losses in Direct Commutating Machines," by Messrs. H. F. T. Erben and H. S. Page.

**Errors of Tests.**—"The Determination of Stray Losses from Input-Output Tests," by Mr. L. T. Robinson; "Sources of Error in Efficiency Determination of Rotating Electric Apparatus," by Messrs. Elmer I. Chute and William Bradshaw.

**Brush Losses.**—"Commutator and Brush Losses," by Mr. W. N. Motter; "Brush Friction and Contact Losses," by Messrs. H. F. T. Erben and A. H. Freeman; "Methods of Determining Brush Losses Due to Contact and Friction," by Messrs. H. R. Edgecomb and W. A. Dick; "Commutation and Brush Losses," by Mr. C. E. Wilson.

#### GROUP III—METHODS FOR TESTING APPARATUS FOR PERFORMANCE

**Generators and Induction Motors.**—"Comparison of Methods of Loading Large Alternating-Current and Direct-Current Generators and Synchronous Converters for Factory Temperature Test," by Mr. F. D. Newbury; "Comparison of Methods of Making Load Tests on Alternating-Current Generators and on Induction Motors," by Messrs. E. F. Collins and W. E. Holcombe; "Notes on Methods of Making Load Tests on Large Induction Motors," by Mr. A. M. Dudley.

**Transformers.**—"Load Tests on Transformers," by Mr. J. J. K. Madden; "Sources of Error in Transformer Tests," by Messrs. W. M. McConahey and C. Fortescue.

#### GROUP IV—MISCELLANEOUS SUBJECTS RELATING TO RATING

**Oil Switches.**—"Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity," by Mr. G. A. Burnham. **Spark-Gap.**—"The Sphere Spark-Gap," by Messrs. S. W. Farnsworth and C. Fortescue. "Calibration of Spark-Gap," by Messrs. L. W. Chubb and Dr. Phillips Thomas.

**Wave Form.**—"Potential Waves of Alternating-Current Generators," by Mr. W. J. Foster; "Wave-Form Distortions and Their Effect on Electrical Apparatus," by Mr. P. M. Lincoln; "A Proposed Wave-Shape Standard," by Mr. Cassius M. Davis.

**Regulation.**—"The Experimental Determination of Regulation of Alternators," by Mr. A. B. Field; "Regulation of Definite-Pole Alternators," by Mr. S. H. Mortensen; "Generator and Prime-Mover Ratings," by Messrs D. B. Rushmore and E. A. Löf.

The opening session will be held at 10 a.m. Wednesday, Feb. 26. There will be morning, afternoon and evening sessions on each day, with the exception of the evening of Feb. 28, when a reception and dance will be held at the Hotel Astor.

#### Automobile Shows in New York

The first section of the automobile shows held in Madison Square Garden and in the New Grand Central Palace this week was devoted to pleasure cars and accessories. Owing to the inability of makers of electric pleasure cars to obtain good locations, however, electric automobiles were conspicuous by their absence, not a single manufacturer being represented in the Garden show and only four at the Palace. Electric lighting and electric starting are the features of the year in the gasoline cars, 69 per cent of the gasoline cars equipped for self-starting being fitted with electric starters. Last season the explosive-gas type of self-starter predominated, but this year only 15 per cent of the cars are thus equipped. It is evident that almost all manufacturers of gasoline automobiles are equipping their cars with self-starters regardless of the selling price of the car. The shows next week will be devoted to commercial vehicles and accessories and a large number of electric cars will be on display.

#### Annual Meeting of the I. E. S.

At the annual meeting of the Illuminating Engineering Society, held at the Aldine Club on Jan. 10, the speakers included the retiring president, Mr. V. R. Lansingh, President-elect Preston S. Millar and Secretary-elect Joseph D. Israel, of the Illuminating Engineering Society, and Mr. W. R. Addicks, president of the American Gas Institute; Mr. J. W. Lieb, Jr., past-president of the American Institute of Electrical Engineers; Mr. T. C. Martin, executive secretary of the National Electric Light Association; Dr. William H. Tolman, director of the American Museum of Safety, and Messrs. A. E. Kennelly, C. H. Sharp and L. B. Marks, past-presidents of the Illuminating Engineering Society. Both the incoming and the outgoing presidents emphasized the fact that the Illuminating Engineering Society is performing highly important work in co-operation with other societies dealing with light or indirectly with light or eyesight. The society has established reciprocal relations with thirty-two other societies, and its co-operation with them has proved highly successful. In addition to President Millar and Secretary Israel, the election of the following officers was announced: Vice-president from the Philadelphia Section, Mr. William J. Serrill; vice-president from the New England Section, Mr. J. W. Cowles; vice-president from the Chicago Section, Mr. J. R. Cravath; vice-president from the Pittsburgh Section, Mr. H. S. Evans; treasurer, Mr. L. B. Marks; directors, Messrs. C. O. Bond, P. W. Cobb and W. Cullen Morris.



## Municipal Street Lighting in Milwaukee

By a recent decision of the Supreme Court of Wisconsin, the city of Milwaukee may construct a municipal electric street-lighting plant without obtaining a certificate of convenience and necessity from the Railroad Commission of Wisconsin. In 1904 the voters of Milwaukee ratified a \$500,000 bond issue for the construction of such a municipal lighting plant. Subsequently another issue of \$150,000 was made, but this was declared illegal by the Supreme Court. A special act of the last Legislature made it legal, however. A site was acquired on Davidson Street, between Mineral and Walker Streets. The city then authorized a new bond issue for \$100,000 and \$300,000 in mortgage certificates. The proposed plant is intended to supply street lighting and illumination for city buildings, and is not to be placed in competition with private companies engaged in commercial lighting. Mr. T. J. Neacy started suit to prevent the further sale of bonds, on the ground that the city had not obtained a certificate of convenience and necessity, as required by the utilities law. The recent decision of the Supreme Court is to the effect that in this case the city need not obtain a certificate from the Railroad Commission.

Recently the Railroad Commission, which has been investigating the street-lighting system in Milwaukee, made a report in which it recommended that the city employ an illuminating engineer, to be retained permanently, if possible, and that this engineer select the types of lamps for street lighting and fix their locations.

## Chicago Drainage Canal Power

Secretary of War Stimson has made a decision refusing the additional diversion of water from Lake Michigan for the Chicago Drainage Canal sought by the trustees of the Sanitary District of Chicago. The Secretary of War says that the Drainage Canal has never received the direct sanction of Congress. He thinks that the withdrawal of 10,000 cu. ft. a second would interfere with the navigable capacity of the Great Lakes and their connecting rivers. In 1899 the Secretary of War permitted the Sanitary District to take 5000 cu. ft. of water per second from Lake Michigan. About \$70,000,000 has been spent in building the canal and the works connected with it. A water-power was created by the flow of water and a 28,000-kw hydroelectric plant has been built and is in operation at Lockport, Ill., a large portion of the electrical energy being used for the purpose of lighting the streets of Chicago. In relation to this water-power development, Mr. Stimson says that for every horse-power realized at Lockport 4 hp could be produced at Niagara, where the natural conditions are much more favorable. On the part of the city of Chicago, it is urged that the present canal represents the development of a national policy for uniting the waters of Lake Michigan and the Illinois River which goes back to 1827. The matter will undoubtedly come up in Congress, and the members from the Chicago districts hope that legislation sanctioning the additional flowage will be enacted. It is not believed, however, that any action will be taken affecting the existing hydroelectric development.

## Myriawatt as the Boiler-Horse-Power

As a result of the presentation of a paper on "The Myriawatt," by Messrs. H. G. Stott and Haylett O'Neill, at the Boston convention of the American Institute of Electrical Engineers, June, 1912, mentioned on pages 2 and 32 of the issue dated July 6, 1912, the term "myriawatt" will doubtless be officially substituted for "boiler-horse-power," by both the Institute and the American Society of Mechanical Engineers. At a recent joint meeting of committees

of these two societies it was unanimously resolved to recommend the exclusive use by the societies of the term "myriawatt" in connection with boilers, producers, turbines and engines and the discontinuance of the use of the term "boiler-horse-power." It was also resolved that Mr. C. O. Mailloux be requested to bring the joint resolution formally to the notice of the International Electrotechnical Commission at Zurich, Switzerland, Jan. 18, 1913.

The resolutions passed in this connection represent the first piece of joint standardization work that has been accomplished between two of the national sister engineering societies having their homes in the Engineering Societies Building, New York City. The resolutions indicate and recommend a simple and satisfactory method of rating the input and output of turbo-generators in terms of one and the same unit—the international watt. Instead of rating the output of a turbo-generator in kilowatts and the input in boiler-horse-power or other heap units, as at present, it becomes very convenient to rate the electrical output in kilowatts and the steam input in myriawatts, because the myriawatt is approximately the same as the boiler-horse-power while it is also exactly ten kilowatts. By this means the long-existing incongruity of stating the input and output in different and disconnected units of power will be eliminated.

## Development of the Electric Vehicle

The New England Section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston held a joint meeting at the Hotel Thorndike, Boston, Mass., on Jan. 10, the feature of the evening being an address by President Arthur Williams of the former organization on "The Development of the Electric Vehicle." Mr. Williams pointed out that there are now about 30,000 electric vehicles in use in the United States, 6000 electric pleasure cars and 4000 commercial machines having been manufactured in 1912. The early machines, which date back about twenty years, were clumsy, expensive and not always dependable, the batteries being heavy and useful only for short-distance service, besides requiring expert handling. In spite of these difficulties several models built in 1899 are still giving good service, and a truck in Philadelphia which was built in 1893 has not missed a day in the last four years. To-day the central stations are becoming aroused to the value of the electric-vehicle load and service; rates are lower for charging and the fields of the electric and gasoline machines are more clearly defined.

In New York the number of electric vehicles in service grew 45 per cent between the summers of 1911 and 1912, and in the last two years electric trucking has increased 400 per cent in Chicago. President Williams accorded high praise to the Boston Edison company's electric-vehicle campaign and to the work of Past-president W. H. Blood, Jr., in connection with the development of the industry. Since the Public Service Corporation of New Jersey entered the campaign two years ago the number of electric vehicles in its territory has risen from 139 to 440 and the average cost of charging service has been reduced from slightly over 4 cents to about 3.5 cents per kw-hr. In the past three years the number of commercial electric vehicles in Boston and vicinity has risen from about sixty to nearly 300. About 80 per cent of the commercial "electrics" are used east of the Alleghenies, the heaviest demand for pleasure cars coming from the Middle West. Chicago operates 2200 of the latter and New York 1700 trucks and delivery wagons of the electric type. The speaker emphasized the important part the association has played in harmonizing the manufacturing, central-station and accessory interests. In two years the original twenty-nine members have grown to 350, representing seventeen electric vehicle makers, fifty-six central stations and some ten manufacturers of accessories, with a combined capital ac-

count of over \$500,000,000. The standardization of the charging plug and garage sign and the stimulation of the garage business, the national advertising campaign of the last two years and other activities of the organization were outlined. A fund of at least \$42,000 will probably be raised again this year for publicity. Ten years ago the price of energy for charging averaged about 23 cents per kw-hr. throughout the United States compared with from 5 to 3 cents to-day. Meanwhile the price of gasoline has risen from 10 to 24 cents a gallon, and higher prices are probable. Electrical energy tends to fall still lower in price, particularly for off-peak loads.

Mr. Williams brought out the point that a recent investigation of the battery-charging load curve in New York, with special reference to the express business, showed that with no restrictions on the use of energy demand was not made for a single kilowatt-hour before 7 p. m., in spite of a total consumption at the rate of 1,000,000 kw-hr. a year. The off-peak character of the load is thoroughly established. Referring to the selling situation in New Jersey, the speaker showed by analysis that 185 gasoline automobiles in the electric-truck class are the products of ninety-eight makers, while 191 comparable "electrics" came from only nine factories. Nine electric competitors were able to sell more cars than ninety-eight opponents. An output of 15,000 electric vehicles is predicted by some authorities for 1913. Within a few days the New England Casualty Company of Boston has notified the Electric Vehicle Association of America that after a careful study of conditions the company has arranged to grant a large reduction of rates to electric vehicles, a decrease which will bring electric motor car insurance 20 per cent below prevailing rates for gasoline machines.

The importance of the electric truck as a means of raising the efficiency of terminal and warehouse delivery service was discussed at length, and Mr. Williams stated that enormous savings in time, money and transportation charges ought to be realized through the substitution of the motor truck for the slow and cumbersome horse. Street congestion can be greatly decreased by the use of electric trucks at night. It is estimated that the electrification of the trucking service to and from six of the important railroad terminals in Chicago would save \$4,320,000 a year in transportation. Such economies would tend to decrease the retail cost of many articles. In closing, the speaker drew an inspiring picture of the future of electric trackless transportation and outlined the further usefulness ahead for the association in promoting co-operation, standardizing equipment, establishing new branches—Boston, New York, Chicago, Philadelphia and San Francisco now being represented in this way—and in stimulating the public, the manufacturer and the central station to further the use of this important economic agency.

#### Discussion

An extended discussion followed the presentation of Mr. Williams' address. Past-president Blood called attention to the great value of statistics in the development of the industry and cited an increase in the riding habits of many American cities of about 100 per cent in the past ten years, as deduced from a recent extended investigation of per capita travel per year in many parts of the country. Facilities for quicker transit stimulate patronage, and the electric vehicle is bound to feel the effects of this tendency. Mr. Converse D. Marsh, New York, emphasized the importance of a horse census in mapping out the electric vehicle market in any city, and gave \$190 as a fair average cost of horse feed and bedding per year. This money should, with a proper reduction for the increased efficiency of the electric vehicle, be turned into the coffers of the central station instead of being consumed by the thousands of isolated plants walking the streets on four legs. Mr. W. P. Kennedy, New York, described an investigation of

several weeks' duration into the location of stables and cost of horse provender in Greater New York, which resulted in the card indexing of substantially every horse installation in the city. There are 120,000 horses in the metropolis, with a feed bill of \$27,156,000 per year. In the solicitation of electric-vehicle sales a knowledge of these horse costs in individual cases is most valuable.

Dr. Harold Pender, Boston, touched upon the saving in time possible by motor trucks compared with horse-drawn vehicles in railroad yards, basing his remarks upon extended observations by the Massachusetts Institute of Technology. The work can be done in about 60 per cent of the time by a motor truck, according to timing tests upon 200 teams and forty trucks of 3.5-tons average capacity. Delays are cut down and backing up, loading and movements in congested areas and streets are greatly improved by the electric truck. Colonel E. W. M. Bailey, Amesbury, Mass., pointed out that the electric passenger car will now perform about 90 per cent of the service required by an automobile owner and at 25 per cent less cost. Mr. D. C. Tiffany, Boston, cited an instance where a former gasoline touring car owner had disposed of his machine in favor of an electric car, having recourse to a hired gasoline touring car for long trips with large parties. The resulting economy proved to be striking. Mr. S. Fred Smith, Salem, Mass.; Mr. M. J. Fitch, Lynn, Mass., and Mr. Day Baker also spoke briefly, Mr. Baker laying special emphasis upon the adequate battery equipment of the vehicle units in the Springfield (Mass.) fire department service. Mr. F. J. Stone, Boston, pointed out that interchangeability of batteries should present no mechanical difficulties where service conditions render it desirable.

#### Activities of the National Contractors' Association

Mr. Ernest Freeman, president of the National Electrical Contractors' Association of the United States, gave an account of the work of that organization at the luncheon of the Electric Club of Chicago on Jan. 9. The association has now about 1250 members. One of its accomplishments has been the introduction of standard symbols in wiring plans. It issues a "Universal Data and Sales Book," which is of much value to contractors, jobbers and dealers. This book, bound in loose-leaf style, gives wholesale and recommended re-sale prices on practically every item entering into electrical construction work. It also contains data sheets showing wage scales, inspection charges, etc., in various cities. The proper way to figure cost of doing business is explained. This book is sold to members and is kept up to date by renewal sheets issued from time to time from the association's office.

Another important feature of the association's work is co-operation with the National Fire Protection Association in the consideration, amendment and harmonizing of the National Electrical Code for electric wiring. The contractors are also trying to bring about standardization in such matters as the shape and dimensions of cut-out boxes and the finishing (as "oxidized copper," for instance) of lighting fixtures. A committee of the association on legislation keeps track of such matters as laws in progress and laws relating to the licensing of contractors in the various states. It has also done useful work in publishing charts showing the size and disposition of wires going into the various sizes of conduits. Mr. Freeman spoke with approval of the work of the new Society for Electrical Development, Inc., with which the association of which he is president is co-operating. One thing that this society may take up is an investigation of the careless and usually un-  
 founded statement that "the fire was caused by crossed electric wires." The speaker also referred to the *National Electrical Contractor*, the organ of the association, and described the methods adopted to build it up.



## H. M. Byllesby on Centralization of Public-Utility Management

Since 1881, when as a youthful draftsman employed by the Edison Electric Light Company he assisted in making the plans for the historic Pearl Street station in New York City, Mr. H. M. Byllesby has been in close touch with electrical public utilities in this country. He is the president of H. M. Byllesby & Company, which he established ten years ago. This company, with headquarters in Chicago, operates forty-one public-utility companies scattered throughout seventeen states of the Union, from West Virginia to California. Mr. Byllesby is therefore in a position to speak with knowledge of modern tendencies in the operation of public-utility properties, and undoubtedly the most pronounced of these tendencies is that toward unification of control or ownership. He was asked for his views on this subject by a representative of the *Electrical World*, and in answer to a number of questions authorized the statement which follows:

### A MOVEMENT THAT IS WELL CONCEIVED

"A movement has been going forward more or less continuously during the last fifteen years in the direction of placing the control and management of local utilities in different communities, which may be remote from each other, in the hands of one central organization. This movement probably had its inception as far back as the early work of the Thomson-Houston Electric Company, under the guidance of Mr. C. A. Coffin, or, still earlier, the work of the United Gas Improvement Company of Philadelphia, and subsequently that of Emerson McMillin & Company and Messrs. Stone & Webster. It has progressed with great rapidity during several years, and notably so in the year just closed. It is bottomed on sound economic principles and violates no theory regarding 'restraint of trade.'

"I believe the movement is well conceived and that, being economically sound in its principles, it will continue. The manifest advantages of the placing of the control of a greater or less number of utilities in the hands of one central management and control are so evident that they scarcely require notice. They embrace notably the beneficial and economic features which are mentioned below.

### ADVANTAGES ENUMERATED

"(A) The purchasing of fuel, apparatus and supplies in wholesale quantities, for prompt payment in cash, with a resultant saving to the members of the group, as against their individual retail and haphazard action.

"(B) The standardization of methods of construction, accounts, apparatus and methods of conducting the business.

"(C) The proper handling of various classes of insurance, which can be done at a saving by a central organization dealing with large amounts, as against results to be reached by the individual properties independently. This applies equally to the placing of insurance with insurance companies or the carrying of the insurance by the combined properties themselves, which would be problematical in isolated situations.

"(D) The placing at the call of the individual utilities comprising any given group of a central expert staff, competent from broad experience to deal with the various complex problems confronting the utility business. These include engineering, construction, publicity, legal questions handled by an experienced, competent staff, and auditing.

"(E) The facility which this grouping affords for the economical finding of capital to supply the continual demands for extensions and enlargements of practically every utility situation.

"(F) The working out by the central organization of methods and appliances, looking to the further sale by the individual companies of their product, embracing gas, power, light, heat and transportation.

"(G) In addition to the foregoing, in a great many cases, is the foundation of the manufacturing plant by means of which one large modern, economically operating and generating plant can supply the product of what otherwise would be a number of smaller and more expensively operated stations.

"(H) By this grouping a number of utilities—each of them at a cost entirely with its means—are placed in possession of the benefits above recited, which would be largely if not totally beyond their reach under separate or isolated ownership and management.

### WHY THE PLAN IS NOT INIMICAL TO THE PUBLIC INTEREST

"There is not an item in the foregoing inventory which is repugnant to any proper conception of economics or which leads to unfair restraint of trade or the curtailing of development, or violates any of the principles so prominently before the public at the present time. On the contrary, this plan, which centralizes the management and control of properties in different communities, is in accordance with the spirit of the times and along the lines of wise and economical practice.

"As in all developments, whether of the privilege and rights of the voter, whether as to the passing and administration of laws, the government of municipalities or the administration of the individual affairs of the commercial world, or in manufacturing or in private life, mistakes, errors and frauds are possible. This possibility, indeed, as everyone recognizes, is part and parcel of the primary conditions of human existence and will be so until Utopia is reached. In the theory of grouping, as such, however, and as practised so far as I know up to the present time, the results have been most satisfactory to the communities served and to investors. Many a small community to-day has at its call gas, electricity and transportation service of an excellence and at a cost which have been made possible only by the carrying out of the groupings herein referred to and which otherwise would have been totally and perpetually impossible. Where these groups of utilities are properly administered and carefully managed, the securities bottomed thereupon are fast taking their place among the soundest before the public. This is entirely in accordance with the results which should follow the facts.

### ON THE QUESTION OF REGULATION

"If the action of the governing bodies before which the utilities companies are compelled to appear is wise and prudent (and I believe the intention of the members of such governing bodies is to be judicial and fair), there will be nothing to interfere with the continual growth of such properties and their continued ability to provide, at a reasonable cost (in fact, it should be at the lowest cost), the capital required for their further useful and profitable development.

"A tendency of the times, however, should be checked. At least in some quarters, this tendency looks to the hampering of such corporations by unfair rules and legislation and results in taking from these corporations the thing which in the past has rendered their development possible; that is, the great and often underestimated element of personal enterprise and creative work.

### THERE SHOULD BE A REWARD FOR PERSONAL ENTERPRISE

"Enterprise and creative work can continue only where, while preventing unfairness and fraud, rewards are allowed to follow the results of intelligent, successful enterprise. The history of economics points unerringly to the deduction that where laws and regulatory measures go beyond their proper function and dip into the unfathomable depths of paternalism and restrictive measures they always have resulted and always will result in putting a period to development and enterprise. In place of these, paternalism brings about the dead level of mediocrity, such as seems heretofore to have been its attendant, as emphasized by the large in-



efficiency of governmental bureaus, their officers and employees (with certain notable exceptions) working under the deadening conditions of their employment.

"It seems a grievous error to deal unfairly with these problems and thus destroy that magnificent creative capacity which has so distinguished the growth of the United States of America. The mass of our citizens will surely not be helped by any such course; the laboring man surely will not be, and if these measures should unfortunately (which I cannot believe) be carried to their extremes, we should shortly be endeavoring, when perhaps too late, to bring back to this country that constructive genius and that daring enterprise which have been great moving forces in our development."

### Recommendations of Governors on Public Utilities

In last week's issue were printed abstracts of the recommendations of numerous governors bearing on public utilities. Excerpts from other messages which have been delivered during the week are given below. Aside from the very general desire for public service commissions in those states not already possessing them, and the strengthening of public utility acts in other states, there appears to be a unanimity of opinion on the moral obligation of the state to protect its citizens against stock-jobbing propositions. Very many of the governors have expressed themselves in no uncertain terms on this subject in suggesting legislation for the control of securities.

#### MICHIGAN

In his inaugural address to the Legislature, Governor Woodbridge N. Ferris of Michigan asked that the powers of the railroad commission be enlarged so as to cover all of the public utility corporations of the State. He recommended that the commission, which now has power to fix rates and regulate the practice of railroads, telephone and power companies, be authorized to make physical valuations of all such properties as it may deem advisable in order that the rates fixed may return reasonable dividends on the actual cash invested. The Legislature was also requested to enact a law similar to the "Blue Sky" law of Kansas, prohibiting the sale of stocks and bonds of any company until the matter has been investigated and approved by the railroad commission.

#### MONTANA

Governor S. V. Stewart, in his first official communication to the Legislative Assembly of Montana, made a plea for a public service commission law, the enforcing of which would devolve on the present Board of Railroad Commissioners, in order to obviate the necessity for and expense of a new commission. A law providing for the supervision of all investment companies and promotion enterprises in the State was also suggested, as well as a law regulating the appropriation and use of water for power purposes. Another piece of legislation recommended by the Governor was a law defining the liability of employers and regulating compensation of employees for accidents received in the course of employment.

#### WISCONSIN

In his message to the Wisconsin Legislature Governor Francis E. McGovern renewed his recommendations for water-power legislation. The first reason assigned for such legislation was the need of public control of the location, construction, height and strength of dams, their sluices and spillways, in the interest of improvement in navigation and safety to life, health and property. In the opinion of the Governor, the State in the exercise of its police power has ample authority to regulate this whole subject in the interest of public safety and the general welfare. The second reason for such legislation was given as

the desirability of providing now for attaining ultimate ownership and operation by the public of all water-powers in the State. This object, it was stated, can be accomplished by providing just and satisfactory means for the condemnation of dams, water and power sites and riparian rights by public utilities, municipalities and the State itself whenever it shall have the constitutional power to acquire and operate them. The third argument given is the desirability of prompt development of water-powers and the harmonizing of public and private rights upon a basis just and fair to all. In addition, Governor McGovern expressed the opinion that in so far as hydraulic energy is required for public purposes the State should reserve the right to compel the maximum development of water-powers for which franchises are granted. In all authorizations to build dams it should require, in cases where the energy may be used either within the State or outside its borders, that its own citizens shall have the preference.

#### MISSOURI

In his inaugural address Governor Elliott W. Major of Missouri recommended the passage of an efficient public service commission law, with adequate powers given to the commission to fix and regulate freight and passenger rates, express rates, telegraph and telephone rates, the charges of electric light, gas, water and power companies and all other public-service corporations doing business in the State. The commission should have authority to supervise the issuance of stocks and bonds and other evidences of indebtedness and also the further power to ascertain the value of the physical properties of the public utilities coming within the provisions of the act. The salaries of the commissioners, he said, should be fixed at a reasonable amount commensurate with the service required of the commissioners and other employees and sufficient to insure that able and competent men will be willing to serve upon it.

#### MINNESOTA

In his second inaugural message to the Legislature of Minnesota, Governor Adolph O. Eberhart voiced the necessity of creating a department of public domain to control the State lands, timber and minerals, as well as waterways, water-powers and drainage. Very few states, he said, possess greater water resources than Minnesota, and if every section of the State is to be developed so as to secure for every home, farm and industry the cheapest method of transportation as well as the cheapest light, heat and power, it is of vital importance that the State shall consider the regulation of water rights and water-powers and not delay action until they have been acquired by private enterprise. On the subject of public utility commissions the Governor said that public utilities must be either owned or controlled by the people. Where the control can be vested in a fair, impartial and competent authority removed as far as possible from political influence it is far superior to ownership. It has been found by experience that it is very difficult to keep municipally owned plants out of politics, and the Governor stated that as a general principle the state or city should not go into any business which can be transacted as well by individuals. He suggested that the Legislature enact a utility law that will bring the greatest benefits to the people at large and also a law preventing the issue and sale of stocks and bonds which have little or no value.

#### OHIO

While the existing law gives to the Ohio commission the right to make a physical valuation, Governor James M. Cox in his first message to the Legislature suggested that the law be made mandatory. The home rule amendment recently carried gives the municipality the right to own and operate utilities, and the Governor maintained that the Utilities Commission should have the right to enforce the same system of uniform accounting on municipally operated

utilities as is now imposed upon private enterprises; otherwise the public will have no means of knowing whether municipal plants are conducted along the lines of efficiency and economy. Simple fairness suggests that in the operation of utilities both private and public ownership must be subject to the same standards of ethics and government. He also suggested a law providing that, in controversies between the commission and a public utility, a court should not be permitted to issue an injunction in rate matters without an investigation.

#### Iowa

Governor G. W. Clarke of Iowa in addressing the members of the Thirty-fifth General Assembly said that it can and ought to render a great public service by passing a well-considered public utilities bill. While the State has the power to control all public service corporations, it seemed to the Governor that its intervention should only be to supervise and regulate in the interest of the common good. In his estimation the local municipality should govern and control so far as it can, and the State should add its strength where municipalities cannot obtain the experts and legal ability to cope with the syndicate. No conditions should ever be allowed to exist, according to Governor Clarke, that place an individual or a group of men at a disadvantage in dealing with a combination of men and money, and especially with corporate organizations authorized by the State to render a public service. He felt it to be the duty of the State to help the municipality in the matter of valuation of plants, reviewing of rates, examination of books, cost of maintenance, and such matters, to the end that the public shall have good service at fair rates in the matter of public necessities, water, light, heat and transportation.

#### COLORADO

Governor Elias M. Ammons in his inaugural address to the members of the Nineteenth General Assembly of the State of Colorado, after expressing the hope that the General Assembly will enact a measure to eliminate from the State bad promotion schemes of all kinds, voiced the need of effective regulation of public utilities in the interest of good service and just rates. The Railroad Commission of the State, he said, proposes amendments to the law under which it is operating to make it more effective but suggests no plan for including other public utilities. Bills have also been prepared which comprehend the entire field of public utilities, and the Governor expressed opposition to two commissions so long as the matter could be handled by the Railroad Commission. He said it is exceedingly important, if the State is to insure a more liberal policy from the federal government in opening up its natural resources such as water-power, that it shall take some affirmative action to control these resources against monopolization. While at the recent election the people voted down two measures for the control of public utilities, the Governor felt that the faulty provisions contained in both were quite sufficient to account for their defeat independently of the real question at issue, and that the vote is no indication that the people are opposed to proper regulation.

### Public Service Commission News

#### MASSACHUSETTS COMMISSION

The Massachusetts Gas and Electric Light Commission has issued an exhaustive decision reducing the price of gas in the city of Haverhill from 85 to 80 cents per 1000 cu. ft., following a protracted investigation arising from complaints by the Municipal Council and by consumers supplied by the Haverhill Gas Light Company. The decision includes an extended discussion of the conditions involved, contrasts the contentions of the parties and reviews the policies of the State in relation to public-utility

regulation, with particular reference to capitalization, return upon the investment, depreciation and surplus accounts. A large part of the decision sets forth the views of the commission along lines of interest to electric as well as gas service companies.

A feature of the case was a motion of the company, which is one of the Stone & Webster properties, to dismiss the complaints because of estoppels alleged to exist against the complainants. In 1910 the Municipal Council granted a franchise to the Haverhill Gas Company, a new corporation organized by the same interests, including price stipulations among the conditions of the grant. The complaint was brought in part by the Municipal Council of 1911, and the board holds that such action was legal in view of the fact that the Municipal Council has no authority to fix prices, such being the function of the commission.

The company contended that a fair price should cover its operating expenses, an allowance for depreciation and a fair return upon the value of its property at the time the controversy arose, including its franchises and privileges, that such value may be proved by the actual cost and reproduction cost of the property and by the amount and market value of its stock and bonds, and that the fixing of a price which will not afford a fair return upon such value amounts virtually to confiscation. Taking its actual cost of 62 cents per 1000 cu. ft. and allowing 8 cents for depreciation and a return of 22 cents, or 6 per cent on \$900,000, for the value of its property and annual sales of 250,000,000 cu. ft. to a population of 44,000, the company claimed that a fair present price would be 92 cents, and that the reduction which might come with an increased output was already anticipated in the price of 85 cents which it had already offered.

The city urged that the fair price depends upon the cost at the burner, including a proper allowance for repairs, renewals and depreciation, and a capital charge based upon the capital stock duly issued, and not necessarily upon the value of the property owned by the company. The city contended that 60 cents was a fair and liberal price, allowing 3.5 cents per 1000 cu. ft., or a return of 10 per cent on the capital stock outstanding. The company claimed that its surplus was built up because it had for many years refrained from dividing all the earnings which might have been legally and properly declared in dividends.

Discussing the policy of the State with respect to security issues, the board emphasizes the plain legislative purpose to prevent the issue of stock for anything besides cash and points out that the prohibition of stock dividends and the provisions for the sale of additional stock at auction or its distribution to the stockholders at a price not so low as to be inconsistent with the public interest are also indications of an early and consistently maintained purpose to prevent surpluses accumulated out of earnings becoming the basis, directly or indirectly, for the issue of stock. On the other hand, no specific limitation has ever been placed upon rates or dividends with a view possibly of rewarding zeal in the skilful conduct of the business and imposing upon the directors, subject to the check of public opinion, a consideration of the welfare of the shareholders and the equities of consumers in the surplus to which they had contributed. The whole body of legislation is plainly designed to allow no capital stock to be issued save for physical property necessary for proper corporate purposes, to keep the authorized issue of capital stock as low as market and other conditions warrant, to compel publicity of corporate affairs, and, on the other hand, to secure the community from the wasteful effects of competition by the exclusion of others from territory already adequately and efficiently supplied, and to provide upon complaint a compulsory regulation in price and so to create a status favorable to low rates and adequate service.

The board states that, in view of the fact that the company has borrowed its present floating debt at an average

rate not exceeding 4.5 per cent and that stocks of successful gas companies in the State are continually traded in on nearly as favorable basis, the allowance of a return of less than 6 per cent is not subject to the charge of confiscation. The several valuations set forth by the parties with such "delusive exactness" should show that rate-making has not yet achieved the position of an exact science. The commission believes that the price named is fair and reasonable and that it will be sufficient to cover all reasonable operating costs, a reasonable allowance for depreciation and a fair return upon the value of the property which the company is actually and necessarily employing for the public convenience. In viewing the subject of depreciation the board states that any future depreciation allowance is the measure of those demands which intelligent management and a wise foresight find necessary for maintaining the property at its normal efficiency. Provision for depreciation, according to the board, is designed only to keep a plant good. The commission points out that it cannot concede the company's claim that franchise or going-concern value should form a part of that property on which a reasonable return should be based.

#### OHIO COMMISSION

On complaint of a moving-picture theater against the Middletown Gas & Electric Company, Middletown, the commission has issued an order reducing the rate. The theater possesses a lighting plant, but maintains a connection with the central station also. For this service the company made a charge of \$3 per kw a month in addition to 3 cents per kw-hr. for energy used. The connected load was 8 kw, making the fixed charge for the service \$24. The commission ordered that there should be no charge for energy used until an amount equaling \$24 a month has been consumed. With this order was another increasing the rates charged for energy actually used. For less than 150 kw-hr. the rate is to be 10 cents; for 300 kw-hr. 9 cents; for 600 kw-hr. 8 cents, and for over 600 kw-hr. 7 cents.

#### MARYLAND COMMISSION

The Public Service Commission of Maryland has handed down a decision in the long-pending case against the Consolidated Gas, Electric Light & Power Company of Baltimore, ordering the company to establish a gross rate of 90 cents per 1000 cu. ft. for gas and 80 cents if bills are paid within ten days. The company is also ordered to file with the commission before June 1 wholesale rates based upon the quantity of gas consumed, these rates to be subject to the approval of the commission. The new rate ordered by the commission for electrical energy is 8.5 cents per kw-hr., with a minimum charge of \$1 monthly. The company was also ordered to revise the terms and conditions under which electricity is now being furnished to the consumers. The new rates, which become effective July 1, compel a reduction of 10 cents in the base rate for gas and of 1.5 cents in the base rate for electrical energy. On the present basis of consumption it is estimated that the loss in revenue from gas will amount to \$337,000 and that from electricity to \$165,000.

#### NEW YORK COMMISSIONS

The Public Service Commission; Second District, has received a complaint from Mayor William Laughlin of the city of Niagara Falls, directed against the Buffalo & Niagara Falls Electric Light & Power Company as to charges for electricity by that corporation. The commission is asked to make an investigation and fix the reasonable maximum prices to be charged for electricity to be hereafter supplied to the city and its inhabitants. The rates now charged are \$52 per annum per lamp for arc lamps for street lighting, 8.3 cents to 3.75 cents per kw-hr., and \$25 to \$35 per hp per annum for energy for motor circuits.

## Current News and Notes

**DIESEL-ENGINE PROPULSED SHIP CROSSES ATLANTIC.**—The *Eavestone*, the first Carls Frères two-cycle Diesel engine to cross the Atlantic, arrived in Norfolk, Va., recently, after a voyage of about 4300 miles from Portugal, with a load of ore. The voyage was made in eighteen days and eighteen hours. The total amount of fuel oil consumed was 73½ tons, an average daily consumption of 7800 lb.

**WATER-POWER IN MICHIGAN.**—In a paper read recently before the Michigan Engineering Society Messrs. L. E. Ayres and B. K. Holland estimated the twenty-four-hour supply of water-power available in the State of Michigan at 631,500 hp, with possible annual income, at the rate of 1 cent per kw-hr., of \$39,000,000. Prof. Homer A. King of the University of Michigan urged an invention of the streams of the State.

**GIFTS TO ELECTRICAL DEPARTMENT, UNIVERSITY OF COLORADO.**—The electrical engineering department of the University of Colorado at Boulder has recently added to its laboratory equipment a 100-lamp Brush arc-lighting machine, a number of series arc lamps, a Wagner booster and several transformers, the gift of the Denver Gas & Electric Light Company of Denver. A 60-kw single-phase Westinghouse generator with exciter has also been presented by the Glenwood Light & Water Company, Glenwood Springs, Col.

**CIVIL SERVICE EXAMINATION FOR ELECTRICAL ASSISTANT.**—An open competitive examination for electrical assistant will be held on Feb. 26 at the places mentioned on Circular No. 81 issued by the United States Civil Service Commission. The salary is \$1,080 per annum. Applicants should be familiar with the practical side of electricity as applied to telegraph, telephone and kindred engineering and should be familiar also with the equipment and methods of installation of telephones, storage batteries, motor generators, auxiliary power switchboards, telephone switchboards and with wire and radio-telegraph apparatus. Form 1312, which can be had from the Civil Service Commission, contains the requirements for applicants desiring to take this examination.

**CHICAGO JOVIANS PLANNING A FORWARD MOVEMENT.**—At a dinner given by the members of the Jovian Order in and near Chicago on Jan. 10, Mr. A. A. Gray presided and speeches were made by Messrs. John F. Gilchrist, of the Commonwealth Edison Company; Mr. Ernest Freeman, president of the National Electrical Contractors' Association; Mr. Sam A. Hobson, past Jupiter; Mr. Eli C. Bennett, of St. Louis, Mercury; Mr. Frank J. Watts, of New York, reigning Jupiter, and Mr. George C. Richards, of Chicago, past Jupiter. Mr. Watts spoke of the need of patent reform in the United States and said that the order would appoint a committee on the subject in order that its influence might be exerted for the purpose of improving present conditions. Of the Old-field bill now pending in the House of Representatives, he said that it has many good features but that the compulsory licensing provision is objectionable. No bill of this character should be passed, Mr. Watts thinks, until it is considered carefully by a patent commission of business men. All the speakers dwelt on the great practical value of co-operation, for which Jovianism stands, and plans for strengthening the order in Chicago and its vicinity were discussed. It is expected that Jovianism will be held about the first of March and that another, on a very large and impressive scale, will be carried out during the annual convention of the National Electric Light Association in Chicago, the first week in June.



## SOCIETY MEETINGS

**WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS.**—The convention of the Western Association of Electrical Inspectors will take place at the Planters' Hotel, St. Louis, Mo., Jan. 28, 29 and 30. Besides a number of papers there will be committee reports covering all sections of the National Electrical Code.

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**ST. LOUIS ENGINEERS GIVE A DANCE.**—The St. Louis Section of the American Institute of Electrical Engineers announces a formal dance at the Missouri Athletic Club on the evening of Jan. 25. Mr. S. N. Clarkson, power engineer for the Union Electric Light & Power Company of St. Louis, is chairman of the committee in charge.

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**INSTITUTE OF CONSULTING ENGINEERS.**—At the annual meeting of the American Institute of Consulting Engineers, held at the Engineers' Club, New York, Jan. 14, Messrs. Henry Holgate, of Montreal, Canada, and Daniel Moran and Charles SooySmith, of New York City, were elected members in council for three years. Twenty-two members attended the session, which was preceded by a dinner. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary-treasurer of the organization.

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**RATE RESEARCH COMMITTEE FORMS.**—At the meeting of the rate research committee of the National Electric Light Association in Cleveland on Jan. 10 and 11, there were present Chairman E. W. Lloyd and Messrs. R. S. Hale, F. W. Smith, Edwin Gruhl, L. H. Conklin, S. E. Doane and W. H. Winslow, members of the committee; Mr. William J. Norton, secretary, and Messrs. Samuel Scovil, G. S. Merrill and M. E. Turner, visitors. The discussion related to the question of forms of rate schedule used by member companies. An effort is being made to ascertain what degree of uniformity there is among electric-service companies in the matter of forms for applications, contracts and schedules. The committee will try to eliminate excess matter in these forms.

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**EFFICIENCY SOCIETY, NEW YORK, JAN. 27-28.**—The annual meeting of the Efficiency Society will be held in the Engineering Societies Building, New York, Jan. 27 and 28. Monday morning's session will be devoted to the subject of organization, with Mr. Harrington Emerson presiding. Management will be the topic of the afternoon meeting, and in the evening Dr. F. A. Cleveland, director of the United States Commission on Efficiency and Economy, will preside at a discussion on governmental efficiency. "Industrial Relations" is the subject scheduled for Tuesday morning. On Tuesday afternoon Dr. Winthrop Talbot will conduct a discussion on industrial hygiene. Mr. H. F. J. Porter, 29 West Thirty-ninth Street, New York, is secretary of the Efficiency Society.

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**ANNUAL MEETING OF THE NEW YORK STATE ELECTRICAL CONTRACTORS' ASSOCIATION.**—The annual meeting of the New York State Electrical Contractors' Association will be held in Syracuse, N. Y., on Jan. 21. The business to come before the meeting will be the election of directors and officers for the coming year. The directors' meeting will be held at 9 a. m., followed by the meeting of the association at 10 a. m. There will be a banquet in the evening. The nominations for officers are: For president, Mr. Frederick Newman, of Newman & Son, electrical contractors, Albany, N. Y.; for treasurer, Mr. James Burns, of Schemmady, and for secretary, Mr. G. W. Russell, Jr., of New York. The delegates from New York City will be Messrs. Ryan, of Cleveland & Ryan; Strong, of the Tucker Electrical Construction Company, and Peet, of Peet & Powers.

**NEW YORK SECTION, I. E. S.**—The lighting of the Auditorium Armory, Atlanta, Ga., in which the National Commercial Gas Association held its 1912 convention, was the general subject of the joint meeting of the New York Section of the Illuminating Engineering Society and the National Commercial Gas Association, held in New York on Jan. 9. Mr. Robert F. Pierce presented a paper dealing with the lighting of Taft Hall, and Mr. James M. Coles read a paper on the lighting of Exhibition Hall. Taft Hall was illuminated by means of gas units placed on ten columns. Each unit consisted of fifteen upright burners surrounded by a translucent bowl, which served to direct a considerable portion of the light toward the ceiling, from which it was reflected to the working plane. The arrangement was such that 50 per cent of the useful light was received from the ceiling and 50 per cent through the bowl. The bowl was of such a size that its surface brilliancy was kept at about 1 cp per square inch. The actual light produced by the unit was shown by means of polar co-ordinates, on each of which was represented the light flux produced in each zone indicated. Exhibition Hall was lighted by means of elaborate gas chandeliers, each being about 10 ft. in height, 15 ft. in diameter and weighing about 1000 lb. In addition to certain small gas outlets for illuminating the fixture proper, each fixture contained fifteen closed gas lamps of the so-called "arc" type. Mr. Norman Macbeth announced that a joint meeting of the New York Section of the society would be held with the Municipal Art Society at the National Arts Club Gallery on Feb. 12. At this meeting the following papers will be presented: "Municipal Street Lighting," by Messrs. C. F. Lacombe and Arthur Williams; "Municipal Building Lighting," by Mr. Charles R. Lamb, and "Sign and Billboard Lighting," by Mr. O. J. Gude.

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**MEETING OF BROOKLYN COMPANY SECTION, N. E. L. A.**—Nearly 600 members of the Brooklyn Company Section, N. E. L. A., and a large number of out-of-town visitors gathered together Monday evening, Jan. 13, for the first meeting of the year. The paper of the evening, "Commercial Engineering," was read by Mr. James L. Wiltse. This paper indicated the important part that engineering now plays in the commercial development of the central station. It covered the necessity for and the present status of illuminating engineering, power engineering, electric automobile engineering and heating engineering and vindicated the practical value to the central station of this kind of work. A spirited discussion followed. The new general manager, Mr. W. F. Wells, spoke on the importance of membership in the Brooklyn Company Section, and ended by an appeal for co-operation to produce the best results. Mr. T. I. Jones, general sales agent of the company, then delivered an address on the "Development of Our Business During 1912." Mr. Jones' talk was illustrated with about 100 lantern slides, showing the growth of Brooklyn electrically during 1912 along all lines. His description of the methods of co-operation with electrical contractors which have been adopted and are now in use in Brooklyn was especially interesting, and the result shows how central-station business can be improved by intelligent work along these lines. Short addresses were then made by Mr. Cox, of the Public Service Electric Company; Mr. Littlefield, of the New York Edison Company; Mr. Becker, of the United Electric Light & Power Company; Professor Sever, electrical engineer of New York City; Mr. Brown, of the Westinghouse Electric & Manufacturing Company; Mr. Coleman, of the United Electric Light & Power Company; Mr. Rosenquest, of the Bronx Gas & Electric Company; Mr. Onken, of the *Electrical World*; Mr. Barton, of the New York & Queens Electric Light & Power Company, and Mr. Wintner, of the General Electric Company. The chairman, Mr. M. H. Bennett, announced the initiation of a campaign for new members.

## New Terminal Post Office in New York—II

Electrical and mechanical equipment, wiring and illumination of the government building over the Pennsylvania Railroad yards. By L. B. Marks and J. E. Woodwell

**T**HE electrical equipment of the post office includes a complete system of conduits and wiring for lighting and motor service, with feeders and meter switchboard, and separate distributing switchboards for delivering energy to the various branch lighting tablets and motors throughout the building.

In addition to the above, complete and separate conduit systems are provided to accommodate the future installation of telephones, automatic clocks, fire alarms, vault protection alarms, signals and call bells. These special systems are to be installed at the time the building is occupied.

The electric energy for lighting and motor service for the building is obtained over direct-current, three-wire, 120-240-volt circuits from the New York Edison Company. The total connected lighting load approximates 883 kw, using a three-wire distribution, and the connected motor load aggregates about 1000 hp, used in driving the various elevators, pumps, fans, etc.

The Edison service feeders enter the building from the center of the block between Thirty-first and Thirty-third Streets on the Eighth Avenue front, through four 4-in. conduits, each containing two 1,000,000-circ. mil cables and one 350,000-circ. mil cable. These cables terminate at the service switchboard of the New York Edison Company, located in the switchboard room where the entire supply of energy used in the building for both lamps and motors is recorded. From this service board connection is made to the motor-service switchboard by means of four 4-in. conduits, each containing one 1,000,000-circ. mil positive cable, one 1,000,000-circ. mil negative cable and one 500,000-circ. mil neutral cable. The 4-in. conduits are connected into special pull-boxes at the rear and base of each of the three switchboards, as hereinafter described.

These three switchboards are located in the basement at a point as nearly central as possible, in order to secure the most uniform distribution to the various parts of the building. The lighting and motor-service boards are placed facing each other on opposite sides of the room, leaving a 4-ft. space behind each board, while the service meter board is located at one end of the room. Each of these boards is constructed of 2-in. thick blue Vermont marble panels, containing the various switches, meters and other

instruments required in connection with the operation of the plant. The connections from the distributing switches on both the lighting and motor-service boards are made by means of copper rods run vertically to connector boards, located at the top and bottom of the board, as required to connect with the outgoing feeder cables.

For the purpose of reading the load on the various motor feeder circuits, the distributing switches are joined through shunts to two thirty-point multiple switches connected with two separate ammeters, one having a maximum reading of 100 amp and the other a maximum reading of 200 amp.

Each of the distributing switchboards is provided with the necessary voltmeters, shunt-type ammeters and recording wattmeters, in addition to the meters located on the service meter board. The wattmeters are connected to double-throw switches in order that they may be bypassed for calibration.

At the rear of each of the distributing and service switchboards is placed a water-tight feeder pull-box of heavy steel construction, so located that conduits running under the basement floor may enter at the bottom of the box. The necessary crossing of feeders is done within the box, the top of which is provided with a continuous slot for leading cables to the connector lugs. The top of this box is entirely removable to permit access.

Owing to the great number of feeders necessary to be connected to the top lugs of the distributing switchboard, a cable racking space is provided over the switchboard. The conduits from various tablets

and motor outlets, located in the first-floor construction, are carried through the ceiling and pass through the ventilating system and terminate at the bottom of the first floor.

### GENERAL DATA FOR LIGHTING SYSTEM

Total number of lamps	3,000
Length of conduit for lighting system, ft.	160,000
Length of wire, No. 10, ft.	200,000
Number of distributing switches	74
Number of multiple switches	200
Number of relay switches	100
Number of voltage cutters	8

locknuts and bushings. The space for racking cables is formed by means of horizontal I-beams about 30 in. below



FIG. 1.—ORNAMENTAL POSTS FOR LIGHTING EIGHTH AVENUE BETWEEN POST OFFICE AND PENNSYLVANIA TERMINAL.

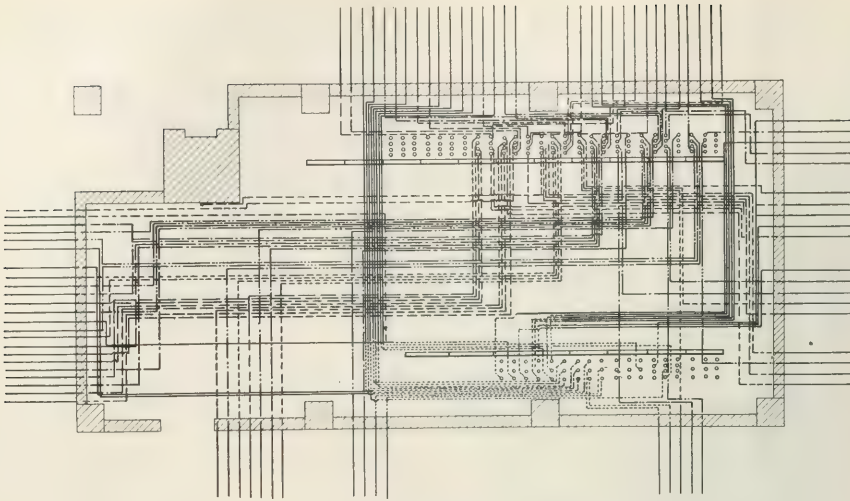


FIG. 2—DIAGRAMMATIC ARRANGEMENT OF FEEDER CIRCUITS FOR LIGHT AND MOTOR SERVICE IN SWITCHBOARD ROOM IN BASEMENT

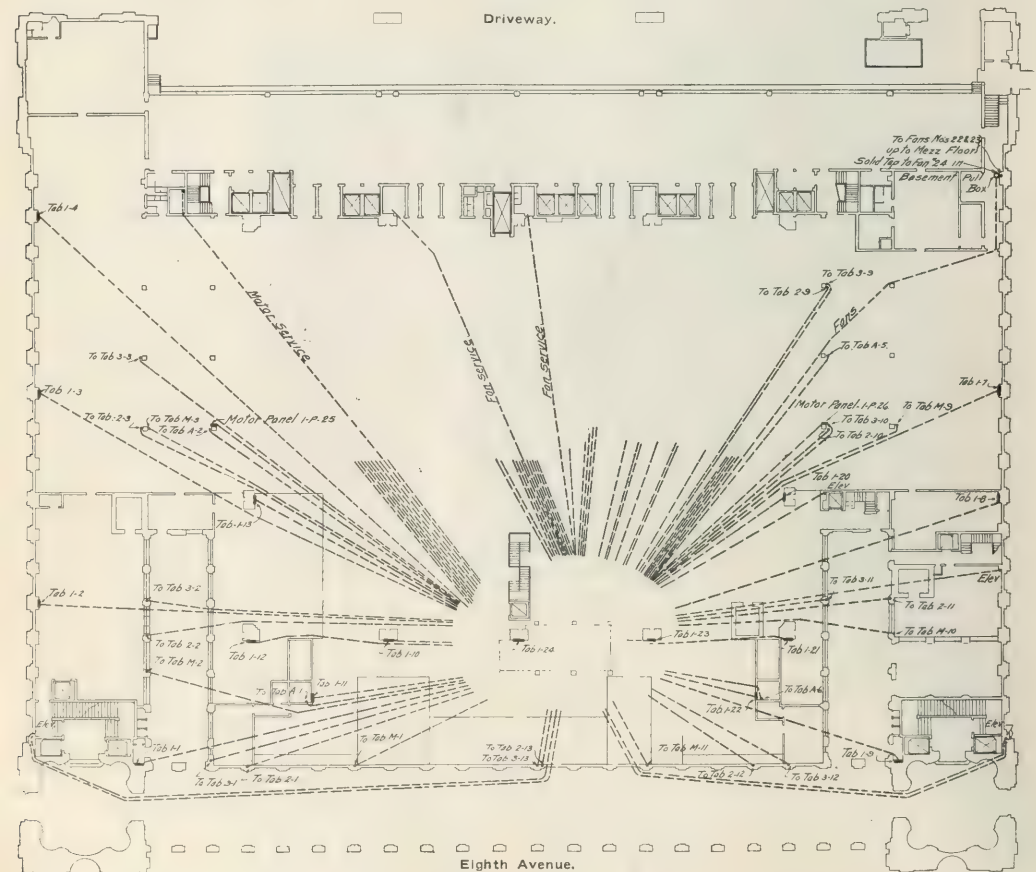


FIG. 3—FEEDER LAYOUT ON FIRST FLOOR, LEADING FROM SWITCHBOARD IN BASEMENT, FOR LIGHT AND MOTOR SERVICE TO THE SEVERAL FLOORS



the duct, and to these beams is secured a metal ceiling with removable plates. Within this overhead space vertical and cross-supporting angles are provided for attaching the insulating clamps by which the cables are secured. The arrangement of racking cables is carried out in symmetrical manner, various cables being carried in parallel rows and

public corridors special cast-iron trims are provided with ground plate glass in doors, these trims being made to match the fire-hose rack inclosures.

**Conduit System.**—All conduit work is run concealed within the floor construction, walls, partitions, etc., with joints made up with white lead and linseed oil. In locating

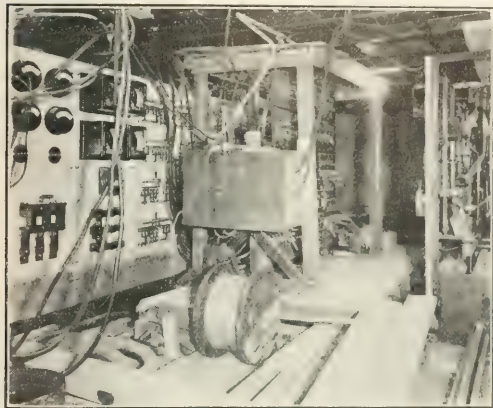


FIG. 4—SWITCHBOARD ROOM; MAIN LIGHTING SWITCHBOARD AT LEFT, MAIN MOTOR SWITCHBOARD AT RIGHT AND TEMPORARY SWITCHBOARD IN CENTER



FIG. 6—SWITCHBOARD ROOM; MAIN LIGHTING SWITCHBOARD AT RIGHT, MAIN MOTOR SWITCHBOARD AT LEFT, CENTRAL-STATION-FEEDER SWITCHBOARD IN REAR

crossovers to the switchboard being made by dropping vertically and passing between the horizontal rows of cables.

The metal plates directly above the connector boards at the rear of the switchboards are made permanent and are provided with holes for porcelain bushings directly over each lug, thus providing for vertical exposed cable connections to all of the switch lugs.

**Distribution Tablets.**—For the sake of uniformity all lighting distribution tablets, seventy-three in number, are made up with twenty-four circuit switches to each tablet, with the exception of the two controlling the circuits in the

the ceiling outlets wooden plugs were secured to the forms at the time the concrete floor arches were poured. These plugs were slightly tapered in order to permit them to be driven out from above after the forms were removed.

Use is made of outlet boxes of shallow type fitted with fixture supports consisting of a horizontal pipe slipped through a "Hickey" screwed to a vertical 0.5-in. pipe and secured to the box by lock-nuts. These fixture studs with the box and entering conduit were set plumb in the holes through the floor arch and then grouted in place with concrete.



FIG. 5—GENERAL VIEW OF THE MAIN WORKROOM, FIRST FLOOR, SHOWING FEEDER CONDUITS FOR LIGHT AND MOTOR SERVICE



FIG. 7—A VIEW OF THE SWITCHBOARD ROOM WITH RECORDING INSTRUMENTS FOR LIGHT AND MOTOR SERVICE

public corridors and main stairways, each of which is provided with thirty-six switches. In all cases the tablets are contained in heavy metal boxes cut and bent from solid sheet metal. Panels of 1-in. blue Vermont marble with 0.75-in. gutter linings are used. Except in public corridors, the tablet trims and doors are made of sheet steel. In the

**Feeder Pin Boxes and Floor Outlets.**—All feeder pull-boxes are of special water-tight design, constructed of cast-iron shell with adjustable collar and floor plate of brass. Boxes are drilled and tapped for conduits in order to insure tightness. In the main workroom on the first floor special large floor boxes are used for connecting circuits

for the local lighting of furniture and equipment. These boxes are similar in construction to the feeder pull-boxes, but smaller, the upper collar of the flange being drilled for the insertion of outlet nozzles or conduit for the extension of circuits to lighting outlets located on furniture. In the remainder of the building small cast-iron floor boxes are used, fitted with an adjustable screw collar having cast-brass flange cover tapped and fitted with plug.

sizes of cables range from No. 4 to No. 4-0, except the service feeders, which include sizes of 500,000 circ. mils and 1,000,000 circ. mils. The branch lighting circuits from the distribution tablets are made up of twin-conductor, double-braided, rubber-insulated wire, known as 30 per cent "Para," in sizes from No. 14 to No. 10 B. & S. gage.

In order to identify the various circuits and to facilitate future testing work and the installation of lighting fixtures,

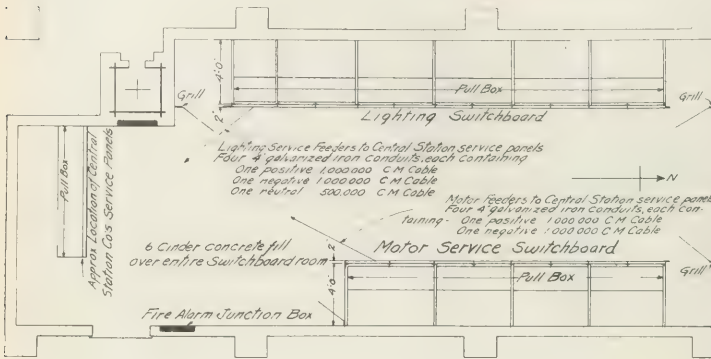


FIG. 8—PLAN OF SWITCHBOARD ROOM IN BASEMENT

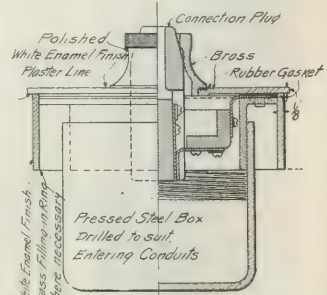


FIG. 11—DETAIL OF PLUG WALL RECEPTACLE FOR LOCAL LIGHTING OF FURNITURE, DESKS, ETC.

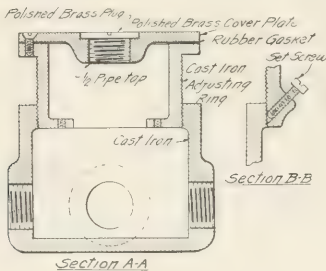


FIG. 9—DETAIL OF SMALL FLOOR OUTLET BOX FOR DESK-LIGHTING, TELEPHONES, CALL BELLS, ETC.

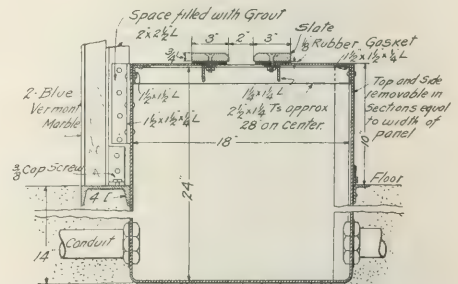


FIG. 12—DETAIL OF FEEDER PULL BOX AT REAR OF SWITCH-BOARDS

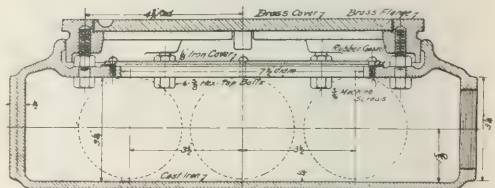


FIG. 13—DETAIL OF WATERPROOF-FLOOR PULL BOX FOR MOTOR AND LIGHTING FEEDERS

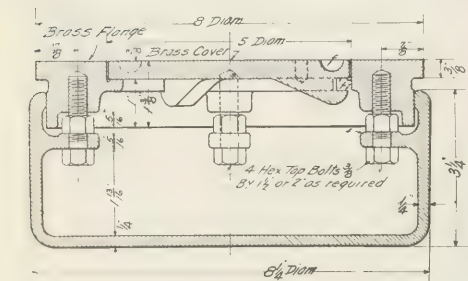


FIG. 10—DETAIL OF SPECIAL LARGE, WATER-TIGHT, ADJUSTABLE FLOOR OUTLET BOX USED IN GENERAL WORKROOM ON FIRST FLOOR, FOR LOCAL LIGHTING OF FURNITURE AND MAIL-HANDLING EQUIPMENT

The floor outlets are in every case located to suit the furniture layouts, with a view to inserting the conduit in the top of the box to protect the wires extending up the side of desks, tables, etc.

**Cables.**—All service and distribution feeder cables are varnished-cambric-insulated conductors, triple-conductor cables being used for three-wire lighting distribution and single-conductor cables being used for motor circuits. The

the wire at each outlet is provided with a small cardboard tag on which is marked the tablet and switch number to which the wire is connected. In addition diagrams are provided in each tablet to indicate the arrangement and control of circuits.

**Changing Over Temporary Work.**—As a portion of this building was completed and occupied before the contracts for the entire building were awarded, it was necessary to

supply a complete wiring system with a switchboard in this so-called "temporary portion." This requirement necessitated the location of a temporary switchboard in the position to be occupied by the permanent switchboard room and the placing of outgoing conduits across the exposed basement floor slab of the uncompleted portion of the building. All the cables which were to be used in the permanent installation were made of sufficient length for the final connections and the excess of cable was coiled and carried on a rack at the back of the temporary board.

#### SCHEME OF ILLUMINATION

The lighting of the new post office building is carried out in the main by general illumination, reinforced where required by local lighting. Direct lighting by tungsten lamps is used throughout. The lamps are housed in reflectors which serve to direct the light to the working spaces.

Some of the executive offices, one of the corridors and the stairways are lighted by means of lamps on wall brackets, but with these exceptions the illumination is derived from lighting units at or suspended from the ceiling. Wall receptacles for attachment of portable lamps are liberally provided, and in some of the larger working spaces floor outlets for the same purpose are installed. Previous to the preparation of lighting plans, accurate layouts were provided, showing the position of furniture in each of the various departments throughout the building. In offices and workrooms a scheme of general illumination was adopted, but in locker rooms, record rooms, storage rooms, etc., which occupy considerable space in the building, the lighting outlets were located over the center of aisles or to meet the local requirements. This layout for local lighting was particularly difficult because of the design of the steel framing in the building, which in many

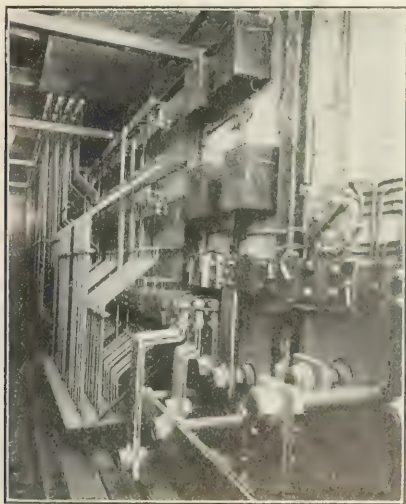


FIG. 14—REAR VIEW OF LIGHTING SWITCHBOARD SHOWING BUSBAR WORK AND VERTICAL COPPER RODS CONNECTING LIGHTING FEEDERS

cases prevented the location of outlets at the desired places.

As an example of the special local lighting requirements for the building, it was necessary to place outlets for fixtures over the "dummy car racks" in the railway mail service division to reproduce the lighting scheme which had previously been adopted for the same layout of racks in the mail cars, as the operators sort the mail at the "dummy

racks" previous to the departure of the trains and continue their work in the cars.

To secure a practically uniform distribution of light over the large circular separation jugs and to avoid objectionable shadows the exact location of outlets for these jugs had to be determined in advance. The illustration shows the arrangement of the outlets and lighting fixtures for

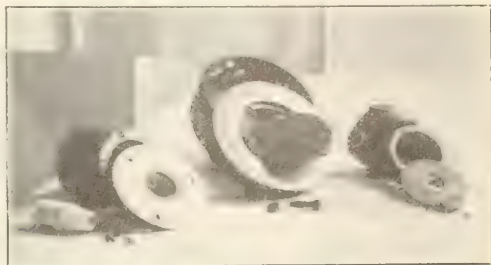


FIG. 15—SPECIAL PLUG RECEPTACLE AND FLOOR JUNCTION BOX

securing uniform illumination both in front and in the rear of the jugs. With this design the mail sorter is provided with good lighting in every working position.

The building contains an examination room in which employees are subjected to a practical test with reference to their fitness for sorting and routing the mail. This test involves the actual performance of the specific work the employee is called upon to perform, and it takes cognizance of both speed and accuracy. The lighting layout of this room is therefore designed to reproduce exactly the lighting system designed for the same class of work in the postal service.

Special provision was made to secure flexibility for the lighting under the huge skylight for the general workroom on the first floor. This flexibility was secured by providing a total of 108 ceiling outlets, evenly distributed, and connecting these outlets by conduit with six separate tap circuits extending the entire length of each group of six outlets. This arrangement permits of separate or of group control of the outlets. As the skylight in which these outlets are located is inclined with varying pitches, special outlet boxes were designed for each case to permit the fixture studs to hang plumb. A general view of this skylight is shown in the illustration.

#### LIGHTING FIXTURES

In accordance with the practice usually followed by the United States Treasury Department, which has control over the mechanical, electrical and illuminating equipment of federal buildings, the lighting fixtures are provided under the appropriation for "furniture and repairs of same for public buildings." The practice of the department is to design the lighting fixtures even in the case of buildings constructed by independent architects, no fee being allowed for this purpose, though in the case of this post office building the architects submitted designs for several of the decorative fixtures. The lighting fixtures thus far installed follow the conventional Post Office Department designs, types of which are shown in Figs. 17, 19, 20 and 21, for fixtures installed in the portion of the building now occupied.

The street lamp posts are similar to those used by the same architects for the Pennsylvania Railroad Terminal on the opposite side of the avenue. The type of post, glassware, size of lamp, height above the street level and spacing were approved by the Department of Water Supply, Gas and Electricity of the city of New York. The ten posts on Eighth Avenue between Thirty-first and Thirty-third Streets will be equipped with 400-watt tungsten lamps spaced from



46 ft. to 48 ft. apart. The twenty posts on the north and south sides of the building will carry 250-watt lamps. The posts will stand 20 ft. over all. The lamps are so mounted that the bottom of the filament is in the horizontal plane passing through the center of the glazed portion of the lantern.

An extended series of tests was made with different types of diffusing glassware to ascertain the most desirable lighting result, intensity of illumination, low intrinsic brightness and absence of sharp shadows being three important considerations. A crystal glass flashed with opal

room, terminating in a large floor box, approximately 15 ft. in length. The circuit, after passing through switchboards (to be installed), will then continue through a system of conduits carried in the floor construction to the various telephone outlets in the building. The floor outlet boxes for telephones are similar to those used for lighting service and are located to meet the furniture layouts of the Post Office Department.

The clock conduit system contemplates the installation of either electric or pneumatically operated systems. The master clock and relay box are located in the assistant

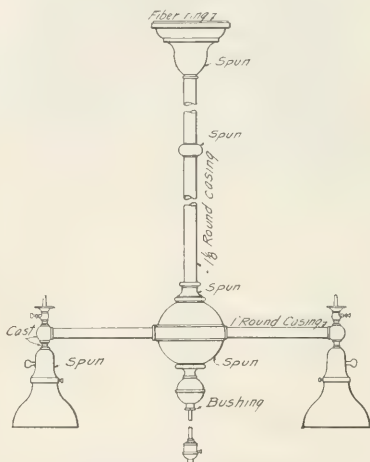
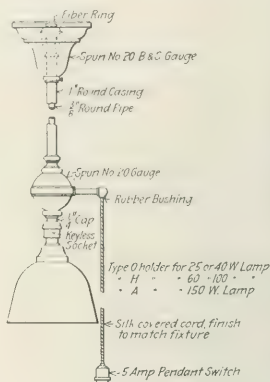


FIG. 17—TWO-LAMP COMBINATION GAS AND ELECTRIC FIXTURE NO. 502, FOR WORKROOMS



FIGS. 19 AND 20—DETAILS OF LIGHTING FIXTURES NOS. 602 AND 603

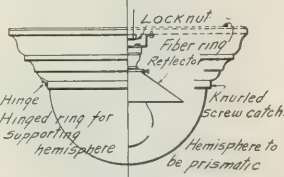


FIG. 21—LIGHTING FIXTURE NO. 520, FOR LOW CEILINGS IN CORRIDORS AND ELEVATOR ENTRANCE HALLS

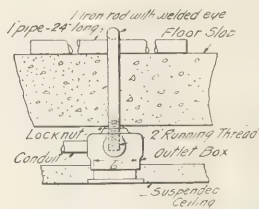


FIG. 18—DETAIL OF SPECIAL OUTLET BOX AND FIXTURE SUPPORT FOR SUSPENDED CEILINGS IN PUBLIC CORRIDORS

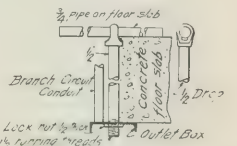


FIG. 22—DETAIL OF CEILING OUTLET AND LIGHTING-FIXTURE SUPPORT

FIG. 16—POST FOR STREET LIGHTING

on one side was found to meet the requirements in the best manner of all the glassware tried.

#### MISCELLANEOUS CONDUIT SYSTEMS

In addition to the electric lighting and motor circuits which have been described, conduit systems have been provided to accommodate the future installation of telephones, clocks, fire alarms, vault protection, call-bell systems, etc. Provision has been made for the various service companies to bring their conduit and wiring into the building under the main steps on the Eighth Avenue side, where the main junction boxes for telephone and telegraph service are installed.

From the telephone junction box the main line feeder conduit is carried directly to the telephone switchboard

custodian's room on the second floor of the building. From the relay box the conduits are run to the various portions of the building where secondary clocks are to be located. The arrangement of conduits provides for not more than twelve clock outlets to be placed on any one circuit. In connection with this system there will be provided a program clock installed in the first-floor workroom by which the various signal bells used in controlling mail movements can be automatically operated. The program bell conduits will be cross-connected with the general clock system. The master clock will be regulated by direct-wire service connection with standard Washington time.

Each of the eight fireproof vaults is to be provided with an electric protective system, connected with external circuits, the service feeders being carried to the assistant

custodian's room, in which will be located the various indicating devices. From this point the conduits extend to each of the several vaults. In order to avoid having live electric wires within the closed vaults, the lighting circuit is arranged as follows: A plug receptacle is located on the outside of each vault door near the lock side of the door and a similar receptacle in a corresponding position on

installed at the time the office furniture is placed in position.

It is important that the United States Post Office railway and mail service divisions, which have quarters in this building, be kept informed regarding the arrival and dispatch of trains operated by the Pennsylvania Railroad Company. For this purpose the railroad company has already installed a tele-autograph apparatus connected with the yardmaster's office, from which records of the train service are dispatched directly into the post office and automatically written by the tele-autograph in plain view of the Post Office employees. This system is to be extended into the general workroom of the post office. Provision has also been made for the installation of a marine ticker, whereby full information will be furnished to the post office regarding the sailings and arrivals of the steamships of the various companies in New York Harbor.

A complete system of conduit is provided for fire-alarm signals, which will be connected with the New York City



FIG. 23—VIEW OF ONE OF THE NEW-TYPE STEEL NEWSPAPER-SEPARATING JUGS IN BASEMENT, SHOWING ARRANGEMENT OF THE LIGHTING FIXTURES EQUIPPED WITH PRISMATIC REFLECTORS AND 100-WATT BOWL-FROSTED TUNGSTEN LAMPS

the inside of the vault. The inner receptacle is connected by conduit and wire to the lighting outlets in the roof of the vault. To secure light within the vault the two receptacles are connected by a "jumper" or extension cord.



FIG. 24—VIEW OF RAILWAY MAIL SERVICE DIVISION IN THE BASEMENT SHOWING POUCH-RACK DISTRIBUTION CASES AND LIGHTING FIXTURES ARRANGED AS IN MAIL CARS; 100-WATT BOWL-FROSTED TUNGSTEN LAMPS BACKED BY PRISMATIC REFLECTORS

To close the vault doors the extension cord must be removed, thus removing any possible fire hazard due to live wires.

A conduit system is also installed for call bells and annunciators connecting the various offices, provision being made for installing buzzers on individual desks or bells on walls as may be required. These call-bell systems will be

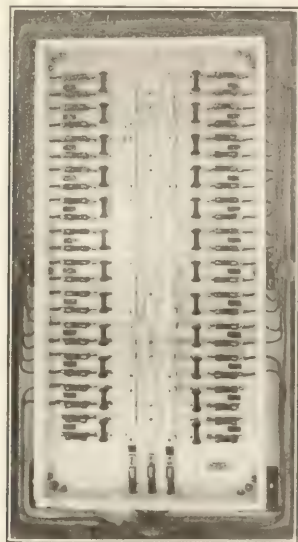


FIG. 25—THE INTERIOR OF ONE OF THE SEVENTY-THREE THREE-WIRE LIGHTING DISTRIBUTION TABLETS OF BLUE VERMONT MARBLE MOUNTED IN ONE-PIECE STEEL BOX WITH ADJUSTABLE LUGS FOR ATTACHMENT OF CAST IRON OR STEEL FRONTS

fire department system. The main service lines entering the building are carried directly to an indicator box in the electric switchboard room, and from this point the conduit encircles the basement and is connected by means of risers to a similar conduit encircling the super-attic of the building. The alarm boxes are located in the various corridors and in the larger workrooms throughout the building. Directly over each alarm box an alarm gong outlet is placed. A fire alarm rung at any point will cause all gongs on the system to ring and will indicate, in the switchboard room in the basement of the building, the location of the box at which the alarm was sent, besides transmitting the signal to the city fire department.

For the purpose of identifying the various outlets and pull-boxes on the several conduit systems, the interiors of these boxes have been painted in different colors as follows: Telephone outlets, blue; clock outlets, green; call-bell outlets, yellow; vault-protection outlets, white; fire-alarm outlets, red; telegraph outlets, brown. As a further means of identification, the covers of the pull-boxes are to be stamped with letters indicating the service.

## Electric Fuse Testing

By A. A. SOMERVILLE

In a recent set of experiments the author had opportunity to observe and consider the advantages and disadvantages of the electric fuse, as used at present. During this investigation several new points were brought out.

Since a fuse is a conductor of such proportions that it will melt when the current in the circuit exceeds a certain prearranged value and thus protect the remainder of the circuit from the harm that would result from undue overload, it will be appreciated that its construction may be varied quite widely. Patents have been granted on such features as the composition of fuse metals, shape of fuse wires or strips, calibration of strips, insulating material surrounding the strips, mounting of fuses and chemical effects of oxides and fluxes, and the state of the art is rather complicated, thereby tending to promote involved litigation in patent causes. The operation of fuses has been in many ways unsatisfactory; the current at which they would blow has always been indefinite and liable to change with the age of the fuse. Generally the carrying capacity of the fuse increases with time, because repeated annealing renders the fuse metal a better conductor. However, the repeated heating and cooling may loosen some of the contacts, thereby making a high-contact resistance which will become unduly heated and thus cause the fuse to blow even when the current is below the normal value. In spite of their faults fuses are invaluable for the protection of small circuits where the cost of circuit-breakers would be prohibitive. Most wiring rules require that fuses be used on every pole where a reduction in size of wire takes place and in each branch where a tap is made off a main line.

Each particular type of fuse has its own place, and care must be taken that the type designed for each class of work is used for that work and that only. For instance, the small piece of copper wire connecting two terminals is the most dangerous fuse that can be used for ordinary work, but the fact remains that it is used frequently for temporary repairs. The same kind of copper wire several feet in length is found to be the safest fuse obtainable for a high-tension transmission line and is used in such work. Unless the wire is long the arc will persist under high voltage and cause damage. The long wire exposed to the air or slightly covered will safely carry the normal load, and when fused it drops away entirely, thereby opening up a long gap and effectually breaking the arc that is started.

Cartridge fuses differ from the preceding in that the fuse metal is surrounded by a tube of insulating material, and this tube is fitted with metal caps to slip into terminal receptacles of the holder. The fuse wire is soldered or riveted to these metal caps. It is this class of fuse that is now almost universally used on small lighting and motor circuits, and it was upon these that a thorough test was made by the author. After a series of exhaustive tests it was decided that almost any kind of wire may be used as a fuse. The fusing current of the wire depends not only on the metal of which it is composed, but also upon its surroundings, the state of its surface and other factors. It is claimed that in time some metals become coated with an oxide and that this holds the metal in place like a protective tube or sheath even after the metal is melted. It was to determine the effect, if any, of this film of oxide on the fuse metal that the following experiment was attempted.

The Underwriters' National Electric Association has made very definite rules for the construction of fuses. At a voltage of from 0 to 250, lines carrying from 61 amp to 100 amp form a class in which a fuse of certain dimensions must be used. For instance, a cartridge fuse having knife-blade contacts and carrying 90 amp at a voltage of from 0 to 250 must be  $5\frac{1}{4}$  in. over all in length. The distance between contact clips must be 4 in., the width of

contact clips  $\frac{7}{8}$  in., the thickness of blades  $\frac{1}{8}$  in., diameter of tube 1 in., length of blades 1 in. and width of blades  $\frac{3}{4}$  in. The fuse cartridge must be sufficiently dust-tight so that lint and dust cannot collect around the fuse wire and become ignited when the fuse is blown. The fusible wire must be attached to the cartridge in such a way that a thoroughly good connection is secured and so as to make it difficult for it to be refilled when melted. It must be classified so as to correspond with the different classes of cut-out blocks and so designed that it is impossible to put a fuse of one class into a cut-out block which is designed to carry any current for which a fuse of a higher class would be required.

The fuses must be so constructed that with the surrounding atmosphere at a temperature of 74 deg. Fahr. they will carry indefinitely a current 10 per cent greater than that at which they are rated, and at a current 25 per cent greater than the normal rating they will open the circuit without doing injury to the fuse tube or terminals. With a current 50 per cent greater than the rating and at a room temperature of 75 deg., they must, starting cold, blow in two minutes. The temperature of the exterior of the fuse must not rise more than 125 deg. Fahr. above that of the surrounding air when the fuse is carrying the current for which it is rated. It must not hold an arc or throw out molten metal so as to ignite easily inflammable material on or near the cut-out, when only one fuse is blown at a time, on a short-circuit, at a voltage for which the fuse is designed. It was upon this class of fuses that the tests spoken of were carried out.

Zinc, tin, copper, aluminum and magnesium were the materials examined, and three insulating materials were tried around the fuse wire, namely, manganese dioxide, slaked lime and borax. From the observation made the following conclusions were drawn: Any metal may be used as a fuse strip, and if conditions are properly adjusted the fuse will blow at a fairly definite overload and make a sharp, clean break in the circuit. The factors that produce ideal conditions differ with the various metals, but the controlling features are relative values of length, width and thickness of the strip, together with the amount and kind of insulating powder surrounding it.

All metals make equally clean breaks when properly adjusted. However, it is slightly easier to work with the metals having the lower melting points, as the thermal insulation is not such an important feature.

The character of the insulating powders used around the fuse wire is without effect except in a thermal way, and the rate at which the powders radiate heat from the fuse wire determines its capacity. The chemical effect, if any, on the fuse wire is negligible.

The load or current that a fuse will carry depends upon the melting point of the metal used, the cross-section, shape and length of the conductor, size of the terminal plugs and contents of the casing, should there be any, surrounding the fuse metal.

The carrying capacity of a fuse varies with the cross-sectional area and inversely as the length, on account of the variation in temperature gradient in the fuse. The carrying capacity increases directly as the size of the copper terminals, since they conduct the heat away; directly as the increase in melting point of one material over another, and as a function of the thermal conducting power of the powdered material surrounding the fuse metal.

Lastly, fuses at their best are very unreliable and no two fuses except by chance will operate in the same way. If a dozen fuses supposed to be alike are blown under the same conditions, the deviation in time required to blow will usually be 25 per cent of the average. It may be said that the unreliability of the fuse with respect to the time-limit specification is its chief bad feature. Although the advance made in the manufacture of fuses has been very marked recently, there is yet ample room for improvement.



## Wireless-Telegraph Station at Fort Myer, Va.

By D. H. TUCK AND M. B. HODGSON

Until recently the United States and Italy were the only ones among the important nations that had not installed government coastal wireless-telegraphy stations for communicating with the merchant marine. Although a number

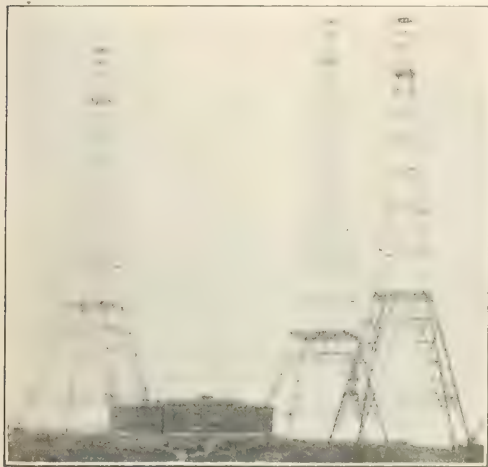


FIG. 1—WIRELESS STATION, FORT MYER

of private commercial stations had been established in this country, these, being operated with the idea of business gain, served merely as news channels for incoming and outgoing steamers and rarely performed the functions of a distributor of general items such as storm warnings, etc., except by special contract. Owing to commercial jealousy, little was attempted along co-operative lines, each company using its own system and being free to transmit and receive as it pleased. The few stations operated by the federal government confined themselves strictly to military and naval uses.

It was to meet this lack of co-operation that the United States government, through the Navy Department, installed the new wireless-telegraph station at Fort Myer, Va. While primarily a distributing center for naval orders, the equipment and facilities of an experimental station have been included, thus, with the practical working equipment, making the station valuable as a laboratory for developing and testing new apparatus. With the coastal stations, the Fort Myer plant will also form a bulletin-distributing bureau. At a prearranged time each day news bulletins will be sent out, giving the bearings of ships, derelicts and icebergs reported, together with storm warnings, etc. Individual reports of maritime interest will also be received and transmitted.

The new station is situated just outside the city of Washington, D. C., among the Virginia hills, 150 ft. above sea level. The entire plant, comprising the laboratory and three great towers, occupies a federal reservation of about five acres. It was designed and built under the supervision of the Bureau of Yards and Docks of the Navy Department, the Baltimore Bridge Company having obtained the contract for erecting the three towers and the National Electric Signaling Company, Pittsburgh, Pa., supplying special apparatus.

The three towers are located at the angles of an isosceles triangle, the two smaller 450-ft. towers being identical, 125 ft. square at the base and tapering to 15 ft. square at the top. The main 600-ft. tower is 150 ft. square at the base and tapers to 15 ft. square at the top. All three are

of the same general type in construction, being built up of box girders whose angles are of  $\frac{1}{2}$ -in. steel reinforced with  $\frac{3}{8}$ -in. plates. The platforms at the top are reached by zigzag ladders arranged with convenient landings. Each of the four uprights of the towers is embedded in a mass of concrete 10 ft. square and reaching into the earth a distance of 12 ft. to a sub-foundation composed of rock and clay.

The entire structures are insulated from the ground by marble washers waterproofed with varnish. One of these pedestals is shown in Fig. 2. The precaution of insulating the bases was taken since there seemed to be no reliable data concerning the possible effects on signaling devices of large electrical capacities like those of the towers. The towers are, however, connected by ground wires and disconnecting switches, so that experimental data of this kind may be obtained in the future.

The building in connection with the station was designed to meet the requirements of a modern radio-telegraph plant including well-equipped research and testing laboratories. Space has also been included for a machine shop and for dormitories for the employees. On the first floor, occupying a space of about 2400 sq. ft., is the generating room. At present 25-cycle, 6600-volt, three-phase electrical energy, supplied by a local central-station company, is stepped down to 220 volts to operate a 200 hp Westinghouse synchronous motor running at 500 r.p.m. and belt-connected to a 220-volt, 500-cycle Westinghouse alternator which operates at 1250 r.p.m. The motor is separately excited by a General Electric direct-current generator, which is also used as a source of energy for auxiliary apparatus.

The output of the high-frequency alternator is for transmitting purposes stepped up to a working pressure of 25,000 volts. The revolving spark-gap employed consists of a 4-ft. wheel whose fifty terminals, corresponding to the fifty poles of the generator, give 1000 discharges per second. The pole spokes are of  $\frac{1}{2}$ -in. copper, 8 in. in length. Because of the high centrifugal forces which the fastenings must withstand, life and apparatus in the vicinity are safe-



FIG. 2—ONE OF THE PIVOT PIVOTS

guarded against possible flying spokes by a 12-in. beam in the plane of the wheel. The minimum spark-gap is  $\frac{1}{64}$ -in., but owing to the high potential the air breaks down about 3 in. ahead of and behind the small gap discharge. A constant electrostatic capacity is provided, consisting of a bank of nine condensers in parallel, each having a rating of 500 mfd. These condensers are made up of steel plates

set in steel cylinders and all air-insulated at a pressure of 300 lb. per square inch. The wave transmitted can be varied by means of three variable inductance units. These inductances, together with the condensers, are the ones formerly used by the Fessenden station at Brant Rock, Mass. The signaling contacts are manipulated from the operating room by relays, a variable resistance of 220 ohms

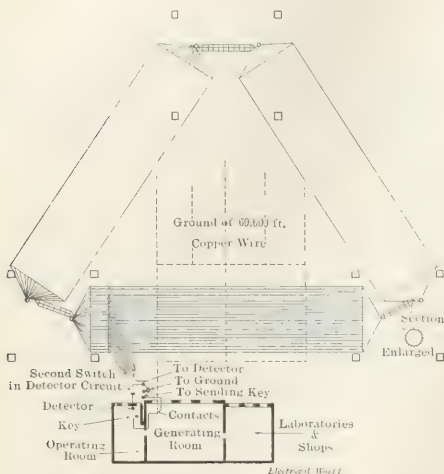


FIG. 3—PLAN OF STATION AND CIRCUITS

being shunted across the contact points on the low-voltage side to prevent excessive arcing at the contacts. The ground wires, which are led out through the basement, terminate in 60,000 ft. of bare copper wire laid in trenches between the towers. The sending wires connecting to the aerials are led out through a heavily insulated window pane, 1 in. thick, to the distributing pole, which is shown in Fig. 5.

At this ingenious device terminate the wires from the generator, controlled by the sending key, the line to the detector, and a third wire which is well grounded. The transmitting and detector wires are extra-insulated from their wire supports by composition strain insulators and from the posts by large double-petticoat porcelain insulators. The terminals of these three wires form the contacts of a three-point switch controlled from the operating

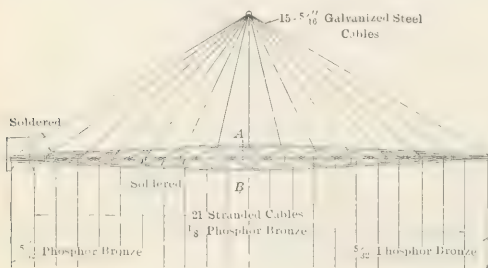


FIG. 4—CONSTRUCTION OF AERIALS

room by a system of chains and pulleys. The movable switch arm leads to the aerial wires. A double-throw, single-pole switch is placed in the detector side of the line. With this switch arrangement it is evident that the operator can at will close the circuit for receiving messages, change over for sending, or ground the entire system, as in time of storms.

The wires are run to the aerial spreaders as shown in Fig. 4. These spreaders are built of 2.5-in. galvanized-iron pipe, reinforced with  $\frac{3}{8}$ -in. strapping of galvanized steel. They measure 88 ft. in length and are square in section, increasing to 3 ft. at the widest part. The weight of spreaders and wires is supported by a bridle of 15  $\frac{5}{16}$ -in. galvanized-steel cables, connected to the pipe by turn-buckles and terminating at the top in a 10-in. steel ring. The aerial wires proper, comprising twenty-three phosphor-bronze stranded cables,  $\frac{1}{8}$ -in. diameter, are soldered both to the iron pipe and to the bridle. These bridles are supported and insulated from the trusses at the top of the towers by ten 10-in. buck links.

The connections between aerials are made by "cages," each cage containing twenty-three phosphor-bronze wires soldered to the bridles of the spreaders. Connections, therefore, are not dependent at any point on one strand or cable. The wires between the 600-ft. main tower and the two 450-ft. towers are about 400 ft. in length, and those between the two smaller towers 300 ft. Forty feet is allowed in each span for sag. From needle-point tests, which showed a spark-length of 11 in., it has been estimated that a potential of 150,000 volts is obtained at the topmost point of the antennas. A cloth sack blown from the top of one of the towers landed on an aerial and instantly burst into flame.

When complete the generating room will also include an

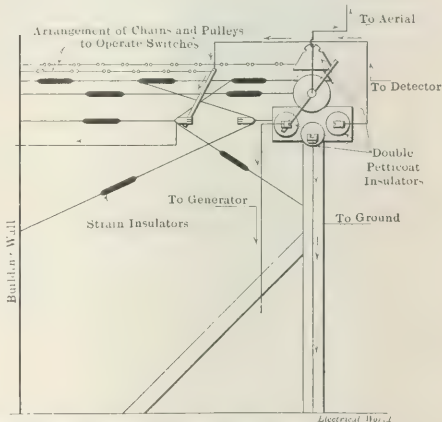


FIG. 5—ARRANGEMENT OF SWITCHES ON DISTRIBUTING POLE

internal-combustion-engine isolated plant. When this source of energy is installed it is hoped to do away with the somewhat elaborate spark-controlling system now used. Several small motor-generator sets will also be available for the lighting and storage-battery systems, and for furnishing 25-cycle, 40-cycle and 60-cycle energy for experimental purposes. From the storage battery emfs of from 1 volt to 250 volts will be available. Provision has also been made in this building for testing complete generating sets for government stations.

Up to the present time the twin Marconi stations at Glace Bay, Canada, and Clifden, Ireland, have represented the highest development in the wireless field. These two stations, with towers 450 ft. high, have intercommunicated for some time. There is also a German station at Nauhen with a 450-ft. mast.

Officials of the new Fort Myer station hope to obtain, when working at full range, a maximum distance of 3000 to 4000 miles. Already communication has been established with the Marconi station at Glace Bay and with the naval station at Key West, Fla., and time signals have been picked up from the station established in the Eiffel Tower at Paris, France.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Delivering Coal with Electric Trucks

Coal companies in the larger cities are increasing and repeating their orders for electric trucks for delivery purposes, for the experience of the past with these battery-driven wagons has proved them cheaper and far more reliable than gasoline cars or any animal motive power. Coal deliveries are mostly city runs and hence fall within the approved province of the electric vehicle. The weather conditions of snow, ice and sleet are likely to be at their worst when coal delivery service is most needed, so the electric truck again scores with its superior dependability despite any weather.

One coal company which, according to the monthly vehicle publication of the Denver Gas & Electric Company, has had exceptional opportunity for studying its electric delivery service employs a car which hauled 435 tons of coal in one

members mutual aid and assistance in case of sickness, accident or death. It is to be conducted for the sole benefit of its members and not for profit. The *Bulletin* will be published monthly and is edited by Mr. L. C. Davis, publicity agent of the sales department, who, among other things, contributed to the first issue an original poem entitled "When Franklin Flew His Kite." Mr. Edison sent a letter saying that he was in sympathy with the object of the publication.

## Spectacular Central-Station Exhibit in Denver

Following its industrial exhibit, described and illustrated in the *Electrical World* of Dec. 21, page 1321, the Denver Gas & Electric Light Company made an exhibit of a more spectacular nature during the recent holiday season. The



PANORAMA OF DENVER CENTRAL-STATION EXHIBIT

month. This was a daily average of 365,624 lb., or 18.3 tons. The largest number of pounds of coal hauled in a single day by the truck amounted to 44,300 lb., the equivalent of 22.1 tons. It covered 63 miles in a day and the record number of trips was seven. The truck was in service 229 hours, but it was engaged in hauling only 126 hours, 103 hours being required to load and unload it. The total mileage for the machine for the whole month was 1005 miles. It took 119 trips, averaging  $8\frac{1}{2}$  miles each, to accomplish that distance.

## Union Electric Bulletin a 1913 Youngster

Dated January, 1913, the first number of the *Union Electric Bulletin* has made its appearance. This is a magazine published by the Union Electric Light & Power Company Section of the National Electric Light Association in St. Louis. The first issue contains an interesting budget of news and gossip relating to company affairs. Mr. A. C. Einstein, the vice-president of the company, contributes the foreword in the shape of a New Year's greeting. Possibly the most important article is an outline of the plans of the new Employees' Mutual Benefit Association of the company. The object of this association is to furnish to its

display was installed in the company's headquarters building at 900 Fifteenth Street, and the accompanying illustration is a reproduction of a panoramic photograph. The exhibit was very successful and aroused a great deal of interest in Denver and nearby cities and towns. All classes of people came in to see it. Although a conspicuous popular attraction, scientific men and engineers did not disdain to witness and explain the various experiments carried out. There were a singing arc, a 1,000,000-volt Tesla coil and a "wireless" electric lamp which was lighted in a bowl of water. The climbing arc also proved of interest. This was built for wireless purposes, and the transformer used was wound for 20,000 volts secondary. An X-ray machine was one of the attractions and resulted in the sale of a similar machine to a local physician. Indeed, while the primary object of the exhibit was to foster the flat-rate propositions and window and sign-lighting activities of the company, it is felt that the show has had a beneficial effect in several other directions.

One of the conspicuous features of the display was the mountain scene in miniature shown in the middle of the accompanying picture. This model represents the vicinity of James Peak and the proposed Moffat Tunnel. It was quite true to life and proved a popular attraction. A



waterfall formed a realistic feature of the hydroelectric equipment in the "mountains," and many of the visitors could not understand where the water came from. A concealed tank was provided, and by means of an electrically driven pump the same water was used continuously. At the right of the picture is shown a booth in which was exhibited an excellent collection of artistic lighting fixtures, lamps and shades.

### A Practical Farmer in Praise of Electricity

Mr. W. H. Brown, manager of the Red River Power Company of Grand Forks, N. D., received a letter recently from Mr. J. D. Bacon, a farmer residing near Grand Forks, who uses electrical energy on his farm. Mr. Bacon wrote: "In answer to your question regarding electric energy on the farm, I will say that we hardly know how to get along without it since becoming used to such a convenience. For threshing and ensilage cutting we are so much better pleased with it than with gasoline or steam that it is hard to compare them, and, besides the great convenience, the expense is considerably less than with either of the others. If farmers in general could realize what a snap it is to have power that can be used simply by turning it on, no matter what the weather is, they would certainly begin to co-operate with one another and have lines put in."

### Central-Station Growth at Salt Lake City

Records kept by the commercial department of the Utah Light & Railway Company of Salt Lake City show that 1500 new houses have been built and connected to the company's lines during the year just closed. In addition about 100 vacant houses have been connected during the year, making a total increase of about 1600 customers during 1912. This growth represents nearly 10 per cent increase in the number of residence customers.

During November, 1912, the Salt Lake company tested 1610 customers' meters with the following results: Meters fast, 31, or 1.9 per cent; meters slow, 76, or 4.7 per cent; meters correct, 1503, or 93.4 per cent. These results correspond closely with the results which had been reported in Salt Lake City for previous months.

### Analysis of Costs in a Refrigerating Plant

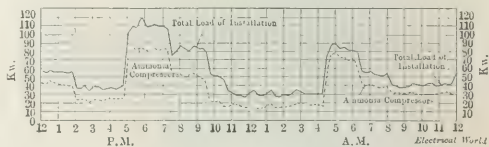
In the following paragraphs are given the results of a cost analysis of the refrigerating plant serving a large skating-rink establishment, together with suggestions as to the relative economy of steam and electric operation and possible betterments. The installation provides two ice surfaces for public use, one of 22,000 sq. ft. for skating and one of 5700 sq. ft. for curling. The rink floors are covered with 1.25-in. iron pipe, laid 4.75 in. apart, center to center, and embedded in gravel to the tops of the pipes. The latter are connected to headers which run along each side of the rink. Cold brine is circulated through the pipes, and the latter are divided into sections of eight each, to permit easy disconnection and repairs. There is 55,860 linear ft. of pipe in the larger rink and 13,707 ft. in the curling rink. The ice surface is built up by spraying the pipes with water, the ice being kept at a thickness of from 1.5 in. to 2 in. above the pipes.

The refrigerating plant is of the compression type and consists of one 400-hp boiler with feed pump and auxiliaries, two 16-in. by 30-in. by 24-in. single-acting York compressors driven by Corliss cross-compound steam engines, an ammonia condenser, a brine cooler, pumps and tanks. The feed water passes through an exhaust-steam heater of 500-hp capacity, leaving it at 90 deg. C. The compressor

engines operate at 125 lb. boiler pressure, exhausting into a vacuum of 22 in. The ammonia condenser consists of eighteen coils of 1.25-in. and 2-in. pipe, twelve pipes high and 19 ft. long, and is supplied from the city mains in conjunction with the water from the surface wells on the premises. This water after leaving the condenser passes through the steam condenser and thence to the sewer, as no cooling tower is provided. The brine cooler is equipped with ten coils of 2-in. and 3-in. pipe 18 ft. long and fourteen pipes high, arranged in two banks, the brine being stored in a 24-ft. by 10-ft. by 8-ft. tank. It is forced through the cooler and floor piping by two Gould triplex double-acting 8½-in. by 10-in. pumps driven through gearing from a line shaft run by an 8-in. by 10-in. horizontal engine. The brine for the curling rink is supplied by a duplex double-acting pump having a capacity of 150 gal. per minute. The steam for heating the building is taken from the boiler through a reducing valve, the indirect system being used, in which air is drawn in over steam coils by a fan run by a 15-hp motor. A similar motor and fan are used to exhaust the vitiated air from the building. The brine in this plant is composed of a solution of calcium chloride and water, having a specific gravity of 1.185. It passes through the floor piping of the rink at a temperature of about 14 deg. Fahr., returning to the tank at about 16 deg. Fahr., after which it is forced by the pumps into the cooler.

#### METHODS OF TEST

An extensive test was run upon the plant to determine its power requirements. The boiler feed was measured by a calibrated water meter inserted in the bypass of the feed line. The returns from the heating system and the engine condensate were weighed in tanks. Cooling water for the condensers was determined by subtracting from the meter



TOTAL LOAD CURVE

measuring the total water used in the plant the water taken by the boiler plus a constant quantity credited to leakage. The latter was determined by a run made with only the boiler-feed pump working, so that the difference between the main meter and the boiler-feed meter gave the leakage loss. Coal was weighed in the usual manner in barrows, and the power developed by engines and compressors was determined by indicator cards. The power taken by motors and lamps was separately metered.

In order that the engines and compressors might be indicated it was necessary to make eight offset arms. At the beginning of the test great difficulty was encountered by the winding of the indicator strings of the ammonia cylinders around the offset arms. As a platform intervened between the indicator and the offset, it was impossible to clear the cords before taking the cards. To prevent this trouble the end of a long piece of elastic was attached to the cord, the other being fastened to the ceiling at a point directly above the indicator.

The accompanying total load curve was obtained by adding together the power in kilowatts necessary to drive the ammonia cylinders and brine pumps and the electrical input as calculated from the wattmeters, plotting the total in fifteen-minute periods. The total power demand of the installation varied in twenty-four hours from 27 kw to 121 kw.

The cost of operating the plant per day by steam power was determined to be \$94.39, itemized as follows: Electricity for lighting and ventilation service, \$11.55; water,

\$23.85; coal, \$24.54; oil and waste, 15 cents; attendance, \$16; insurance, 75 cents; depreciation, \$9.05; taxes, \$2.47; interest, \$6.03; total cost per day, \$94.39.

The energy consumption for lighting service every twenty-four hours was 135 kw-hr., and for motors driving fans 27.3 kw-hr., the maximum demand being 33.6 kw for these services. The cost of electricity for lighting and ventilation therefore averaged 6.8 cents per kw-hr. There was fired 12,270 lb. of coal every twenty-four hours, at a cost of \$4 per ton. The water consumption was 18,377 cu. ft. per day, the boiler using 69 cu. ft. per hour, the leakage being 88.1 cu. ft. and the condensing requirements 607.9 cu. ft. per hour. An allowance of 0.5 per cent per annum was made for insurance, interest being taken at 4 per cent and taxes at \$16.40 per \$1,000. The investment cost of the plant was \$55,000, and the load-factor on a twenty-four-hour run was 50 per cent, the average peak for one hour being 110.8 kw maximum. The instantaneous load-factor was 45.8 per cent, figuring on the extreme peak of 121.1 kw.

#### ESTIMATED COST OF ELECTRIC DRIVE

A careful study of the plant indicated that it furnished a highly desirable load from the central-station standpoint, provided off-peak rates could be applied. It is estimated that electric service can be installed successfully if a net average rate of about 2 cents per kw-hr. is applied on an off-peak arrangement by which the installation will take only energy for lighting and ventilation from the supply mains during the peak itself.

It was determined that in case electrical operation should be provided a 26-hp steam boiler 42 in. in diameter and 12 ft. long, containing forty-five tubes, would suffice for heating the incoming air. The cost of this boiler was estimated at \$386. Steam is supplied for air heating at 3-lb. pressure. Constant-speed motors are required for driving the ammonia compressors, and two 100-hp outfits of the direct-current type, with a speed rating of 575 r.p.m., were determined for this service. Only one of the two compressors is required to keep the surface of the rink frozen, permitting substantially full-load operation of the motor and consequent maintenance of high economy. For driving the brine pumps, whose speed is varied from time to time, a cumulative compound-wound motor of 25 hp was advised.

The following items are used in figuring the investment for electric operation. First is shown the cost of steam equipment not necessary for electric service, and this total, \$28,275, gives, when subtracted from the original investment of \$55,000, the cost of equipment essential to either plant. To this last is added the cost of equipment for purely electrical operation, or approximately \$42,000, which is the total upon which fixed charges must be met in running the plant by electricity. The figures are: Engines and compressors, \$18,150; brine pump engine, \$700; boiler, \$6,000; boiler-feed pump, \$425; feed-water heater, \$400; dry vacuum pump and steam condenser, \$1,600; boiler-room piping, \$1,000; total, \$28,275. New equipment required with electrical operation: Two compressors, \$12,000; two 100-hp motors, \$2,084; one compound motor, 25 hp, \$417; boiler for heating system, \$386; erection of heating boiler, \$75; belts and motor installation, \$100; portion of old investment retained, \$26,725; total investment for electric drive, \$41,787.

This is based on the assumption that the full initial cost of the steam equipment not needed with electric driving could be returned, but as a shrinkage is almost inevitable in the sale of second-hand apparatus, an allowance of only 50 per cent of the original cost of steam plant discarded was made. On this assumption there would have to be added to the investment for electric drive about \$14,000, which would presumably be lost in the sale of the steam equipment, making a total of about \$56,000 upon which fixed charges must be paid. These were taken as 5 per

cent interest, 6 per cent depreciation and repairs and 2 per cent insurance and taxes, or a total of 13 per cent. The total overhead expense on this basis of the electrical installation was found to be \$7,280 per year, or, roughly, \$20 per day. The estimated cost of operation by electricity was as follows per diem: Electrical energy, 1330 kw-hr. at 2 cents net (off-peak), \$26.60; coal for heating, \$3.31; water, \$22.06; oil and waste, 15 cents; labor, \$9.23; total, \$61.35; fixed charges per day, \$20; approximate total cost of electrical operation, \$81.35.

The cost of attendance is found to be greatly reduced, as the analysis shows, with the use of electric service. Under steam-operation conditions the plant runs with two shifts, having an engineer and fireman at night and a helper in the daytime, a chief engineer being in charge of the entire plant. The survey indicated, however, that with the electric drive only a chief engineer and helper would be necessary during the daytime, with an electrician at night. It also appeared that the peak load could be shifted to early afternoon with electric driving by freezing on a thick coat of ice after the morning hours and planing it down before the evening opening instead of freezing it again. By driving the compressors hard just before the peak load comes upon the central station the brine may be cooled sufficiently to keep the ice surfaces in good condition until the peak is passed. It appeared that the installation of a cooling tower would be desirable in the plant. The cost of this was estimated at \$1,500, and it was figured that the saving in water would pay for the tower within three months, regardless of whether steam or electric drive were used. At the time of the test the engine valves in the compressor units were poorly adjusted. Proper setting of these would improve the economy of the plant under steam-driven conditions, but the survey indicated that the total cost of operation by electricity would probably fall well within that possible by steam.

#### A New Year's Window Exhibit

The new and the old were appropriately represented in a novel window display exhibited during the first week of 1913 at the offices of the Kentucky Electric Company, Louisville, Ky. The infant "1913" was shown in an old-fashioned hooded cradle rocked by an electric motor. An old-style milk bottle, in contrast with the modern electric milk-warmer, stood near the sleeping youngster. An electric stove was set alongside a coal range, an electric table-lamp was shown with one of the coal-oil variety, and a percolator was contrasted with a battered coffee-pot, while an electric bed-warmer was compared with a sticky hot-water bottle.

#### Red Lamps Mark Baltimore Fire-Alarm Boxes

A number of the outlying city fire-alarm boxes in Baltimore are now marked by 25-watt tungsten lamps inclosed in red weatherproof globes, readily distinguishing the boxes in cases of emergency on dark nights. The lamps are wired in groups supplied from the regular metered central-station service of the nearest fire-engine house. Attendants on duty at these posts, with the exception of one, are on duty off at dawn. To insure maintenance of the markers, the officers are instructed to report any broken lamp to the firemen. So all renewal stocks are kept at each engine house, and a fireman is sent out to make the replacement as soon as reported. According to Mr. Douglass Burnett, of the Baltimore Consolidated Electric Light & Power Company, which supplies the energy for these fire-box markers, Mr. J. B. Yeakle, local superintendent of fire-alarm telegraph, plans to extend the signal-lamp system to other alarm boxes, the present installation having already proved its utility and value.

# Wiring and Illumination

## Indirect Lighting

At the December meeting of the London Illuminating Engineering Society a paper on modern methods of indirect lighting was read by Messrs. F. W. Willcox and H. C. Wheat. A large number of pictures of indirect-lighting installations were shown. The authors divided the methods of lighting into four classes, namely, direct lighting in which the greater part of the illumination is received directly from the source of light or through reflectors; direct lighting in which the greater part of the light is received from diffusing globes and spheres; semi-indirect lighting, and indirect lighting proper. The comparative advantages of these different methods were discussed. The authors brought forth arguments to combat some objections that have been raised to indirect lighting. For instance, it is thought by some that with this method the brightness of the ceiling is too high, but the authors quoted figures to show that the brightness is in general not more than about one-tenth candle-power per square inch. In the same way the objection that too much light is given to the walls was shown not to be serious, as a moderately high illumination is usually needed there in order that pictures and the like may be shown to advantage. The argument stating that it was a disadvantage to the indirect-lighting fixture to have the bowl appear dark was met with the statement that when several lamps are placed at intervals the light given out from one unit serves to illuminate the bowl of the next to some extent, and hence this dark appearance is not so prominent.

Indirect lighting is considered by some to produce a flat and cheerless effect, but this impression usually soon passes off. As an instance of the possible efficiency of the system, the authors quoted a case in which 4.83 lumens per watt were obtained. This is a result which appears distinctly high, and is probably attainable only under very favorable conditions. It is now recognized that indirect lighting is not "shadowless," but merely produces very soft shadows.

In the discussion several speakers expressed the opinion that the semi-indirect system of lighting gives preferable results from the artistic standpoint. Mr. C. A. Baker remarked that total indirect lighting makes the plans of the lighting engineer subservient to the nature of the walls and ceilings in the rooms, which naturally darken with age. He also pointed out that with an adjustable suspended lamp one can easily alter the illumination within wide limits and secure as much as 6 ft.-candles if it is desired. With indirect lighting one cannot make this alteration, and a liberal allowance of light is therefore necessary under this system.

An interesting addition to the discussion was presented by Mr. V. H. Mackinney, who showed the new Holophane semi-indirect lighting unit and several photographs made of rooms lighted with this unit taken entirely by artificial light. The unit consists of a specially designed inverted bowl, which directs approximately 75 per cent of the light upward, a large amount of the remaining 25 per cent being transmitted downward. Mr. Mackinney showed an interesting method of displaying the distribution of light from units instead of polar-candle-power curve. He reproduced a photograph of a room on which was mapped out below the photograph the illumination on the working plane. The distribution of surface brightness on the ceiling was shown above the photograph and the distribution of brightness on the walls was shown at the side. It was suggested that this method of showing the distribution of light from a unit would often be appreciated by the non-technical public, who are apt to be mystified by elaborate diagrams, and polar curves but who readily understand the method used by Mr. Mackinney.

## Bell and Lamp Signal Systems—I.

BY SYDNEY F. WALKER.

One of the greatest among the difficulties that have been encountered in the operation of electric signals in mines of all kinds has been the great drain upon the batteries and the difficulty of keeping them in working order. No battery more complicated than the open-type Le Clanché was considered acceptable for a long time. Later the mercury bi-chromate cell introduced by Fuller met with some

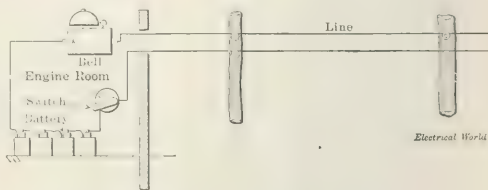


FIG. 1—DIAGRAM SHOWING ARRANGEMENT OF OLD FORM OF TWO-WIRE ENGINE ROAD SIGNAL IN BRITISH COLLIERIES

favor, but in the majority of cases that battery was thought too complicated. The Le Clanché battery, as is well known, will not withstand heavy drains of current unless special provision is made to enable it to do so. In the early days of electric signaling the pioneer who had the matter in hand did not appreciate that fact. The writer's experience has indicated that the secret of success with the Le Clanché battery for mining signals consists in making the individual cells very large and in having a large carbon plate surface, a large quantity of oxide of manganese and carbon inside the porous pot and the oxide of manganese of as high a percentage as possible. Like all chemicals that are sold in the open market, commercial oxide of manganese varies in quality, the variation on the commercial oxides of manganese being from 25 per cent up to 90 per cent. Bearing in mind that the 30 per cent variety will contain other elements, which will start polarization when the sal-ammoniac solution penetrates to them and the cell has commenced to work, it is not surprising that cells made up with this form of manganese run down very quickly. On the other hand, cells made with 90 per cent and over—the higher the better—will withstand a leakage current for a long time, and even a short-circuit for a certain time, without giving out.

In British collieries the open-type Le Clanché cell has for some years been giving way to the dry cell. The first

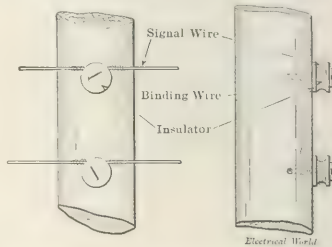


FIG. 2—WIRES AND INSULATORS FIXED TO PIT PROPS

dry cell was brought out nearly thirty years ago. As usual, though the idea was good, its design was bad and the cells were not satisfactory. Modern dry cells, in which care is taken to use oxide of manganese of great purity, carbon of great purity and to have a large supply of sal-ammoniac in solution, perform their work as satisfactorily as do the best of the open-type cells.

Of the early signals employed in British collieries mention should be made of the simple engine-room signal, con-



sisting of a single bell, connected to a battery of Le Clanché cells and to two naked iron wires. The connections were made as shown in Fig. 1. By pressing the two iron wires together the circuit was closed and the bell rang. The naked iron wires were stretched along the side of the road and were secured to small earthenware insulators, held to props, beams or plugs by the aid of screws. Troubles arose in the operation of this signal owing to the leakage from one naked wire to the other and to the accumulation of dirt, coaldust and other matter upon the wires. The dirt trouble was easily dealt with when once those who had to use the signal understood it. At first it was thought that the signal was out of order because it could sometimes be rung from a distance from the engine room but not near by. The miners were instructed to clean the wires in any convenient way before bringing them into contact with each other, and that trouble ceased.

The trouble due to the leakage current proved to be more serious. If, as very frequently happened, the air of the mine was humid, the moisture condensed upon the insulators and the props supporting them, and there was the usual multiplication of leakage paths. The leakage problem was solved in two ways: First, by making the cell very large and of the best material, as explained above, and, second, by employing a relay in extreme cases. The

shaft, but in the writer's experience it was wiser not to do so. The use of this wire increased the cost of installing the signal, and it also increased the liability of breakdown. The insulated wire in the shaft was a very frequent source of trouble. Usually it was stapled to plugs in the side of the shaft, and the staples often cut through the insulation. Since the advent of compressed air, and especially since the electric motor has come into use for driving haulage plants in mines, the plant on the surface has gradually been done away with and the machinery placed underground.

Another natural development of the signal shown in Fig. 1 is that shown in Fig. 3, in which there are two bells, one at each end of the road, and either two or three naked galvanized wires. One battery was usually employed, though some electrical men and some colliery managers liked to have two. The usual arrangement of connections was that in which the one battery was placed in the engine room with one lead connected to the third return wire. The other terminal of the battery was connected to the bell, and a wire from the first bell led to the second bell at the other end of the engine road. A second wire from the other side of the second bell was brought back to the neighborhood of the engine room. It will be seen that by bringing the second wire into contact with the return wire by rubbing them together the circuit was completed and both bells

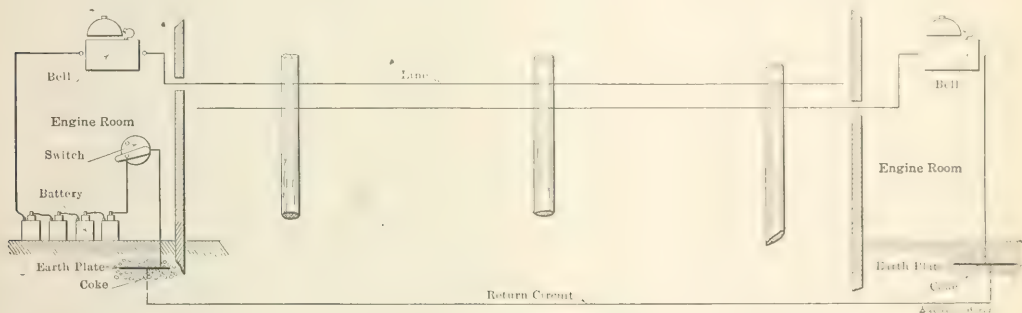


FIG. 3—CONNECTIONS OF OLD FORM OF ENGINE ROAD SIGNAL, WITH A BELL AT THE END OF THE ROAD AS WELL AS IN THE ENGINE ROOM

writer placed a number of cells in connection with the naked iron wires and the relay, so that the leakage current could be reduced to a minimum. The main battery was connected to the contacts of the relay and the bell. The result obtained was highly satisfactory.

One other trouble which arose in connection with these signals was occasioned by the falling in of the roof and the repairing that was done on the roads at night. The repairers seldom attempted to keep the wires clear of each other when taking them down to make necessary repairs behind the props supporting them. A fall of roof invariably brought the two wires together, thereby forming a short-circuit and exhausting the battery. The trouble was overcome by inserting a switch between the bell and the battery. In the writer's experience he found that a substantial form of plug switch answered best. The engine man could carry the plug in his pocket, so that there could be no chance of connection being made during his absence. When falls occurred in the night the battery did not suffer.

An extension of the signal shown in Fig. 1 was frequently employed in the early days, when the steam haulage engine was placed on the bank, the haulage rope passing down the shaft, around pulleys at the bottom of the shaft and thence along the engine road. It was necessary, of course, to signal to the engine room, and hence the battery and bell were located there, one insulated wire and one naked wire being placed in the shaft for the purpose. In some cases a second insulated wire was installed in the

shaft, but in the writer's experience it was wiser not to do so. The use of this wire increased the cost of installing the signal, and it also increased the liability of breakdown. The insulated wire in the shaft was a very frequent source of trouble. Usually it was stapled to plugs in the side of the shaft, and the staples often cut through the insulation. Since the advent of compressed air, and especially since the electric motor has come into use for driving haulage plants in mines, the plant on the surface has gradually been done away with and the machinery placed underground.

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wrang together. The same troubles arose in the maintenance of this signal as with the one shown in Fig. 1, but they were very much accentuated. The leakage paths were increased, and the chances of wires coming together from falls of roof and during repairs were also increased. The employment of a second battery at the farther end of the road was evidently quite useless, as it would not be so easily reached for cleaning and repairs, and it was usually exposed to considerably more local leakage than the one in the engine room. The third wire was often dispensed with, the battery being connected to ground at the engine room, the bell at the far end being also connected to ground, as shown in Fig. 3. Pressing the two wires together as before completed the circuit. A trouble with this signal in addition to those mentioned above resided in the ground connection. Only a small current was required to operate the signal, and there was no difficulty in obtaining a good ground connection at the engine-room end, but it was sometimes difficult to maintain a good connection at the farther end. Where there was moist earth, driving a spike into it was usually sufficient, or a connection could be made to the delivery pipe from a pump, or even to the rails. In some cases, however, the ground at the farther end was very dry, and in those cases the ground contact could not be relied upon.

In a later instalment the signals used in several well-known collieries will be discussed, and the growth and development of modern shaft signals will be traced.

## Recent Telephone Patents

### SWITCHBOARD CIRCUITS

Mr. R. H. Manson, of Elyria, Ohio, has patented a trunk circuit adapted for use with switchboards of the two-wire type. The trunk is of the calling-circuit variety and provides the full ringing, disconnect and guard signal features. One of the special features is the control of the application of ringing current by the "B" operator from the "A" end. Thus, no matter how the "B" operator manipulates the ringing keys, no ringing current is sent out until after the "A" operator has picked up that particular trunk. This patent is assigned to the Dean Electric Company.

A patent granted to Mr. H. G. Webster, of Chicago, and assigned to the Kellogg Switchboard & Supply Company describes an automatic ringing circuit. With this type of circuit ringing is started by depressing a locking key and is then intermittently maintained until released by the response of the called subscriber. In the particular circuit described the release of the ringing current is controlled by a differential relay. A balance in the windings of this relay is brought about by the response of the called subscriber.

### MISCELLANEOUS APPLIANCES

Mr. J. K. Rhodes, of Brooklyn, N. Y., is the inventor of a transmitter for the use in aiding persons talking to the deaf. The particular feature lies in including within the transmitter casing an adjustable resistance which controls the sensitiveness of the instrument. The resistance coils are disposed about the periphery of the casing, while the contact dial and arm are upon the rear of the casing so as to be concealed when the transmitter is in use.

Messrs. E. E. Dildine and J. A. Rugh, of St. Paul, have patented a cordless jack box in which the connections are made without the use of cords by the registering of the plug parts with the various jack springs. The plugs consist of collars of various lengths insulated from each other, and these collars make contact with the jack springs in such a way as to complete the desired circuits, each collar serving as a part of the circuit. This patent is assigned to the Sandwich Electric Company.

## Letter to the Editors

### Employer's Right to Employee's Invention

*To the Editors of the Electrical World:*

SIRs:—Referring to the discussion of the employer's right to an employee's invention appearing on page 57 of your issue of Jan. 4, while I agree that an employee is legally bound to comply with the provisions of a signed agreement, I beg to take issue with the statement that he is morally bound as well.

The question arises, How is an employee induced to enter into a contract with his employer? If he enter a contract which binds both parties to certain duties, the moral obligation to assign inventions is obvious. This applies mainly to employees of high standing whose ingenuity is their valuable asset, on which their compensation is based.

It is quite different, however, with the employee who, whether having an academic or a less thorough training, is obliged to look for a position in the "Wanted" column among advertisements for butchers, barbers, colored porters, "German and wife for farm," etc. Such a man's compensation, as a rule, is not based on his experience and personal value as a worker, but rather on a common market price, and eventually on the pressure of work. Employees of this type are often requested to sign agreements which bind

them to assign any invention to the employer, although the latter, in turn, has no obligation to the employee but may free him any time at pleasure. The reason for assigning so valuable an asset without receiving anything in return is the fear, or even the surety, on the part of the employee that he otherwise will lose his job. The morality of such an action is of a kind equivalent to the practice of an unskilled laborer who pays cash to the boss to keep his job.

Many employees sign away their inventive activity in the expectation that they will never have to turn over anything of value, but the mistake of this course will be apparent as soon as they happen to strike a valuable idea. It is the employee of this class, too, who receives little encouragement from employers toward inventive activity, and whose success is entirely dependent on himself. Therefore the product of his private labor should not without due compensation be assigned to those who have not contributed to its success. If the employee receive compensation for regular labor only, his obligation to his employer should stop right there, and any disposition of his own time and labor should be compensated for additionally; otherwise his condition would approach that of industrial slavery.

The United States patent law expressly gives the inventor the sole right to make, use and vend his invention for the term of seventeen years, without restricting this right in any way. The patent having an equivalent value can be handled the same way as any tangible property. Why should one be forced, then, to give such property away without compensation? Is it morally right to receive another's property without any compensation whatever, although, on the other hand, demanding both compensation and profit for one's own product? And is it morally right to take from an economically weaker person the only chance of rising to a deserved higher position? Morality, it is true, is a relative conception, but still there can be only one morality for which an individual or a people should strive.

Contracts binding an employee beyond the term of his employment, with penalties far exceeding the earning capacity of his whole life and vitally impairing his ability to earn, have been in vogue in Germany, particularly in the chemical industry. Through the efforts of the Verein der Technischen Privat-Beamten, mainly on political grounds in influencing legislation, the "morality" of such contracts has decreased until they now have no standing in the courts whatever, being considered contrary to good morals.

The claim of employers to patent rights of their employees varies with different instances. Many firms will claim shop rights only for furnishing material and paying for labor spent, while others request submission of all inventions, eventually paying a nominal sum for patents assigned and releasing all unsuitable inventions. Still others will pay all expenses for patent applications, retaining for assignment only the suitable patents. A large manufacturing concern has the form for assignment of all future inventions printed on its employees' record cards, and the affirmation by signature of the employee's veracity regarding his record at the same time assigns, without any compensation, any inventions he may make.

It seems pitiful enough that a striving and unsuspecting inventor is so frequently subjected to the freezing-out process; but even worse is the fact that all chance should be taken from him before he even has the opportunity of being an inventor.

That the employer legally has the right to an employee's inventions has never been fully settled by the courts; and this question may remain in doubt until the general custom has prevailed long enough to canonize it. In that event, at some future period it may be "morally right" to claim an employee's patent rights.

Youngstown, Ohio.

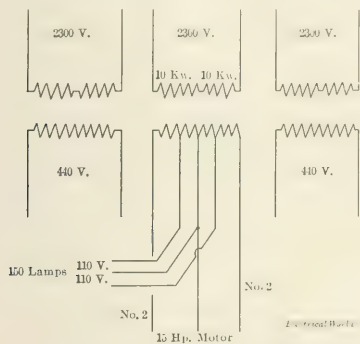
A. F. JOBKE.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Rearrangement of Three-Wire System to Reduce Voltage Fluctuations

In a Kansas flouring mill operated by 220-volt, three-phase motors trouble was experienced with the flickering of the lamp circuits supplied from the same feeders as the motors. As first installed, the transformers were arranged to furnish 220-volt, three-wire service from a single phase



DIAGRAMMATIC VIEW OF CIRCUIT ARRANGEMENT

of the three available. The 10-kw transformers were provided with middle taps and these were first used as the neutral connections of the 110/220-volt, three-wire system for the lighting service.

With the 15-hp motor fed from the same lines, the lamps flickered badly each time the motor was started and stopped or underwent a change in load. Connections were then changed to the arrangement shown in the accompanying sketch, the three-wire system being converted to 110/220-volt service, with the "outside wires" taken from new quarter points midway between the original neutral and the outside motor circuits. In place of the 220-volt lamps formerly used, 110-volt lamps were installed. The result has been the practical elimination of the flicker that was formerly so objectionable, probably owing largely to the fact that the low-voltage filaments have greater heat-storage capacity and thus are less sensitive to voltage variations than the 220-volt lamps.

## Drying Out Submerged Machines

Owing to the fact that generating stations are often located on river banks, because of the ready supply of water for boiler feed and condensing purposes, and inasmuch as flood conditions often prevail on such streams, it not infrequently happens that the generating apparatus is submerged. Of course, on streams subject to periodic floods precautions are taken to keep the equipment above the highest point ever reached by the water. In times of flood very little can be done while the apparatus in the station is under water. Service is interrupted, and often after the water has receded it takes a number of days to dry out the apparatus before service can be restored. It is on such occasions that the operating engineer must exercise his ingenuity, since it is

out of the question to build special means for drying out the machines, and since it is expedient to start the machinery at the earliest possible moment that this can be done.

In a late flood which engulfed the equipment of a central station, hand pumps were mounted over the various pits containing the engine and turbine auxiliaries until a centrifugal pump could be hitched up and arranged to throw water out of the engine-room window. It happened that the turbines were set high enough to escape the water, but all of the auxiliary machines and the equipment in the boiler room were submerged. When the water in the river began to recede, the submerged auxiliary motors were raised as quickly as possible and the field coils and armatures removed. After cleaning and rough drying the machine windings affected, the coils and armatures were placed in drying ovens. The armatures of the larger machines, which were too heavy to be readily handled, were dried by means of steam radiators mounted in the space occupied by the field coils. The ends of the machines were covered with a tarpaulin, and small fans were used to keep the air in circulation around the armature. Other units were dried by means of stoves placed inside a temporary wooden framework built over the sets and covered with strong paper, fans being arranged to maintain a continuous air flow through the inclosure. By this means it was possible to start some of the units in a few days, and the final drying-out process was effected by the application of a heavy low-pressure current.

In a flood which was experienced at Kansas City, Mo., some ten years ago the station of the Kansas City Electric Light Company was submerged, the water reaching just above the main bearings of the alternators. Not only was every piece of electrical machinery in the station soaked with water, but upon everything there was also a thick deposit of mud. The high-tension busbars, which were below the main floor, were also filled with this same slimy mud, which was not thick enough to shovel and yet too thick to pump. In addition, every piece of electrical apparatus was covered with a liberal supply of cinders, refuse and other debris. As soon as the water became low enough the mud was scraped and washed off the apparatus and a hose was turned on the armatures. After washing out all mud and picking the cinders out of the small cracks, heaters were used to dry out the machines, and when some of the moisture had been thus driven off, energy from another station in the city, which luckily was not so far away, was used for completing the drying-out operations. It was nine days before the first alternator was completely dried out. This machine was operated on an overcurrent for the first time so some coils burned out. The same trouble was experienced with the second alternator, and in each case the coils lost were those located at high-water mark. It was supposed that the coils were damaged by the mud which floated down from the works farther up the river. The smaller armatures were dried out by means of steam coils, fires and compressed air, and the cores and coils of the transformers were taken out of their cases and washed and dried in the sun. Eleven days after the flood the station was again in operation. Recent experience with submerged motor-driven pumps in mines also bears testimony to the wonderful amount of abuse modern electrical apparatus can withstand and still be put back into service.



## Overhauling an Electric Station Engine

By J. F. HOBART.

The management of a small station having occasion to install another steam engine, and having little cash to spare, cast about for a good second-hand engine and was offered an 11-in. by 13-in. automatic, self-contained engine, with the guarantee that it would be completely rebuilt and placed in such condition as to do the same work as when new. The engine was purchased and installed, whereupon it developed that the governor was faulty, there being considerable lost motion in the bolts and pins upon which the regulating parts were pivoted. After considerable correspondence it was agreed that new bolts should be procured at the expense of the dealer who sold the engine, and thus the regulator matter was finally satisfactorily settled. Later trouble developed in the crosshead, and it was found impossible to keep that connection tight. The pin would work loose, and no matter how well or frequently the crosshead brasses were keyed up, a bad knock between them and the pin would always manifest itself.

Investigation exposed the repair methods shown in the diagram. The pin, shown in section at *A*, had been turned down nearly  $\frac{3}{16}$  in. smaller in diameter than when first made, probably owing to the fact that the crosshead brasses had worn badly and would not fit the pin. After turning down the pin—which never should have been done—the brasses were babbitted to bring them down to the size of the pin. The layer of babbitt shown at *BB* was only  $\frac{3}{32}$  in.

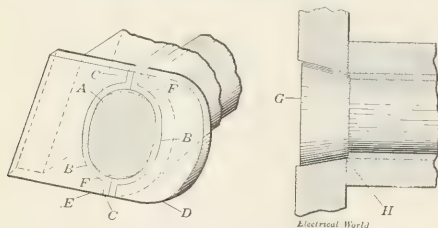


DIAGRAM SHOWING FAULTY REPAIR METHODS

in thickness, and the 2 tons or more of steam pressure on the piston, acting against the babbitt *BB*, forced the soft metal out of place so that a thin additional shim was required every morning to keep the wrist connection tight.

To make matters worse, the shop which did the babbitting chanced to be out of "special" babbitt at the time the repair job was done and lined the brasses with ordinary babbitt, fit only for large journal bearings. It was also found that the engine attendant in filing off the soft babbitt which daily oozed out of the bearing had relieved the edges of the babbitt at *FF* so very much that nearly one-half the bearing surface of the babbitt against pin *A* had been removed. The taking away of one-half the bearing surface necessarily increased the pressure of the pin against the babbitt, thus forcing the soft metal out of the brasses onto adjoining surfaces. It was also discovered that the pin had run loose at some previous time until the taper head had been drawn into the crosshead beyond the tapered portion *G*. This permitted an interference at *H*, and the pin being unable to enter the crosshead farther remained loose therein, constantly wearing the hole larger and becoming looser all the time. To remedy this trouble, the engine dealer was called upon to furnish a pair of new brasses from the engine builder, and a new pin was made in a local shop, with the tapered portion or head *G* larger than the old one so as to fit the enlarged taper hole in the crosshead. A mechanic carefully fitted the new pin into the distorted hole in the crosshead, filing, chipping and scraping the metal away until a full fit was obtained along the original angles but slightly larger in diameter.

A thin coat of red lead was evenly distributed with the finger over the entire taper surface of the hole in the crosshead in fitting the pin, the spots coming in contact being indicated where the red lead was rubbed off. In this manner the engine was restored to its original condition and was actually as good as new as far as the crosshead and its pin and brasses were concerned. It should be pointed out in this connection that one should never buy second-hand engines without taking them down and giving them a thorough survey.

## Overcoming Overload on Series Arc-Lamp Circuits

By CHARLES E. HIGH

It sometimes happens in planning the installation of a series arc-lighting system that sufficient allowance has not been made for the future growth of the plant, with the ultimate result that the constant-current transformer which has been provided becomes overloaded. Many times this overload is not sufficiently large to justify the expense of securing another constant-current unit. This was the case with our plant. A twenty-five-lamp transformer had been installed with the plant and first connected for 60 per cent load. This was later changed to 80 per cent load, then to full load, and with the addition of still more lamps the intensity of the light began to diminish. To overcome this difficulty a scheme was devised which is shown diagrammatically in the accompanying illustration. The primaries of two 3-kw, 2200/440-volt stationary-element potential transformers were connected in multiple with the

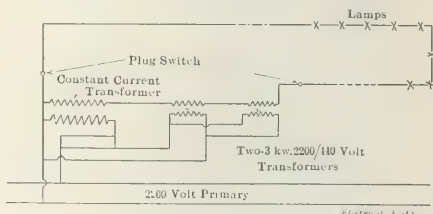


DIAGRAM OF CONNECTIONS

primary of the constant current unit, and the secondaries of all three transformers were then placed in series and connected directly to the lamp circuit. This plan allowed the operation of thirty-seven lamps on a twenty-five-lamp circuit and gave satisfaction in every way. The lamps returned to their normal brilliancy and no transformer was heated excessively. The constant-current transformer, operating on the margin, as it were, and maintaining the current at 6.6 amp, was assisted by the stationary element units, which boosted the voltage on the circuit and helped supply energy to the extra lamps. Care must be exercised in making the connections that proper polarities be maintained in the transformers.

## Methods of Locating Trouble

What methods are used for determining the location of grounds and short circuits on underground high-tension three-phase feeders? P. G. A.

In one system with which we are acquainted, the grounds on three-phase feeders are first located by means of low-tension direct current through a voltmeter. Then the bank of lamps passing from 10 amp to 15 amp is connected to the grounded phase through a current-reversing apparatus which reverses the direction of the current once every five seconds. A man equipped with a compass passes over the cable and the fault is indicated by a decreased deflection. In ordinary practice the presence of smoke in a manhole indicates within a very short distance where a short-circuit occurs.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Change of Energy Loss with Speed in Direct-Current Machines.**—W. M. THORNTON.—With the increasing use of large turbo-generators the exact knowledge of the change of energy loss with speed becomes important. No single rule covering the whole range of speeds is known at present, but different rules are assumed for low-speed ranges and for high-speed ranges. The present paper gives an account of measurements made for the purpose of examining the dependence of loss on speed, using a  $7\frac{1}{2}$ -hp direct-current four-pole motor running at a normal speed of 1500 r.p.m. The windage tests are novel in that they were made by running the machine in air and in vacuo. One of the conclusions from the present experiments is that there are at least two terms in the wind resistance of electrical machines, one corresponding to the formation of eddies, the other to a skin friction. For modern types of covered armatures only the former wind resistance factor becomes important at high speeds, while for smooth, covered surfaces the latter is not negligible at low speeds. The bearing friction loss is relatively higher at low speeds than at high, the index decreasing with rise of speed. Pole lamination has apparently an effect upon hysteresis as well as upon eddy-current loss. In the discussion H. H. Law spoke of several cases where simple alterations in the ventilating arrangements had effected an enormous reduction in the windage losses. In new designs the determination of the windage loss was largely a matter of experiment, but the influence of surface speed had to be carefully watched. C. H. Davidson remarked that in turbine-driven plants the accurate determination of windage losses was of the highest importance because they formed such a large proportion of the total. In large direct-current sets running at high speeds and fitted with powerful forced ventilation the windage loss might amount to as much as 40 per cent of the total losses and in alternators to 25 per cent or 30 per cent of the total.—*London Electrician*, Dec. 20, 1912.

**Polyphase Induction Machines.**—G. VALLAURI.—An article illustrated by diagrams on the passage of the polyphase induction machine through synchronism. In a polyphase induction motor the torque developed consists of two torques which are of an entirely different nature. One is the torque due to the action of the rotary field on the rotor currents induced by it (currents in the rotor windings and eddy currents in the rotor iron). The other is the torque due to the action of the rotary field on the magnetization produced by it in the rotor iron. For a fully loaded motor the latter torque is only 0.5 per cent of the total torque and is usually neglected for this reason. However, for the exact measurement and separation of the losses, as well as for the explanation of the power variation which occurs while the machine passes through synchronism, this small torque is of great importance and the fact that it has been neglected has caused misunderstandings. The author endeavors to sketch the functions of this torque.—*Elek. und Masch.* (Vienna), Dec. 22, 1912.

**Synchronous and Non-Synchronous Reactance.**—J. REZELMAN.—Another article in his long serial in which the author investigates the reactance of alternating-current machines. In this chapter he discusses fully the case of alternators having solid salient poles, both single and polyphase. A 75-kva, eight-pole, three-phase alternator producing 120-volt, 50-cycle energy at 750 r.p.m. is the basis

of the discussion and calculations.—*London Electrician*, Dec. 27, 1912.

**High-Speed Machines.**—MAURICE LE BLANC.—The first part of an article discussing the possibilities of constructing machines for very high angular speed. The author explains how most of the difficulties disappear if the rotor does not revolve around a rigidly fixed axis but is able to choose in each instance its axis of rotation just as a spinning top would do on a perfectly polished surface. The article is to be continued.—*La Lumière Elec.*, Dec. 21, 1912.

**Magnetic Leakage in Transformers.**—J. MURRAY WEED.—In a former article by the author formulas were derived for calculating the reactance of transformers and the eddy-current losses in the conductors, both of which are directly due to the leakage flux. The present instalment has reference to the nature and calculation of the mechanical stresses which are produced by this flux and which, at times of short-circuit, may result in serious damage to or even destruction of the unit.—*Gen. Elec. Review*, January, 1913.

**Mercury-Vapor Rectifiers.**—B. B. SCHAEFER.—An English translation of his recent German paper on improvements in mercury-vapor rectifiers of large ratings, having steel tubes as containers. The original German paper has already been abstracted in the *Digest*.—*London Elec. Review*, Dec. 27, 1912.

### Lamps and Lighting

**Controlling Equipment for Train Lighting.**—A note on a recent British patent (No. 4119, Dec. 19, 1912) of G. Inrig and L. Inrig. For controlling the output of a self-regulating reversible dynamo used in conjunction with accumulators for train lighting, the armature is built in two sections called the armature disks and the core. A non-magnetic metal casing or "tube socket" is keyed to the shaft against the commutator. One end of a soft-iron tube is secured to this socket, the other extending through the armature tunnel. The armature disks are secured on this tube. The core consists of soft-iron disks threaded on a metal tube fitting freely on the shaft. The core is cone-shaped. An ordinary Pickering ball governor is fitted on the shaft at the pulley end, one end of the links being attached to the core and the other to a movable collar on the shaft. This controls a quick-break knife switch. A small electromagnet in series with the shunt fields is fitted to the machine frame, iron keepers being fitted on two of the brush arms. These magnets hold the brush rocker in position when the machine is working. When normal speed has been reached the governor closes the knife switch, which is in the accumulator circuit. As the speed varies the governor adjusts the position of the coned core in the armature so that the pressure is kept constant. It is also arranged that at excessive speed the switch is automatically opened.—*London Elec. Eng'ing*, Dec. 26, 1912.

### Generation, Transmission and Distribution

**High-Tension Constant-Current Operation of Mines.**—SYDNEY F. WADSWORTH.—An article in which the author points out the advantages of the Thury high-tension direct-current system over the three-phase system for mines. Two cables are used instead of three. This in itself is a great advantage in mining work. Furthermore, while with the three-phase system practically the full pressure of the service is present at all points, with the high-tension constant continu-

ous-current system the full pressure between the two cables is present only near the switchboard. As the switchboard is receded from the difference of pressure between the two cables decreases. In mining work this appears to be a matter of considerable importance, since at the face of the coal, after allowing for all special arrangements for supplying the different districts, the pressure between the two service conductors would be comparatively small. With three-phase parallel working if a "short" occurs anywhere between two phases the whole service is put out of operation until the "short" is taken off and the cable repaired. With the high-tension constant continuous-current system the only effect of a "short" between two cables anywhere is the cutting out of the apparatus previously in service beyond the "short." The chances of shock with the high-tension constant continuous-current system would be considerably lessened in the working of most mines by the fact that the pressure between the live cable and the return conductor, the outer, decreases all the way from the surface to the workings. Finally the direct-current system is believed to be more economical.—*London Elec. Review*, Dec. 27, 1912.

**French Water Powers.**—HENRI PRESSON.—A list, with maps, of water-powers along the coasts and the frontiers of France. This completes the author's extended statistical articles on water-powers in France.—*La Revue Elec.*, Dec. 6, 1912.

### Traction

**Electrification of Trunk Railways.**—G. HULDSCHNER.—A comparison of the different systems. High-tension direct current for trunk railways requires the highest first cost of all possible systems. "Articles in American journals attempting to prove that the contrary is true show only too clearly that their conclusion is inspired by the hopes of industrious designers of direct-current machines." It is often also said that the three-phase system is suitable perhaps for railways with heavy grades, while for the flat country the single-phase system is the proper one. In one important respect this is wrong, since the single-phase motor with its speed characteristics adapts itself very well to mountainous roads, while the three-phase motor adapts itself directly to the requirements in a flat country where the highest power is required at the highest speed. Other considerations, however, change completely this conclusion as to the adaptability of both types of motors for flat and mountainous roads. The example shows that when there are some reasons in favor of one system there are always other reasons against it. The author then discusses the problem of regenerating energy. The economical importance of regeneration is usually considerably overrated, according to the author, the real importance being in the simplification of the work of the locomotive attendants. However, braking with regeneration of energy is not without danger, in case the electric connection between the motors and the station should be interrupted in some way and the emergency brake should not act immediately. As to line construction the difficulties of the three-phase system are thought to be overrated. The author thinks that it is too early to draw general conclusions. There is sense in agreeing on a uniform system for a state like northern Germany, but there is no reason, he thinks, in trying to reach international agreements as to one standard system. For the present it is best to build as many railroads of as many different systems as possible.—*Elek. und Masch.* (Vienna), Dec. 22, 1912.

**Boosters.**—J. G. CUNLIFFE AND R. G. CUNLIFFE.—An article on railway feeder networks. Recent developments in street traction have resulted in a greater intensity of electrical loading, i.e., in power demanded per mile of track. Boosting is thus becoming increasingly necessary. The main principles underlying the use of boosters, both positive and negative, are considered.—*London Electrician*, Dec. 27, 1912.

**Marine Propulsion.**—W. P. DURTNALL.—A paper read before the (British) Society of Engineers. The problem of marine propulsion is stated and a historical survey is made of the different solutions. The thermal and propeller efficiencies of steam-driven ships are discussed, and the conditions that the motive power must comply with are tabulated. The steam turbine is considered and is shown to be unsuitable for direct coupling to the propeller shaft. Finally an electric transmission system, known as the "Paragon," is advocated and described. The equipment of the United States ship *Jupiter* is mentioned.—*London Electrician*, Dec. 27, 1912.

### Installations, Systems and Appliances

**Insulation, Recorder and Leakage Current Indicator for Alternating-Current Circuits.**—At the recent exhibition of the Physical Society in London the insulation recorder shown in Fig. 1 was exhibited. The leakage current from the three-phase system to earth, after passing through a choking coil, is measured on a recording instrument and a leakage indicator connected in series. The pointer of this latter instrument is fitted with a contact so that when the current exceeds a predetermined amount a battery circuit is closed, the fuse *F* blown and an alarm bell begins to ring. To insure the absolute working of the instrument a small coil in the secondary circuit holds the pointer over against

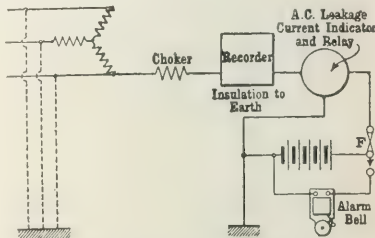


FIG. 1.—DIAGRAM OF INSULATION RECORDER AND LEAKAGE CURRENT INDICATOR

the contact once contact is made. The recorder is operated on the tapping principle, the pen touching the paper only at short intervals. This makes the operation very sensitive and accurate. The testing system is traversed only by low-tension direct current and is therefore perfectly safe to handle.—*London Electrician*, Dec. 27, 1912.

**Tariff.**—VOIGT.—Some remarks with respect to the use of the Potsdam tariff which has been mentioned repeatedly in the *Digest*. A tariff based on the same principles is used for agricultural districts, there being a fundamental charge per year per acre and an additional charge per kilowatt-hour consumed. Discount is allowed on the latter charge according to the amount of energy used.—*Elek. Zeit.*, Dec. 19, 1912.

### Wires, Wiring and Conduits

**Aluminum Arresters.**—R. T. WAGNER.—The first part of an illustrated article on the construction, installation and maintenance of aluminum arresters and their auxiliaries. The first aluminum arrester designed for use on a large transmission system in this country was put in service about seven years ago. Since that time hundreds of installations have been made under varied conditions in all parts of the world. While essentially unchanged, the later designs naturally embody certain improvements resulting from both laboratory work and a careful study of all installations. The present instalment discusses the formation of the hydroxide film on the aluminum, the dissolution of the film, the construction of the arrester, horn-gaps, charging resistances, the difference between arresters for grounded and non-grounded neutral circuits and the transfer device.—*Gen. Elec. Review*, January, 1913.



### Electrophysics and Magnetism

**Entropy and Temperature.**—V. KARAPETOFF.—A discussion of the relation between entropy and temperature with illustrations by means of analogues. In dealing with the common forms of energy we consider two factors, an intensity factor and a quantity factor. For instance, in electrical energy the ampere-hour, or quantity of electricity, is the quantity factor, and the voltage is the intensity factor. The nature of each of these factors is easy of conception. Heat energy is similarly characterized by temperature, the intensity factor, and entropy, the quantity factor. An understanding of the nature of entropy, however, is usually acquired with considerable difficulty, and in order to give a tangible picture of this quantity factor the author first reviews three old analogues in explanation of entropy, one by Zeuner and two by Mach, and then proposes and discusses a fourth, in which a fictitious heat-fluid or caloric is introduced. The entropy of a body is defined as the quantity of caloric in it, and the temperature as the pressure of this caloric. Some caloric is assumed to be in a bound state within the molecules of the body and to be liberated during irreversible processes. A review is made of the principal thermodynamic phenomena in the light of this analogue or picture, and it is shown that changes in entropy, temperature, volume and pressure can be predicted by a simple reasoning.—*Gen. Elec. Review*, January, 1913.

### Electrochemistry and Batteries

**Storage Battery.**—In connection with the exhibit of the Edison storage battery at the London Physical Society's recent exhibition some notes are given on the latest construction of the Edison battery. Several often-accentuated special features are no longer considered essential, for instance, the addition of cobalt and of bismuth to the active material. The electrolyte contains 0.5 per cent of lithium hydrate in a 21 per cent solution of caustic potash. The tubes for the material, which are vertically arranged in the frame of a positive electrode, have a length of  $4\frac{1}{2}$  in. and consist of nickel-plated steel finely perforated. They are strengthened by small rings, are provided with a spiral overlapping seam and contain nickel and nickel hydrate. The negative material is contained in the well-known small trays (or pockets) of very fine nickel-plated steel, likewise very finely perforated. They are provided with lids bent over at the edges and contain iron oxide with some mercury compound. These small trays are horizontally arranged. In the larger cells two square frames are united to one electrode of double the height. A five-plate cell weighs 4.6 lb., a twenty-five-plate cell 41 lb.—*London Engineering*, Dec. 20, 1912.

**Copper and Nickel in Electric Furnace.**—M. STEPHAN.—An account of some experiments on the reduction of copper and nickel ores in the electric furnace.—*Met. and Chem. Eng'g*, January, 1913.

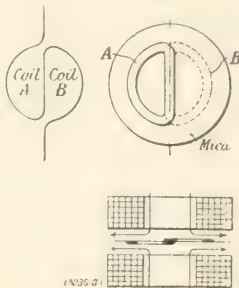
**Electrolytic Processes for Zinc.**—VICTOR ENGELHARDT.—A paper on recent progress in electrolytic processes for zinc. The author gives a sketch of the different processes proposed, with special reference to the processes developed by the Siemens & Halske company and to recent advances made by that company in the making of lead peroxide and manganese peroxide anodes.—*Met. and Chem. Eng'g*, January, 1913.

**Electrolysis of Sodium Chloride.**—A. J. ALLMAND.—An illustrated paper on two electrolytic cells devised by Billiter. The first is the Billiter-Siemens diaphragm cell with a horizontal diaphragm, being used in various plants. The second is the Billiter-Leykam gravitation cell, which is described in some detail.—*Met. and Chem. Eng'g*, January, 1913.

### Units, Measurements and Instruments

**Alternating-Current Instruments.**—Among the exhibits of a British firm at the recent exhibition of the Physical

Society in London was the J. T. Irwin astatic alternating-current dynamometer, which is said to be practically uninfluenced by external fields even if irregularly distributed. The two moving coils *AB* (Figs. 2, 3 and 4) are of D shape, with their straight limbs adjacent and close to the axis of rotation. The current flows through them at any moment in the same direction. They are mounted side by



FIGS. 2, 3 AND 4—MOVING COILS OF ASTATIC DYNAMOMETER

side on a disk of mica, which is pivoted or suspended in the radial field from two fixed parallel coils joined in opposition. In one position the plane of the moving coil is parallel to the plane of the fixed coils. The natural period of the moving system is high, and effective air-damping is provided by the mica vane, which turns in a closed chamber. The close juxtaposition of the coils eliminates errors due to external fields. High sensitivity and quick working are claimed both for the suspended and the pivoted forms, and portable instruments measuring the volts, amperes and watts are constructed on this plan. In the Irwin reflecting dynamometer the moving coil has a robust suspension and a periodic time of one second. The resistance of the fixed coil is 0.03 ohm, its inductance  $9 \times 10^{-4}$  henry; the moving coils have a resistance of 20 ohms and an inductance of  $3 \times 10^{-4}$  henry. When they are fitted with a scale of 1 m radius a full-scale deflection is obtained with 0.01 amp in the moving coils and 6 amp in the fixed coils.—*London Engineering*, Dec. 27, 1912.

**Voltage Rises with Electromagnets.**—P. KUSCHWITZ.—The author shows that in the design of protective devices to prevent detrimental rises of voltage due to the disconnection of inductive apparatus it is not sufficient so to dimension them that there are no sparks at the contacts when opened. Care must also be taken that rises of voltage at other places of the circuit cannot hurt the magnet coils or the protective devices themselves. In order to find out whether this has been accomplished sufficiently a vacuum lightning arrester in parallel to the parts of apparatus to be protected has very appreciable advantages when it is employed as a testing instrument.—*Elek. Zeit.*, Dec. 26, 1912.

**Air Condensers.**—H. SCHERING AND R. SCHMIDT.—An illustrated description of a set of standard air condensers with units of 0.5, 0.02 and 2  $\mu$ f of 0.01 mfd, and also an account of an adjustable rotary condenser by means of which intermediate values can be obtained. Parallel connection is accomplished by putting the condensers one above the other so that the total capacity equals the sum of the single condensers. There is then no necessity of making the connecting wires into consideration at all.—*Elek. Zeit.*, Dec. 26, 1912.

**Pyrometry in Steel Works.**—C. R. DOWLING.—A general account is given of the various methods at present available for the measurement of high temperatures. These include thermocouples, thermal radiation pyrometers, electrical resistor methods, optical pyrometers and calorimetric pyrometers. *London Engineering*, Dec. 13, 1912.

### Telegraphy, Telephony and Signals

**Magnifying Feeble Telegraph Currents.**—S. G. BROWN.—An experimental lecture delivered at the recent exhibition of scientific apparatus by the Physical Society in London. Methods for increasing the relative power of cables are becoming very important. The first method described relates to improvements in the sensitiveness of the siphon recorder. In the siphon recorder of the moving-coil type inertia of the parts, back emf of the coil, friction of air, suspension and inking had to be overcome; the coil and siphon had to have a definite period of oscillation, depending upon the speed of the signals and ranging from 0.3 to 0.1 second. The sensitiveness could be improved by shortening the siphon (which is about 2.5 in. long as a rule) and by narrowing the coil (having 500 turns of 2-mil wire at a mean radius of  $\frac{3}{4}$  in.). The inertia of the coil and of the siphon should be equal in order to minimize the inertia of the system, but it was practically inadvisable to go below fifty or a hundred turns, and Mr. Brown hence magnified the motion of the coil in the first device he exhibited. A fine fiber, kept in tension by flat springs, was attached to an arm carried by the moving coil and to a vertical fiber on the siphon suspension device, which was fixed on an aluminum carrier held by a vertical fiber at the top and by two parallel fibers 0.2 in. apart below. The one leg of the siphon was on the axis of the suspension between the two latter fibers, and the whole suspension device was vibrated up and down by the aid of a lower (very weak) and an upper flat spring, so as to jerk the ink out. The siphon contained red aniline dissolved in methylated spirits, and its working end was ground flat to give closely spaced dots. When the instrument was adjusted to 10.5 natural periods per second, with a 300-ohm 300-turn coil, a current of 50 micro-amp gave a full-sized signal corresponding to a deflection of 0.1 in. on the paper, and the back emf was reduced to a quarter or less of its ordinary value. On the largest Atlantic cables an increase in speed of 30 per cent had been realized by these means. The second improvement concerned a thermoelectric relay. In this device a very light thermopile of five junctions (platinum, and platinum with 20 per cent of iridium) was kept oscillating between two small alcohol flames by an arrangement resembling the one adopted for the siphon, some of the fibers being phosphor-bronze wires. The flames were wick burners, each provided with a copper cap fixed above a few turns of a copper wire coil, which became hot and insured a steady production of vapor. In the neutral position both ends of the thermopile were dull red; when deflected by the cable current one junction became bright red, the other almost dark. There was a lag in the thermal current, but it was inappreciable for cable work, and in fact advantageous with simplex working, because it facilitated the balancing of the sending current which might affect the receiver. With a natural period of the coil equal to 8.7 periods per second and a 480-ohm 480-turn coil, a coil current of 0.03 milliamp gave a current of 0.81 milliamp from the pile through an external resistance of 42 ohms, the thermopile itself being deflected by 0.075 in. Thus there was a magnifying power of twenty-seven. The remarkable property of this relay was that its magnifying power was constant and that it multiplied the impulses received in exact proportion to their strength, as was shown by curves. How this was possible Mr. Brown further explained by the simple mechanical experiment that a heavy weight, suspended by a string coiled round a rotating spindle, could easily be raised almost without pulling the free end of the string up at all, because additional power came from the motor driving the spindle (a treadle in the demonstration). This principle of mechanical power magnification was utilized in a third device, by means of which it was possible to work an ordinary siphon writer, normally requiring 3 milliamp, by a current of 10 microamp. On a German-American cable an increase of speed of 40 per cent had

been maintained in three weeks' trials by the aid of the thermocouple.—*London Engineering*, Dec. 20, 1912.

**Wireless Telegraphy Generator.**—E. F. W. ALEXANDERSON.—An illustrated article in which the author first gives a few notes on the generating equipments used in present-day wireless-telegraph stations in which the spark method with 500-cycle energy is employed. He then enumerates the reasons why this system will probably be superseded in the near future by those using continuous trains of waves generated by high-frequency alternators. The paper describes the design of an inductor alternator for directly producing outputs at 100,000 and 200,000 cycles, and also an alternator in which telephone current is used for field excitation and in which the current generated by the armature has a volume larger than the energy used in the telephone for excitation.—*Gen. Elec. Review*, January, 1913.

**Great Britain.**—The annual report of the British Postmaster-General on telegraphy, telephony and wireless telegraphy. The most important event of the year was the transfer of the system of the National Telephone Company to the State.—*London Electrician*, Dec. 13, 1912.

### Miscellaneous

**The Future of Electricity.**—Some further interviews with prominent French and Italian electrical engineers. Barbillion discusses some problems of electrical training in French schools and universities. Riccardo Arno predicts that central stations will be forced more and more to make a charge for extra-phase currents; Arno's method of accomplishing this has been already adopted by a number of stations in Italy. Marius Latour thinks that new principles of dynamo-electric machinery can hardly be expected, as every possible type seems to have had its chance of being invented. But improvements will be made in mechanical respects, etc. Really great progress is to be hoped from the laboratories of the physicists and the chemists. Grosselin thinks that power transmission by cables is bound to increase with the length of alternating-current transmission systems.—*La Lumière Elec.*, Dec. 21, 1912.

## Book Review

**POWER LOSS CALCULATOR FOR ELECTRICAL CONDUCTORS.** Devised and published by Ralph U. Fitting, Pine and William Streets, New York City. 1912. Three pages and two calculators. Price, \$5.

A handy calculator for the use of engineers in calculating transmission-line problems. The calculator itself is in two parts, the first of which is based on the assumption that the line-charging current or electrostatic capacity effect is negligible. The known quantities in the problem are kilowatts to be delivered, length of line, volts between phase wires at receiving end, and power-factor of load; the calculator determines the per cent of power lost in single-phase, two-phase or three-phase circuits of copper, aluminum or copper-clad steel. The second portion of the calculator is for determining the correction to be applied to the result obtained in the first instance on account of neglecting the line-capacity effect. In most cases this calculator will determine the line loss to within 1 per cent of loss. In a specific case the following results were obtained: Given a three-phase, 50-cycle, 111,100-volt line, with 250,000-circ.-mil conductors spaced 10 ft. between adjacent phases, all in one plane, a load power-factor of 0.921 lagging and a product of 2,420,000 kw-miles (kilowatts delivered multiplied by length of line in miles), then the computed loss will be 4.73 per cent, the calculator loss uncorrected 5.10 per cent, the capacity correction 0.57 per cent, and the calculator loss corrected 4.53 per cent. This calculator may be regarded as very useful for making preliminary plans or checking final calculations.

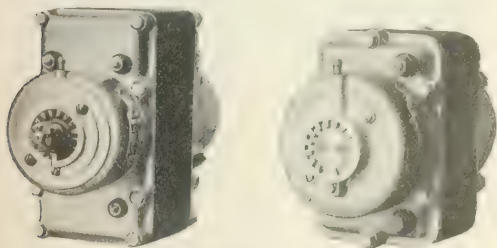
# New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed  
Manufactured Products of Interest to Electrical Readers

## Electric Starting, Lighting and Ignition Systems for Automobiles

The Westinghouse Electric & Manufacturing Company has entered the accessories market with starting, lighting and ignition outfits. The equipments so far announced are starting motors, lighting generators, combined ignition and lighting generators, and combined starting and lighting motor-generators—all 6-volt systems. For starting and lighting one motor-generator is used, and for ignition and lighting one generator and one ignition coil. All timing and distributing parts are contained in the generator, thus simplifying both the electrical and the mechanical connections.

A feature of the motors and generators is the heat-resisting compound in which all windings are baked. This compound cements the windings together and prevents them vibrating and jarring loose—and the compound, it is claimed, will not soften even at 250 deg. Fahr. Oil, gaso-



TWO TYPES OF 6-VOLT DYNAMOS

line, water and alcohol are also said to have no effect upon this compound. The generators operate in connection with a storage battery, which supplies energy when the engine is running at low speeds and when the car is idle. By an arrangement of the generator winding the battery is charged at all running speeds when lamps are not burning, and when the lamps are burning the generator supplies the energy for the lamps and in addition charges the battery above the balancing speed. The arrangement is said to be such that the battery is at no time charged at an excessive rate. Regulation of battery charging is accomplished by the generator itself and without the use of any relays or solenoid-operated regulators. The system is self-regulating and no adjustments are necessary. The generators have wound-field coils.

Ignition is accomplished through single-unit spark coil, operating in conjunction with timing and distributing parts on the generator. The battery, either alone or acting with the generator, furnishes continuous energy. The timer or interrupter gives automatic spark advance, and also increases the period of contact as the speed increases to make the spark uniform regardless of speed.

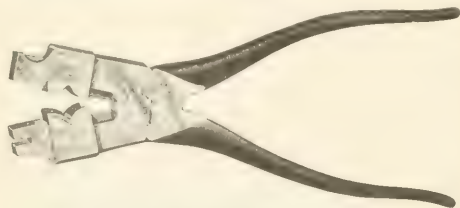
The Westinghouse starting motors are designed with a view to minimizing the discharge of the battery during starting. This is done by adapting the power of the motor to the requirement that it turns the engine over as one would do in cranking by hand. This takes considerably less power than would be required to spin the engine unnecessarily at high speed, and makes possible the use of

a lighter battery and a lighter charging generator because of less capability for charging.

The motors and generators have ball bearings and steel shafts and frames. They are entirely inclosed and thus are dust-proof and liquid-proof. Lightness of weight is secured by a compact arrangement and design of the parts. Starting, lighting and ignition switches, meters and wiring details are furnished complete with standard equipments by the manufacturing company.

## Wire-Skinning Pliers

A tool for removing insulation from wire has been placed on the market by Mathias Klein & Son, 562 West Van Buren Street, Chicago. Referring to the illustration, it will be noted that there are knives on both sides of the tongues for cutting the insulation, that another knife splits the insulation lengthwise of the wire and finally that the end of



WIRE-SKINNING PLIERS

the jaws is cross-hatched to give a good grip in pulling off the insulation. Another knife is provided for scraping the wire, if necessary, and there are a slot for bending loops in ends of wires and a knife for side cutting. At present these wire-skinning pliers are manufactured only in a size for use with No. 14 wire.

## Electric-Lighting System for Automobiles

To avoid the difficulties arising from the use of small and delicate parts in automobile lighting the Rushmore Dynamo Works, Plainfield, N. J., have designed a system of utilizing the property belonging to iron wire of increasing its electrical resistance considerably at a temperature slightly below red heat. The voltage and current are in proportion up to about 1000 amperes, after which the resistance is increasing so that there is an automatic increase in a largely increased voltage for each additional ampere of current.

The first and most primitive method for utilizing this property of the iron wire was to connect the iron coil as an automatic rheostat in the main circuit. This arrangement allowed the dynamo voltage to rise unchecked with the speed and the surplus output was absorbed in heat by the iron coil. Aside from its wastefulness, this system gave very imperfect regulation. A slight step in advance was made by connecting the shunt-field coil beyond the iron coil, thereby holding the voltage at the terminals of



the field coil fairly constant. This did not give a constant field, but a self-weakening field.

The solution was found in supplementing the main-shunt field coil with a bucking coil arranged as a shunt around the iron "ballast coil." The bucking coil opposes the main field coil but is not under any condition quite so strong as the latter. When the ballast coil is cold it practically short-

has to pass through the bucking coil. This intensifies the action of the latter so much that the output is held down to an average of 3 amp, which takes care of the small lamps and delivers a small current to the battery, thereby always keeping the latter charged.

It is claimed that owing to the large output of the dynamo daylight charging (other than the small constant 3-amp current) is unnecessary. Operating the dynamo when light is wanted produces automatically at ordinary driving speeds all the energy required. As a lamp takes about 1 amp to every 6 cp, head lamps as large as 30 cp each will take only 10 amp for the pair, leaving a sufficient margin to supply the side and tail lamps and still deliver a

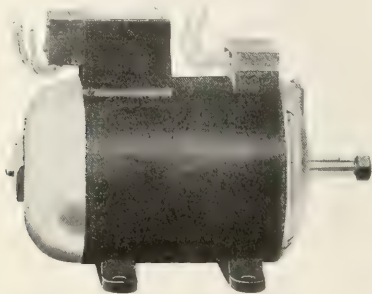


FIG. 1—THE DYNAMO COMPLETE

circuits the bucking coil, so that the effect of the latter is negligible and the main-shunt coil has its full effect. Thus at low speeds the dynamo acts practically like an ordinary shunt dynamo and builds up an effective output at the lowest practicable speed. When, however, the critical speed and temperature of the ballast coil are reached the resistance of the latter increases rapidly, thus forcing the excess current through the bucking coil and decreasing the excitation due to the main-field coil.

When the parts are properly proportioned it will be found that the dynamo will generate a small current of the necessary voltage for charging even at 200 r.p.m., and it attains its normal or critical output at about 600 r.p.m. From this speed to the highest the rise in output when connected to the storage battery is trifling. At the highest speeds the field excitation is said to be only one-sixth of what it would be without the bucking coil.

A 28-lb. dynamo, it is said, operates at an output of about 12 amp, which may rise to 14 amp at maximum speed. A larger size, weighing 43 lb. and intended to run at engine speed, develops about 15 amp normally and 16

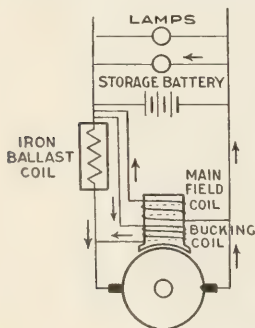


FIG. 2—CIRCUIT DIAGRAM

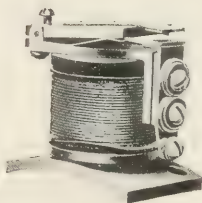


FIG. 3—AUTOMATIC CUT-OUT

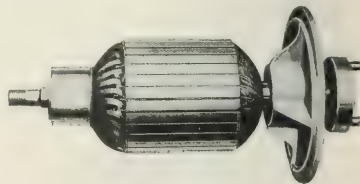


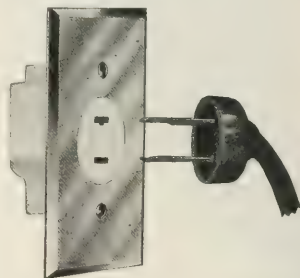
FIG. 4—SLOW-SPEED ARMATURE

small charge to the battery. The fact that daylight charging is not necessary is an additional advantage, as it relieves the owner of the responsibility for seeing that his battery is kept charged.

### Flush Receptacle

A receptacle which is interchangeable in that it provides for the use of either a surface plug or a polarity plug in connection with it has recently been put upon the market by the Machen & Mayer Electrical Manufacturing Company of Philadelphia, Pa. The receptacle, an illustration of which is shown herewith, fits flush with the wall plate which is used to give a pleasing finish and to cover the aperture containing the wall box. The receptacle is 1 3/16 in. deep, allowing room for wiring in a shallow wall box, and it is said that it is substantial in construction and neat in appearance.

It is further stated by the makers that the receptacle may be installed regardless of the type of plug to be used and that it may be wired without removing the porcelain cap. The internal construction has received special attention and has been so arranged that arcing across the con-



FLUSH RECEPTACLE AND PLUG SWITCH

to 18 amp maximum. These weights include the cut-out. The usual automatic cut-out is provided to disconnect the dynamo from the battery at speeds too low for charging. The ballast coil is mounted on the dashboard in connection with the head-lamp switch. Closing the head-lamp switch also puts the ballast coil in circuit; opening it disconnects the ballast coil, so that the entire output of the dynamo

tacts even on high voltages is prevented. A polarity plug in connection with this flush receptacle has been found to be especially adaptable for use with small motors, heating apparatus and the like, and for laboratory and experimental work where the polarity must not be reversed. The receptacle fits standard switch boxes and may be had in practically any finish.

### Sectional Conduit System for Steam Pipes

The Berwind-White Coal Mining Company is one of the largest operators in the bituminous field, and in many respects its most interesting operations are in and near Windber, Pa. This town has a population of 12,000 and is situated high in the mountains not far from the city of

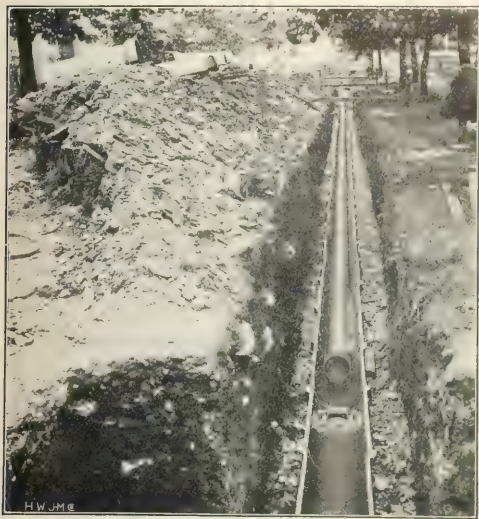


FIG. 1—LOWER HALF OF SECTIONAL CONDUIT WITH STEAM PIPES PARTIALLY INSTALLED

Johnstown. The municipality is practically owned by the coal company and allied interests.

Some years ago the Windber Heating Company was formed and a large power house was built at the entrance of one of the coal mines. This plant furnishes energy for lighting and motor service in the mines and for a large portion of the town and also steam for residence heating. At the present time the company is under contract to supply heat for 58,000 sq. ft. of radiation. In all the early installations the piping was insulated with wood covering. About a year ago one line was opened up and what was left of the wood covering was removed and sectional conduit substituted. This proved so satisfactory that the company recently replaced over 2000 ft. of steam line with sectional conduit, making a total of 3325 ft. of this system.

The recent installation, of which two views are shown, is an 8-in. main line, running from the power house up a steep hill and down a grade to the heart of the town, where it connects to the branch mains. There is no return line on this system, live steam being carried into each building at a low point, so that the return will flow back into a trap, from which it is allowed to go to waste.

Several difficult conditions had to be met with, such as the line passing through coal veins and hard pan, through which surface water containing sulphur percolated, soaked through the wooden protection and corroded the steel pipes. Consequently it was necessary to remove a considerable quantity of pipe, although it had been in place only three years. In laying this pipe line it was found necessary to cross under the gutter of a roadway which carried mine water containing a large percentage of sulphur. In laying the new conduit and pipe at this point the course of the steam was temporarily diverted while the conduit was laid across its path. A concrete dam was constructed in the gutter with the conduit embedded in it. This prevented the backfilling from washing away, securely held the con-

duit in line and kept it free of danger from sulphuric water.

As originally laid the pipe was allowed to take the curvature of the ditch, with unnecessary strains placed on joints, resulting in their leaking. In laying the new system care was taken to secure the correct grade. A ditch was dug 3 ft. wide and to the necessary depth. In the bottom of the ditch a channel 9 in. deep and 12 in. wide was made. In this was laid a sub-drain 6 in. in diameter, the bottom of which was covered with 6 in. of crushed stone of rather coarse grade. Upon this was laid a layer of fine chip stone, to form a fairly even bed for the bottom half of the tile conduit.

At every fifth section of tile was a supporting tee, with the bell of the branch down and the base filled to the flow line of the conduit with rich concrete, as will be noted in Fig. 1. In this concrete were set roll frames of the proper height. These frames are designed to carry the entire weight of the pipe and permit it to move under expansion and contraction without placing any strain on the tile conduit.

The steam pipe was then laid and the expansion joints were placed in the line in manholes at proper intervals. For testing purposes the pipe was then subjected to a hydraulic pressure of from 20 lb. to 60 lb., according to the steam pressure to be carried in the line where the test was made.

The top halves of the conduit were then placed in position, the longitudinal joints being well washed with neat cement mortar, and the bell joints were cemented to insure their being watertight.

Asbesto-sponge filling was packed in the conduit all around the steam pipe, as shown in Fig. 2, after each top section had been secured in place. Crushed stone of medium size was filled in until the bells of the second half were covered with 3 in. of stone. Then the ditch was filled up and tamped.

The manholes were made with 13-in. concrete foundation walls to a height even with the top of the lower half of the conduit. The conduit was brought through the man-

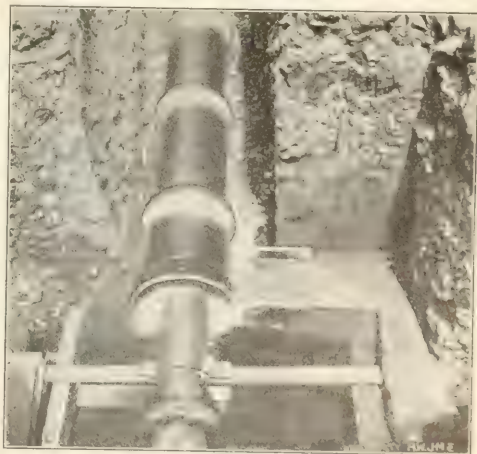


FIG. 2—COMPLETED INSULATION AT MANHOLE

hole walls, so that the edges of the tile were flush with the inside of the walls. In order that the tile should have bell ends in the manholes, unions were used in laying the first sections on the down-grade side of all manholes. Over these concrete foundation walls brick walls were built and brought in at the top to the proper size to receive the manhole plates. Wherever the tile entered the manholes the

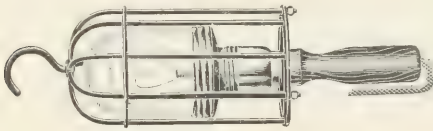


pipes were covered with sleeves of sectional asbesto-sponge felted pipe covering and the openings around them were closed with a shutter.

Aside from its simplicity and the facility afforded for its rapid installation, these sectional conduits, which are made by the H. W. Johns-Manville Company, New York, are said to be impervious to water, dampness and acids. Being made from a special combination of stoneware, clay and other ingredients, they form a particularly durable protection for underground steam pipes subject to corrosive action from chemicals. An additional advantage found in the use of these conduits is that, owing to their method of construction, the weight or movement of pipes cannot injure the conduit. It can be opened up for inspection or removed and relaid without damage to the piping.

### Vapor-Proof Portable Lamp Guard

The McGill Manufacturing Company, of Valparaiso, Ind., is putting on the market a vapor-proof, water-tight portable guard for use in breweries, tanneries, gas plants, cement plants and other places where a guard of this character is needed and there is danger of short-circuiting.



VAPOR-PROOF PORTABLE LAMP GUARD

The unit is provided with a glass globe which screws tightly over the lamp and is in turn protected by a wire guard.

### An Electric Tachometer

There are many operations in which it is desirable to have permanently connected to an engine or machine an accurate speed indicator which will show at a glance the



ELECTRIC TACHOMETER AND SPEED RECORDER

speed at which the machine is operating or will keep a continuous record of speed throughout the period of operation. The Brown Instrument Company and the Keystone Electrical Instrument Company of Philadelphia, Pa., are placing on the market an electric tachometer which it is said will perform these duties in a satisfactory manner.

The instrument consists of a small generator, designed for use with this tachometer and generating 25 volts at 1000 r.p.m. On account of this voltage generated, an instrument which is dead-beat in operation can be supplied. The instruments have unusually high resistance, exceeding 3000 ohms in each, so that the length of leads connecting the magneto and the indicating instrument has no effect on the readings. One, two or three instruments may be connected to the same generator without affecting the indications. This high-resistance feature is advantageous, for oftentimes after the generator and one indicating instrument have been installed it is desirable to place a recording instrument in an office or at another convenient point, and this can be connected to the generator without recalibrating the instrument.

With many machines operation at a certain speed is necessary to produce the best results. For instance, in large machine tools it is desirable to know the cutting speed, in blast furnace plants the number of cubic feet of air per minute blown into the furnace is checked from the engine speed, and in practically all testing laboratories speed is an important measurement. It is claimed that this electric tachometer will bring all these operations under more accurate control.

### Electric Cooking Installation in a Maharajah's Palace

Electric stoves and other cooking utensils made in the United States have found their way into high social circles in India, and appear to be appreciated there. The accompanying illustration shows the kitchen in the palace of the Maharajah of Mysore, where electric cooking appliances made by the Hughes Electric Heating Company of Chicago are installed. In the foreground is seen a table equipped with a charcoal stove, used before the electric range and other utensils were installed. At the left is a four-hole electric range. The "griddles" are equipped for three-heat intensities, consuming at maximum 880 watts, at medium 440 watts and at low heat 220 watts. The oven has two three-heat units, located at top and bottom. The range has a broiler attachment and is provided with a warming closet and a shelf extending the full length of the stove underneath the oven. Other electric cooking appliances in the Maharajah's installation are six three-



ELECTRIC COOKING INSTALLATION IN INDIA

burner hot plates, four two-burner hot plates, two table stoves and six self-contained ovens. All were made by the Hughes company.

From a letter written by Mr. C. F. Beames, chief electrical engineer for the Mysore government, it appears that the appliances have made a decided "hit."



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Purchase Control of Wilmington & Philadelphia Traction Company.**—The National Properties Company of Pittsburgh has acquired a controlling interest in the Wilmington & Philadelphia Traction Company through purchase of a large block of that company's common stock. The purchase was made through Messrs. H. B. Hollins & Company, of New York, and Messrs. Newburger, Henderson & Loeb, of New York and Philadelphia, together with Messrs. Scott & Company, of Wilmington. This gives to the National Properties Company control of the electric lighting business of Wilmington, Del., and of the street railway systems in that city and in Chester, Pa. There is also a connection between these street railway lines and those in Philadelphia. The capitalization of the Wilmington & Philadelphia Traction Company will not be enlarged. In addition to this recent acquisition, the National Properties Company controls the Pittsburgh City Light & Power Company and several water companies in the West. Its president is Mr. Van Horn Ely, of Pittsburgh; Mr. W. F. Havemeyer, of Philadelphia, is vice-president, and Mr. B. N. Busch, of Messrs. H. B. Hollins & Company, New York, secretary-treasurer. Mr. H. D. Anderson is auditor. The company has offices at 15 Wall Street, New York, and in the Commonwealth Building, Pittsburgh. Mr. Ely is to be president of the Wilmington & Philadelphia Traction Company, succeeding Mr. Oscar T. Crosby, who has sold his interest in the company, has resigned and expects to go abroad at an early date for an extended tour. Mr. T. W. Wilson, now assistant to the president, will become vice-president and will remain in active local control of the Wilmington company. No immediate extensions or improvements are contemplated by the purchasers, according to Mr. Ely, who stated this week that the properties are in excellent condition.

**Western Electric Prize Salesmen in Conference.**—Some thirty-five of the prize salesmen of the Western Electric Company and fifteen of the general office men took part in a conference held in Chicago from Jan. 6 to 11. The prize salesmen are the men who make the best records at the eighteen district offices. The contests are determined quarterly, and badges of different colors indicate the number of contests won. Thus a blue badge designates a four-time winner, a red badge three successes, and so on. The number of badge winners up to Jan. 1 in the Western Electric organization was eighty-nine. Salesmen who had not been winners in prize contests before March 1, 1912, were eligible to attend the Chicago conference and inspect the Hawthorne factory. The program of the week included talks on various subjects by men inside and outside of the organization, presentation of prize badges, inspection of the shops and various entertainment features. On the night of Jan. 9 the Hawthorne Men's Club gave a banquet at the Hotel La Salle to which the prize salesmen and other visitors were invited. This banquet is said to have been the largest ever held in Chicago, 988 men sitting down to it. On the following evening there was a conference banquet, at which a number of prominent Western Electric men were in attendance, including Messrs. W. P. Sidley, vice-president; Gerard Swope, general sales manager; H. F. Albright, general superintendent; F. V. Bennis, supervisor; O. D. Street, general telephone sales manager; E. W. Rockafellow, general supply sales manager; F. A. Ketcham, central district manager, and H. L. Grant, Chicago sales manager. One interesting statement made during the conference was that the Western Electric Company did the largest business in its history in 1912, the sales reaching over \$70,000,000.

**British Telephone Award Followed by Stock Decline.**—Sitting as a court of arbitration, the British Railway and Canal Commission, consisting of five judges of the High

Court, rendered a decision on Jan. 13 that the government shall pay \$62,576,320 to the National Telephone Company for its system, which was taken over by the Post Office Department on Jan. 1, 1912. All of the telephones in the British Isles, 648,000, passed into the hands of the State through this transfer. The National company originally demanded \$105,000,000 for its interests, but this figure was reduced by many millions through compromises during the trial, which lasted seventy-three days. During the trial an agreement was reached as to the value of the plant, this sum being \$51,568,825. More than 600 men were employed for eighteen months at a cost of \$1,250,000 in making an inventory of the properties. Following agreement as to the value of the plant, it became necessary for the court to determine what additional amounts should be paid to the company. It had been expected that a total award of between \$80,000,000 and \$90,000,000 would be made to the company, so that the judgment of the commission for about \$62,000,000 was followed by a thirty-two-point decline in the quotations of the company's stock. This fell from 141, at which it had stood for some time, to 109. At times last year the price was as high as 162. It has been stated repeatedly that since the government took over the telephones the service has been exceedingly unsatisfactory.

**Will Erect a Steam Generating-Station Near Toledo.**—Control of the Maumee Valley Electric Company of Maumee, Ohio, and of the Suburban Light & Power Company, of Perrysburg, Ohio, has been obtained by the Crawford interests, of New York, which organized the Auglaize Power Company in 1911. The Defiance (Ohio) Gas & Electric Company is controlled by the same interests. A steam generating station, to cost about \$500,000, is to be erected near Toledo and energy from this station will be supplied to towns between Defiance and Toledo. W. P. Wallace, who has been general manager of the Auglaize company, will be manager of all the properties. H. L. Crawford, of H. L. Crawford & Company, New York, has been chosen president of the Auglaize Power Company, while E. L. Crawford, of Crawford, Patton & Cannon, New York and Philadelphia, heads the Defiance Gas & Electric Company. Eugene Reinfrank, general counsel for the companies, is president of the Valley Light & Power Company, but its organization has not been completed yet. A reference to the hydroelectric developments of the Auglaize Power Company appeared in these columns May 18, 1912.

**Copper Down to 17 Cents a Pound.**—As had been expected since publication of the December statement of the Copper Producers' Association, showing an inventory of nearly 20,000,000 lb. in surplus stocks as a result of refusal by consumers to pay the high prices demanded by the selling interests, concessions were made this week by the latter domestic producers. Many of the smaller selling interests offered electrolytic copper last week under 20 cents a pound, the price which has been maintained since Jan. 1, and on Jan. 14 quotations below that figure were made by the larger selling interests in the market. At the end of the day electrolytic was available at prices ranging between 17½ cents and 17 cents a pound, and offerings as low as 16½ cents were made by second hands. Actual sales were in small volume, the general attitude on the part of consumers being to hold off until it is determined whether still lower levels will be reached.

**Oro Electric Corporation Seeks Franchise in Stockton.**—The State Railroad Commission of California has set Feb. 11 for a hearing upon the application of the Oro Electric Corporation of San Francisco for permission to engage in the electric-service business in Stockton, Cal. Service in that city is now furnished by the Western States Gas & Electric Company.

**Electric Bond & Share Company Financing.**—Directors of the Electric Bond & Share Company at a meeting held January 14 authorized the issuance of \$1,500,000 additional preferred stock and \$1,500,000 additional common stock. They also voted an extra cash dividend of \$1,500,000 to the holders of the company's common stock, payable to holders of record at the close of business on January 14, 1913. The \$1,500,000 preferred stock will be offered for subscription at par and accrued dividend to holders of preferred stock of record at the close of business on January 14, 1913. The common stockholders have agreed to purchase at par and accrued dividend so much of such preferred stock as shall not have been subscribed for by preferred stockholders on or before February 1, 1913. The \$1,500,000 common stock will be offered for subscription at par and accrued dividend to holders of common stock of record at the close of business on January 14, 1913. With the issuance of the new stock the company will have outstanding a total of \$5,000,000 preferred stock and \$5,000,000 common stock. The regular quarterly dividend of 1½ per cent on the preferred stock, payable February 1 to stockholders of record January 27, and the regular quarterly dividend of 2 per cent on the common stock, payable January 16 to stockholders of record January 15, have also been declared.

**General Gas & Electric Company's Business Is Increasing.**—Improvement continues to be shown each month in the returns of the General Gas & Electric Company, which was formed last year by W. S. Barstow & Company, 50 Pine Street, New York, as noted in these columns July 6, 1912, to take over and operate public utilities in Ohio and Vermont. In the twelve months ended Nov. 30, 1912, gross returns from these properties showed a gain of about \$92,600, as compared with returns in the corresponding period last year. Net earnings increased by about \$36,500 and the surplus for dividends by some \$32,250. The company is extending its transmission lines for about 20 miles in Vermont so as to serve a large number of slate quarries with electrical energy. There are some seventy-five quarries in the region, from which a number of contracts have already been secured. A vigorous campaign for the business of the others is now in progress. Substantial increases in the earnings of the Northwestern Ohio Railway & Light Company, which is controlled by the General Gas & Electric Company, are expected during the present year. An increase of at least \$10,000 in passenger and freight revenues by June 30, 1913, is regarded as probable by the company, and a gain of some \$30,000 in revenue from lighting business is also considered likely.

**Seek to Foreclose Susquehanna Power Mortgage.**—Action to foreclose the mortgage on the property of the Susquehanna Power Company, which has water rights on the lower Susquehanna River, was begun last week by the Girard Trust Company of Philadelphia, trustee under the mortgage. It is desired to sell the property. The bill was filed by Stevenson A. Williams, of Belair, and John H. Barnes, of Philadelphia. This action was taken by the trust company because of the pressure of bondholders of the power company for interest and because the efforts which have been made to re-finance the company have failed thus far. The Susquehanna Power Company went into the hands of receivers last July, George R. Willis, of Baltimore, and Stevenson A. Williams, of Belair, being appointed. It is understood that after the business of the present company has been closed another attempt will be made to organize a power company along ideas similar to those which governed the Susquehanna company.

**Republic Railway & Light's New Station Ready for Operation.**—The new station of the Republic Railway & Light Company at Lowellville, Ohio, has been completed and will be placed in active operation within the next week or so. Part of the equipment in the new station was used to help carry the peak load on the company's system during the holiday season. Energy will be furnished from this station to the electric railway and lighting companies in Youngstown, Ohio, New Castle and Sharon, Pa., and to a number of smaller communities in that section. The station contains two 9375-kva turbine units, which will generate energy at 2300 volts. This will be transmitted at 13,000 volts. The plant will be run condensing, with surface condensers. The engineering and construction work in con-

nection with the plant has been done by the Stone & Webster Engineering Corporation.

**Puget Sound Traction, Light & Power's Report.**—A statement of its earnings for 1912, with an estimate of those for December, has been issued by the Puget Sound Traction, Light & Power Company. This company, as was noted in the *Electrical World* Jan. 13, 1912, was formed early last year under Maine laws, as a consolidation of all the important public-utility properties operated by Stone & Webster in the Puget Sound district, and included the Pacific Coast Power Company, Seattle Electric Company, Seattle-Tacoma Power Company, Puget Sound Electric Railway, and the Whatcom County Railway & Light Company. The company was reincorporated later in the year, as was noted July 6, under Massachusetts laws, its stock being non-taxable in that State. The financial statement shows gross returns of \$8,377,883; net earnings, \$3,502,788; interest charges, \$1,749,509; sinking fund charges, \$223,887; net income, \$1,529,392; preferred dividends, \$589,392; common dividends, \$742,176, and a balance for addition to the surplus of \$197,764.

**Acquires Nebraska Properties.**—The Continental Gas & Electric Corporation, which was recently incorporated under Delaware laws, has taken over the water, gas and electric properties at Beatrice, Plattsmouth and York, Neb., and those at Red Oak and Shenandoah, Ia. The new corporation has taken over the bonds and stocks of the companies controlling these properties. The Continental Gas & Electric Corporation has an authorized capitalization of \$5,000,000 common, \$1,000,000 preferred and \$5,000,000 5 per cent first-lien collateral trust bonds. There is \$1,250,000 common stock, \$300,000 of the preferred stock and \$685,000 of the bonds outstanding. The bonds issued have been sold to P. W. Brooks & Company, of New York.

**American Light & Traction to Increase Capital.**—A special meeting of the stockholders of the American Light & Traction Company has been called for March 17 to vote upon an increase in the authorized common stock from \$15,000,000 to \$40,000,000. There is now about \$11,426,200 common stock outstanding and also \$14,236,200 of the \$25,000,000 authorized 6 per cent cumulative preferred stock. It is understood that the proposed increase in common stock foreshadows continuance of the company's policy of paying quarterly dividends of 2½ per cent in cash and 2½ per cent in common stock for some time to come.

**Otis Elevator Company Had a Good Year.**—Earnings of the Otis Elevator Company in 1912 were the largest in the history of the company. Gross business increased about 10 per cent over that in the preceding year, and net earnings also showed a satisfactory gain. The company is now paying dividends at the rate of 6 per cent on the preferred stock and 4 per cent on the common. W. D. Baldwin, president of the company, who recently returned from a European tour, considers that the outlook abroad for 1913 in his business is exceedingly bright.

**Northern Ohio Traction & Light Company's New Plant Nearly Ready.**—Work is going forward rapidly on the Northern Ohio Traction & Light Company's new 38,000-kw station at Cuyahoga Falls. Earnings of the company are improving, the gross returns for 1912 (with December estimated) being \$2,999,400, as compared with \$2,694,024 in 1911. Net earnings are placed at \$1,289,425, as against \$1,201,498, and the surplus for the stock at \$763,863, which compares with \$679,466 in 1911.

**Merges Missouri Utilities.**—The Missouri Public Utilities Company, which has filed articles of incorporation at St. Louis with a capital of \$1,000,000, has taken over the public-utility properties in Charleston, Sikeston, Ilmo and Fornfelt, Mo. It is stated that negotiations for the acquisition of several other properties in the southeastern part of the State are in progress.

**Upper New York State Telephone Companies Absorbed.**—The New York Telephone Company has advised the Public Service Commission for the Second New York District that it has purchased the Hamilton (N. Y.) Telephone Company and the Citizens' Standard Telephone Company, which operates in Phoenicia, Rosendale, Kingston and Shokan, N. Y.



**Protective Committee for Bullock Electric Preferred Stockholders.**—Charles L. Harrison, R. Clifford Shinkle and George D. Eustis have been selected as a stockholders' committee by the holders of the preferred stock of the Bullock Electric Manufacturing Company of Cincinnati, Ohio, to co-operate in the protection of their interests in the reorganization of the Allis-Chalmers Company, which holds a controlling interest in the Bullock company through the purchase of the common stock. The Allis-Chalmers Company paid the 6 per cent dividend on this stock under a guarantee until it became financially involved. The receiver also made payments, but notice has been given that no further payments will be made. There is \$1,170,000 of this stock outstanding. George Bullock, of New York, one of the heaviest holders of the preferred stock, will co-operate with the Cincinnati stockholders and signatures will be secured as rapidly as possible to the agreement.

**American Telephone & Telegraph Issues \$67,000,000 Bonds.**—The directors of the American Telephone & Telegraph Company voted on Jan. 14 to authorize an issue of \$67,000,000 twenty-year 4½ per cent convertible bonds to be offered to stockholders for subscription at par and interest in the proportion of 20 per cent of their holdings of stock. The bonds will be dated March 1, 1913. They will be convertible into stock at \$120 per share between March 1, 1915, and March 1, 1925. President Vail in a circular to the stockholders says that the issue is to provide for construction and other corporate requirements and that it is expected that the earnings from the employment of the proceeds of the bonds will meet the additional charges necessitated, so that the surplus earnings of the company will not be disturbed.

**Bell Telephone Gains.**—In the eleven months ended Nov. 30, 1912, gross earnings of the Bell telephone system in the United States, comprising those of the American Telephone & Telegraph Company and associated holding and operating companies in this country, not including connected independent or sub-licensee companies, were \$181,411,083, as compared with \$163,686,329 in the corresponding period of the previous year. Total expenses were \$128,599,603, as compared with \$116,720,188, leaving net earnings of \$52,811,480, as against \$46,966,141. Surplus earnings, after deduction of interest and dividends (paid for nine months and estimated for two months), were \$12,998,234, as against \$10,827,805 in the eleven months ended Nov. 30, 1911.

**Detroit Edison to Issue Additional Common Stock.**—Directors of the Detroit Edison Company are to meet shortly to decide upon the amount of additional common stock to be issued for financing the extensions and improvements made to its properties last year. Between \$2,000,000 and \$3,000,000, it is understood, will be issued and offered to stockholders at par after Feb. 1, so that holders of the company's debenture bonds which are convertible into stock at par on that date may participate.

**Annual Meeting of Doherty Operating Company.**—At the annual meeting of the Doherty Operating Company this week the retiring directors were re-elected, and they organized subsequently by re-electing the former officers. Henry L. Doherty & Company have taken additional space in their present headquarters at 60 Wall Street, New York, and now occupy the entire thirteenth, fourteenth and fifteenth floors and a part of the twelfth floor.

**Marlboro (Mass.) Company to Issue Stock.**—Stockholders of the Marlboro (Mass.) Electric Company have voted to apply to the board of Gas and Electric Light Commissioners for authority to issue 1300 shares of new stock. The proceeds are to be used for refunding floating indebtedness incurred by the company in paying for additions and improvements.

**Paducah (Ky.) Light & Power Directors Re-elected.**—At a recent meeting of the stockholders of the Paducah (Ky.) Light & Power Company and the Paducah Traction Company the old directorates of these corporations were re-elected.

**Appalachian Power Extending Its Lines.**—The Appalachian Power Company, Bluefield, Va., has completed the transmission line between Pulaski and Radford and is now supplying energy over it.

## Industrial Securities

Security	Capital Stock Listed	PERCENT		QUOTATION	
		Per Cent	Period	Jan. 8	Jan. 15
Allis-Chalmers, 2d assess	\$17,151,100			11½	14
Allis-Chalmers, pf., 2d as					
American Tel. & Tel.	14,034,700			77½	72½
Amalgamated Copper	153,887,900	1	Q	1394	1344
American Tel. & Tel.	334,712,300	2	Q		
Electric Storage Battery	16,074,425	1	Q	54	53
General Electric	77,726,700	2	Q	185	182½
Mackay Cos., c.	41,380,400	1	Q	84	85
Mackay Cos., pf.	50,000,000	1	Q	68	64
Western Union Tel.	79,943,400				71
Westinghouse, E. & M., c	31,685,300	1	Q	78	74
Westinghouse, E. & M., pf	3,998,700	14	Q	121½	121½

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

	Jan 7	Jan 14
Copper	Bid Asked	Bid Asked
Standard, spot	17.00 17.37	18.25 18.50
London, standard, spot	76 8 d	69 17 6
Prime Lake	17.00 17.37	16.75 to 17.00
Electrolytic	17.55 to 17.65	16.50 to 16.75
Casting	17.35 to 17.45	16.25 to 16.50
Copper wire, base	19.00	19.00
Lead	4.35	4.35
Nickel	45.00	45.00
Sheet zinc, best smelter	9.00	9.00
Silver, spot	7.35	7.35
Tin, spot	50.20	50.80
Aluminum		
Prompt delivery	26.00 to 26.50	25.75 to 26.25
Future	25.75 to 26.25	25.50 to 26.00

## OLD METALS

Heavy copper and wire	16.00	15.50
Brass, heavy	10.00	9.50
Brass, light	8.50	8.00
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

## COPPER EXPORTS IN JANUARY

Total tons to	Jan. 9, 1359	Jan. 15, 12,920
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## Personal

**Mr. Bassett Jones, Jr.**, is making a combined business and pleasure trip to the Panama Canal Zone. He will return to New York on Jan. 20.

**Mr. Walter S. Weller**, employed by the Metropolitan Electric Company, Reading, Pa., as an illuminating expert, has been appointed sales agent.

**Mr. R. M. Bassett**, formerly in charge of the Cincinnati office of the Murphy Iron Works, has been made manager of the company's Chicago office.

**Mr. E. Holcomb**, manager of the Consumers' Electric Company of St. Paul, Minn., has been elected president of the Minnesota Electrical Association.

**Mr. W. L. R. Emmett**, of the General Electric Company, delivered a lecture on "The Electric Propulsion of Ships" in the hall of the Franklin Institute, Philadelphia, on Jan. 9.

**Col. George P. Scriven**, of the Signal Corps, U. S. A., has been nominated as chief signal officer by President Taft as successor to Brigadier-General James Allen, who retires next month.

**Mr. D. D. Maxwell**, of Milwaukee, Wis., has been appointed manager for the properties of the Central Illinois Utilities Company at Watseka, Ill., to succeed Mr. H. J. Frith, resigned.

**Mr. L. A. McArthur**, assistant to General Manager W. L. Davidson of the Pacific Power & Light Company, Portland, Ore., has been made local manager of the company's properties at North Yakima, Wash.

**Mr. N. C. Draper**, manager of the Sioux Falls (S. D.) Light & Power Company, was recently elected president of the Dakota Club, a social organization having a membership of more than 200 business men of Sioux Falls.



**Mr. L. Hey Sharp**, of Sydney, N. S. W., associate member of the (British) Institution of Electrical Engineers, is visiting the United States on a tour around the world by way of New York, San Francisco and Honolulu.

**Mr. L. R. Krumm** has been transferred from the post of electrical engineer, Signal Corps, U. S. A., to the position of chief of the radio division, Bureau of Navigation, Department of Commerce and Labor, Washington, D. C.

**Mr. F. L. Hutchinson**, secretary of the American Institute of Electrical Engineers, has just recovered from a mild attack of typhoid. He has returned from the hospital to his home, and is preparing to resume his secretarial duties.

**Mr. Alexander McIver**, formerly connected with the Westinghouse interests in New York City, has been appointed supervising engineer of the stations of the Columbus (Ohio) Railway & Light Company, succeeding Mr. F. R. Brosius.

**Mr. Thomas Woulfe** has resigned his position as manager of the properties of the Illinois Northern Utilities Company at Sterling, Ill., to accept a position as superintendent of power for the Marion, Bluffton & Eastern Railway at Indianapolis, Ind.

**Mr. A. A. Pope**, assistant general inspector of the New York Edison Company, has suffered the loss of his wife, who died suddenly on Jan. 13. Mr. Pope is well known in the lighting field and his many friends will be pained to learn of his bereavement.

**Mr. F. R. Brosius**, who has been supervising engineer of the generating stations of the Columbus (Ohio) Railway & Light Company, has been appointed supervising engineer of the generating stations of the Columbia Gas & Electric Company, Cincinnati, Ohio.

**Mr. C. O. Pardo**, who has been employed as district commercial manager for the Carolina Power & Light Company at Oxford, N. C., has resigned to enter the ministry. Mr. Pardo has been appointed pastor of the Presbyterian Church at Greenville, N. C.

**Mr. H. R. Kingman**, manager of the North Yakima (Wash.) plants of the Pacific Power & Light Company, has been transferred to Texas to take charge of a consolidation of plants recently acquired by the American Light & Power Company, New York.

**Mr. G. F. Atwater**, superintendent of the Greenwich (Conn.) division of the United Electric Light & Water Company, has been transferred to the South Norwalk division, with headquarters at South Norwalk, Conn., succeeding Mr. George F. Caffery at the latter place.

**Prof. Charles F. Burgess**, of the University of Wisconsin, has been awarded the Octave Chanute medal by the Western Society of Engineers of Chicago for his paper on "Electrolytic Corrosion of Iron in Concrete," read before the electrical section of that society early in 1911. An abstract of this excellent paper and the discussion following it was given in the *Electrical World* of April 6, 1911, page 827.

**Mr. George P. Nichols** and his brother, Mr. Samuel F. Nichols, of Chicago, who constitute the firm of George P. Nichols & Brother, were called to Grafton, Mass., last week by the death of their father, Mr. George K. Nichols, on Jan. 6, at the age of eighty-six. The elder Mr. Nichols served two terms each in the Senate and lower house of the Massachusetts Legislature, and was a commissioner to the World's Fair of 1893 in Chicago.

**Mr. Oscar T. Crosby**, president of the Wilmington (Del.) & Philadelphia Traction Company, has sold his interest in that company to the National Properties Company, of Pittsburgh, which has just acquired control of the Wilmington property, and has also resigned the presidency. He will leave shortly for an extended tour of Asia and Africa. Mr. Van Horn Ely, of Pittsburgh, president of the National Properties Company, is his successor.

**Mr. Joseph Bradley Murray**, assistant engineer of the Illuminating Engineering Bureau of the New York Edison Company, has been appointed assistant to General Manager W. F. Wells of the Edison Electric Illuminating Company of Brooklyn. Mr. Murray is a graduate of Yale and has

served an apprenticeship in the various departments of the New York Edison Company. He is a son of Mr. Thomas Murray, vice-president of the latter company.

**Mr. Philip S. Dodd**, formerly connected with the *Electrical Review* and more recently director of the commercial development department of the National Quality Division of the General Electric Company, has been appointed secretary-treasurer of the Society for Electrical Development, Inc., New York. Mr. Dodd has severed his connection with the National Quality Division of the General Electric Company to devote all his time to his work with the Society for Electrical Development.

**Mr. J. M. Wakeman**, formerly general manager of the McGraw Publishing Company, whose return to America was noted in these columns on Nov. 30, has been appointed general manager of the Society for Electrical Development, Inc., New York. The object of the Society for Electrical Development is to promote the use of electrical energy and to further the interests of lighting companies, manufacturers, jobbers, contractors and dealers through a vigorous co-operative campaign of publicity, etc., to guide which Mr. Wakeman is eminently fitted.

## Obituary

**Mr. William H. Hornberger**, electrical engineer and inventor, died at his home in Lafayette, Ind., Jan. 3. Mr. Hornberger was identified with the early electrical development of Elkhart, Ind., and for many years was engaged in the manufacture of transformers in Lafayette.

**Mr. James Whiting Johnson**, district manager in Chicago for the General Electric Company, died of pneumonia, after a short illness, on Jan. 14, at his home in that city.



JAMES W. JOHNSON

Mr. Johnson was born in Waverly, N. Y., Dec. 3, 1862, and was the son of the Rev. David Johnson, a Presbyterian clergyman. He had lived in Chicago since boyhood and was a student at the Hyde Park High School. He began his business career as an office boy for the Bell Telephone Company in 1878, being associated then and for many years thereafter with Mr. B. E. Sunny. Mr. Johnson remained with the Bell company and its successor, the Chicago Telephone Company, until 1885. For two years thereafter he was managing partner of the firm of Johnson, Holland & Company, which was formed to exploit the storage-battery business. In 1887 Mr. Johnson became manager of the Northwestern Electric Accumulator Company, and a year later he entered the Chicago office of the Thomson-Houston Electric Company as a salesman, Mr. Sunny becoming associated with the office on the same day. With the exception of a period of about three years when he was connected with the United States Fire & Police Telegraph Company, Mr. Johnson was connected with the Chicago office of the Thomson-Houston company and its successor, the General Electric Company, until his death. In the early days he was manager of the isolated-plant department, and later he was successively manager of the lighting department and the power and mining department. Then he was made assistant district manager, and since May, 1908, when Mr. Sunny retired to become president of the Chicago Telephone Company, he had been district manager. Mr. Johnson was a quiet, unassuming man, but he possessed much reserve force and was a keen student of business conditions and tactful in his dealings with men. A widow, a married daughter and three brothers survive him. One of the latter, Mr. George B. Johnson, is manager of the Electric Shop of Chicago.

[illegible]

SACRAMENTO, CAL.—The City Commissioners have granted the Great Western Pwr. Co., of San Francisco, the contract for furnishing

9. KALE, III.—The sample poles are to be erected on the streets under the city lighting committee and the Commercial Club to make electrical contacts to use for the ornamental street-lighting system to be installed on Main Street next spring.



**DUNDEE, ILL.**—The Pub. Ser. Co. of Northern Illinois, of Chicago, has submitted a contract to the Village Board offering to supply electricity for lighting the streets of the village with 50-cp tungsten lamps on a moonlight schedule, at \$15 per lamp per year. The Village Boards of Dundee, East Dundee and Carpentersville are jointly considering the proposition.

**FARMERSVILLE, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the local electric-light plant, owned by Charles H. Nobbe. Martin McLean will be retained as superintendent for the present.

**GALESBURG, ILL.**—The City Council has refused to amend the franchise given to Weinberg Brothers to operate an electrical distributing system in the city so that they could secure power from outside of the city. Weinberg Brothers contemplated securing power from the Mississippi River Pwr. Co. at Keokuk, Ia.

**GIRARD, ILL.**—The City Council has sold the municipal electric-light plant to Tucker & Stowell, lessees of the Virden El. Lt. Co., for \$17,000. A 25-year franchise has been granted to Tucker & Stowell.

**HILLSBORO, ILL.**—The Hillsboro El. Lt. & Pwr. Co. is erecting a transmission line from Hillsboro to Coffeen to supply electricity for the Clover Leaf Mining Co.

**LINCOLN, ILL.**—The Lincoln Wtr. & Lt. Co. in asking for a renewal of its 25-year franchise, which expires in five years, offers to furnish electricity free of charge for 25 years for maintaining the 16 ornamental street lamps about the court house square.

**LOCKPORT, ILL.**—The Northern Illinois Cereal Co. has requested the City Council to renew the contract between the Sanitary District of Chicago and the city of Lockport for the purpose of furnishing electricity to private concerns within the city.

**PEORIA, ILL.**—Bids will be opened Jan. 22 by the Peoria Pleasure Driveway and Park District for electric wiring, plumbing and heating for the proposed pavilion at South Park. Walter Murray is secretary.

**VIRGINIA, ILL.**—The property of the Virginia Lt. Ht. & Pwr. Co. has been purchased by the Western Utilities Co., of Chicago. The consideration is said to be \$25,000. M. Yaple is secretary of the Virginia company.

**BLUFFTON, IND.**—Mayor Frank S. Smith in his annual message to the City Council gave his approval of the decision of the Council to make extensive improvements to the municipal electric-light plant.

**GOSHEN, IND.**—We are informed that contract for improvements to the municipal electric-light plant will probably be awarded before March 1.

**HUNTINGTON, IND.**—The establishment of a municipal electric-light plant to supply electricity for residential lighting is recommended by Mayor Milo Feightner in his annual message to the Common Council. The Mayor also cites that there is urgent need for repairs to the county street-lighting plant and suggests a consolidation of this plant with the proposed municipal lighting plant.

**LAPORTE, IND.**—The County Commissioners of Laporte County have granted John H. Sullivan, of Chicago, Ill., a franchise to erect transmission lines on the public highways in Hanna, Cass and Dewey Townships. Plans are being prepared by Mr. Sullivan to establish an electric power plant to serve the towns of Hanna, Lacrosse and Wanatah, also the farmers along the line. The location of the plant has not yet been definitely decided upon. Doran & Conboy, of Laporte, are local representatives.

**PETERSBURG, IND.**—The plant of the Petersburg El. Lt. & Pwr. Co. has been badly damaged by floods.

**BURLINGTON, IA.**—The Burlington Pwr. Co., which has a franchise to furnish electricity in West Burlington, has opened an office at 401 North Street, Burlington. The company will begin work at once on plans for the erection of its substation to distribute electricity generated at the Keokuk dam.

**MUSCATINE, IA.**—The Davenport & Muscatine Ry. Co. is planning to supply electricity to the farmers residing along the route of the interurban railway between Davenport and Muscatine.

**WAYLAND, IA.**—At a special election held recently the proposition to grant a franchise to D. D. Bentzinger to furnish electricity for lamps in Wayland for a period of 25 years was carried.

**CANTON, KAN.**—The city of Canton has engaged the Alamo Engine & Supply Co. to take charge of the construction of the proposed municipal electric-light plant. Bids for construction of the plant will be received about Feb. 20. The cost of the work is estimated at about \$10,000. T. N. Frantz is city clerk.

**MULBERRY, KAN.**—At an election held recently the proposition to issue \$45,000 in bonds for the installation of an electric-light plant and water-works system was carried. The cost of the electric-light plant is estimated at \$30,000.

**LAFAYETTE, KY.**—The property of the Lafayette Ice & El. Co. has been purchased by Samuel Bumpus, of Lafayette.

**LEXINGTON, KY.**—Sargent & Lundy, Jackson and Michigan Boulevards, Chicago, Ill., have charge of the proposed improvements to the plants of the Kentucky Utilities Co., of Lexington, located in Somerset and Eminence. Detail plans have not yet been completed.

**MUNFORDVILLE, KY.**—The Munfordville El. Lt. Co. is planning to build an electric-light plant here, to cost about \$3,000. Bids for

construction of plant will be received about Feb. 1. J. O. Bright, of Munfordville, is engineer in charge.

**MURRAY, KY.**—The Murray Lt. Co. has announced that it will completely reconstruct its line connections as soon as the weather permits.

**PADUCAH, KY.**—The Board of Public Works has asked for an appropriation of \$50,000 from the municipality, a portion of this sum to be expended for the installation of ornamental lamp standards in the downtown district.

**MOUNT AIRY, MD.**—We are informed that George W. Runkles and Emory Wagner do not propose to establish an electric-light plant, as reported in the issue of Jan. 4. They are installing an ice plant and laundry machinery.

**BELLEVILLE, MICH.**—The Eastern Michigan Edison Co., of Detroit, contemplates the construction of a dam and power plant in Belleville to develop about 3300 hp, at a cost of about \$450,000. Upon completion of the Belleville project plants will be erected in Dexter and Delhi and the Argo dam raised about 2 ft.

**BLOOMINGTON, MICH.**—Negotiations are under way for the establishment of an electric-light plant. They include a contract for lighting the streets of the village for a period of ten years at a cost of \$200 per year. L. E. Hawks, of Chicago, Ill., is interested in the project.

**CLAYTON, MICH.**—At an election held Jan. 6 the proposition to install a municipal electric-light plant was carried. Bids will soon be taken for an oil engine, generator and switchboard.

**DETROIT, MICH.**—The Dresden Brick Co., recently incorporated, is reported to be in the market for electrical equipment.

**GRAND RAPIDS, MICH.**—The Grand Rapids-Muskegon Pwr. Co. is now arranging its development work for the coming season. It includes the completion of the extensions to Sparta, Kent City, Bailey and Casnovia and development of the local electrical service.

**KALAMAZOO, MICH.**—It is reported that bids are being received for machinery for the new municipal electric-light plant, for which bonds to the amount of \$150,000 have been authorized.

**THREE OAKS, MICH.**—Owing to the municipal electric-light plant being unable to give adequate service, the town is contemplating turning the street-lighting service over to the Indiana & Michigan El. Co., of Buchanan.

**VERNON, MICH.**—The village has entered into an agreement with the Consumers' Pwr. Co., of Corunna, to light the streets of the village for a period of ten years, to replace the lamps now in use with tungsten lamps and to furnish the service at the same cost as the present service.

**SEDALIA, MO.**—The City Lt. & Trac. Co., recently organized, has taken over the property of the Sedalia Lt. & Trac. Co. The new company is controlled by the Consolidated Cities Trac. Lt. & Pwr. Co. Extensive improvements and additions will be made to the electric generating station and the street-railway lines. H. D. Fruehauf has been appointed general manager, E. W. Pfennig secretary and treasurer, and D. F. Webster superintendent.

**WEBSTER GROVES, MO.**—Sealed proposals will be received by J. D. Wilson, city clerk, Webster Groves, Mo., until Feb. 3 for lighting the streets, alleys, avenues and public grounds of Webster Groves with electricity for a period of 10 years, beginning Sept. 1, 1913. The proposal is to be based on a minimum of 300 60-cp, 100 200-cp and 10 350-cp Mazda or tungsten series street lamps, burning on an all-night schedule. The bidder receiving the street-lighting contract will also be granted a franchise for selling electricity for commercial purposes in Webster Groves. Bids will also be received for furnishing electricity, based on a minimum of 100,000 kw-hr. per annum, for lighting purposes, delivered to the city's substation at the city limits or other suitable location, to be distributed by the city over its own pole lines. Plans and specifications are on file in the office of the city clerk, Webster Groves, and in the office of the city engineer and the Fuller-Coutt Co., Chemical Building, St. Louis, Mo. W. F. Biederman is Mayor.

**GREAT FALLS, MONT.**—Work has begun on the development of power at the Great Falls of the Missouri River, which it is estimated will require two years to complete and will cost about \$4,000,000. Henry A. Herrick is chief engineer; Frank Scott, of Great Falls, will be engineer in charge of the local dam. It is announced that Mr. Herrick will also have charge of the construction of a dam on Clark's Fork of the Columbia River.

**RENO, NEV.**—The Nevada Valley Pwr. Co. has filed with the county recorder a trust deed in favor of the International Trust Co., of Denver, Col., to secure a bond issue of \$3,000,000, to provide funds to build its power plants. The power site proposed to be used by the company is located on the Truckee River at the Laramarsino Bridge, about 7 miles from Reno. The company, in addition to its power sites, owns lands and a number of rights-of-way. The directors are: H. D. Donforth, of Reno, who is local agent; Edson Adams, Edward Bowes, Milton Hamilton and A. F. Tarley, all of Oakland, Cal.

**CONCORD, N. H.**—The Board of Aldermen has accepted the proposition of the Concord El. Co. for lighting the city and has authorized the Mayor to sign the contract for the city. Under the terms of the new contract the company is to furnish 206 tungsten lamps of 200 cp at \$48.50 each per year, 197 tungsten lamps of 60 cp at \$23.50 per lamp per year, and 26 40-cp tungsten lamps at \$18 each per year. In addition the company will also install 85 tungsten lamps of 60 cp to replace Welshach gas lamps, 82 tungsten lamps of 40 cp to replace a



like number of open-flame gas lamps and 17 tungsten lamps of 200 cp on Main Street, between Freight and Center Streets. Work will begin immediately on the installation of the new system.

**ASBURY PARK, N. J.**—The plans for the proposed ornamental lighting system for the boardwalk to be installed by the Beach Commission provides for the erection of from 85 to 90 ornamental standards, carrying five-lamp clusters, to cost from \$6,000 to \$8,000. From 85 to 90 100-watt Mazda and from 320 to 360 60-watt Mazda lamps will be used. The system will be maintained by wires placed in conduits under the boardwalk. W. P. Sherman is secretary of Public Grounds Commission.

**JERSEY CITY, N. J.**—Sealed proposals will be received by the Boulevard Commissioners of the County of Hudson, Court House, Jersey City, until Jan. 23 for furnishing the following general supplies and materials during the fiscal year ending Nov. 30, 1913: 5000 ft. No. 6 weather-proof line wire, 2000 ft. No. 6 weather-proof duplex wire, 3000 ft.  $\frac{1}{4}$ -in. mast arm wire, 2000 ft. No. 8 galvanized wire, 300,000 round copper-coated carbons,  $\frac{1}{2}$  in. by 12 in. Samples may be seen at the office of the Boulevard Commissioners, Court House, Jersey City. J. C. Sweeney is clerk.

**JERSEY CITY, N. J.**—Sealed proposals will be received by the Board of Street and Water Commissioners until Jan. 20, City Hall, Jersey City, for furnishing and maintaining electric arc lamps for the period ending Feb. 1, 1914, and for further period ending Feb. 1, 1918 (each proposition to be separate), in accordance with specifications for same on file in the office of clerk of board. Blank forms and specifications may be obtained at the office of the chief engineer, City Hall, Jersey City. The minimum number of lamps to be furnished and bid upon shall be 1800. Edward B. See is clerk.

**CLAYTON, N. M.**—We are informed that the municipal electric-light plant was not destroyed by fire, as published in the issue of Jan. 4. E. E. Kirtley is superintendent.

**ARCADE, N. Y.**—Bonds recently voted by the village of Arcade have been sold for \$9,500. The proceeds are to be used for the purchase of a new electric generating unit for the municipal electric-light plant.

**JAMESTOWN, N. Y.**—The Board of Lighting Commissioners is considering the possibility of purchasing additional equipment for the municipal electric-light plant. The installation of a new turbo-generator and new boilers has been discussed and possibly there may be some extensions to the station building.

**NEW YORK, N. Y.**—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, until Jan. 21, for furnishing all labor and material for inspection and maintenance of electrical apparatus as follows: (a) For the boroughs of Manhattan and the Bronx; (b) the boroughs of Brooklyn and Queens; (c) the borough of Richmond. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

**ONEIDA, N. Y.**—The Board of Public Works has accepted the bid of the Adirondack El. Pwr. Co. for lighting the streets of the city. Under the new contract a large number of arc lamps will be replaced by tungsten lamps.

**ROCHESTER, N. Y.**—Plans are being considered for the installation of a new lighting system on Main Street between the bridge and York. It has been decided to replace the present double arc lamps with lamps similar to those on East Avenue. Work will begin on the installation of the system as soon as the ordinance is adopted and the ornamental standards secured.

**CHARLOTTE, N. C.**—The plans for the new lighting system for the city to be installed by the Charlotte Pwr. Co. provide for the erection of 214 posts carrying 60-watt Mazda lamps, to be maintained by underground wires.

**WILSON, N. C.**—The City Council is contemplating submitting the proposition to issue \$160,000 in bonds, the proceeds to be used to enlarge the municipal electric-light plant and for street improvements. Benton & Moore, of Wilson, are engineers.

**KENTON, OHIO.**—The Hardin-Wyandotte Ltg. Co. will make improvements to its plant, including the installation of two boilers, two 500-kw alternating-current, 60-cycle generators and the erection of three substations to be located at Forest, Dunkirk and Upper Sandusky. E. W. Lothrop, of Boston, Mass., is engineer in charge. P. M. Magley is manager.

**SPRINGFIELD, OHIO.**—Plans for the proposed ornamental street lighting system provide for the erection of about 150 lamp standards to be maintained by underground conduits. Contracts for the work will probably be let in the spring. The cost of the work is estimated at from \$20,000 to \$25,000. Fred S. Green, care of the Springfield Commercial Club, is chairman of lighting committee.

**STUEBENVILLE, OHIO.**—The City Council has adopted a resolution to build an electric-light plant, to cost \$250,000.

**COLLINSVILLE, OKLA.**—The city contemplates extensions to the municipal light and water plants, involving an expenditure of about \$20,000. W. F. Keller is engineer in charge.

**HOOD RIVER, ORE.**—The Hydro-Electric Co. has filed with the county clerk for record a mortgage for \$100,000 to secure a bond issue of like amount. The company proposes to develop two water-power sites on Hood River and extend its transmission lines into The Dalles, where

transmissions have already been obtained. J. T. Thompson is vice-president and manager.

**PORTLAND, ORE.**—The E. S. Wood, counsel for the Northwestern El. Co., states that the company will soon begin the construction of an electric line up the White Salmon River. The Northwestern El. Co. is negotiating for a site on Adams Street, between River and Loring Streets, on which it proposes to erect an auxiliary power station.

**PORTLAND, ORE.**—The committee here has adopted a resolution authorizing the installation of 254 arc lamps to be erected in different parts of the city of the Portland Ry. Ltg. & Pwr. Co., which lends the contract for street lighting.

**PANAMA.**—Proposals will be received at the office of the assistant purchasing officer, Isthmian Canal Commission, 224 State Street, New York, N. Y., until Jan. 22, under zone requisition 6263-A, for furnishing necessary suspended lamps, ceiling lamps, suspended fixtures, wall brackets, etc., to equip the new Panama station building. Further information may be had upon application to Major Woodrill L. Simpson, assistant purchasing officer, 24 State Street, New York, N. Y.

**HARRISBURG, PA.**—Application will be made to the Governor on Jan. 20 by Allison C. Harrison and William Kibbich for a charter for the Berwyn Ltg. Ht. & Pwr. Co. and the Penn. Mhds. Ltg. Ht. & Pwr. Co. The companies propose to operate the townships named. E. E. McCurdy is solicitor.

**HARRISBURG, PA.**—Final agreements have been filed at Harrisburg for the merger of the gas and electric companies in the northern end of Schuylkill County. It is proposed to combine the service of all these companies and furnish electricity from one large power and light plant at Mahanoy City, Shenandoah and surrounding townships. The population to be served will be greatly extended from Butler Township on the west to Union Township on the east. Charters for this territory were recently secured by E. F. Jarvis, Valentine Pfrom, Chester J. Hill, Walter Dietrich and Seth W. Brown. The service extends over coal tracts owned by the Reading and Lehigh Valley coal companies, and D. W. Kaercher, local attorney for the latter company, also represents the new companies. The companies merged in this district have been chartered under the name of the Schuylkill Gas & El. Co. with a capital stock of \$1,000,000; those in the Hazleton district under the name of the Hazleton El. Co.; those in Clearfield and Centre Counties under the name of the State-Centre-Electric Co., of Clearfield, with a capital stock of \$95,000, and those in Indiana under the name of the Clymer El. Co., of Clymer, with a capital stock of \$35,000.

**PHILADELPHIA, PA.**—Sealed proposals will be received by the School Board of Philadelphia for furnishing electrical material for use in schoolrooms, including switches, wire, incandescent bulbs and fixtures. Further details can be obtained at the office of the superintendent, William Dick, 2242 Land Title Building, Philadelphia.

**READING, PA.**—The Metropolitan El. Co. has under consideration extensive plans for supplying electricity to the farming districts to operate all kinds of farming machinery.

**ROYALTON, PA.**—The Borough Council is considering plans for the installation of an electric-light system. It is proposed to purchase electricity from the York Haven Wtr. & Pwr. Co., to be supplied through the substation here. At present the town is using two arc lamps, which it proposes to discard and to install at least 30 tungsten incandescent lamps for street-lighting.

**WHEATLAND, PA.**—Under the street-lighting contract recently awarded the Shenango Valley El. Ltg. Co., of Sharon, by the Borough Council, the company is to furnish 600 100-watt lamps, 4000 Mazda lamps, the construction work to be completed by Feb. 1. The company was also granted a 50-year franchise for commercial and power business. The question of extending the commercial and power lines into Wheatland will be taken up after the street-lighting system is completed. This service will be supplied from the Sharon substation. J. C. Chesnut is superintendent.

**PROVIDENCE, R. I.**—Bids will be asked by the board of public works engineering division of the Department of Public Works for the installation of central electrical division and power house, including with a capacity of 500,000 gal. daily, to use the existing pumping station.

**BRISTOL, TENN.**—The Electric Transmission Co. is being organized for the purpose of developing the water power of the Tennessee falls near Bristol to supply electricity in this entire section. The company contemplates an investment of \$1,000,000. As first electricity will be supplied to the mines in this district. B. L. Dumas and associates are interested in the project.

**FALLS, TENN.**—The H. H. S. & M. Co. is negotiating the purchase of electrical equipment for this plant.

**FALLS, TENN.**—The H. H. S. & M. Co. has applied the contract for furnishing material for the construction of an ornamental street-lighting system in May and June, 1913, to the Falls El. Ltg. & Pwr. Co. The contract for the street-lighting was awarded to the Mosler Mfg. Co. of St. Louis.

**EL PASO, TEX.**—The Rio Grande Valley El. Co. has awarded a contract to the Stone & Webster Engineering Corp., of Boston, Mass., for the construction of its interurban electric railway, which is to run from El Paso down the valley of the Rio Grande to Ysleta. The El Paso El. Co., which is also a subsidiary of the Stone & Webster syndicate, will make extensive improvements to its local current conductors, substations and transformers.

Several of the lines will be extended, a 1200-volt condenser generator will be installed at the El Paso power plant and an electric transmission line erected from the plant to the city limits at Washington Park to deliver electrical power to the valley line. Five interurban cars will be purchased.

**PLANO, TEX.**—The Wilcox Lt. & Pwr. Co., which purchased the property of the Plano Lt. & Pwr. Co., expects to erect transmission lines to Richardson to supply electricity for lamps and motors; also power for a cotton gin within the next three months. Electrical energy will be purchased from the Texas Trac. Co. C. W. Potts is manager of the Wilcox Lt. & Pwr. Co.

**SAN SABA, TEX.**—The San Saba Ice & Lt. Co. writes us that it does not contemplate the installation of a new plant, as published in the issue of Jan. 4. The City Council recently granted the company an extension of 50 years on its franchise. F. B. Hall is manager.

**ALEXANDRIA, VA.**—A committee has been appointed by the Alexandria Court House Citizens' Association to ask the County Supervisors to have the plans for installing lamps and making sidewalks from the court house along the Ballston Road to Rosslyn carried out. It was also directed that C. T. Jesse, as a committee of one, make an investigation of the possibilities of lighting the Ballston Road through the Fort Myer Heights and Colonial subdivisions.

**CENTRALIA, WASH.**—The Washington-Oregon Corp. has applied for a franchise to build an electric line along the county road from the fair grounds to Centralia.

**PORT ANGELES, WASH.**—The Angeles Tel. & Teleg. Co. will soon begin work on the reconstruction and enlargement of the local telephone system. C. J. Farmer is president and general manager.

**PORT WASHINGTON, WASH.**—Applications have been made to the City Council by the Olympia Lt. & Pwr. Co. and John H. Dalton, of Chicago, Ill., for a franchise to install and operate an electric street railway in Port Angeles. The application of John H. Dalton and associates was presented first.

**SEATTLE, WASH.**—The Board of Public Works has instructed City Engineer Dimock to prepare plans and specifications at once for the construction of a dam at Cedar Lake for the city water and light system, to cost about \$1,500,000. Plans will be ready for estimates about March 1.

**SEATTLE, WASH.**—The Municipal Lighting Department expects to erect within the next 18 months one 10,000-kw steam-turbine generating station and to purchase 500 hp in boilers with all equipment, one or two steam turbo-generators having an aggregate rating of 10,000 kw with complete auxiliary equipment for same, switches and switchboard instruments for above plant. The department also expects to purchase within the next 12 months material for distribution system, amounting approximately to \$100,000, largely wire and meters; also material for lighting system, to cost approximately \$200,000, mostly series tungsten street lamps. J. D. Ross is superintendent.

**MILWAUKEE, WIS.**—The decision handed down by the Supreme Court on Jan. 8 held that the city could erect and maintain a municipal electric-light plant any time it saw fit. The court also holds that there has been no material diversion of the \$500,000 in bonds raised in 1906.

**CASPER, WYO.**—The Natrona County El. Co. expects to purchase 120 25-ft. by 6-in. top, 30 30-ft. by 6-in. top and 20 35-ft. by 7-in. top red cedar poles within the next six months; also within the next 14 months the company expects to purchase one 150-hp oil gas producer and gas engine or fuel oil engine. J. A. Ward is general manager.

**NEW WESTMINSTER, B. C., CAN.**—The Canadian Western Lumber Co. announces that it will make extensive additions to its works in New Westminster, including the installation of a 1875-kw power plant, involving an expenditure of about \$500,000.

**VANCOUVER, B. C., CAN.**—The City Council of West Vancouver has adopted a resolution calling for the construction of a municipal lighting and power plant.

**VANCOUVER, B. C., CAN.**—The Pacific Great Eastern Devel. Co., a subsidiary of the Pacific Great Eastern Ry. Co., has applied to the Dominion government for permission to appropriate and utilize for power purposes 2,000 second feet of water from the Cheakamus River in Howe Sound District.

**WINNIPEG, MAN., CAN.**—The city of Winnipeg has decided not to build a steam auxiliary power plant at present, but instead to begin work immediately on plans and construction of a two-circuit, 110,000-volt transmission line from the power plant at Point du Bois to the city, paralleling the present 60,000-volt line on the opposite side of the right-of-way. Steel towers with concrete footings will be used. The footings will be put in during 1913 and the line will be ready for service by Nov. 1, 1914. During the coming year two new hydraulic generating units, with a rating of 6500 hp each, will be installed, with switching equipment and transforming apparatus of 9000 kw, which at the generating station will consist of one 9000-kw, three-phase unit and at the receiving station of three 3000-kw, single-phase transformers. The increased load will require an extension to the McPhillips Street substation and the arc-lighting substation at May Street and the downtown station on King Street. In addition to these extensions there will also be a new substation erected in the Fort Rouge district, which will be served by a duplicate underground 13,000-volt feeder. Appropriations of \$250,000 for the new hydraulic and substation equipment and of \$700,000 for the new transmission line have been made. The W. F. Skinner Co., Ltd., which is

promoting a central steam-heating company, has submitted a proposition to the city to supply an emergency service of 10,000 kw from low-pressure turbines. Messrs. Herdt and Kennedy are consulting engineers.

**RICHMOND HILL, ONT., CAN.**—Arrangements have been made whereby the Toronto & York Radial Ry. Co. will supply electricity for street and residential lighting in Richmond Hill. The lighting system, it is understood, will be installed by the town, and the company agrees to furnish energy to operate it at \$26.50 per hp per year. Twenty-six 80-watt tungsten lamps will be erected on Yonge Street.

**ST. MARY'S, ONT., CAN.**—The Town Council has instructed Superintendent Miller to prepare plans for extensions to transmission lines of the municipal electric-light system; also to secure estimates of cost of recording instruments for keeping checks on the peak load. Thomas M. Clark is recorder.

**TORONTO, ONT., CAN.**—The Hydro-Electric Power Commission of Ontario, Continental Life Building, Toronto, proposes to issue about Jan. 15 specifications for various materials to be used in connection with the construction of approximately 125 miles of double-circuit, 110,000-volt transmission line and for equipment for substations for transforming 20,000 hp from the line emf to 13,200 volts. Various types of apparatus will be considered; for instance, different material for conductors and different types of steel construction for supports. Tenders for the above material will be called for in March. F. A. Gaby is chief engineer.

**WALKERTON, ONT., CAN.**—A by-law authorizing an extension to the electric-light service and to grant a franchise for five years was carried.

**CEDAR RAPIDS, QUE., CAN.**—Orders have been placed by the Cedar Rapids Mfg. & Pwr. Co. for 12 waterwheel units aggregating 120,000 hp. Nine units of 10,000 hp will be built by the I. F. Morris Co., of Philadelphia, Pa., which will also supply exciters, governors, pumps and auxiliary equipment. The remaining three 10,000-hp units will be supplied by Wellman, Seaver & Morgan Co., of Cleveland, Ohio.

**MONTREAL, QUE., CAN.**—The stockholders of the Cedar Rapids Pwr. Co. have voted to retire the present issue of \$10,000,000 in bonds and to replace it with an issue of \$15,000,000, to be issued from time to time as required for development of property.

**QUEBEC, QUE., CAN.**—Among the recommendations in the report submitted by the commission appointed by the Quebec Legislature to make a study of the water-powers of the Province is the regulation of the flow of water in the St. Maurice River by the construction of a dam at La Loutre (Otter) rapids which would control the flow and give a much more even supply all the year around. According to the estimates made, the dam would provide an even supply of 18,000 cu. ft. per second throughout the year at Grand-Mère, Shawinigan and La Tuquette. The cost of the work is estimated at \$1,300,000.

**MOOSE JAW, SASK., CAN.**—Sealed tenders will be received by the City Commissioners, Moose Jaw, Sask., until Feb. 10, for furnishing and installing one 1500-kw steam turbine and generator. Specifications and general conditions may be obtained upon application to J. D. Peters, electrical superintendent, Moose Jaw; the Commercial Intelligence Branch, Board of Trade, 73 Basinghall Street, or London Chamber of Commerce, London, Eng. A. W. Mayberry, L. W. Rundlett and W. F. Heal are City Commissioners.

**WEYBURN, SASK., CAN.**—A by-law authorizing an expenditure of \$35,000 for extensions to the municipal electric-light plant has been approved.

**CONCHENO, CHIHUAHUA, MEX.**—The Concheno Mining Co. is installing an electric power plant at its mines at Concheno for the purpose of providing power to operate the machinery of its ore-reduction mill.

## New Industrial Companies

**THE ALADDIN LAMP & ELECTRIC COMPANY**, of Seattle, Wash., has been incorporated with a capital stock of \$12,000, by J. J. Horsfall, Robert Waddell and Norman Waterhouse, all of Seattle.

**THE BALL-WASHBURN MOTOR COMPANY**, of Rochester, N. Y., has been granted a charter with a capital stock of \$25,000 to manufacture motors and machinery. The incorporators are: W. H. Ball, C. H. Washburn and A. R. Ball, of Rochester.

**THE CENTENNIAL ELECTRIC COMPANY**, of Port Ewen, N. Y., has been incorporated by William M. Halstead, Henry Hutchinson and Guy V. Williams, 116 Broad Street, New York, N. Y. The company is capitalized at \$25,000 and proposes to manufacture and deal in electrical apparatus.

**THE CHELSEA OPERATING COMPANY**, of New York, N. Y., has been incorporated by William A. Winter, Henry T. Franklin and William G. Lenz, 548 West Twenty-fifth Street, New York, N. Y. The company is capitalized at \$10,000 and proposes to manufacture machinery, dynamos, etc.

**THE ELECTRIC COACH CORPORATION**, of New York, N. Y., has been incorporated with a capital stock of \$500,000 to manufacture motor vehicles. The incorporators are: John Larkin, Alexander S. Andrews and Richard J. Lynch, of New York, N. Y.



**THE EMERGENCY ELECTRIC COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$2,500 to manufacture and deal in electrical apparatus. The incorporators are: Hyman Polonsky, Arthur B. McCold and Samuel Cone.

**THE ILLINOIS POST COMPANY**, of Springfield, Ill., has been chartered, with a capital stock of \$30,000, by T. M. Lawrence, T. J. Noble and B. F. Bliss, of Springfield. The company proposes to manufacture concrete posts.

**THE INDUSTRIAL ELECTRIC MANUFACTURING COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$3,000 to deal in electrical devices. The incorporators are: F. A. Vollbrecht, George Towar and William F. Hoffman.

**THE KING LIGHT COMPANY**, of Peoria, Ill., has been incorporated with a capital stock of \$125,000 to manufacture lighting systems. The incorporators are: E. Selts, M. M. Lockwood and C. B. King, of Peoria.

**THE RAILWAY SAFETY DEVICE COMPANY**, of Marion, Ind., has been granted a charter with a capital stock of \$25,000. The company proposes to manufacture and deal in derail automatic switchlocks and other safety devices for use by electric and steam railroads. The directors are: B. B. Shively, M. C. Shroderbeck, M. L. Leapy and William Carroll.

**THE RELIABLE TROLLEY RETRIEVER COMPANY**, of Flint, Mich., has been incorporated with a capital stock of \$10,000 for the purpose of manufacturing electrical appliances.

**THE ROLLER ELECTRIC COMPANY**, of Anderson, Ind., has been incorporated with a capital stock of \$10,000 to manufacture and sell electric machinery of all kinds. The directors are: E. C. Toner, R. M. Roller and P. H. Branden.

**THE ROYAL DISPLAY FIXTURE COMPANY**, of New York, N. Y., has been incorporated by Irving O. Wildey, S. S. Ostertag and Max Rabinowitz, 45 Cedar Street, New York. The company is capitalized at \$15,000 and proposes to manufacture fixtures, chandeliers, brackets, etc.

## New Incorporations

**EUREKA, ILL.**—The Eureka Tel. Co. has been incorporated by M. F. Clinton F. and Carrie M. Melick. The company is capitalized at \$2,000, and proposes to do a general telephone and electric business.

**INDIANAPOLIS, IND.**—The Universal Trac. Co. has been incorporated with a capital stock of \$50,000 by Truman B. Funk, William D. Myers and James E. Kepperly.

**ST. LOUIS, MO.**—The Missouri Pwr. & Service Co. has been granted a charter with a capital stock of \$2,000 for the purpose of acquiring, building and operating plants for generating power, light, heat, etc. The incorporators are: S. D. Cahle, John F. Ryan and William E. Minor.

**CINCINNATI, OHIO.**—The Terminal Construction Co. has been incorporated with a capital stock of \$6,000,000 for the purpose of constructing railroad terminals, electric-light and power plants, etc. The incorporators are: W. B. Enslow, R. M. Baker, J. William Hogan, Jr., N. H. Richardson and W. R. Fulton.

**BROKEN BOW, OKLA.**—The Broken Bow Lt. & Pwr. Co. has been granted a charter with a capital stock of \$5,000 by H. M. Kirkpatrick, C. E. Baxter and A. E. Hart, of Idabel, and others.

**PORTLAND, ORE.**—The Middle West Gas & El. Co. has been incorporated with a capital stock of \$5,000,000 by Albert A. Jones, T. L. Croteau, Albert A. Richards, A. B. Farnham, Clarence G. Trott, J. R. Griffin and C. I. Doane, all of Portland.

**HARRISBURG, PA.**—Charters have been granted by the State Department for the following companies: The Arcadia Lt., Ht. & Pwr. Co., of Montgomery Township; Burnside Lt., Ht. & Pwr. Co., of Burnside Borough; Harvey Lt., Ht. & Pwr. Co., of Burnship Township, and Smithport Lt., Ht. & Pwr. Co., of Banks Township. Each company is capitalized at \$5,000, and the incorporators are: L. D. Gardner, W. H. McQuiken and S. M. Houston, all of Glen Campbell. The main offices of the companies will be located at Glen Campbell.

**HARRISBURG, PA.**—Charters have been granted by the State Department to nine electric companies to operate in Northampton County and vicinity, with main offices in Nazareth, as follows: Hinton, Semide, Tecumseh, Iroquois, Secaucus, Seneca, Powhatan, Onondaga and Mingo electric companies. Charters have also been granted to the Williams Township El. Co., of Philadelphia, to operate in Northampton Township, to the Little Lehigh El. Co., of Philadelphia, to operate in Lehigh Township, and to the Muncy Creek and Clifton Township El. Co., of Montgomery, to operate in Lehigh County. Each company is capitalized at \$5,000.

**PITTSBURGH, PA.**—The Youth Hydro-Electric Co. has been incorporated with a capital stock of \$5,000 by C. W. Tanker, of Pittsburgh; L. C. Lamb, of Knoxville, and G. T. McLaughlin, of Milwaukee.

**WILKES-BARRE, PA.**—The Tioga El. Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of \$5,000. Edward A. Swenson, of South Washington Street, Wilkes-Barre, is interested in the project.

**NASHVILLE, TENN.**—The Nashville Trac. Co. has been incorporated by Walter O. Farmer, of Nashville; Russell A. Alger, Henry Lehard, George N. Hendrie and W. Hewie Moor, of Detroit, Mich. The company is capitalized at \$500,000 and proposes to build street railways and interurban lines. T. M. Steyer, of Nashville, is counsel for the company.

## Trade Publications

**PULLEY'S**—The Pulley Company, New York, has issued the "Pulley's" and published by the Pulley Company, 245 Grand Street, New York, N. Y., and is the only publication for the Rope and Pulley Company, Oneida, N. Y.

**GLASSWARE**—The Holophane Works of the General Electric Company has recently issued a bulletin entitled "1913 Suggestions in Illuminating Glassware." Some seventy-five additions to the Fostoria lines of artistic glassware are given.

**PAVING**—The Paving Machine Company, New York, has issued the "Paving Machine" and published by the Paving Machine Company, 245 Grand Street, New York, N. Y., and is the only publication for the Paving Machine Company, Oneida, N. Y.

**ALUMINUM FACTS AND FIGURES**—The British Aluminum Company, Limited, 109 Queen Victoria Street, London, E. C., England, has distributed an attractive little pocket book of thirty-two pages, in leather binding, briefly describing the properties of aluminum rods, wire, bar and strip, sheets, strains, tubes and sections.

**WOOD PIPE**—An attractive, well-illustrated ninety-four-page catalog having sent out by the Washington Pipe & Lumber Company, Tacoma, Wash., tells the story of its wooden-stave pipe, its value, usefulness and durability. Tables of capacities and velocities, showing the flow of water through wooden-stave pipe, are included.

**TWIST DRILL COMPANY'S CALENDAR**—The Cleveland Twist Drill Company, Cleveland, Ohio, is sending out an attractive calendar 18 in. long by 11 in. wide. The upper half of each month's dates contains an advertising talk on the various manufactures of this company. The last four pages are devoted to tables and shop information.

**METER AND TRANSFORMER**—A "Duncan Product" is being issued by the Duncan Electric Manufacturing Company of Lafayette, Ind. The sheet contains thirty-one pictures. The company also calls attention to the cupped diamond bearing and other features of its Model R meter for switchboard service.

**WIRING SPECIALTIES**—The H. T. Paiste Company, Philadelphia, Pa. These tablets are a series of standard iron fittings which are used in connection with wiring in iron conduit and which provide convenient openings in such work for lamp outlets, for branches or for pulling in the wires. Bulletin No. 87, issued by this company, deals with the new Paiste interchangeable socket.

**"THE HOUSE ELECTRICAL"**—In line with the newer note in publicity methods—that of educating the consumer—the Pettingell-Andrews Company, Boston, Mass., has recently brought out a very creditable book entitled "The House Electrical," with a subtitle "Being a Brief Description of the Ideal Home and How to Plan and Equip It." Its author is Mr. Carroll Westall, manager of publicity for the Pettingell-Andrews Company. The book is 6 in. by 9 in., is well printed, beautifully illustrated, and its contents are thoroughly readable. It is bound in heavy boards and has an attractive cover.

## Business Notes

**THE ROYAL ELECTRIC COMPANY** has moved its Philadelphia office and plant from 30 South Second Street to 27 North Second Street.

**THE GENERAL PIPE, BENDING & ELECTRIC COMPANY**, recently incorporated for manufacturing piping materials, including bends, welded leaders, Van Nostrand, valves, etc., and for the manufacture of electrical fixtures at 245 Grand Street, New York, N. Y., has elected as its officers: Mr. James W. Paving, president; Mr. W. L. Paving, secretary; Mr. W. L. Paving, treasurer; and Mr. M. M. Paving, manager.

**THE STANDARD UNDERGROUND CABLE COMPANY OF CANADA**, Ltd., has moved its Montreal office, which will handle all Canadian business, to 100, 102 and 104, St. James Street, Montreal, P. Q.

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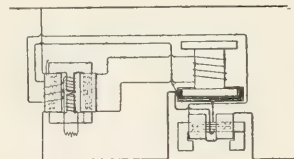
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# Weekly Record of Electrical Patents

## UNITED STATES PATENTS ISSUED JAN. 7, 1913

- 1,049,333. **PRIMARY BATTERY**; Edward C. Brice, Mansfield, Ark. App. filed April 24, 1912. Carbon-cup electrode with porous cup for electrolyte.
- 1,049,347. **PRIMARY BATTERY**; George S. Engle, Providence, R. I. App. filed April 10, 1909. Partitioned zinc-cup electrode.
- 1,049,354. **JEWEL MOUNTING**; William Godber, South Orange, N. J. App. filed March 4, 1907. Upper and lower jewels bear on steel ball.
- 1,049,359. **ELECTRIC TOASTER**; Frank Ernie Hewitt, Toronto, Canada. App. filed Feb. 24, 1912. Vertical toaster has pivoted bread holder.
- 1,049,362. **FUSE HOUSING**; Duncan C. Hooker, Farmington, Conn. App. filed April 2, 1912. Housing includes insulator for supporting fuse.
- 1,049,365. **MERCURY METER**; Dugald C. Jackson, Boston, Mass. App. filed Aug. 5, 1907. Transformer has adjustable leakage gap.
- 1,049,366. **PROTECTING DEVICE FOR ELECTRIC CIRCUITS**; Ray P. Jackson, Edgewood Park, Pa. App. filed March 13, 1911. Fusible material in electrodes melts and short-circuits gaps.
- 1,049,367. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; Henry D. James, Pittsburgh, Pa. App. filed April 10, 1908. Starting resistance is controlled by weakened core member.
- 1,049,370. **SAFETY FUSE**; Louis Kovacs, Chicago, Ill. App. filed Oct. 30, 1911. Plug lengths proportional to critical current strength.
- 1,049,371. **CUT-OUT SWITCH**; Louis Kovacs, Chicago, Ill. App. filed Oct. 30, 1911. Fuse cartridge forms switch blade.
- 1,049,375. **JUNCTION BOX FOR ELECTRICAL CONDUITS**; Ernest R. Le Manquis, Fair Oaks, Pa. App. filed April 26, 1911. Conduits telescope into box.
- 1,049,377. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; Harry A. Lewis, Norristown, Pa. App. filed May 22, 1911. Movable finger engages adjustable drum contacts.
- 1,049,403. **METER SWITCH**; Maurice C. Rypinski, Pittsburgh, Pa. App. filed Jan. 10, 1908. Multiple-contact switch with preventive adjustments.
- 1,049,404. **ELECTRICAL TERMINAL**; Yasudiro Sakai, East Pittsburgh, Pa. App. filed Jan. 7, 1911. Insulating bushing with clamping casing.



1,049,365.—Mercury Meter.

- 1,049,405. **INSULATOR**; Ferdinand Schaub, Jersey City, N. J. App. filed July 9, 1908. Two-part knob with straight and annular grooves.
- 1,049,415. **ELECTRICAL OPERATING DEVICE**; Richard Van R. Sill, Newark, N. J. App. filed March 12, 1909. Rudder steering head controlled by sectionally wound motor.
- 1,049,460. **CONTROLLER FOR ELECTRIC MOTORS**; John Desmond, Chicago, Ill. App. filed Dec. 13, 1909. Adjustable contact arms.
- 1,049,484. **ELECTRIC-CURRENT REGULATOR**; William G. Houskeeper, Philadelphia, Pa. App. filed Feb. 21, 1911. Combination of series transformers of different ratios.
- 1,049,488. **ELECTRICAL HEATING DEVICE**; George A. Hughes and Trevor M. Cayton, Chicago, Ill. App. filed June 11, 1910. Interchangeable connection of resistors.
- 1,049,499. **RECEIVER**; Oscar M. Leich, Genoa, Ill. App. filed March 15, 1910. Construction.
- 1,049,506. **ALTERNATING-CURRENT INDUCTION MOTOR**; Burton McCollum, Washington, D. C. App. filed March 18, 1912. Secondary contains cobalt resistors.
- 1,049,516. **ELECTRICAL THERMOSTAT**; Max Nemmert and George Schnabel, Hamilton, Ontario, Canada. App. filed Nov. 24, 1911. Dumb-bell glass tube containing mercury.
- 1,049,517. **ELECTRIC COOKER**; Will Nichols and Charles V. Uzzell, Denver, Col. App. filed Feb. 19, 1912. Fireless cooker with double air space.
- 1,049,522. **ELECTRIC GAS LIGHTER**; John Y. Parke, Philadelphia, Pa. App. filed April 6, 1912. Mechanism for producing spark.
- 1,049,526. **DESK TELEPHONE APPARATUS**; Niels Pedersen, Genoa, Ill. App. filed June 4, 1909. Switch hook with base contacts.
- 1,049,537. **SELECTOR**; Harry O. Rugb, Sandwich, Ill. App. filed Feb. 15, 1910. Notched contact wheel actuated by magnets.
- 1,049,558. **BLOCK-SIGNAL AND TRAIN-CONTROL SYSTEM**; Jasper Blackburn, Kirkwood, Mo. App. filed Sept. 21, 1908. Motor moves semaphore to non-signaling position.
- 1,049,562. **LAMP SOCKET AND SWITCH DEVICE**; Charles G. Burton, Peru, Ind. App. filed Aug. 7, 1911. Switch operated by rotating lamp and shade.
- 1,049,568. **CHRONOMETER-CONTROLLED SIGNALING DEVICE FOR TELEPHONE-EXCHANGE SYSTEMS**; Irving D. Fellows, Syracuse, N. Y. App. filed Feb. 25, 1911. Branch circuit including clock-setting mechanism.
- 1,049,576. **TROLLEY SUPPORT**; William Hadden, Crafton, Pa. App. filed March 14, 1911. Wheel mounted on bow-spring harp.
- 1,409,586. **AUTOMATIC FIRE ALARM**; Frank Koup, Syracuse, N. Y. App. filed June 19, 1912. Fusible contact-closing device.
- 1,049,624. **MEANS FOR JOINING ELECTRODES**; Edouard Viertel, Treptow, near Berlin, and Hermann Viertel, Lichtenberg, near Berlin, Germany. App. filed March 21, 1912. Threaded-nipple internal connection.
- 1,049,636. **ELECTRIC-CIRCUIT CONTROLLER**; Harry M. Abernethy, Cleveland, Ohio. App. filed May 25, 1908. Drum contact strips held by dovetailing.
- 1,049,657. **TROLLEY-POLE CLAMP**; Leslie G. Bowen, Kansas City, Mo. App. filed June 2, 1911. Clamp socket with locking jaws.
- 1,049,686. **AUTOMATIC SWITCH MECHANISM FOR ELECTRIC LOCOMOTIVES**; Robert R. Dunlop, Columbus, Ohio. App. filed July 6, 1911. Interlocking circuits for multiple-voltage trolley.
- 1,049,687. **FLAME ARC LAMP**; Henry G. Dyer, Collingswood, N. J. App. filed Jan. 12, 1912. Lower electrode is hollow and connects with regenerative duct.
- 1,049,703. **INDUCTION MOTOR**; Alexander M. Gray, Milwaukee, Wis. App. filed Feb. 28, 1910. Centrifugal means for connecting short-circuit ring.
- 1,049,708. **AUTOMATIC ELECTRIC CUT-OUT**; Josef Henrik Hallberg, New York, N. Y. App. filed July 27, 1911. Equivalent resistance automatically replaces burned-out lamp.
- 1,049,750. **ELECTRIC HEATING STOVE**; Albert E. Mastin, Sacramento, Cal. App. filed Feb. 19, 1912. Electric heater elements in lower compartments.
- 1,049,759. **ELECTROTHERAPEUTIC APPLIANCE**; William B. Oliver, Collingswood, N. J. App. filed July 8, 1908. Massage device with contact rollers.
- 1,049,771. **CONDUIT FOR ELECTRICAL CONDUCTORS**; Frank D. Saylor, Pittsburgh, Pa. App. filed Feb. 26, 1910. Armoring tube with spiral strips filed with plastic material.
- 1,049,775. **APPARATUS FOR PRODUCING ELECTRICAL DISCHARGES**; Russell Spaulding, Chicago, Ill. App. filed April 28, 1910; renewed Sept. 19, 1912. High-tension electrodes and motor blowers in transformer circuits.
- 1,049,786. **INCANDESCENT LAMP**; Ezechiel Weintraub, Lynn, Mass. App. filed Oct. 2, 1908. Combination mercury-vapor and incandescent lamp.
- 1,049,920. **ELECTRIC METALWORKING APPARATUS**; Adolph F. Rietzel, Westerly, R. I. App. filed July 10, 1909. Arrangement of contact clamps between heavy bus conductors.
- 1,049,957. **FRICTION CLUTCH**; Alonzo W. Whitcomb, Worcester, Mass. App. filed June 2, 1911. Electromagnet expands beveled friction wheels.
- 1,049,961. **BATTERY**; Robert C. Wood, New York, N. Y. App. filed May 10, 1912. Apertured pan with oxide forms negative element.
- 1,049,962. **SYSTEM OF ELECTRICAL SUPPLY**; William C. Woodland, Warren, Ohio. App. filed Dec. 6, 1911. Primary and secondary reactances in transformer circuits.
- 1,049,975. **ELECTRIC SWITCH**; Frederic Barr, New York, N. Y. App. filed Feb. 18, 1911. Receptacle switch with contact segments.
- 1,049,976. **ELECTRIC SWITCH**; Frederic Barr, New York, N. Y. App. filed March 27, 1911. Switch lever operates through curved slot in shell.
- 1,049,977. **ELECTRIC SWITCH**; Frederic Barr, New York, N. Y. App. filed July 1, 1912. Cam and spring-arm contact mechanism.
- 1,049,978. **ELECTRIC SWITCH**; Frederic Barr, New York, N. Y. App. filed July 12, 1912. Pull switch for wall use.
- 1,049,979. **ELECTRIC FURNACE MEMBER AND PROCESS OF MAKING IT**; Frederick M. Becker, Niagara Falls, N. Y. App. filed Oct. 12, 1911. Carbon electrode coated with ferro-tungsten.
- 1,050,000. **TROLLEY-CONTACT SIGNAL OR SWITCH SYSTEM**; Troy Cope, New Waterford, Ohio. App. filed Oct. 18, 1910. Trolley side-contact control relays.
- 1,050,002. **ELECTRIC IGNITING DEVICE FOR EXPLOSIVE ENGINES**; Edward P. Cowles, Sparta, Mich. App. filed May 12, 1902. Magneto with field built into flywheel.
- 1,050,004. **IMPLEMENT FOR INSTALLING AND REPAIRING ELECTRIC CONDUCTORS**; Jeremiah Cronin, Wapakoneta, Ohio. App. filed May 13, 1912. Insulator socket device for handling line conductors.
- 1,050,019. **ELECTRODE**; Joseph L. R. Hayden, Schenectady, N. Y. Original application filed July 9, 1910; divided and this application filed May 1, 1912. Calcium titano-fluoride is light-giving element.
- 1,050,020. **ELECTRIC-LAMP-SUPPORTING MEANS**; Reinhold Herd, Crafton, Pa. Original application filed Jan. 8, 1909; divided and this application filed July 27, 1909. Conductors retrieved by insulator reel.
- 1,050,021. **ELECTRIC SWITCH**; Edward M. Hewlett and Charles C. Badeau, Schenectady, N. Y. App. filed Nov. 12, 1900. Full-roll mechanism for operating oil switch.
- 1,050,068. **LAMP-CORD ADJUSTER**; Frederick C. Mezger, Gatun, Canal Zone. App. filed May 13, 1912. Double reels with friction mounting.
- 1,050,072. **ARC LAMP**; Waldemar Ruhling, Berlin, Germany. App. filed May 11, 1911. Insulating flux renders slag volatile.
- 1,050,081. **LINE-DROP COMPENSATOR**; John Pearson, Somerset, Wis. App. filed Oct. 10, 1907. Phase transformer has rotatable adjustment.
- 1,050,082. **METHOD OF LINE-DROP COMPENSATION**; John Pearson, Somerset, Wis. App. filed July 22, 1910. Voltage and current circuits combined to produce regulating circuit.
- 1,050,085. **ELECTRICALLY DRIVEN MACHINE FOR TILLING THE GROUND**; Wilhelm Wortman, Mayence, Germany. App. filed July 18, 1912. Gathering reel for cable and movable tool frame.

# Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER and AMERICAN ELECTRICIAN

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No. 4

## Electricity and the Ice Crop

The mildest winter season within man's memory for many decades, which has fairly turned New York into a winter resort, will not prove itself an unmixed blessing if the next three months are like the last. What the ultimate consumer is now saving in fuel he will be likely next summer to expend for ice, and it may not buy a great deal of ice at that. Fortune will be the community which draws its supply, not from natural sources, but from the producers of the artificial brand. Even if a normal crop of natural ice is secured as the result of a few weeks of real winter, the work of harvesting it is likely to create an exceptional demand for labor, with attendant increase in cost. Next summer's ice market promises, at the present time, to be a fairly stiff one, and the outlook is encouraging for the central-station managers who have gone into the artificial-ice business as a profitable side line.

## Electric Starting Motors for Gasoline Cars

While the automobile shows held in New York City during the past two weeks were lamentably lacking in exhibits of electric pleasure and commercial vehicles, there was evidence on all sides of the great changes which have taken place during the past year in the gasoline engine starter field. Indeed, among the really big things of the year in the gasoline automobile field are the electric-lighting and engine-starting systems which have been evolved. Last season the explosive-gas type of self-starter predominated, but this year the electric type of engine starter occupies the premier position. About 70 per cent of the gasoline vehicles which are using starters at all are fitted with electric starters, and while previously such refinements were only to be found on expensive cars, this year witnesses their introduction on cars of all classes. Three types of electric lighting and starting systems are to be had—the single-unit system, comprising a motor-generator set; the double-unit system, consisting of a separate generator and a separate motor for starting or a motor-generator set and a magneto, and the three-unit system, made up of an individual generator, cranking motor and magneto. A storage battery is of course necessary for all three systems. Where a motor-generator set is employed, the unit is in positive engagement with the engine and rotates when the latter is in motion. On the other hand, the cranking motor, where such is used, is only in engagement with the engine when it is desired to start, and when the engine is running under its own power the cranking motor is at rest. The voltages used in electric cranking and lighting systems range from 6 to 24 volts. Certainly the advent of any system which by the touch of a switch will automatically start an engine and do away with the laborious process of cranking would be received with wide

open arms by users of gasoline machines. Having found the electric lighting and starting system reliable and convenient, it may be that users of gasoline cars will eventually find electric cars to be more so.

## High-Speed Alternators

At the last meeting of the American Institute of Electrical Engineers, reported elsewhere in this issue, an interesting paper on turbo-alternator design was read by Mr. B. G. Lamme, who has had much experience with that type of machine. The paper points out that the trend of design in recent years has been to increase the output of turbo-alternators for central-station service, and thus greatly to increase the intensity of heat generation per unit of volume, or per unit of surface, in these machines. This has called for a corresponding intensity of cooling action. Very powerful forced ventilation is now needed in order to keep down maximum working temperatures. The paper is, moreover, a plea for the use of mica as the insulating substance in the windings of such machines, in order to increase the safe range of working temperatures. This increase in acceptable temperature range is, indeed, not a mere incidental advantage; it is an inevitable necessity, without which further progress in turbo-generator design would soon be halted.

## Optimism for the Industry

"I have learned to be an optimist concerning anything electrical," was the inspiring statement of a prominent central-station official in a recent address before an audience made up chiefly of the younger employees of a neighboring utility company. The remark was occasioned by some doubts the speaker had himself expressed concerning an electrical process whose usefulness is still in question, although its possibilities seem enormous. Unable to satisfy himself of the finality of the claims made either pro or con by scientific advocates and skeptics, and yet determined to prove the truth to his own mind, the official has set up experimental apparatus and is going after his own results, animated by the professional optimism best described in his own words. As the electrical industry becomes more and more conventionalized, there is increasing need for such broad catholicity of view and liberal attitude of mind, which are ready to consider the possibilities of even the unproven. It must not be forgotten that the mighty energy-transmission schemes of to-day are but exaggerations of the feeble electromagnetic effects first discovered by Henry, and that the triumphant conquest of the electric motor in every branch of modern industry exemplifies simply a concrete optimism that was not discouraged by the ineffectiveness of the original means at hand. So many times has the electrical industry seen barely hopeful phenomena developed into great commercial

successes at an age which has produced the wonderful development of the past few years can well afford to be optimistic in withholding too quick judgment on electrical futurities that now seem open to controversy.

### Central Georgia Transmission Plant

One of the interesting features of the practice of the last few years in energy transmission is the tendency to separate the generating and distributing interests of the same plant, so that the energy supply is sold at wholesale from the generating plant to distribution companies, which assume the burden of finding and developing the market and bringing the electricity to it. Whether this is likely to be a growing tendency or simply represents a phase of the general development of transmission one can hardly say, but the tendency certainly has resulted in the building of a number of transmission lines which might not have been undertaken so promptly had the original organization, busy with the development of hydraulic privileges, been relied upon to carry through the whole process. The Central Georgia Transmission Company, whose system is described elsewhere in our columns, is an organization for the sale of energy over a considerable territory in middle Georgia contiguous to the region already supplied with energy by the Central Georgia Power Company, from which the transmission company buys its energy on a long-term contract. The transmission lines connect Atlanta, Hampton and Monticello with the system of the generating company, and substations in each place take care of the local distribution. Energy is transmitted at 66,000 volts and delivered to customers at 11,000 or 2300 volts. The conductors forming each circuit are on a single side of the pole, but not directly over each other, being slightly staggered to lessen the possibility of contacts due to a heavy load of sleet. It is a simple precaution to take, although it strikes one as practically quite unnecessary with so conservative a span-length as that here used, about 550 ft.

Each tower carries two stranded steel cables grounded at each pole for protection against lightning, which is considerably to be feared in this particular territory. The transmission circuits themselves are of No. 0 equivalent-stranded aluminum. Two miles of the main circuit pass through the suburbs of Atlanta, running along the curb line of the street, and here, of course, it became necessary to occupy less ground area and thereby to reduce the tower to what is really a carefully designed square latticed pole, which carries the conductors in precisely the same way as the other towers but on a slightly shorter span, some 425 ft. on the average.

Another interesting part of the system is a large switching tower near the Hampton substation. This is a latticed steel structure supporting in the free open air the group of long switches for sectionalizing and interconnecting the lines at this particular point. In some of the Pacific Coast plants the open-air switching system has been used very successfully, and not uncommonly it forms an addition to power houses and substations, but its use in Eastern plants has been somewhat limited, so that this Southern example is rather a striking one.

The main substation at Atlanta is of about 9000-kw rating, and is equipped with a complete feeder system with duplicate low-tension buses supplying energy to feeders at 11,000 volts. The whole system is worked by electrically operated switches from a switchboard on the main floor of the substation, the current for the purpose being derived from a storage battery charged by means of a rectifier from the alternating-current circuits. Each of the other two substations is of 900-kw rating, the one in Monticello being supplied with energy from one pole line carrying a single 66,000-volt circuit. Altogether the system is a capital example of recent tendencies in both line construction and operation.

### Joint Recommendations of A. S. M. E. and A. I. E. E. Committees

The recent announcement of certain recommendations of joint committees from the American Society of Mechanical Engineers and the American Institute of Electrical Engineers is interesting not only for the significance of a joint society action but also for the significance of the recommendations themselves. It is noteworthy that this is the first piece of joint standards committee work undertaken, so far as we have information, between sister engineering societies in the United States, and why we should have had to wait so long for it is hard to perceive. The mechanical and electrical engineers have much in common. It would seem that in the future they will have much more in common. In fact, it would seem that twenty years hence there will be no line of demarcation left between an electrical and a mechanical engineer, except in regard to the specialty he may happen to be engaged in. Mechanical engineers will be so surrounded with electrical apparatus, and electrical engineers so surrounded with mechanical apparatus, that their experience will necessarily merge.

It is to be hoped that in the broad interests of engineering there may be a continuance of the joint action and co-operation of standards committees of the two societies concerned. Indeed, it is desirable that the movement should go further. The four great national engineering societies are the civil, the mechanical, the electrical and the mining, not to mention more recent societies in collateral branches. So closely are the technical interests of these groups interwoven that there should manifestly be standards committees permanently appointed by each for itself, with the understanding that joint sessions of two or more of these shall be convened by mutual direct invitation whenever desirable. In this way, each society's standards committee might meet independently, say, once a month, but they might meet conjointly, say, twice a year. The joint actions would, of course, be subject to the approval of the respective governing boards. This simple arrangement would not only serve to cement harmonious co-operation but also would facilitate much needed standardization in overlapping fields.

In regard to the recommendations themselves it is good to see how simple they are and how much complexity they would eliminate if adopted. As long as electric generators were constructed either belt-driven or on separate bearings their efficiency could be determined independently of that of their prime movers. Even when the generator was



directly connected and not mounted on separate bearings, but so as to be capable of independent operation, the same procedure could be followed with some stretch of imagination, but when the prime mover and the generator are incorporated into a single structure so closely as they are to-day in turbo-generator steam units it becomes necessary to test them as single machines taking in power in steam and giving it out in electricity. It then becomes a mirth-provoking spectacle to find the engineers testing the machine by measuring the power input in boiler-horse-power or in thermal units per hour and the power output in watts or kilowatts. Clearly, the power should be measured in one and the same unit at both input and output. While it would be perfectly feasible to measure and state the power output in terms of heat, to match the input custom, yet the process would be cumbersome and unsatisfactory.

On the other hand, the watt is a unit of power of any type—thermal, mechanical, chemical or electric—and it is a simple matter to express the thermal input in watts or myriawatts. As Mr. H. G. Stott pointed out in his paper last year, it happens that the boiler-horse-power is so nearly equal to the myriawatt, or ten kilowatts, that the difference is likely to appear only in careful measurements. The mechanical engineer can surely find no objection to the name of James Watt as a unit, and the prefix "myria" belongs to the established international system of units, as, for instance, in the myriameter. In fact, the English word "myriad" has two meanings, namely, a very large number and ten thousand. We hope, therefore, that the proposals of the joint committees will find favor and adoption among engineers generally, whether mechanical or electrical, and that the watt, in any of its decimal multiples, will come into general use for power measurements.

### Peat as a Source of Electrical Energy

As our readers are well aware, within the last few years many experiments have been made, both here and abroad, with peat used as a practical fuel. Most of the work has been profitless so far as this country is concerned, but reports from various parts of the European Continent have shown occasional successes notable enough to be somewhat encouraging. One of our foreign contemporaries has been publishing of late an important series of papers, abstracted in our *Digest*, concerning the practical application of peat as fuel. As is well known, peat is, so to speak, the product of a very early stage of coal development, the beginning of the systematic carbonization of vegetable material which under possibly different conditions might in time result in coal. So far as the composition goes, peat may be regarded as having a crude resemblance to lignite. The latter carries less moisture, less volatile matter and more fixed carbon, peat running to something like 50 per cent volatile matter and 20 to 25 per cent fixed carbon with about an equal percentage of moisture when thoroughly dried. However, peat is very widely distributed and not at all bad fuel under favorable circumstances, to wit, when it can be dug cheaply and used on the spot. It is essentially a fuel of the moors and bogs, carrying at least 50 per cent of moisture, and generally much more when dug, and requiring to be freed from most of this by artificial drying or exposure to air.

The German experiments referred to have been carried out on a comparatively large scale in the East Friesland district under government supervision, and have resulted in the operation of a transmission plant of considerable output distributing energy over a network of wide extent and serving an extremely useful purpose quite aside from the demonstrational importance of its use of peat as a fuel. The district is very rich in peat, the deposits being of rather good quality. In fact, even at a large increase over the present demand for energy in the territory reached there is certainly a supply of peat sufficient to last for centuries. The plant now in use is of about 4000-kw rating in three turbo-generators fed by four water-tube boilers with super-heaters, and the general distribution is at 20,000 volts. The peat is cut by motor-driven machinery and handled in a thoroughly businesslike way. Under such circumstances peat, despite a rather low thermal value, becomes a thoroughly practicable fuel. Depending on air drying implies that the consumption on a weight basis would vary more or less with the weather, but it is found on the average that from 2.5 kilograms to 3 kilograms of peat per kilowatt-hour is about the usual consumption. It is a question whether direct consumption of peat is as advantageous as its use for making producer gas, a procedure which its large percentage of volatile matter would naturally suggest. In fact, some further German experiments, referred to in the papers under consideration, indicate that by resorting to gas production the consumption of peat per kilowatt-hour can possibly be brought down to less than 1.5 kilograms, certainly to 2 kilograms, per kilowatt-hour, the results being materially better than in direct combustion.

The calorific value of peat is, of course, low, hardly more than 6000 or 8000 heat units per pound, even when pretty thoroughly dried, and, of course, proportionately less when wet. Nevertheless, at the consumption here stated, peat is a cheap fuel when it can be cheaply obtained. The price being taken at \$1.25 per metric ton, the cost of fuel per kilowatt-hour is less than a third of a cent, even when used on a comparatively small scale, as in the plant cited. Certainly fuel having half the calorific value of high-grade steam coal must be regarded as cheap at \$1.25 per ton, even though it be more difficult and troublesome to use under the boilers than coal. The German experiments are well worth investigation by the engineer. The salient facts disclosed are those which have become evident in previous investigations, showing that the whole question of economy in the use of peat turns on the ability to get a cheap supply locally. Mining with machines on a large scale and in a fairly homogeneous deposit enables this to be done. The next serious question is drying the peat to a point where it can be advantageously utilized. When the sun-dried product can be used, a condition existing only under favorable circumstances, a very useful and low-priced fuel is at hand. If an attempt be made to free the peat from moisture on a scale large enough to permit its transportation as fuel, the general result has been and is likely to be failure. Only in a few fortunate regions where peat and labor are cheap and the market near can peat be used successfully outside its own locality. But as a local fuel for use in energy-distribution works in a region of plentiful supply and cheap labor it has much to recommend it.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### New York Legislative Committee Opposed to State Hydroelectric Scheme

In the Jan. 4 number of the *Electrical World* there was published an extensive account of the plans of the New York State Conservation Commission, which proposed a state-wide scheme of hydroelectric development and high-tension transmission under state ownership and operation similar to that which now obtains in the Province of Ontario, Canada. The joint legislative committee named to investigate the state's water-power resources has just submitted its report, recommending a plan for conservation and utilization diametrically opposite to that of the conservation commission. The committee declared that it would be impossible for the State of New York to develop a sufficient amount of hydraulic power to make any appreciable impression on the power demands of the State. It investigated the plan of the Hydro-Electric Power Commission of Ontario and reports that, in its opinion, measured by economic and business standards, the plan is not a success. Accordingly the committee opposes the adoption of a similar plan by the State. The committee points out that there is within the State a daily hydraulic consumption of over 2,000,000 hp and that to deliver this to the point of utilization would require over 8,000,000 hp at the penstock. It finds that there is undeveloped within the State only 1,196,800 hp, 262,700 hp of which is actually owned by the State, the rest being claimed by private owners. The committee declares, regarding the Hydro-Electric Power Commission of Ontario, that it has never developed any water-power but has acted merely in the capacity of middleman in the merchandising of electrical energy; that it furnishes electricity to the municipalities below cost; that if the same methods were applied as are employed in business transactions of a similar nature there would be an annual loss of at least \$432,170, and that in addition to this loss to the Province the local distribution systems of the municipalities would also show a loss. It is claimed that the municipal system of Toronto showed a net loss to June 30, 1912, of \$268,984.

### Railroad Commission of California Plans Elaborate Induction Tests

As the result of complaints of inductive interference by high-tension transmission lines, presented to the Railroad Commission of the State of California by telephone companies, the commission has authorized the organization of a joint committee made up of representatives of the various utilities involved and of the Railroad Commission. This committee has just undertaken a series of tests to throw new light on the subject of induction. The representatives of the telephone and telegraph interests on the committee are Messrs. A. H. Griswold, R. W. Gray, C. H. Temple and L. M. Ellis. The transmission companies are represented by Messrs. H. A. Barre, Louis Elliott, P. M. Downing and J. E. Woodbridge; representing the railroad interests is Mr. A. H. Babcock, and the representatives of the State Railroad Commission are Messrs. R. A. Thompson, A. R. Kelly, L. E. Hoar and J. T. Shaw.

The program of tests to be carried out is quite elaborate. There will be complete electrical tests on various types of telephone circuits to determine their electrical

and physical conditions when not subjected to transmission-line interference, as well as complete tests on various types of transmission systems, without power on the system, to determine their electrical and physical characteristics. Combination tests for various types of telephone and transmission systems under normal and abnormal operating conditions of both systems will also be made.

These will embrace complete electrical tests of various types of telephone circuits under normal operation of the transmission systems; of star-connected, grounded-neutral, and of delta-connected transmission systems; of single-phase and of direct-current railroad systems; of telephone and star-connected, grounded-neutral, and of delta-connected transmission systems operating under conditions other than normal, and of telephone and single-phase and of direct-current railroad systems.

### Electrical Farming Near Dayton, Ohio

Some of the possibilities of electric-soil stimulation as a central-station off-peak load were pointed out in a talk before the New York Companies' Section, N. E. L. A., Jan. 20, by Mr. F. M. Tait, president and general manager of the Dayton (Ohio) Lighting Company, which is carrying on comparative experiments in the introduction of nitrogen into the soil by electric discharges.

"I have learned to be an optimist in anything electrical," said President Tait. If the effectiveness of electrical stimulation of plant growth can be demonstrated, he went on to show how a vast agricultural off-peak load might be developed for the central station's machines during the idle hours from, say, 10 p. m. to 5 a. m. In the evening, after the city demand is passed, the output of the power plant could be turned into the country, replenishing the soil and deflecting to the central station's advantage the outlay now made for the tons of fertilizer which the farmers buy. Crops might then be raised independently of, even rainfall, for motor-driven irrigating pumps would supply all necessary moisture.

Unable to satisfy itself of either the value or the deficiency of electric-discharge methods of plant stimulation from information obtainable from outside sources, Mr. Tait's company is undertaking its own experiments at a farm 6 miles from Dayton, supplied with central-station service. Duplicate flower boxes have been fitted up in a greenhouse so as to obtain identical conditions of sunlight, moisture, heat, etc., except that one set of plants will be electrified, while the other will be subject only to ordinary conditions.

Besides the usual equipment of motor-driven farm machinery, barn and residence lighting, etc., these electrified farms near Dayton enjoy outdoor lighting from tall steel poles carrying 500-watt tungsten lamps 75 ft. above the ground. The resulting illumination is most effective for driving or finding one's way about the farm grounds at night. The steel poles are also equipped with cords and sheaves, so that they may be used as flagstaffs during the daytime.

Electrical construction on the farm has its own special problems and difficulties, sometimes ludicrous as well as serious, according to Mr. Tait. While one of the metal

flagpoles was being raised it got beyond the control of the men and fell with one end in contact with the 6600-volt transmission circuit and the other across a barbed-wire fence. Instantly the fences for miles around became charged and every fence post began to smoke. It was only by quick work that the cross was cleared before injury had been done to persons or animals attracted by the curious phenomenon of a wire fence undergoing spontaneous combustion. On another occasion a line gang was painting poles the dark-green color which has been adopted to make them less conspicuous against the countryside. The painters failed to notice that a herd of steers was in the field. After the men had gone the cattle went up to inspect their work, licked all the paint off the poles within 4 ft. of the ground, and in fifteen minutes three of the animals lay dead from poisoning. These steers cost the electric company \$150 apiece, and it failed even to get redress from the paint manufacturer under the pure-food law.

### Edison Electric Safety Lamp

In accordance with announcements previously made in these columns, the American Museum of Safety, New York City, awarded the Rathenau gold medal to Thomas A. Edison on Jan. 23 for his electric safety lamp. The lamp, which is said to represent the culmination of several years' work on the part of Edison, is shown herewith. Its make-up is simple and rugged and as fool-proof as possible. Two nickel-iron cells are used, the positive of one and the negative of the other being grounded to the can and the two cells connected together and placed in a nickle-plated steel case. Spring terminal contacts on the battery connect with nickle-plated steel contact plates affixed to, but insulated from, the top of the case. No insulation is provided between the two

to preclude the possibility of disconnecting it without unlocking the case and withdrawing the lock bar from articulation with the eye on the terminal. It is therefore impossible for a miner to cause a spark by disconnecting a wire in a mine. For a portion of its length at both ends the twin conductor is incased in flexible steel which serves as an anchor and prevents sharp bending of the conductors.

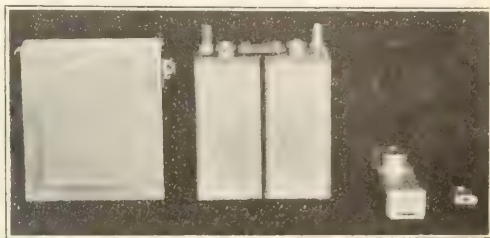


FIG. 2 STORAGE BATTERY AND CASE

The cap outfit comprises a parabolic reflector provided with a flange supporting a thick glass lens cushioned on gaskets, a small tungsten lamp, a socket for supporting the lamp and reflector, and a hook to fit into the miner's regulation cap. It is impossible for the miner to tamper with the lamp without disrupting a severable mechanical seal on the flange of the reflector. To provide mechanical strength a thick lens of proper optical conformation is employed.

In Fig. 1 the battery case is shown attached to the back of a miner. It will be noted that the conductors lead upward through a guide in the miner's cap and pass over to the lamp, which is attached to a leather support on the front of the cap. The case is shown locked, as in practice the intent of the inventor is that the outfit shall be given to the miner by the electrician fully charged and in service. The battery complete weighs about 2 lb. and is a trifle over 5 in. wide and 4.5 in. high. The battery has an emf of 2.4 volts, and it will give 4 amp-hr. The tungsten lamp is rated at 2 cp.

### A. I. E. E. Affairs

At the January meeting of the board of directors of the American Institute of Electrical Engineers indorsement was given to the recommendation of the standards committee of the Institute and a special committee of the American Society of Mechanical Engineers that the term "myriawatt" be applied to the quantity formerly known as the "boiler-horse-power," the use of the latter term being discontinued.

Past-president Charles F. Scott was appointed first vice-president on the executive committee on organization of the International Electrical Congress, to fill the vacancy caused by the resignation of Mr. W. D. Weaver.

Chairman Rugg of the meetings and papers committee announced that arrangements had been made for a series of four lectures to be delivered before the Institute by Prof. E. P. Adams, of the Palmer Physical Laboratory, Princeton University, on Tuesday evening of each of the last two weeks in March and the first two weeks in April, under the auspices of the electrophysics committee. The board voted to extend an invitation to appoint the secretaries to the members of allied engineering societies through their respective secretaries.

The secretary was instructed to communicate with the secretaries of other engineering societies, inviting their members to attend the sessions of the midwinter convention and to take part in the discussions. The board voted to omit the February New York meeting in order that the committee might devote itself to the midwinter meeting.

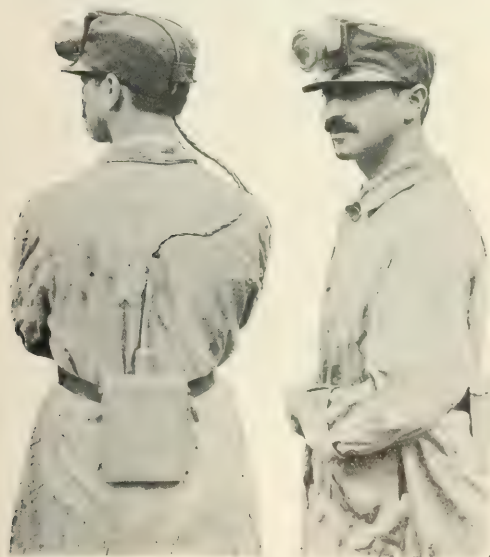


FIG. 1—SAFETY LAMP ATTACHED TO MINER

cells or between the cells and the case. When the hinged top on the latter is brought down and fastened by means of a hasp to the staple, the battery is secured and the case may be locked.

The twin-conductor flexible cord is provided at one end with a terminal, which when shoved into the socket on top of the battery case becomes fastened in such a manner as



A communication was read from Prof. W. F. Durand, chairman of the conference committee on the International Engineering Congress, San Francisco, 1915, stating that the local committee of the congress was being organized and that it was desirable for the Institute to appoint its representatives on the committee at the earliest possible date. The president was authorized to appoint three representatives on the local committee.

### Peoria Electrical Show

The second annual Peoria Electrical Show was opened in the Coliseum in that city on Jan. 18. It presented an attractive appearance, and, judging by the interest taken by press and public, the attendance promised to be good. One side of the large central space was occupied by a stage, and here were given musical, vaudeville and other performances, including a high-potential "fireworks" exhibition and lecture.

The Peoria Gas & Electric Company made an exhibit of lighting and electric-cooking apparatus. The "show" feature in this space was a tungsten lamp suspended pendulum-wise from a swinging strip of glass and illuminated without any visible source of electricity, although there was a near-by induction coil (or what looked like one), with ostentatious copper-wire terminals extending near similar wires projecting from the lamp socket. A close observer, however, might have noticed tiny strips of tinfoil on the narrow edges of the glass pendulum, and these formed the path of the current to the 110-volt lamp.

The Illinois Traction System displayed, in operation, electrically controlled block signals. Several creditable pieces of "wireless" and other apparatus made by the pupils of the Manual Training High School of Peoria and other schools attracted attention. As noted elsewhere in this issue, a number of manufacturers exhibited their products in attractively decorated booths.

Mr. Leroy A. Mills was the manager of the show, which was announced to be closed on Jan. 25.

### Testimonial Banquet to Mr. W. H. Blood, Jr.

About 150 men prominent in the central station and the electric vehicle industries tendered a testimonial banquet to Mr. W. H. Blood, Jr., past-president of the Electric Vehicle Association of America, on Jan. 16, at Delmonico's, New York City. After the dinner started general jollification set in, and while the various courses were being served an orchestra and male quartet rendered popular selections, the hosts joining in the choruses, which were provided in printed form. Mr. R. M. Searle, vice-president of the Rochester (N. Y.) Railway & Light Company, joined later by Mr. Charles Blizard of the Electric Storage Battery Company, started the general jollification by playing the bones, and Mr. Thomas Murray, vice-president and general manager of the New York Edison Company, favored the diners with several tenor solos which were heartily enjoyed and applauded. Mr. Arthur Williams, who is Mr. Blood's successor as president of the Electric Vehicle Association of America, acted as toastmaster, and after reading congratulatory messages from Messrs. Louis Ferguson, Chicago; C. E. Michel, St. Louis; G. H. Harries, Chicago; Guy Tripp, New York; R. F. Pack, Minneapolis; O. B. Young, C. A. Stone and E. S. Webster, Boston, quarter-minute speeches were made by Messrs. C. L. Edgar of Boston, J. F. Gilchrist of Chicago and F. M. Tait of Dayton. Mr. Blood, responding to the toast proposed by Mr. Williams, in which the latter referred to the splendid efforts of the guest of the evening in behalf of the association, expressed his appreciation of the honor thrust upon him and graciously named various members of the

association to whom credit was due for much of the work thus far performed. After the speeches were over professional entertainers made merriment till almost midnight.

### New York Auto Truck Show

There was an aspect about the aisles of Madison Square Garden and the New Grand Central Palace, New York, this week decidedly different from that of last week, when pleasure cars rather than motor trucks and delivery wagons were on exhibition. The attendance, although far less dense, was of a different character. Most of those who attended had transportation problems of their own which they hoped could be solved by the motor vehicle. The majority of the exhibitors were manufacturers of gasoline cars, but there was a fair representation of electric vehicles. The exhibits of the latter, eight in number, were grouped at the New Grand Central Palace, and the newest feature in the construction of the models shown was a worm and gear drive. In this drive the armature of a single motor is directly connected to a worm gear, which operates the differential gearing through a short shaft. There was a large array of ignition and electric starting systems on exhibition at Madison Square Garden, there being a very decided leaning toward electric starting in both pleasure and commercial gasoline vehicles this year.

### Mr. Arthur Williams on the Electric Vehicle

Because of the scarcity of exhibits of electric vehicles at the two large automobile shows held in New York for the past two weeks the inference has been drawn in many quarters that the use of the electric vehicle is on the wane and that its gasoline competitors are increasing in popularity. The manufacturers of electric vehicles, however, have drawn attention to the fact that it was impossible for them to obtain good exhibition spaces at either show regardless of the expense involved, and rather than have their machines placed in out-of-the-way corners or galleries many decided not to exhibit at all.

That the popularity of the electric vehicle is increasing rather than on the wane was brought out by Mr. Arthur Williams, president of the Electric Vehicle Association of America, in an address before a joint meeting of the New England Section and of the Electric Motor Car Club of Boston on Jan. 10, an abstract of which address was published in the *Electrical World* of Jan. 18. Mr. Williams, as is well known, is a past-president of the National Electric Light Association and president of the Association of Edison Illuminating Companies and numerous other national bodies, besides the Electric Vehicle Association of America. The New York Edison Company, with which Mr. Williams is associated, has been a consistent user of electric vehicles for years, and Mr. Williams has given much thought to the vehicle and to its possibilities. Asked to supplement his Boston address on the development of the electric vehicle, Mr. Williams made the following statement to a representative of the *Electrical World*:

#### RAPID GROWTH OF ELECTRIC-VEHICLE INDUSTRY

"One of the 'signs of the times' is found in the rapid growth of the electric-vehicle industry for business and commerce. For both purposes these vehicles are seen in increasing numbers on the streets of our cities. This is due partly to the improvement in the vehicles themselves and partly to the growing appreciation of the public of the advantage of this method of power movement, contrasted with any other now available.

"Other things being equal, the service that is most attractive, simple, adequate, convenient and economical will survive and prevail. That has been true of the candle over the pine knot, of the oil lamp over the candle, and of gas

and electricity over oil. It is true of animal over human power, of mechanical over animal power, and now of the electric motor over the reciprocating engine. In pleasure cars those who appreciate convenience, simplicity and economy will use the electric automobile; in business those who demand the most reliable and the cheapest service will use the electric vehicle. It is the survival of the fittest.

"It would be unfair and foolish to deprive the gasoline engine of the enormous credit it deserves in the development of the modern automobile. Each successive stage in human development has been of incalculable value to the people of the time. We readily imagine the luxury of the candle, then of the lamp, of ever-increasing brilliancy, and then of gas, which to-day is still a most attractive illuminant, and now the electric light. What a relief was the use of animal power for that formerly furnished by human beings! Then came the revolution to all industry by the utilization of steam in the reciprocating engine. So with the gasoline pleasure or commercial car—it has its place. But, step by step, year by year, our minds will reach the conclusion that the field of the gasoline car is limited and that the great part of pleasure riding and commercial haulage will be accomplished with the portable storage battery and the electric motor.

#### SPIRIT OF CO-OPERATION MANIFESTED

"A new spirit is growing in this industry. It is exemplified through the Electric Vehicle Association of America. It is a spirit of co-operation between the central stations and the manufacturers of vehicles, motors, batteries and accessories, and between their representatives and the public.

"There is a common purpose to improve designs and materials, to standardize parts, to increase facilities, and in the interest of the electric vehicle to work unitedly for the common good. This is contrasted with the older spirit when each manufacturer thought his interests were conserved by depreciating as far as he could the product of his competitor, with the result that the prospective purchaser became so discouraged in going from manufacturer to manufacturer or from agent to agent that he gladly welcomed the competent and sometimes almost inspired representative of the gasoline motor car.

#### STANDING OF MEN BEHIND THE MOVEMENT

"A crowd as well as an individual makes an impression upon the observer and, like the individual, has a personality. It was a wonderful aggregate of personality, suggesting the highest degree of skill in manufacture, in selling, in administration and executive efficiency, that gathered in Boston in the central-station and electric-automobile interests a few nights ago. And one could not do other than feel privileged to belong to an industry such as that represented by the electric-vehicle and central-station men who met in New York as hosts at the testimonial dinner to Mr. W. H. Blood, Jr., on Thursday evening, Jan. 16. If men of character, personality and ideals, united in a common cause, mean anything at all, these men in their collective as well as individual personality mean a great future for the electric vehicle, whatever the purpose of its use."

#### Electric-Vehicle Insurance Rates Lowered

During the past two years the insurance committee of the Electric Vehicle Association of America, of which Mr. Day Baker, Boston, is chairman, has endeavored to secure a preferential rate on pleasure and commercial automobiles operated by electricity. Less than a year ago the committee announced a reduction of a 10 per cent preferential rate, and on Jan. 6 the New England Casualty Company, of Boston, announced a preferential rate for electric vehicles which is approximately 20 per cent lower than the rates charged for gasoline cars.

#### Electric-Vehicle Growth at Boston

At a recent meeting of the Electric Motor Car Club of Boston President Day Baker exhibited an interesting curve sheet from which the accompanying table has been drawn up, showing the development of commercial electric-vehicle applications in the Boston district, traced from the beginning of battery-driven truck and delivery-wagon service to the present. From 1902, when the first two machines were put in commission in Boston, little was accomplished until 1908, when determined efforts were undertaken to stimulate interest in the field by various battery and accessory in-

ELECTRIC-COMMERCIAL-VEHICLE GROWTH AT BOSTON

Year	New Cars	Total	Year	New Cars	Total
1902	2	2	1908	13	34
1903	5	7	1909	28	62
1904	2	9	1910	57	119
1905	1	10	1911	74	193
1906	7	17	1912	86	279
1907	4	21			

terests, together with one or two prominent electric-truck manufacturers. During the past three years a rapid gain has been made in the electric-vehicle field at Boston, and the increase in the rate of application following the beginning of the Boston Edison campaign in 1911 is clearly shown. At the present writing more than 300 commercial electric vehicles are either in service or on order at Boston.

#### Importance of Electric Truck as Central-Station Load

In a paper presented before the regular monthly meeting of the Electric Vehicle Association of America in New York on Jan. 21, Mr. H. W. Hillman, of the General Vehicle Company, discussed the relative importance to the central station of the load supplied by the electric truck as compared with that of other classes of apparatus. By means of a census of thirty central stations situated in cities ranging in population from 1,000,000 down to 25,000 inhabitants, the author of the paper compiled a table on the basis of the relative annual income per kilowatt of the necessary plant equipment. In this list are included small and large residences, small retail stores, churches, industrial motor installations of one, two, three, eight and twenty motors, drugstores, saloons and one 2-ton motor truck. It is interesting to note that the revenue derived from the electric truck is second only to that of the saloon and the drugstore.

In comparing the truck with the electric flatiron as an energy consumer, it was stated that while it would take eighty-six irons to equal the annual income from one 2-ton truck, the iron would represent a connected load of 51.6 kw, while the truck would call for only 6 kw. On the same plant equipment the electric truck has eight and one-half times the earning capacity of the electric flatiron.

When compared with the industrial motor load, the author stated that an electric-truck battery is connected on the line from six to eight hours every night, while industrial motor installations are frequently on the line less than three hours each day. From a compilation of figures presented it was shown that the load-factor of an electric truck is 35 per cent and for the average industrial motor installation it is only 10 per cent.

During the discussion of the paper the meeting was addressed by Messrs. Joseph Becker, of the United Electric Light & Power Company; M. S. Seelman and D. F. Tobias,



of the Brooklyn Edison Company; C. V. Marsh, of the Bates Advertising Company; E. W. Curtis, of the General Vehicle Company; C. W. Price, of the *Electrical Review*; H. H. Rice, of the Waverley Company; S. G. Thompson and T. F. Bloodworth, Jr., of the Public Service Electric Company; Harvey Robinson, of the New York Edison Company; J. Johnson, of the Yonkers Electric Light & Power Company; R. L. Lloyd, of the Philadelphia Electric Company, and H. F. Thompson, research associate of the Massachusetts Institute of Technology.

Mr. Hillman, in closing the discussion, appealed to the central-station managers for closer co-operation with the electric-vehicle salesmen. He stated that in order to bring to the front this branch of the central-station business, which is presenting a high annual income, good load-factor and off-peak demand, co-operation is necessary, and that the advantage to be gained by both parties is certainly very evident.

### Northwestern Cedarmen at Duluth

The seventeenth annual meeting of the Northwestern Cedarmen's Association was held in Duluth, Minn., on Jan. 7 and 8. Mr. T. P. Bradley, of Duluth, the president, occupied the chair. In his annual address he commented on the organization of the Cedarmen's Exchange for Interinsurance and also referred to an order of the Interstate Commerce Commission in the matter of the investigation of alleged irregularities and discrepancies in the weighing of freight by carriers. Mr. Bradley contended that the carriers do not give proper consideration to claims for overweight. He said that the members of the association are paying out hundreds of thousands of dollars every year in payment of freight charges, and as long as the railroads refuse to recognize any weights other than those of their track scales, the association and its members should leave nothing undone to secure accurate weighing. The railroads make an allowance of only 500 lb. a car for stakes and supports in the equipment of open cars. The average weight of stakes actually used in loading a car of poles is about 1200 lb. This means that the shipper is required to pay freight on the remaining 700 lb. The speaker hoped that the time is not far distant when the railroads will be required to furnish open cars properly equipped for the loading of poles or else make a provision in their tariffs giving an allowance of 1200 lb. to the pole shipper. Mr. Bradley said that the pole business had shown some improvement in the year 1912. At the present time stocks are broken, with a marked shortage in some sizes.

Secretary H. H. McKinney, of Minneapolis, in his annual report said it was probable that about the same amount of stock would be put in this season as a year ago. The association had twenty-two calls for inspection during 1912, thirteen of which were for poles. Mr. McKinney suggested that steps be taken at the present session of the Legislature of Minnesota to secure the enactment of a law giving the State Railroad and Warehouse Commission the same authority over the weighing of lumber and forest products as it has now over grain, hay and coal. The Northwestern Cedarmen's Association now consists of thirty-two members, the new members admitted in 1912 being the Curry & Whyte Company, of Duluth; the I. Stephenson Company, of Wells, Mich.; the Clark Pole & Tie Company, of Bemidji, Minn.; Finch Brothers, of Superior, Wis., and the Learned Cedar Company, of Minneapolis.

At the afternoon session of Jan. 7 Mr. Robert H. Ross, manager of the Cedarmen's Exchange, outlined the work being done by that organization. Mr. E. L. Clark, chairman of the insurance committee, offered a resolution, which was adopted, to the effect that it is the duty of the members of the association to use the insurance of the Cedarmen's Exchange as much as possible.

The Wednesday morning session was given over to a discussion of the proposed changing of the name of the association from the Northwestern Cedarmen's Association to the Northern White Cedar Association. On motion of Mr. Clark a special committee of three will be appointed to report on this subject at the next annual meeting. Another special committee will consider changes in the constitution in reference to time of meetings.

Officers for 1913 were elected as follows: President, Mr. W. C. Moss, Minneapolis; vice-president, Mr. J. W. Benham, Chicago; treasurer, Mr. W. B. Thomas, Manistique, Mich.; secretary, Mr. H. H. McKinney, Minneapolis; directors, Messrs. E. L. Clark, Minneapolis; H. W. Reade, Escanaba, Mich.; M. K. Bissell, Escanaba, Mich., and L. A. Page, Jr., Minneapolis. The annual banquet was held on the evening of the first day and was greatly enjoyed.

### Western Red Cedar Association

At the annual meeting of the Idaho Cedarmen's Association, held Jan. 14 at Spokane, Wash., the name of the organization was changed to that of the Western Red Cedar Association to include the larger geographical distribution of the present membership, practically all of which was represented at the meeting. A feature of the session was the report received from Mr. J. B. Knapp, United States assistant district forester, Portland, Ore., covering comparison tests of Michigan white-cedar and Idaho red-cedar poles, 25 ft. in length, with 7-in. tops. The Idaho poles examined were declared very much superior by the forester, the Eastern poles containing varying amounts of center rot and a good many knots. For comparisons of strength, obtained with a 200,000-lb. Olsen testing machine, he submitted these figures, based on allowances for equal pole diameters: Modulus of rupture, pounds per square inch, Michigan white cedar, 3400; Idaho red cedar, 6670. Breaking load, pounds per square inch, Michigan white cedar, 8450; Idaho red cedar, 18,510.

The following officers were unanimously elected for the ensuing year: President, Mr. H. C. Culver, Sandpoint, Iowa; vice-president, Mr. M. P. Flannery, Spokane, Wash., and secretary-treasurer, Mr. R. L. Bayne, Spokane, Wash. Messrs. W. M. Leavitt and E. A. Lindsley, with the president as member ex officio, were appointed as a committee to draft a constitution and by-laws for the association, the dues of which have been raised to \$25 a year.

### Contractors on Cost-Keeping and Co-operation

At the midwinter convention of the Illinois Electrical Contractors' Association, held in Peoria on Jan. 17 and 18, there were two open sessions. At the first one Mayor Woodruff of Peoria gave an address of welcome, and there were speeches by Mr. Ernest Freeman, president of the National Electrical Contractors' Association, and a number of others.

About sixty-five contractors attended the convention, at which Mr. William McGuineas, of Chicago, presided. The principal feature of the afternoon session of Jan. 17 was an illustrated address by Mr. Frank L. Decker, of Chicago, on "Bookkeeping for Electrical Contractors." In introducing Mr. Decker Mr. McGuineas remarked that the former was the working member of the committee on education appointed at the last convention. There is a great need, the president said, for educational effort among electrical contractors, to the end that they may learn to analyze their work according to modern methods.

Mr. Decker remarked that electrical contractors need training as much as men in any other class of business. The contractors should learn how to do business, and particularly they should understand modern methods of cost-



keeping. In this educational work the benefits of association are very apparent. After this preamble, the speaker traced an assumed job of electrical construction and gave lantern-slide pictures of the different tickets and bookkeeping sheets needed to make a complete and scientific record of it. Beginning with the sales-order ticket, he followed with the job-cost sheet, the charge ticket, the credit ticket and the loose-leaf ledger sheet where the account is entered. The recapitulation sheet was also illustrated by the speaker.

In the particular case under discussion, Mr. Decker assumed a flat overhead expense of 20 per cent of the cost of the job. The total cost is that of the merchandise used added to the labor and the overhead expense. The difference between the total cost thus ascertained and the price obtained is the profit, of course.

The bookkeeping sheets illustrated by Mr. Decker included a record of cash received, the bank statement, the record of checks drawn, journal entries (entries relating to other than cash transactions), record of invoices payable, distribution sheets of various descriptions, accounts payable, record of checks drawn, loss-and-gain statement (monthly) and the payroll (weekly).

In the discussion of Mr. Decker's paper Mr. W. P. Ball of Moline, explained his system of bookkeeping for contractors. Mr. Alexander Knauber, of Chicago, praised the Decker system as a simple one and remarked that if the electrical contractor will ascertain his real costs he will remove the greatest stumbling-block in the electrical contracting business.

Mr. J. T. Marron, of Rock Island, also commended the Decker system, which, he says, is intended for the great army of small electrical contractors who have no system at all, and not for the few who have modern methods of bookkeeping in use. He added that the National Electrical Contractors' Association might indorse the Decker system.

Mr. T. D. Buckwell, of the Peoria Gas & Electric Company, was introduced and spoke of the relations of the electric-service company and the contractors in Peoria. He told of the "electrical page" in Peoria newspapers and also of the company's individual plan of advertising. The Peoria company does not do any inside wiring, leaving that for the contractor. It sells signs, but is glad to have others sell them also. In relation to the sale of appliances it does not cut prices, and so far as lamps are concerned, it gives no free renewals of any kind. In general, the Peoria company is anxious to co-operate with the contractors. Electric-service companies spend much time and money in endeavoring to ascertain their own costs, and Mr. Buckwell remarked that he was glad to see that the contractors are doing likewise.

Mr. F. E. Bolte, of East St. Louis, as a contractor, spoke in laudatory terms of the amicable relations in Peoria. He said the central-station companies should appreciate the importance of workmanlike wiring in connections made with their systems.

As an indication of the appreciation of the work which has been done on the bookkeeping system, the officers of the association, through Mr. McGuineas, handed Mr. Decker a check for \$50.

"Reflectors and Their Use" was the title of an illustrated address given by Mr. J. M. La Belle, of Bloomington, representing the National X-Ray Reflector Company of Chicago. The speaker illustrated a large number of fixtures and installations, both for indirect and direct illumination. He remarked that hospitals furnish a particularly favorable field for the use of indirect illumination. Newer fixtures illustrated are the illuminated-bowl indirect-lighting fixture and the new indirect-lighting table and piano lamps.

There was a brief discussion following this paper, and Mr. J. N. Pierce, of Chicago, said that the contractor who is not informed on illumination is out of date.

## Wisconsin Electrical Association

All told, the attendance at the fifth annual meeting of the Wisconsin Electrical Association, held in Milwaukee on Jan. 15 and 16, was about 160. Several subjects of importance were discussed, and there were a number of exhibits, including a display made by the Railroad Commission of Wisconsin. Mr. Irving P. Lord, of Waupaca, president of the association, occupied the chair, and Mr. George Allison, of Milwaukee, as secretary-treasurer, reported fifty-six active and fifty associate members on Jan. 1, 1913, the treasury balance on that date being \$1,197.48.

In a brief address President Lord said that the year 1912 had been a fairly prosperous one for the electric-service companies of Wisconsin. The Railroad Commission has done much in raising standards of service among the smaller stations. The speaker expressed his belief that, in general, the Legislature wants to do what is right by the utilities. The lawmakers need accurate information from operating men, and the Wisconsin Electrical Association should furnish much of this information. All members should assist the association's committee on legislation.

## THE QUESTION OF TAXATION

Mr. T. A. Pamperin, of Oconto, a member of the committee on taxation, said that a bill for the purpose of regulating taxation in Wisconsin was in preparation. The new income-tax law has raised many questions, and, among others, that whether the corporations should pay the income tax on their bond interest and stock dividends. Mr. Clement C. Smith, of Milwaukee, pointed out that the income tax of corporations was levied not on physical value but on net earnings without deducting depreciation. He thinks that if the Tax Commission increases taxes the Railroad Commission should permit higher rates for service. The Tax Commission means to be fair, he said, but the trouble is that the burden of taxation is not distributed equitably. Much interest was manifested in this question and Messrs. George B. Wheeler, of Eau Claire; W. H. Winslow, of Superior; P. H. Korst, of Janesville, and others took part in the discussion.

## MAINTENANCE OF ARC LAMPS

Mr. L. H. Lathrop, of Marinette, read a paper on "Proper Operation and Maintenance of Arc Lamps." He mentioned the fact that rectifier tubes used with metallic-flame systems may be given longer life by immersion for several hours in a bath of boiling water. The importance of employing competent arc-lamp repair men and of their making daily reports was emphasized. Co-operation with policemen in reporting outages should be welcomed. In the discussion Mr. Lathrop said that with metallic-flame-arc lamps one man might trim as many as 300 lamps per day. If the lamps have been allowed to get out of order, the repair man and trimmer will be kept busy in looking after a much smaller number.

## RULES OF ELECTRIC SERVICE IN WISCONSIN

A paper on "The Proposed Revision of Standards of Electric Service Now Under Consideration by the Railroad Commission of Wisconsin" was read by Mr. J. N. Cadby. The proposed rules relate principally to meters and meter testing, interruption of service, inspection and other matters. An abstract of this paper will appear in a subsequent issue.

## THE MILWAUKEE FARE CASE

An able analysis of the street-railway-fare rate decision of the Railroad Commission of Wisconsin in the case of The Milwaukee Electric Railway & Light Company was given by Mr. Edwin S. Mack, of the company's counsel.

## LIABILITY INSURANCE

Mr. Ernest Gonzenbach, of Sheboygan, presented a report from the committee on liability insurance. Wisconsin has a workmen's compensation law, but before this

law was enacted the committee found the situation was intolerable, owing to the exactions of the liability-insurance companies. Three plans of relief were discussed, the one favored by the committee being insurance in a mutual company such as has been organized at Wausau for the purpose of carrying the liability insurance of Wisconsin manufacturers under the provisions of the workmen's compensation law. Representatives of insurance companies addressed the convention, and on the succeeding day the committee presented a supplementary report recommending that the liability insurance, both public and employers', of the members of the association be carried by the Employers' Mutual Liability Insurance Company of Wausau, a separate class to be formed for the members of the Wisconsin Electrical Association. It is said that the rates of this mutual company are approximately 40 per cent of those of the old-line casualty companies. This report, which was advisory and not legally binding on the members, was adopted.

#### WORK-ORDER SYSTEMS

Mr. G. W. Kalweit described, with the aid of lantern slides, the work-order system of The Milwaukee Electric Railway & Light Company. In the lighting department of this company the classification of capital expenditure for work-order charges covers sixty-one accounts. For reserve-fund expenditure in the same department seventeen accounts are necessary.

Train dispatching and the handling of train crews on interurban railways were discussed in a paper read by Mr. Edward Hammett, of Sheboygan.

#### UNIVERSITY LABORATORY TO DO COMMERCIAL TESTING

In his paper on "The Standards Laboratory of the University of Wisconsin" Mr. F. A. Kartak announced that the laboratory is about to do commercial testing. Average fees for testing indicating instruments will run from \$1.50 to \$7 each; for watt-hour meters, from \$2.50 to \$3.50 each; for a single incandescent lamp as a standard for other tests, \$2; for commercial incandescent lamp testing, \$1.50 for ten lamps or less. Mr. William Bradshaw, of Pittsburgh, gave some valuable hints in discussion.

#### DAY LOADS IN SMALL TOWNS

An excellent paper on "Building Up a Day Load for a Small Central Station" was read by Mr. W. E. Haseltine, of Ripon, who gave the practical results of a campaign for day load in a town of less than 4000. Mr. Haseltine's paper is abstracted on page 196 of this issue, together with curves showing the gain in load.

#### RESUSCITATION FROM ELECTRIC SHOCK

Dr. Charles H. Lemon, chief surgeon of The Milwaukee Electric Railway & Light Company, gave a valuable and interesting lecture and demonstration on resuscitation from electric shock and the use of the pulmotor. He demonstrated the prone method advocated by the N. E. L. A. and the American Medical Association. Dr. Lemon said that he had known death to result from contact with a conductor carrying 100 volts, while, on the other hand, he had treated but the day before a man who had been prostrated by a 13,200-volt shock and had recovered. The manipulation for forced respiration should be persisted in

for at least one hour. It must be begun within ten minutes of the shock.

#### OVERHEAD CONSTRUCTION

A practical paper was that of Mr. C. R. Phenicie, of Green Bay, on the "Overhead Distribution System of an Electric Utility." He said that some operators figured that the initial cost of an overhead line should be covered, roughly, by two years' gross revenue from it. The N. E. L. A. standards of overhead construction were praised. One recommendation made by Mr. Phenicie was that transformers be fused to one and one-half times the normal rating in amperes. The writer laid great stress on the need of careful, thorough and frequent inspection of overhead work. Sagging wires should be tightened at least once in two years. Mr. R. M. Howard, of Winona, said that proper overhead construction will often obviate underground agitation in municipalities. Where there are many trees a protective ground wire is a very valuable feature of a pole line. Mr. Winslow, of Superior, said that in that city where customers off the company's lines desired service it was proposed that if the extension cost the company no more than \$30 there should be no extra cost to the customer beyond the regular service charge. If the cost of the extension is more than \$30, the customer can pay for it himself or he can guarantee \$10 a year in revenue to the company for each \$25 of initial cost above the \$30 base rate. On motion of Mr. C. C. Smith, a resolution was adopted providing for a committee of three to prepare standards for inspection of overhead construction.

#### ELECTION OF OFFICERS AND CONCLUDING BUSINESS

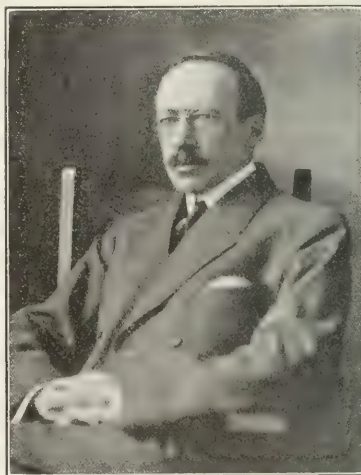
On recommendation of a nominating committee, consisting of Messrs. Clement C. Smith, George B. Wheeler and J. S. Allen, officers for the ensuing year were elected as follows: President, Mr. William H. Winslow, Superior; first vice-president, Mr. William Wallen, Oshkosh; second vice-president, Mr. P. H. Korst, Janesville; third vice-president, Mr. M. C. Ewing, Wausau; secretary-treasurer, Mr. George Allison, Milwaukee (re-elected). The association voted to hand Secretary Allison \$300 in recognition of the value of his services during 1912.

An advisory committee of five members, one to be the president and the other four to be appointed by the president, will look after the association's interests in matters of legislation. This committee has authority to retain counsel and to incur necessary expenses. It will also succeed to the duties of the former tax committee.

A proposal that the annual meeting of 1914 be a three-day convention was referred to the executive committee. Messrs. O. M. Rau, C. N. Duffy and H. P. Andrae were appointed a committee to represent the association in matters connected with the projected Milwaukee Electric Show. After the usual resolution of thanks adjournment was taken.

#### THE NEW PRESIDENT

Mr. William H. Winslow, the new president of the Wisconsin Electrical Association, is a representative type of the progressive electric-service operator in a city of less than 50,000 population. He is vice-president and general manager of the Superior Water, Light & Power Company of Superior, Wis. Born in Chicago in 1867, he went to Superior in 1889, becoming cashier of his present company,



PRESIDENT-ELECT WILLIAM H. WINSLOW



which was formed at that time. Thereafter he was promoted to be, successively, secretary, manager, general manager and vice-president. Mr. Winslow is a student, and his keenness of mind has been recognized. He was president of the Wisconsin Gas Association in 1911 and is a member of the important rate research committee of the National Electric Light Association. He is also a member of the Illuminating Engineering Society and the American Water-Works Association. He has been an occasional contributor to the *Electrical World*.

#### ANNUAL BANQUET

A number of ladies graced the annual banquet, held on the night of Jan. 15, with an attendance of 185. Mr. C. Nesbitt Duffy, of Milwaukee, was toastmaster, and there were speeches by Mayor Bading of Milwaukee, President Lord, and Messrs. Humphrey J. Desmond, editor of the *Catholic Citizen*; Charles L. Benjamin, advertising manager for the Cutler-Hammer Manufacturing Company; Herbert N. Laflin, a lawyer; George B. Wheeler, of Eau Claire, general manager of the Chippewa Valley Railway, Light & Power Company; August E. Stadlbauer, of Milwaukee, and Sam A. Hobson, Western manager of the *Electrical World*.

### High-Speed Turbo-Alternator Design

At the meeting of the American Institute of Electrical Engineers held at New York, Jan. 10, Mr. B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., presented a paper on the subject of "High-Speed Turbo-Alternators—Designs and Limitations."

The real problems in turbo-alternator design, said the author, have developed with the demand for large, high-speed machines, although questions of weight, noise and through-shaft construction had been met and solved earlier in the evolution of such units. Bolted-on rotor shafts have superseded through shafts for very high speeds, and both the radial-slot and parallel-slot types of rotors have inherent advantages for machines of certain capacities. With the omission of the through shaft the parts of the shaft adjacent to the rotor core proper have been made very much heavier, and this, combined with the solid rotor core, gives great stiffness or rigidity compared with the former type. The conditions have allowed much larger cores, with correspondingly increased outputs. Radial-slot construction eliminates bending moments in the rotor teeth, putting all parts in tension under the centrifugal stress. Some cores have milled slots; others are provided with inserted teeth. Parallel slots facilitate winding construction. Four-pole, parallel-slot construction is, however, inferior to the radial-slot type in magnetic section and available copper space. Winding space is also limited by the physical requirements against bending and breaking. Again, on account of the grouping of the field copper into a narrower zone in the parallel-slot type, the heat conduction from the copper presents a more difficult problem than in the radial type.

With present high-speed machines ventilation is difficult on account of the large total loss which occurs in a limited space, requiring very large volumes of cooling air at very high velocities. Various ventilating systems were described by the author and the effects of temperature limitations upon design discussed. The troubles of proper ventilation lie principally in the large total loss expended in a very limited space. No matter how thoroughly the ventilating air is distributed through the heat-generating body or however effective the heat-dissipating surfaces may be, the total air supplied must be ample in quantity or its temperature will be raised an undue amount. Where occasional cleaning of the machine is difficult, it may be ad-

visable to clean or filter the ventilating air before it is admitted.

In addition to considering insulating materials with reference to their mechanical strength and resistance to heat, the author discussed the general problems of temperature rise and heat flow as applied to machine design. The use of mica in various forms, he said, has solved many difficulties due to high temperatures and to static discharges. Such material withstands 125 deg. C. safely.

In turbo-alternator apparatus the temperatures actually obtained are liable to be materially higher than the usual methods of measurement will indicate. A rough measure can be obtained by exploring coils or thermocouples. However, it is evident that such coils, if located next to the copper, will not give the correct temperature measurement if the flow of heat is from the iron to the copper, while a coil next to the iron will not give the correct result with the flow from the copper to the iron. The manufacturer, with his guarantee of 40 deg. C. by thermometer, actually builds for possible temperatures of 70 deg. to 90 deg. C. in some parts of the machine, for he expects to find fairly high temperatures in some cases with exploring devices. The usual guarantee of 40 deg. C., therefore, should be considered as only a relative indication of a safe temperature in such apparatus.

Copper and iron losses in turbo-alternators are greater than those of low-speed units of corresponding rating. Protection against fire within the machine is effectively provided by doors or valves, entirely cutting off the interior of the machine from the outside air. Regulation is sacrificed to some extent, in order to limit short-circuit current, by making the armature reactance as high as the design will permit.

Although the high temperatures prevailing in turbo-generator operation are due to forcing the construction too far, this feature has been forced no further than many others. In fact, according to the author, the whole design has been carried far beyond the most economical construction from the generator standpoint alone. As a result the whole machine is more or less a compromise between desirable conditions as a generator and the most economical conditions as part of a combined turbine and generator unit.

Mr. H. G. Stott, New York, who, as chairman of the power-station committee, presided during the meeting, opened the discussion, tracing briefly the development of modern generating units from 100 kw per pole up to present possibilities of 12,000 kw to 15,000 kw per pole. Ventilation is the major problem, he said, which confronts present designing engineers.

Mr. H. G. Reist, Schenectady, N. Y., referred to the use of flexible-shaft construction for turbo-alternators, permitting increased speeds and higher outputs. To apply steel-support rings under high enough stress to offset the centrifugal forces at high speeds would require temperatures which might injure the windings. Composite mica, being built up of paper, varnish, etc., offers the possibility of charring and may also be attacked by corona discharges. Good, inherent regulation is without advantage, since hand or automatic control is necessary in all cases, and good regulation means sacrifice of both valuable economy and protection against short-circuit.

Mr. R. B. Williamson, Milwaukee, Wis., said that the disadvantages of circumferential and radial ventilation by the author have been overcome by providing multiple air paths in the station. Air filters, while valuable in many cases, may become worse than useless when clogged or dirty. A cloth filter mentioned, however, handled 40,000 cu. ft. of air per minute during eighteen months without being cleaned. Liability of break-downs between conductors, rather than to ground, make mica insulation desirable between turns.

Mr. Philip Torchio, New York, pointed out that increased rotor lengths may require expensive real estate, so that



while cheapening machine construction one may be adding heavily to station costs. Comparing the results of radial and parallel-slot design, he exhibited curves showing short-circuit currents forty times full-load current for the radial-slot machine and thirteen times for the parallel-slot generator of similar characteristics. This difference in reactance Mr. Tocchio traced to field construction.

Mr. C. J. Fechheimer, Ampere, N. J., observed that good rotor design is necessarily a good compromise between the five limiting factors of stresses, temperature, cost, regulation and ability to maintain voltage. Safety demands conservative treatment of stresses, but, second in importance, comes the temperature limit for charring insulation. Commercial design often requires proportioning of parts so that dies, etc., shall be interchangeable for future machines.

Mr. W. L. Emmet, Schenectady, N. Y., pointed out that purchasers should not overlook the problems and difficulties met in designing turbine machines lest they force, upon manufacturers conditions undesirable in both construction and operation. While mica is indestructible at 125 deg. C., the materials with which it is usually mixed may undergo destructive distillation at even lower temperatures.

Mr. Paul M. Lincoln, Pittsburgh, Pa., spoke of the importance and close interrelation between the problems of ventilation, temperature and insulation. High air velocities are necessary in the restricted spaces of modern machines, and these extreme velocities may of themselves generate heat. Since electrical insulation cannot be designed with good heat conductivity, high thermal drops in the insulation must be tolerated.

Mr. Peter Junkersfeld, Chicago, emphasized the desirability of smooth air passages without sharp corners when designing ventilating shafts. The speaker also recommended the provision of thermometer coils giving internal-machine temperatures, which may be useful as an indication when the machine becomes clogged and ready for cleaning.

Mr. H. M. Hobart, Schenectady, N. Y., spoke of cleaning air by passing it through water sprays. This method has the advantage of adding desirable humidity, besides lowering the temperature of the air. Good engineering design, he said, should include consideration of depreciation and obsolescence. Past history has shown clearly enough that, after ten years' use at the outside, a given machine will be far inferior to one of recent design.

Mr. W. L. Waters, Pittsburgh, Pa., told how energy wasted by inefficient ventilating blowers might actually warm the air, reversing the result sought. One machine, ventilated by a 100-hp blower, really ran cooler when the blower was taken off. Carefully worded specifications and elaborate, detailed guarantees are usually not only of little value, said Mr. Waters, but are often inadvisable from the false idea of security they afford. Prospective purchasers should realize that, after all, they must necessarily depend on the ability and standing of the manufacturer.

Mr. C. A. Adams, Boston, Mass., showed that if the current density in the copper remains unchanged the armature copper loss will vary inversely as the peripheral velocity. He also outlined methods of calculating heat escape from alternator coils.

Mr. A. B. Field, Pittsburgh, Pa., spoke of difficulties in getting steel suitable for turbo-field construction. Although there are many more machines running at their critical speeds than is generally believed, the advantages of freedom from unbalancing due to minor short-circuit conditions make lower speeds desirable.

In closing the discussion the author, Mr. Lamme, spoke only of the subject of temperature, insisting that 125 deg. C. internal temperatures have been prevalent longer than is generally realized. Mica, when properly put on, he declared, is safer at 125 deg. than other insulations at 90 deg. Even fibrous insulation in one case ran three months at 125 deg., while mica would have stood indefinitely.

## Railroad Commission Makes Exhibit at Wisconsin Convention

For the first time in its history the Railroad Commission of Wisconsin exhibited at a public-utility convention during the meeting of the Wisconsin Electrical Association in Milwaukee on Jan. 15 and 16. The experiment was entirely successful, the room being a great center of attraction. The exhibit was educational in its nature, being designed to show the electrical men what the commission is doing. The manner of testing meters was illustrated; also the method of making street-lighting and interior-illumination tests. There was a map showing the electric power plants of the State and the districts for inspection work. Signs about the room called attention to the importance of insulating guy wires, of having streets illuminated instead of simply lighted, and of eliminating meter errors instead of compensating for them. One of the most interesting features of the exhibit was a number of incandescent lamps mounted upon a display board in the order of their candle-power. The lamps were all standard 16-cp carbon lamps which had been in service for varying periods of time, the brightest ones giving something above the standard rating and the blackest one giving less than 11 cp. Above these lamps was plotted the curve of candle-power and of efficiency. Mr. J. N. Cadby, of the engineering staff of the Railroad Commission, was in attendance and read a paper before the association.

## The Conservation Movement

In a speech before the American Forestry Association at Washington recently Hon. Walter L. Fisher, Secretary of the Interior, said that the opponents of the conservation movement are devoting themselves chiefly to the accusation that the conservationists represent a purely negative principle and that the policy of the conservation movement is to withdraw from the fields of activity the national and natural resources and to prevent their effective and prompt development. In denying this accusation, the speaker said that the water-powers of the country have been tied up to its great disadvantage, because while the fuel resources are destroyed in their use the water-power that is developed is perpetual and continuous, and its use is the most living and vital example of conservation. It is therefore to the interest of the country and its citizens, Secretary Fisher said, to urge and to secure the adoption of a policy which will permit these resources to be used as promptly and as fully as possible. The reason why so little has been accomplished, he thought, was not the inherent difficulty of the situation, but the obstacles which have been intentionally thrown in the way of that policy by people seeking to discredit the movement.

It happened that in March, 1911, by a rider attached to an appropriation bill a provision was inserted which gave the head of any department having utilization of public lands and reservations the right, under rules and regulations prescribed by him, to grant an easement for a period not to exceed fifty years for electric transmission lines and for telegraph and telephone lines. At the end of the rider a provision was added that those who already had revocable permits for a particular transmission line could obtain grants upon the same terms and conditions as were prescribed for others. Seizing upon this rider as the first and only opportunity, the Secretary of the Interior put into effect certain rules and regulations to give the constructive policy something of an impetus. These regulations, according to Secretary Fisher, went farther than it was thought necessary and wise to go, but the extreme view was adopted and the regulations were sent out to all the power interests in the United States, notice being given them at the same time of a conference at which the Secretary of the Interior would be glad to listen to suggestions for modifications.

One of the particular interests represented at that conference was the Great Falls Power Company, which asked nothing from the federal government and needed nothing from the federal government so far as the power site of itself was concerned, but needed a right-of-way over public lands and national forests for its transmission lines. The company was then engaged in active negotiations with the Chicago, Milwaukee & Puget Sound Railroad system for the electrification of its road through the mountain regions where water-power is available. The power company had a revocable transmission-line permit to cross the public domain, but the railroad company was unwilling to make a contract with it unless a permanent permit could be obtained. (For an account of the permit accepted by the power company see the *Electrical World*, Jan. 11, 1913.) Secretary Fisher stated that when the power company made the contract with the railroad company the contract was submitted to the Department of the Interior, whose purpose it was to prevent by a manipulation between two interests an excess charge for the electricity purchased by the railroad company which would be a bar to effective rate regulation by the Interstate Commerce Commission. The great significance of this particular grant, he said, is twofold—first, in that it marks the first step toward the electrification of the transcontinental railroads, and, second and in Secretary Fisher's judgment far more important, because it makes effective the sort of regulations regarding large power interests for which conservationists have contended.

### Annual Report of the Hydro-Electric Power Commission of Ontario

The record of Ontario's publicly owned power system for the fiscal year of 1912 is strikingly set forth in the annual report of the commission, now being compiled for distribution. A statement of receipts, expenditures and capital cost of the Niagara system to the end of the year has just been made public by the chairman of the commission, Hon. Adam Beck, in advance of the rest of the report. For the first quarter of the fiscal year of 1912 the revenue of the commission was \$108,920.08 with a load of 43,149 hp. During the next three months the income was \$117,213.59 and the load 58,326 hp. The increase was more rapid during the third and fourth quarters, when the receipts were \$127,986.00 and \$157,681.88 respectively and the load 64,306 hp and 80,723 hp respectively. The total revenue for the year reached \$511,801.88. These receipts were for energy delivered, including charges for administration, general expenses, operation, maintenance and interest. The yearly expenditure reached \$456,635.43, and the expenditure for the fourth quarter, which showed a large increase in the quantity of energy delivered, was only \$28,000 above that of the first quarter, indicating the steady decrease in percentage of cost with increase in energy consumption. The surplus for the year was \$55,166.45, which has been nominally set aside as a depreciation reserve.

The total capital expenditure upon the system up to the end of the provincial year (Oct. 31) was \$4,158,824.24. This is classed under four headings—right-of-way, transmission lines, transformer stations and distribution stations, as follows:

<b>Transmission lines:</b>	
Steel tower lines .....	\$1,537,977.72
Wood pole lines .....	493,037.99
Telephone lines .....	129,068.98
Relay system .....	44,537.33
Conduit and cable system .....	40,967.88
<b>Total .....</b>	<b>\$2,256,129.86</b>
<b>Transformer stations .....</b>	
<b>Right-of-way .....</b>	<b>1,322,806.73</b>
<b>Distributing stations .....</b>	<b>\$40,088.85</b>
<b>Total cost .....</b>	<b>\$4,158,824.24</b>

### Model Public Utility Bill

The department on regulation of interstate and municipal utilities of the National Civic Federation, of which Mr. Emerson McMillin is chairman, will hold a meeting of its executive council in New York on Jan. 25. At that meeting it is hoped to clear away most of the matters that remain for action in connection with the model bill regulating public utilities which the federation has in preparation. A report on the work of the department will be presented at the annual convention of the federation to be held in New York Jan. 28 and 29.

The importance of the work undertaken by the National Civic Federation may be gauged from the personnel of the following sub-committees having the matter in charge:

**Rates.**—Mr. Halford Erickson, Railroad Commission of Wisconsin (chairman); Messrs. Charles R. Crane, Chicago; F. A. Delano, president Wabash Railroad, Chicago; Alexander C. Humphreys, president Stevens Institute, Hoboken, N. J.; F. K. Lane, Interstate Commerce Commission, Washington, D. C.; J. C. Lincoln, manager traffic bureau, Merchants' Association, New York; Theodore N. Vail, president American Telephone & Telegraph Company, New York.

**Control of Service.**—Mr. W. D. Kerr, National Civic Federation (chairman); Messrs. H. C. Abell, American Light & Traction Company, New York; Union N. Bethell, vice-president New York Telephone & Telegraph Company; M. S. Decker, Public Service Commission, Second District, Albany; B. A. Eckhart, Chicago, Ill.; Charles L. Edgar, president Edison Electric Illuminating Company, Boston; D. O. Ives, manager transportation department, Chamber of Commerce, Boston, Mass.; W. D. Pence, Railroad Commission, Madison, Wis.; Robert R. Prentiss, chairman State Corporation Commission, Richmond, Va.; R. N. Searle, vice-president Rochester (N. Y.) Railway & Light Company; Alfred H. Smith, vice-president and general manager New York Central & Hudson River Railroad, New York; Charles A. Stone, Stone & Webster, Boston; William R. Wheeler, traffic manager, Chamber of Commerce, San Francisco, Cal.; W. J. Huddle, consulting engineer, Madison, Wis.

**Accounts and Reports.**—Mr. E. M. Bassett, formerly Public Service Commissioner, First District, New York (chairman); Messrs. J. E. Allison, Public Service Commission, St. Louis, Mo.; Edward G. Connette, president International Railway Company, Buffalo, N. Y.; W. M. Daniels, Board of Public Utility Commissioners, New Jersey; C. N. Duffy, vice-president Milwaukee (Wis.) Electric Railway & Light Company; B. S. Garvey, general auditor Chicago Telephone Company; Edwin Gruhl, North American Company, New York; Adna F. Weber, chief statistician Public Service Commission, First District, New York; R. H. Whitten, Public Service Commission, First District, New York.

**Control of Capitalization.**—Mr. M. R. Maltbie, Public Service Commission, First District, New York (chairman); Messrs. W. J. Clark, General Electric Company, New York; George B. Cortelyou, president Consolidated Gas Company, New York; B. H. Meyer, Interstate Commerce Commission, Washington, D. C.; James Speyer, New York; Timothy S. Williams, president Brooklyn Rapid Transit Company.

**Franchises.**—Mr. Blewett Lee, Illinois Central Railroad, Chicago (chairman); Messrs. Alfred L. Baker, attorney, Chicago; H. M. Bollen, Chicago; John H. Carlisle, Watertown, N. Y.; Samuel Insull, president Commonwealth Edison Company, Chicago; John H. Roemer, Wisconsin Railroad Commission, Madison, Wis.; Mason B. Starring, president United Railways Investment Company, New York; John H. Wigmore, dean law school, Northwestern University, Chicago; Thomas N. McCarter, president Public Service Corporation, Newark, N. J.; Josiah T.



Newcomb, New York; Leo S. Rowe, professor University of Pennsylvania, Philadelphia.

*Ways and Means*.—Mr. F. Q. Brown, New York (chairman); Messrs. William Barbour, president Linen Thread Company, New York; T. C. du Pont, Wilmington, Del.; John H. Gray, Minneapolis; V. Everitt Macy, New York; Emerson McMillin, New York; Josiah T. Newcomb, New York; Albert Shaw, New York; Isaac N. Seligman, New York; F. C. Walcott, New York; J. G. White, New York; Arthur Williams, New York; T. S. Williams, Brooklyn.

*Safety of Operation*.—Mr. Arthur Williams, New York Edison Company (chairman); Messrs. W. G. Lee, Cleveland, Ohio; William B. McKinley, president Illinois Traction System, Peoria, Ill.; W. S. Stone, Brotherhood of Locomotive Engineers, Cleveland, Ohio; Daniel Willard, president Baltimore & Ohio Railroad; W. R. Willcox, Public Service Commission, First District, New York.

*Form*.—Mr. John H. Gray, director of investigation, New York (chairman); Messrs. W. S. Allen, American Telephone & Telegraph Company, New York; E. W. Bemis, Chicago; Charles P. McCarthy, Legislative Reference Library, Madison, Wis.; Edgar J. Rich, Boston, Mass.

### Interstate Commission Investigation of Telephone Company

The Interstate Commerce Commission, to which Attorney-General Wickersham has referred the case of the so-called "telephone trust," has undertaken the investigation of the American Telephone & Telegraph Company. In his letter of transmittal to the chairman of the Interstate Commerce Commission, the Attorney-General calls attention to the policy of the American Telephone & Telegraph Company as set forth in its annual report for the year ended Dec. 31, 1910. In this report it is stated that the American Telephone & Telegraph Company is a centralized, general administration for all the Bell companies. It does the financing for the extension of the business; it furnishes the engineering, operating and other experts; it maintains a productive and protective organization so far as patents are concerned; it defends all the companies against all infringements; it undertakes to bring about improvements by working out the ideas and suggestions of others; it avoids all duplication of effort, of experiments, apparatus, etc.; it looks after the public relations of the companies, and performs all that service which is common to all, leaving to the local companies the local management.

According to the Attorney-General, representatives of many of the independent telephone companies have complained to the Department of Justice that the American Telephone & Telegraph Company has not contented itself with the normal extension of its system, but that it has purchased competing lines in such a manner and in such circumstances as to destroy competition. It is also contended that it has refused, either directly or through competitive and originally independent lines acquired by it, to make connections between the local lines not owned or controlled by it and its own long-distance lines; that it has discriminated between the lines of the Western Union Telegraph Company, in which it owns a large interest, and the lines of the Postal Telegraph Company in cases where subscribers to its telephone lines requested to be put into communication with the Postal Telegraph Company. It is also complained that the rates maintained by the company are unusually high in places and between communities where there is no competition, in contrast to the low rates prevailing where competition exists.

The Attorney-General is of the opinion that many of the questions cannot be appropriately dealt with by the law department of the government, but should be made the subject of regulation after a careful investigation of the

whole subject by the Interstate Commerce Commission. He states that the powers vested in the commission by statute are ample, and that although the public utility commissions or similar bodies in the various states have jurisdiction in such matters as are complained of, such regulation cannot be a satisfactory method of ultimate solution of the questions arising out of telephone operation.

The interstate commerce act, as at present in force, makes telephone, telegraph and cable companies engaged in sending messages from one state to another common carriers within the meaning and provision of the act, and makes it unlawful for any common carrier to give any undue or unreasonable preference or advantage to any particular person, etc., or to any particular description of traffic, or to subject any particular person, company or locality, etc., to any unreasonable prejudice or disadvantage in any respect whatsoever.

No comprehensive investigation into the organization, management and conduct of telephone companies has, so far as the Attorney-General is aware, ever been had by governmental agency. The investigation of the law department has dealt only with suggested violations of the Sherman anti-trust act; but the whole problem of the relation of the government to the transmission of intelligence is one so far-reaching in its importance, and one that so affects the welfare of the community, that it appears to Attorney-General Wickersham to be a subject which should be thoroughly studied from the standpoint of the public, in order that a governmental policy with respect to the telephone and telegraph business may be intelligently formulated and adopted. All of the information which has been collected by the law department has been placed at the disposal of the Interstate Commerce Commission.

### Public Service Commission News

#### WISCONSIN COMMISSION

The annual report of the Wisconsin Railroad Commission has been submitted to the Governor. The total number of utilities making report to the commission was 1136, an increase of forty-six over the year ended June 30, 1911. Of this number 244 were electric, 54 gas, 156 water, 666 telephone and 16 heating utilities. During the year 1096 cases were disposed of, as against 703 cases the preceding year. The electric-utility cases amounted to 248, or an increase of sixty-three. Forty-one decisions on formal electric-utility cases were issued. Authority to issue stocks, bonds and other evidences of indebtedness was granted during the year to 138 corporations, involving the total sum of \$77,615,744, divided as follows: Stocks, \$5,132,687; bonds, \$61,330,900; equipment trust certificates, \$10,955,000; notes, \$1,097,166.

During the year the electric railway business showed a considerable development. For all classes the value of property and plant at the beginning of the year was \$57,818,859, or an increase of 7 per cent over the corresponding figures for 1911. Operating revenues increased 8.1 per cent over 1911 and 14.33 per cent over 1910. The increase in net income from 1910 to 1912 was 21.3 per cent. In the case of electric utilities the value of the property at the beginning of the year was given as \$39,933,952, or an increase of 8.35 per cent over 1911. The construction during the year, however, showed a decrease of 29.38 per cent over the year previous. The total operating revenues increased 8.79 per cent and the net income 17.05 per cent. For gas utilities the value of the property at the beginning of the year was given as \$25,418,734 and for telephone utilities as \$16,787,143. New telephone construction increased 38 per cent.

The report makes note of the increasing service which the commission is rendering by acting in the capacity of a board of arbitration on matters of dispute between municipi-



palities and public utilities, which in the ordinary procedure could not be brought before the commission. In the matter of the controversy between the city of Waupaca and the Waupaca Electric Light & Railway Company, the commission's opinion embodied one of the most involved and thorough investigations along lines of illuminating engineering that have ever been made.

The report notes that eight suits have been brought against the commission, one of which involved an electric utility. But one case has been decided, and that in favor of the commission.

In the matter of the application of the Madison Gas & Electric Company to review an ordinance of the city of Madison requiring the removal of poles and wires from certain streets, the commission has determined that the ordinance is unreasonable and therefore null and void. The decision called attention to the fact that under the present system of street lighting it would be impossible to remove more than one-half of the poles, and that consequently it would be unreasonable to require the company to expend over \$1,000 each for the removal of the remainder. The company, in the commission's opinion, has done all that it could reasonably be expected to do until such time at least as a change in the system of street lighting shall make it necessary to remove the suspension poles now in use.

The Monticello Electric Light Company has been authorized to abolish its present practice of charging a meter rental of 10 cents per month and to substitute therefor a minimum monthly bill of 50 cents.

#### RHODE ISLAND COMMISSION

The Public Utilities Commission has presented its first annual report to the Legislature. The board recommends that its powers be broadened and that statutes be enacted giving it authority to make a physical valuation of all the public utilities in the State. Rates have been filed with the board by forty-five utilities, and the commission states that this action has operated to fix the future charges of the utilities upon a uniform basis for every one of a like class, with the prevention of discriminations. The only discriminations that now exist are those arising from contracts entered into between public utilities and their customers prior to the enactment of the public-utilities law, and such contracts are extremely limited in number and will practically all expire by limitation within the next few years.

## Current News and Notes

**HIGH-TENSION ELECTRICAL LABORATORY FOR HARVARD.**—The president and fellows of Harvard University have acknowledged a donation of \$50,000 from Miss Harriet Otis Cruft to be used for a new high-tension electrical laboratory, which will be housed in the Cruft Memorial Building.

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**TO HARNESS THE COLUMBIA RIVER.**—Legislation is proposed whereby the States of Oregon and Washington will harness the Columbia River at Five-Mile Rapids, 2 miles above the lower entrance of the Celilo Canal and 5.5 miles up the Columbia from The Dalles. A minimum of 100,000 hp may be developed. A commission of competent hydro-electric engineers to investigate and report to the Legislature is asked for.

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**EXPIRATION OF AMERICAN AND FOREIGN PATENTS.**—In a decision handed down on Jan. 20 the Supreme Court holds that American patents on inventions patented in foreign countries expire with the expiration of the foreign patent, notwithstanding claims that the treaty of Brussels of 1900 provides otherwise. The decision was rendered in a case between the Cameron Septic Tank Company and the city of Knoxville, Iowa.

**RESALE PRICE ON PATENTED ARTICLES.**—The Supreme Court, it is announced, will review a case under the patent laws involving the right to fix the resale price on patented articles. A druggist of Washington, D. C., attempted to sell a patent medicine at a price below that fixed by the manufacturer, and an action was brought for infringement of the patent rights. This case and the "corn flakes" case will be followed with the greatest interest.

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**WATER FROM NEW YORK BARGE CANAL FOR POWER PURPOSES.**—The deputy conservation commissioner of the State of New York has proposed that the Conservation Commission be authorized to use the surplus water of the Barge Canal for the generation of electricity. It is also proposed to supply the municipalities within the district with electricity at cost and to create a division of hydroelectric power in charge of a deputy commissioner at a salary of \$7,000 a year.

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**SOCIETY OF ELECTRICAL DEVELOPMENT, INC.**—An invitation will be issued shortly by the Society for Electrical Development to the entire electrical industry to attend a conference at the Engineering Societies Building, New York, for the purpose of discussing concrete methods for carrying out the publicity plan through which the society hopes to carry on its co-operative movement for increasing electrical trade. An account of the meeting of the society's organization committee on Jan. 14, at which the by-laws were approved and directors and officers were elected, appeared on page 128 of the *Electrical World* for Jan. 18, 1913.

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**PROPOSED MERGER OF CITY OF CHICAGO AND SANITARY DISTRICT.**—Merger proposals seem to be infectious. A resolution has been introduced in the City Council of Chicago by Alderman Theodore K. Long looking toward the merging of the Sanitary District of Chicago with the city of Chicago. The Sanitary District is a municipal corporation with geographical boundaries including nearly all the city of Chicago, with considerable territory outside of it. It was formed to divert the flow of the Chicago River from Lake Michigan to the Desplaines River and thus through the Illinois River to the Mississippi, to save the source of the city's water supply from contamination. One reason why the city did not do this work itself was because it could not do so constitutionally without exceeding its debt limit. The District has expended about \$70,000,000, and Alderman Long's idea is that inasmuch as the Sanitary District has nearly fulfilled the purpose for which it was organized—that is, the safeguarding of Chicago's water supply—it should now be merged in the city.

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**TO REGULATE ELECTRIC TRANSMISSION COMPANIES IN MASSACHUSETTS.**—Legislation to curb the powers of the electric transmission companies which have secured control of the State's waterways will be recommended by the Massachusetts Gas and Electric Light Commission in a special report to be submitted to the Legislature shortly. At present these companies are functioning as public utilities with practically no restriction whatever, while all the gas and electric lighting concerns in the State are rigidly supervised. The fear is that the transmission companies, heavily capitalized, will reach out into the lighting field and that they will then be in a position to force many of the small local lighting companies to sell at almost any price offered them, thus destroying competition. It is understood that the commission will recommend to the Legislature that these transmission companies be placed under its supervision and be subjected to the same restrictions regarding the issue and sale of securities to which the smaller concerns are subjected. Plans are also afoot to stop the sale in other states of electricity generated by the water powers of Massachusetts.

### SOCIETY MEETINGS.

**MINNESOTA CONVENTION.**—It is announced that the next convention of the Minnesota Electrical Association will be held in St. Paul on March 11, 12 and 13. Mr. E. Holcomb, of the Consumers' Power Company, has been elected president.

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**BYLLESBY CONVENTION POSTPONED.**—The fourth annual convention of H. M. Byllesby & Company and affiliated companies, which was arranged to be held in Chicago Jan. 23 and 24, has been postponed until June. This action has been taken on account of events which prevent the attendance of some of the officials of the firm and many managers of local properties.

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**NEW YORK STATE ELECTRICAL CONTRACTORS' ASSOCIATION.**—At the annual meeting of the New York State Electrical Contractors' Association, held in Syracuse, N. Y., on Jan. 21, officers for the current year were elected as follows: President, Mr. F. W. Newman, Albany; vice-president, Mr. H. N. Smith, Syracuse; secretary, Mr. G. W. Russell, Jr., New York, and treasurer, Mr. J. P. Burn, Schenectady.

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**SONS OF JOVE AT NEW YORK.**—Mr. F. M. Tait, president of the National Electric Light Association and general manager of the Dayton (Ohio) Electric Lighting Company, spoke before the Sons of Jove luncheon at Michaud's Restaurant, Broadway and Forty-second Street, New York, Jan. 22. A lecture on and a demonstration of the pulmotor are announced for the next meeting, to be held at the same place, Feb. 6.

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**COSMOPOLITAN COMPANY SECTION OF N. E. L. A. IN CHICAGO.**—At the recent annual meeting of the Cosmopolitan Electric Company Section of the National Electric Light Association in Chicago officers were elected as follows: Chairman, Mr. E. Gilroy; vice-chairman, Mr. H. E. Wulfin; treasurer, Mr. H. A. Weigle; secretary, Mr. C. F. Brown; executive committee, Messrs. J. C. Furlong, A. W. Marriner and C. T. Wickman.

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**SAN FRANCISCO ELECTRICAL DEVELOPMENT LEAGUE.**—At a meeting of the Electrical Development League of San Francisco on Jan. 14 an address was delivered by Mr. J. R. Bibbins, resident engineer for Bion J. Arnold, traction engineer, of Chicago, on the growth and development of San Francisco and its transportation facilities, the address being illustrated by stereopticon views of San Francisco and other large cities of the country.

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**REJUVENATION IN MILWAUKEE.**—A successful rejuvenation of the Jovian Order was held at the Republican House, Milwaukee, on Jan 16 in connection with the annual convention of the Wisconsin Electrical Association. A class of twenty-three candidates was initiated, and later there was a banquet at which Mr. Sam A. Hobson, of Chicago, third Jupiter, acted as toastmaster, speeches being made by a number of Jovians from Milwaukee, Chicago and elsewhere.

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**GROUP MEETING OF SOCIETIES IN MILWAUKEE.**—About Feb. 15 it is planned to hold a joint meeting of a number of technical societies in the Auditorium, Milwaukee. It is expected that the societies participating will be the Chicago Section of the Illuminating Engineering Society, Wisconsin Engineering Society, Milwaukee Engineering Society, Milwaukee Section of the American Institute of Electrical Engineers, Milwaukee Company Section of the National Electric Light Association, Milwaukee Section of the American Chemical Society and Milwaukee Electrical League.

**MICHIGAN ENGINEERING SOCIETY.**—At the thirty-fourth annual meeting of the Michigan Engineering Society held at the University of Michigan, Ann Arbor, Jan. 7-9, papers were read, among others, as follows: "Preliminary Investigations for Water-Power and Water Supply," by Mr. Robert E. Horton, Albany, N. Y.; "The Need of Hydraulic Data," by Messrs. L. E. Ayres and B. K. Holland, and "Hydroelectric Development in Michigan," by Mr. H. Von Schon. Prof. H. W. King led a discussion on the water-power resources of Michigan. Mr. W. W. Tefft, of Jackson, was elected president.

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**PITTSBURGH JOVIAN LEAGUE.**—Formal consolidation of the Electrical Boosters' Club of Pittsburgh, Pa., with the local Jovian Electrical League was effected Jan. 9 at a luncheon at the Fort Pitt Hotel. Mr. M. F. Knapp, Jovian statesman, presided, and addresses were made by Messrs. G. W. Provost and Henry Harris. Officers of the new league will be elected shortly, the board of control to include representatives of local utility companies, manufacturers, jobbers and contractors. In addition to the weekly luncheons, there will be business meetings on the first Saturdays of March, June and December. A Jovian theater party is announced for Feb. 7 at the Nixon Theater, Pittsburgh.

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**COLORADO ELECTRIC CLUB ELECTS OFFICERS.**—At the meeting of the board of directors of the Colorado Electric Club on Jan. 14 officers were elected as follows: President, Mr. Benedict Shubart, of Linrooth, Shubart & Company, Denver; first vice-president, Mr. Joseph Reardon, of the Clayton school and former city electrician of Denver; second vice-president, General Irving Hale, General Electric Company, Denver; secretary-treasurer, Mr. C. F. Oehlmann, Denver Gas & Electric Light Company. At a meeting on Jan. 16 Mr. W. H. H. Cramer, local highway commissioner, spoke on "Efficiency in Municipal Affairs." The club's membership is now 727, and the attendance during the last year averaged 112.

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**WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS.**—The eighth annual meeting of the Western Association of Electrical Inspectors will be held at the Planters' Hotel, St. Louis, Mo., Jan. 28, 29 and 30. The following addresses are announced: "Electrical Porcelain: Its Manufacture and Uses," by Mr. F. A. Driscoll, Chicago; "High-Voltage Transmission-Line Requirements," by Mr. H. B. Gear, Chicago; "Electrical Laboratory Test Problems," by Mr. B. H. Glover, Chicago; "The 660-Watt Branch Circuit and Its Relation to Mazda Lamps," by Mr. W. H. Blood, Jr., Boston, Mass.; "The Present Status of Grounded Secondaries," by Mr. W. J. Canada, president of the inspectors' association, Denver, Col. Reports are also scheduled from the following chairmen of committees: National Electrical Code, Mr. F. D. Varnam, St. Paul, Minn.; outside wiring, Mr. W. Michaelson, Omaha, Neb.; theater wiring, Mr. F. L. Lucas, Toledo, Ohio; electric signs, Mr. E. Anderson, Minneapolis, Minn.; show-window lighting, Mr. F. P. McGough, Omaha, Neb.; instructions for public safety, Mr. T. D. McColl, Toledo, Ohio; underground systems, Mr. H. T. Wreaks, New York; induction motors, Mr. F. J. Burch, Chicago; electric hoists, Mr. H. C. Horstmann, Chicago; laws and ordinances, Mr. W. S. Boyd, Chicago; architects' specifications, Mr. F. H. Moon, Indianapolis, Ind.; signal systems, Mr. F. S. Anderson, Evanston, Ill.; public safety, Mr. W. J. Canada, Denver, Col.; electric traction systems, Mr. F. R. Daniel, Indianapolis, Ind.; rubber-covered wire, Mr. V. H. Tousley, Chicago, Ill. On Tuesday evening a complimentary dinner will be tendered to members. Mr. W. S. Boyd, 76 West Monroe Street, Chicago, is secretary-treasurer of the inspectors' association.

# High-Tension Transmission System in Central Georgia

**Substations and 66,000-volt steel-tower lines of the Central Georgia Transmission Company—  
Towers of special construction for city circuits**

THE Central Georgia Transmission Company was organized in December, 1911, to distribute and sell energy in large quantities in certain sections of middle Georgia contiguous to the territory supplied by the Central Georgia Power Company, from which company the transmission company obtains its supply of energy under a long-term contract. The Central Georgia Transmission Company has an authorized capital of \$2,000,000 common stock and \$2,500,000 first-mortgage 5 per cent bonds. It is one of the Georgia Light, Power & Railway's properties and is under the general direction of Messrs. A. B. Leach & Company, New York City. The head office of the company is located at Macon, Ga.

## TRANSMISSION SYSTEM

The main part of the transmission system runs for a distance of 34 miles from Atlanta, Ga., through Hampton to Griffin, Ga., at which point it connects with the system of the Central Georgia Power Company. A branch line, 10 miles in length, runs from the power plant of the Central Georgia Power Company to Monticello, Ga. Substations are located at Atlanta, Hampton and Monticello.

Final surveys were completed by Jan. 1, 1912, and the clearing of the right-of-way, 150 ft. wide, was immediately undertaken. This right-of-way runs through the counties of Spalding, Henry, Clayton and Fulton, principally rough country, some of which was covered with virgin timber, but

in spite of very bad weather the clearing was completed by March 1, 1912.

## TOWERS

The towers have a somewhat different arrangement of conductors from that heretofore in use on the ordinary transmission tower. In the accompanying illustrations it will be seen that they carry two overhead ground wires for protection against the severe lightning experienced in the section served, and, furthermore, the conductors on each side of the tower are staggered to prevent contact between wires due to unequal unloading of sleet following heavy sleet storms, which are not uncommon in that territory.

The insulators are of the suspension type for the reason that the pin-type insulators have proved unsatisfactory in this territory for voltages above 30,000. The transposition of the conductors, there being one complete roll, is made upon three transposition towers, 10 miles apart, one-third of the roll on each tower so as to eliminate transposition in the span.

The last 2 miles of this line is through the suburbs of Atlanta, running for some distance along the curb line. It was therefore necessary to design a special type of tower to meet these conditions. The city towers are set in concrete with approximately 13 cu. yd. per tower foundation.

The strain and suspension towers are 16 ft. square at the base and are approximately 60 ft. high. In three in-

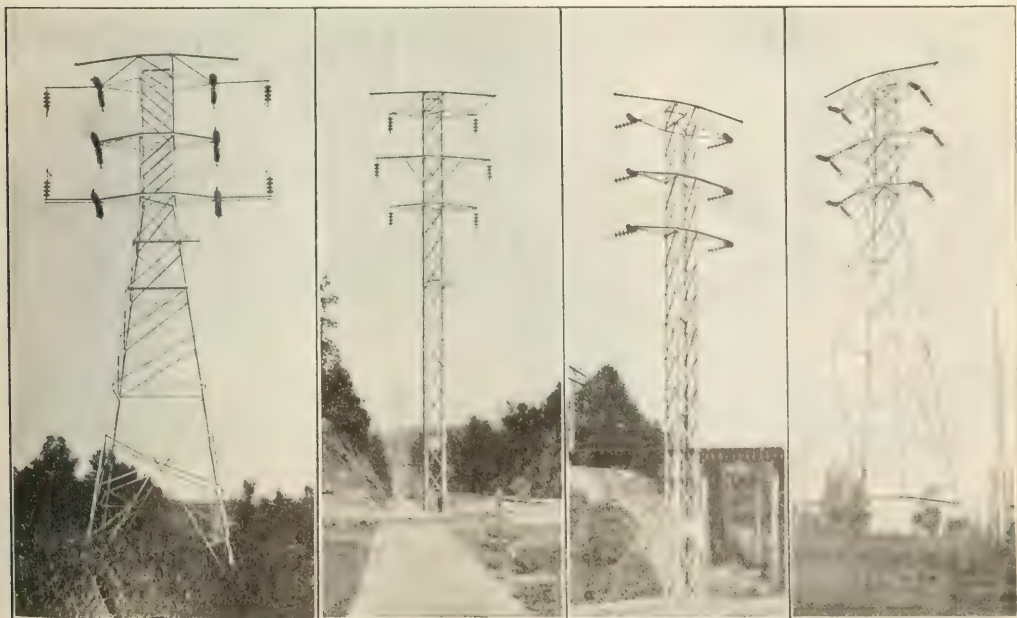


FIG. 1—TYPES OF INTERMEDIATE AND STRAIN TOWERS USED IN THE COUNTRY AND IN CITY STREETS



stances a 10-ft. extension is used, making a 70-ft. tower. The height to lowest cross-arm is 44 ft., allowing for a 25-ft. clearance of conductors from ground under the worst conditions. All towers carry two overhead Siemens-Martin galvanized strand-steel ground wires  $\frac{3}{8}$  in. in diameter and two circuits of three aluminum 167,830-circ. mil wires, equivalent to No. 0 copper.



FIG. 2—SUBSTATION IN ATLANTA

The suspension towers are designed for a breast pull of 11,000 lb., a torsional pull of 6,000 lb. and a vertical load of 1200 lb. applied at the end of each cross-arm, with a 1500-lb. pull at the ground-wire supports, and weigh 3200 lb.

The strain towers were located approximately one to a mile and at angles and long spans, and they are designed for a breast pull of 16,000 lb., a torsional pull of 9000 lb. and a vertical load of 2000 lb. applied at the end of each cross-arm, and for a 2000-lb. pull at the ground-wire supports, and weigh 3800 lb. These towers were not set in concrete except where the earth was poor.

The city-type tower was built to meet the same loads as the strain tower, but the span was shortened to an average of 425 ft., whereas the average span on the other towers is 550 ft., the longest span being 1100 ft.



FIG. 3—A 150-FT. RIGHT-OF-WAY IN THE OPEN

The wire was strung to meet the combined conditions of 0 deg. Fahr.,  $\frac{3}{8}$ -in. ice and 30-mile wind, under which conditions the elastic limit of the wire would not be exceeded. The telephone lines are carried on a separate wooden pole line except for the last 2 miles of the line. Energy is transmitted at 66,000 volts and delivered to customers at 11,000 and 2300 volts.

## SUBSTATIONS

The Atlanta substation is a brick and concrete structure, fireproof throughout. The station is designed for 900 kw, of which one bank, or 4500 kw, was first installed. The second bank is now being installed, owing to the increased demand on the station, and will be ready in February.

The two lines entering this substation come through oil



FIG. 4—INTERIOR OF ATLANTA SUBSTATION

circuit-breakers to the high-tension bus, which is separated into two parts by means of disconnecting switches. The leads from the low-tension side of the transformers go through oil switches to the low-tension buses, which are mounted in a brick bus structure. The low-tension buses are divided into two parts by means of disconnecting switches, and from each part three 11,000-volt feeders lead out from the station. Air-type choke coils are used on both high-tension and low-tension leads of each bank of transformers, and electrolytic arresters are connected to both high-tension and low-tension buses.

All the high-tension apparatus is on the main floor of the substation, and the low-tension bus structure is in the basement. All switches are electrically operated from the switchboard on the main floor by a 44-cell, 80-amp-hr. storage battery, charged by means of a rectifier.

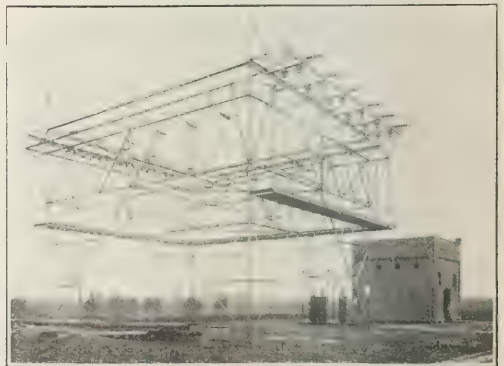


FIG. 5—SWITCHING TOWER AND HAMPTON SUBSTATION

A second substation, designed for 900 kw, was erected at Hampton for delivering energy to the cotton mills in that place, where the switching tower for sectionalizing or switching the lines in any manner desired was also built.

The Hampton substation is of concrete, fireproof construction and is also protected by electrolytic lightning arresters and air-type choke coils. This substation was

placed in service with 10 miles of transmission line between it and Griffin in July, 1912. The entire system was placed in commercial operation on Sept. 1, 1912, and since that date has given continued satisfactory service.

A third substation of 900 kw was put in operation in November, 1912, at Monticello, together with 9 miles of 66,000-volt single-circuit wooden pole line for supplying energy to the city of Monticello and manufacturing industries located there. This building is an exact duplicate of the Hampton substation.

The towers were furnished by Milliken Brothers, Inc., of Milliken, Staten Island, N. Y. The insulators and fittings were furnished by the Ohio Brass Company of Mansfield, Ohio. The aluminum cables for the transmission line were made by the Aluminum Company of America. The station apparatus for Atlanta and Hampton was purchased from the Westinghouse Electric & Manufacturing Company, and that for Monticello from the General Electric Company. The transmission line and stations were designed and built by the company's own organization, under the direction of Mr. William H. Felton, president; Mr. T. F. Wickham, vice-president, and Mr. L. A. Magraw, chief engineer.

### New Terminal Post Office in New York—III.

By L. B. MARKS AND J. E. WOODWELL

The issues of the *Electrical World* of Jan. 11 and Jan. 18 described the electrical and mechanical equipment and the wiring and illumination of the new terminal post office in New York. In this instalment is described the equipment for heating and ventilating the building, electric and hydraulic elevators, pneumatic door-operating system and vacuum cleaning system.

#### HEATING AND VENTILATION

All occupied portions of the post office building are supplied with fresh air by means of an extensive system of mechanical ventilation. The east foyer, the pavilions and the main workroom under the skylight on the first floor, as well as the east rooms and pavilions of the second and

is a total of 41,000 sq. ft. of hot-water direct radiation in the building, sufficient heating surface having been provided to keep the building properly warmed independently of the requirements for ventilation.

The warming of air for ventilation is accomplished by two groups of "Vento" heaters, each group consisting of a primary and secondary heater and containing a total of

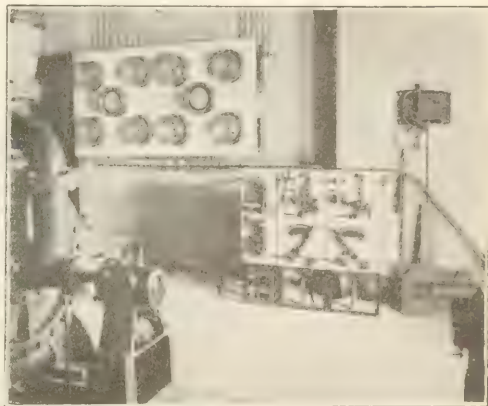


FIG. 2—GAUGE BOARD AND AUTOMATIC CONTROL PANELS FOR PUMPS

21,200 sq. ft. of steam-radiation surface. In each group a spray-head air washer is located between the primary and secondary heaters. Water for the air-washer sprays is furnished by two motor-driven centrifugal pumps.

Fresh air is drawn into two vertical shafts through adjacent court windows on the second, third and attic floor levels. From there it is led through the heaters and air-washers and forced through the distributing airways by means of four 200-in. full-housing steel-plate double-inlet

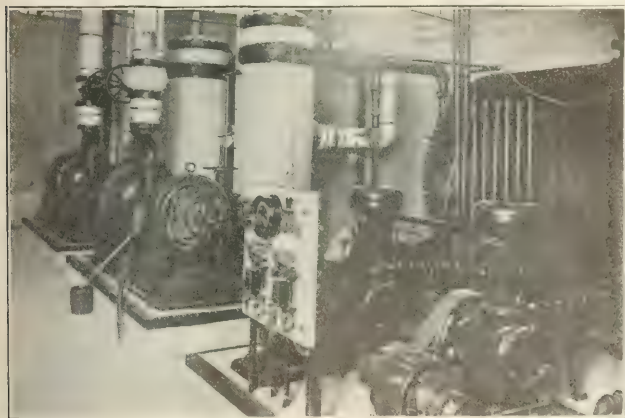


FIG. 1—PUMP ROOM, SHOWING HOT-WATER HEATERS AND CIRCULATING PUMPS, THERMOSTATIC-CONTROL APPARATUS, ETC.



FIG. 3—SOLE OF TWO OF THE 200-IN. MOTOR-DRIVEN FAN BLOWERS SUPPLYING PULLING VENTILATION, 100,000 CUBIC FT. AIR PER MINUTE

third floors, are heated by the indirect method. The remainder of the building, representing approximately 80 per cent of the total, is equipped with a hot-water direct system having forced circulation. All indirect heating is by steam. The water for the direct system is heated by steam in two vertical, closed heaters and is forced through the system by two motor-driven centrifugal pumps. There

are two for each group of heaters. A total quantity of 300,000 cu. ft. of air per minute is handled by these fans. The supply of steam to the primary and secondary heaters is under thermostatic control, the final temperature of the air delivered for ventilation being 70 deg. Fahr.

This air is distributed by means of sheet-metal airways and through four principal uptakes. From these uptakes

trunkways are carried in or at the ceilings of the several floors, with run-outs to the various sections and rooms of the building. All of these airways, except the vertical up-takes, are of sheet metal.

For indirect heating 124,000 cu. ft. of air per minute is taken from the quantity supplied by the four main fans and reheated by tertiary heaters having a total of 5600 sq. ft. of radiation, divided as follows: One heater for the first-floor foyer and pavilions; fifteen heaters for the main workroom under the court skylight on the first floor, and two heaters through which air is drawn by two 90-in. full-housing steel-plate fans to be forced to the second-floor and third-floor east rooms and pavilions.

The supply of steam to the tertiary heaters for the first floor is controlled by thermostats located on the same level. Thermostats located in each fan-discharge line control the

through the roof by two 24-in. multi-blade fans and four duplex sets of 66-in. propeller fans.

Complete and independent seat ventilation is provided for all toilet rooms. The system comprises round sheet-metal piping with soldered joints, connected to four independent multi-blade fans, which are located in the super-attic and discharge outboard through the roof.

An electric tele-thermometer system is also provided in the building, being so arranged that by shifting a switch the operating engineer can at once determine the temperature in various chambers and airways of the ventilating system and in typical rooms throughout the building, besides measuring the temperature of the supply and return of the hot-water system.

The motive power required in connection with the entire heating and ventilating equipment is furnished by electric

TABLE I—SCHEDULE OF MOTORS FOR HEATING AND VENTILATING APPARATUS.

Apparatus	H <sub>P</sub>	Speed			Efficiencies			Make	Service
		Max	Normal	Min	Full-Load	Three-fourths Load	One-half Load		
200-in. blower	45	136	119	90	83	82½	80½	Garwood	Main air supply
200-in. blower	45	136	119	90	83	82½	80½	Garwood	Main air supply
200-in. blower	45	136	119	90	83	82½	80½	Garwood	Main air supply
200-in. blower	45	136	119	90	83	82½	80½	Garwood	Main air supply
160-in. blower	8	170	150	112	75	74	71	Garwood	Basement exhaust
90-in. blower	3	300	260	195	80	78	73	Garwood	East front—second and third floors
90-in. blower	3	300	260	195	80	78	73	Garwood	East front—second and third floors
66-in. propeller fan	3	175	152	115	80	78	73	Garwood	Exhaust through skylight
66-in. propeller fan	3	175	152	115	80	78	73	Garwood	Exhaust through skylight
66-in. propeller fan	3	175	152	115	80	78	73	Garwood	From first-floor workroom
66-in. propeller fan	3	175	152	115	80	78	73	Garwood	From first-floor workroom
48-in. propeller fan	2	400	350	262	80	78	73	Garwood	Exhaust east foyer—first floor
Two 66-in. propeller fans	5	240	200	150	75	74	71	Garwood	Main exhaust from super-attic
Two 66-in. propeller fans	5	240	200	150	75	74	71	Garwood	Main exhaust from super-attic
Two 66-in. propeller fans	5	240	200	150	75	74	71	Garwood	Main exhaust from super-attic
Two 66-in. propeller fans	5	240	200	150	75	74	71	Garwood	Main exhaust from super-attic
42-in. multivane fan	0.82	425	240	76	74½	71	71	Garwood	Rear basement exhaust
15 in. multivane fan	0.125	425	240	80	78	73	73	Garwood	Exhaust locker room, basement; 120-volt motor
15 in. multivane fan	0.7	90	80	78	73	73	73	Garwood	Exhaust for toilet; local ventilation
15 in. multivane fan	0.92	975	80	78	73	73	73	Garwood	Exhaust for toilet; local ventilation
15 in. multivane fan	0.82	950	80	78	73	73	73	Garwood	Exhaust for toilet; local ventilation
15 in. multivane fan	1.00	750	80	78	73	73	73	Garwood	Exhaust for toilet; local ventilation
24-in. multivane fan	1.00	400	80	78	73	73	73	Garwood	Exhaust, northeast pavilion, second and third floors
24-in. multivane fan	1.00	400	80	78	73	73	73	Garwood	Exhaust, southeast pavilion, second and third floors
Multivane fan	125	600	80	78	73	73	73	Garwood	Exhaust for ejector pit
5-in. turbine pump	10.0	250	490	78	75	75	75	Garwood	Circulation hot water
5-in. turbine pump	10.0	250	490	78	75	75	75	Garwood	Direct-heating system
2-in. volute pump	2.0	1200	80	78	73	73	73	Garwood	Return condensation to boiler plant
2-in. volute pump	2.0	1200	80	78	73	73	73	Garwood	Return condensation to boiler plant
1½-in. centrifugal pump	0.5	1080	80	78	73	73	73	Garwood	Expansion tank supply
6-in. volute pump	15	650	570	430	85	83	79	Economy	Circulation of water for air washers
6-in. volute pump	15	650	570	430	85	83	79	Economy	Circulation of water for air washers
2-in. volute pump	2.0	1200	80	78	73	73	73	Economy	Drainage south air-washer, steam and hot-water systems
2-in. volute pump	2.0	1200	80	78	73	73	73	Economy	Drainage, north air-washer
3½-in. by 4-in. air compressor	1.5	1700	.....	.....	.....	.....	.....	Westinghouse	Air supply for thermostatic system valve and damper control
3½-in. by 4-in. air compressor	1.5	1700	.....	.....	.....	.....	.....	Westinghouse	

admission of steam to the tertiary heaters for the east rooms and pavilions of the second and third floors.

The discharge of air from the building is effected entirely by fans. Air is removed from the basement by one double-inlet multi-blade fan, having a 42-in. wheel, and by two 160-in. full-housing steel-plate double-inlet fans. Air from the east foyer is discharged by a 48-in. propeller fan into the basement adjacent to the two steel-plate fans which discharge outboard. Air from the main workroom on the first floor is discharged outboard by four 66-in. propeller fans located in the monitor, being passed through the space between the upper and lower glasses of the skylight.

Throughout the remainder of the building the air is conducted to the super-attic by metal flues located in the exterior and courtwalls, and from there is discharged

motors. The controllers of practically all these motors are arranged for obtaining a speed variation of about 15 per cent above normal.

A schedule of the motors required to drive the heating and ventilating apparatus is given in Table I.

#### ELEVATOR SERVICE

The elevator equipment of the post office building includes twenty electric worm-gear traction elevators and four direct-acting hydraulic-plunger elevators. The plunger elevators travel from the first floor and basement of the post office structure down to the train platforms of the Pennsylvania Railroad utilized for the receipt and dispatch of mail. These elevators are used as auxiliaries to the mail-handling apparatus previously described. The hydraulic service for their operation is obtained from the



plant serving the Pennsylvania Terminal Company, which maintains and operates these elevators.

The elevator service for the superstructure of the post office building includes five passenger cars, fourteen combination passenger and freight cars and one freight car. All elevator machines are of the latest duplex-worm trac-

controlling apparatus is mounted on 1.5-in. blue Vermont marble slabs. Each car is provided with a controller switch and supplementary car emergency switch. All motors are of special design to carry temporary overloads of at least 50 per cent.

A typical curve of motor efficiency obtained by actual

TABLE II—ELEVATORS													
ELEVATOR NUMBERS													
	1, 2, 5, 6	3	4	7, 19, 20	15	8	10, 11, 13, 14, 16, 17	12	2	24	9, 18	21, 22	
Type.....	Electric Passenger	Electric Passenger and freight	Electric Passenger	Electric Passenger and freight	Electric Passenger and freight	Electric Passenger and freight, safe lift	Electric Passenger and freight	Electric Passenger and freight	Electric Passenger and freight	Electric Passenger and freight	Hydraulic Freight	Hydraulic Freight	
Car size.....	5 ft. 10 in. by 7 ft. 1 in.	6 ft. 5 in. by 7 ft. 4 in.	5 ft. 2 in. by 6 ft. 2 in.	5 ft. 8 in. by 7 ft. 9 in.	5 ft. 8 in. by 7 ft. 9 in.	5 ft. 8 in. by 7 ft. 9 in.	5 ft. 8 in. by 7 ft. 9 in.	6 ft. 0 in. by 15 ft. 1 in.	5 ft. 3 1/2 in. by 12 in.	5 ft. 0 in. by 12 in.	6 ft. 6 in. by 15 ft. 0 in.	6 ft. 0 in. by 15 ft. 0 in.	
Normal capacity, lb., exclusive of car.....	3250	4200	2500	4750	4750	4750	5000	7500	3000	3000	7500	7500	
Maximum capacity, lb., exclusive of car.....	3800	5000	3000	5500	5500	6500	5500	8000	4600	5600	9000	9000	
Normal speed, ft. per minute, up or down.....	300	200	250	150	200	200	100	100	200	300	120	100	
Motor, hp.....	35	35	16	85	35	35	25	30	24	30	80	80	
Motor, r.p.m.....	800	800	800	800	800	800	600	460	800	800	800	800	
Total car travel.....	65 ft. 3 in.	37 ft. 9 1/2 in.	19 ft. 9 1/2 in.	86 ft. 9 1/2 in.	86 ft. 9 1/2 in.	86 ft. 9 1/2 in.	19 ft. 9 1/2 in.	19 ft. 9 1/2 in.	32 ft. 50 ft.	74 ft. 4 in.	32 ft. 2 in.		

tion type. A schedule of the elevator data is given in Table II.

Owing to the complicated nature of the framework and the restricted headroom over the several elevator shafts difficulty was found in many cases in securing a suitable arrangement of apparatus without complication of sheaves and idlers. In some instances it proved to be impossible to place the machines over the shafts, and in nearly all cases special framing supports were required. In order to install certain of the freight-elevator machines, it was necessary to provide trap doors in the roof of the super-atic to permit original assembly of the machines and future repairs to the installation.

Since the tracks and platforms of the Pennsylvania Railroad extend under the post office building, all the elevator

test is shown in Fig. 6. The guaranteed efficiencies for all motors are: For full load, 89 per cent; for three-quarters load, 87 per cent, and for half load, 83 per cent.

All cars as well as counterweights are provided with centrifugal-governor and guide-grip safety devices, the governors being electrically connected so as to operate the controlling circuit and main brake before affecting operation of the guide grips.

Each elevator is, in addition, provided with three limit-stop switches, located in the shafts at both the upper and lower travel limits of the car. These switches are mechanically operated by contact with the car and are electrically connected with the controlling apparatus so that the first and second switches when engaged by the car perform the same function as the car-control switch in the event of the

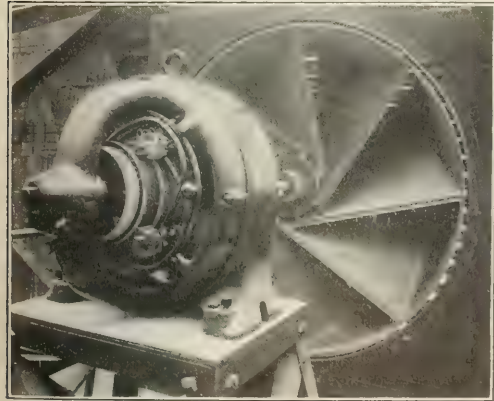


FIG. 4—EXHAUST FAN IN GENERAL WORKROOM

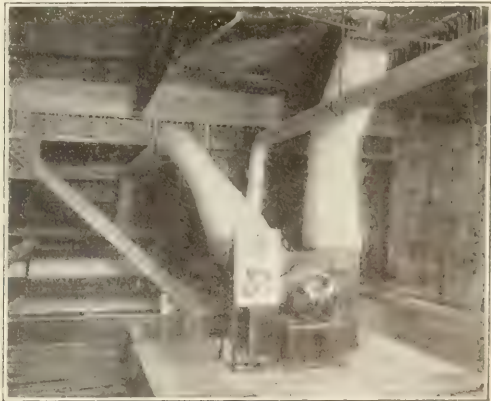


FIG. 5—EXHAUST SET FOR LOCAL VENTILATION OF BOULETS

pits were made up of heavy reinforced construction, with water-tight sheet-steel pans. These pans were specially framed to receive the spring-return oil buffers provided for both the cars and the counterweights belonging to the elevators.

The elevators are equipped with the latest type of magnetic control, arranged with solenoid-actuated switches. All

operator failing to operate the car switch properly. The third switch, if engaged, opens the main-line circuit through the circuit-breaker and applies the main brake.

All elevators are equipped with special low-carbon steel cables for traction-elevator service, capable of carrying a working load of 20,000 lb. per 3/4-in. cable and 27,000 lb. per 1-in. cable.

Owing to the limited space in certain shafts for elevators operated in pairs, it was necessary to provide special vertical framing and supports extending the entire length of the shaft for attaching the car center guides and counterweight guides.

On account of the heavy trucking service for the combination passenger and freight elevators, the cars are constructed with  $\frac{1}{4}$ -in. sheet-steel wainscot to a height of 4 ft., and the floors are of 2.5-in. tongue-and-grooved maple flooring.

The passenger cars and the combination passenger and freight cars, having the full travel from the basement to the attic, are equipped with a signal system, including an external signal lamp over each entrance door, in conjunction with hotel-type car annunciator signals. These latter consist of a double row of miniature lamps corresponding to the several floors which the car serves, one row representing the upward movement of the elevator and the other the downward travel. The wiring is arranged so that pressing the "up" or "down" button on any landing causes the external lamp at that landing and the corresponding miniature lamp in the car annunciator box to be lighted, the lamps remaining lighted until the call is answered.

The short-rise elevators having a travel of more than one floor are equipped with standard drop-signal annuncia-

with the necessary air supply and exhaust connections, and are designed to secure an air-cushioning effect at the end of the stroke in opening or closing. The air-supply valves for these cylinders are actuated by levers, which, in the case of the elevator car doors, are engaged by the car when approaching and leaving the landing. The car is also equipped with a hand lever by which the operator can open and close the doors as desired. This mechanism is so arranged that the shaft doors will automatically close when the car leaves the landing. Doors to the various passageways and vestibules are operated by hand levers from both sides of the doors.

Compressed air for operating the doors is furnished by two National two-cylinder, 6 in. by 8.5 in., single-stage, water-jacketed, motor-driven air compressors, each designed for compressing 82 cu. ft. of free air per minute to a pressure of 80-lb. gage. The pumps are driven by 15-hp motors running at 1200 r.p.m. The pump units are cross-connected to a supply pipe delivering into a primary pressure tank which will carry the delivery pressure of the compressors. From this the air passes through a reducing valve to a secondary pressure tank which will carry the constant air pressure required to operate the engines of the door-operating mechanism. Each compressor is equipped with an automatic controlling device designed to start one motor when the air pressure in the primary receiving tank

TABLE III—RESULTS OF TEST OF 8.5-IN. X 6-IN. AIR COMPRESSOR AND MOTOR

Time	MOTOR, 15 HP, 240 VOLTS, 51 AMP					Temperatures	
	Volts	Amp	Speed	Pressure, Lb per Sq. In.			
7:15 A.M. ....	240	49.5	1193	80	Cooling water entering, 17 deg. C.		
8:15 A.M. ....	240	49.5	1190	80	Cooling water leaving, 44 deg. C.		
9:15 A.M. ....	240	49.0	1200	80	Gal. of water per hour, 34		
10:15 A.M. ....	240	48.5	1202	80	Surrounding air.....	21 deg. C.	Rise
11:15 A.M. ....	240	48.5	1207	80	Front motor-bearing.....	40 deg. C.	14 deg. C.
12:15 P.M. ....	240	48.5	1200	80	Rear motor-bearing.....	39 deg. C.	18 deg. C.
1:15 P.M. ....	240	48.0	1208	80	Armature winding.....	49 deg. C.	28 deg. C.
					Commutator.....	54 deg. C.	33 deg. C.
					Series field.....	53 deg. C.	32 deg. C.
					Yoke.....	42 deg. C.	21 deg. C.
					Air discharge pipe.....	114 deg. C.	93 deg. C.
Insulation break-down test:							
Armature and frame.....1500 volts alternating current.				Series and frame .....1500 volts alternating current.			

tors, while cars having a travel of only one floor are provided with call-bell signal.

All signal apparatus is operated from a low-voltage system receiving energy from a number of motor-generator sets.

The various safety devices on the elevators have been put to a thorough test and have been found to meet every requirement.

#### PNEUMATIC DOOR-OPERATING SYSTEM

Past experience in various post office buildings has demonstrated the necessity of installing heavy steel doors leading to the various elevator shafts and passageways used for trucking service. On account of the size of the openings required some of these steel doors weigh as much as 1000 lb. each in the case of a single-section door, or 500 lb. each for a double-section door. As it would be impracticable to operate these doors rapidly by means of a hand-operated mechanical device, it was found necessary to provide an automatic mechanism worked by compressed air.

The total number of doors thus operated at the various elevator shafts, vestibules and passageways throughout the building is seventy-four. The mechanism for the doors comprises pairs of air engines consisting of cylinders with pistons connected to the counterweighted doors by steel cables running over sheaves. These cylinders are fitted

falls to a predetermined minimum and to stop the motor when the maximum receiving pressure has been obtained. Should one compressor, however, not be sufficient to maintain the minimum pressure, the second, or auxiliary, compressor will then automatically be put into operation when the pressure has fallen about 5 lb. below the minimum, the auxiliary compressor remaining in operation until the maximum pressure has been nearly attained. The auxiliary compressor will then be the first one to be cut out of service. The controlling apparatus is cross-connected so that either compressor may be used for regular service while the other is held in reserve as an auxiliary.

All piping is of standard galvanized iron throughout and is fitted with drip connections at all low points of the system to permit drainage of water of condensation.

According to the performance required by the contract, the continuous operation of twenty-five of the seventy-four doors, at the rate of one each minute, must be accomplished by the operation of only one of the air compressors running at normal rating. Each of the doors must open or close completely in an operating time not greater than twelve or less than eight seconds, and elevator doors shall be capable of being immediately checked or reversed by the operator, irrespective of the direction of travel of the car.

The principal data relating to the pneumatic door-operating equipment are given in Table III.

## VACUUM CLEANING SYSTEM

The vacuum cleaning system installed in the building was designed with a capacity to operate continuously eight 20-in. bare-floor renovators at one time.

To meet this requirement two 50-hp motor-driven horizontal reciprocating-type vacuum pumps are provided, each having a cylinder displacement of 1200 cu. ft. per minute. A feature of these pumps is the use of the machine base as a dust separator and collector. Air from the sweepers is led through water in the base casting before passing to the pump. The valves are of the rotary type and are so arranged that by turning them through 180 deg. the vacuum pump is converted into an air compressor. This arrangement permits the suction lines to the base to be closed off and allows the water, with the collected refuse, to be discharged directly into the sewer. The vacuum in the suction line is maintained practically uniform by means of a by-pass valve, which automatically permits the air to pass from one cylinder to the other in case the vacuum exceeds that for normal operation. Each pump is driven by an electric motor through herringbone V-shaped gears to insure practically noiseless operation.

The sweeper outlets throughout the building are so located that any point in any room may be reached with a renovator by means of a 75-ft. length of hose. No pipe smaller than 1.5-in. is used in the branches, and the pipe risers are at least 2 in. in diameter. The main suction

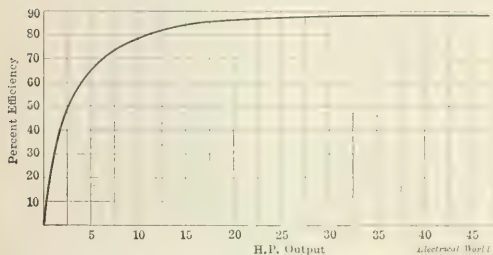


FIG. 6—EFFICIENCY CURVE OF ELEVATOR MOTOR

line in the vacuum-cleaner room enters two centrifugal dust separators, one in the line leading to each machine.

To facilitate the convenient operation of the system over such a large floor area there are provided a number of combination portable hose reels and renovator cabinets of compact design, capable of carrying full equipment of renovators and 100 ft. of non-collapsible hose. The installation is designed to maintain a vacuum of 15 in. of mercury column with all outlets closed.

The performance specifications, in addition to imposing a capacity test of the pumps, require that a mixture of 25 lb. of bolted wheat flour, 20 lb. of sand and 5 lb. of charcoal, when evenly scattered over 5000 sq. ft. of bare floor, shall be cleaned with a standard-size bare-floor cleaner at a rate of not less than 8000 sq. ft. per hour.

The plant was also required to be capable of operating at 12-in. vacuum eight bare-floor renovators of the largest size, each attached to 75 ft. of hose, with a power demand of not more than 40 kw. The two American Rotary Valve Company vacuum pumps are of the two-cylinder tandem type, each cylinder measuring 25 in. by 10 in. The pumps are capable of handling 600 cu. ft. of free air per minute from a vacuum of 12 in. of mercury. The 50-hp motor has a specified efficiency of 90 per cent at full load.

## CONCLUSION

Preliminary work in connection with the planning of the mechanical and electrical equipment of the new post office building, as described herein, was begun about five years ago. The consulting engineers were called upon not only

to design this equipment but to supervise its installation. The work has been continuous and is now practically completed.

A section of the building occupied by the railway mail service was placed in service over two years ago; the remaining portions will be ready for occupancy early this year.

The entire building was constructed under the direction

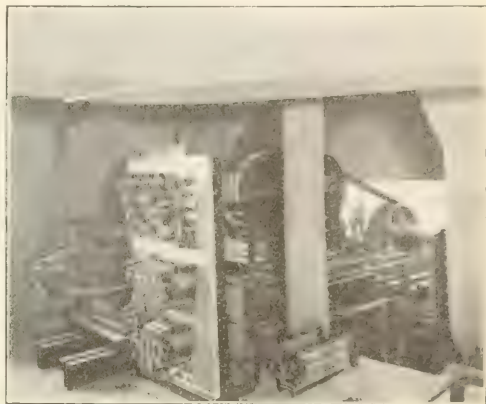


FIG. 7—PASSENGER-ELEVATOR EQUIPMENT

of the United States Treasury Department, Messrs. McKim, Mead & White acting as architects and Messrs. L. B. Marks and J. E. Woodwell, New York City, serving as consulting engineers.

The main contractors for the electrical and mechanical work are as follows: Mail-handling machinery, Lamson Consolidated Store Service Company and Otis Elevator Company; electric wiring, Van Wagoner-Linn Construction

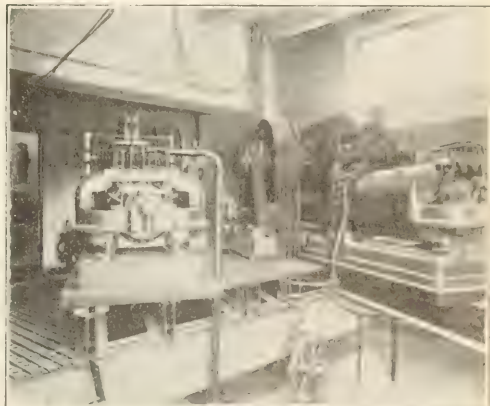


FIG. 8—TWO OF THE TWELVE WORM-GEAR TRACTION PASSENGER AND FREIGHT ELEVATORS

Company; lighting fixtures installed to date, Cassidy & Son Manufacturing Company and the Mitchell Vance Company; heating and ventilation, Baker, Smith & Company; electric elevators, Otis Elevator Company; hydraulic elevators, Standard Plunger Elevator Company; pneumatic door-operating devices, Burdett-Rowntree Manufacturing Company; vacuum cleaning machinery, American Rotary Valve Company.



# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## An Iron Campaign by Mail at Mobile

During a Christmas appliance campaign at Mobile, Ala., 325 electric flatirons were sold with the aid of a letter coupon sent to local customers of the Mobile Electric Company. This explained that the company would accept the letter, in lieu of \$1.50, on the purchase of an electric iron. The reason assigned for granting the bonus, as given by Mr. R. E. Flower, contract agent for the company, was that, while most business firms gave away calendars or souvenirs of some sort during the holiday season, the Mobile Electric Company wished to give something of real value. The result of these letters was the sale of 325 flatirons. The irons were sold for cash only. The receipts paid not only for the irons but the cost of advertising as well.

## Gear Electric Vehicle in New York-Boston Run

Completing a 251-mile run from New York to Boston in twelve hours and fifteen minutes is the record, over hilly roads with many muddy detours, just established by a Church-Field geared-type electric roadster. For a shorter distance between the two cities, 224 miles, the previous speed record for an electric vehicle had been twelve hours and twelve minutes. Detours made by the Church-Field vehicle account for the discrepancy in mileage.

The trip was made by Mr. C. R. Forth, of New York, and a companion. The car carried standard lead batteries and equipment, an extra tire casing, four tubes and 40 lb. of baggage. The hilly route followed caused the Church-Field two-speed transmission to show to advantage. The weather was cold and considerable snow was encountered, making it necessary three times to leave the main road. In spite of these difficulties, the car's average speed per hour for the distance was 21.3 miles. No trouble was encountered and no adjustments were made.

## Important Electric-Vehicle Announcement in St. Louis

Now that the electric-vehicle industry in St. Louis has grown to large proportions, the Union Electric Light & Power Company of that city announces that it will withdraw from the field of selling electric vehicles and supplies and doing garage work, confining itself to its regular business of generating and selling electricity.

Early in 1906, when there were but eleven electric vehicles in St. Louis and a woeful lack of expert and intelligent attention to the subject, the central-station company began an aggressive educational campaign which included the opening of garages and taking the local representation for some well-known types of pleasure and commercial cars. Largely as the result of this policy, the use of the electric vehicle has expanded rapidly in St. Louis, until to-day it is said that there are more than 700 "electrics" in operation on the streets of that city.

The electric-service company has now decided that the time has arrived when it should withdraw from active competition with others in selling and garaging. It has therefore given up its agencies and will close its public garage at Twentieth and Locust Streets as soon as its customers

can be accommodated elsewhere. The Rauch & Lang Carriage Company, which the electric-service company has represented, is about to open a garage and salesroom in the West End, and the General Vehicle Company has likewise arranged for local representation, as has the Electric Storage Battery Company, for which the Union Electric Light & Power Company has also acted as distributor.

Mr. C. E. Michel, who has been manager of the automobile department of the electric-service company and who has done much to build up the use of the electric vehicle in St. Louis, will continue in the employment of the company, and his services will be at the command of either buyers or sellers of electric vehicles when desired.

## Building Up Day Load in a Town of 3800

"It was only after long consideration and the wearing out of innumerable pencils that we could finally make up our minds to attempt twenty-four-hour service, and even then it was with the expectation of having to operate several years at a loss, for we were peculiarly situated," said Mr. W. E. Haseltine in recounting before the Wisconsin Electrical Association, Jan. 15, his experiences in building up a demand for day service at Ripon, Wis., a town of 3800 inhabitants.

The place itself was hardly one to offer much encourage-

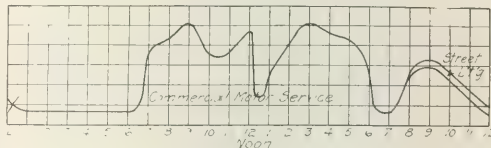


FIG. 1—STATION LOAD CURVE JUNE 27, 1912, MOONLIGHT, STREET LIGHTING REDUCED, STORES CLOSED

ment for the success of a venture of this kind. Its population was largely made up of retired farmers and there were practically no manufacturing establishments. When it is understood that the community had not increased a soul in population during the last twenty years there will be little wonder that the central-station manager hesitated.

After arranging an attractive rate schedule, under which energy for motor service was to be sold at 9 cents, net, per kw-hr. for the first sixty hours' use, and 4.5 cents per unit thereafter, the newly formed commercial department went in search of "power" customers. Going over the entire town, a list was made up of everyone who could possibly use motor service—it was an extremely short one—together with the number of horse-power in motors and the various motor-driven equipment thought to be required by each. The local staff was entirely without experience in motor practice, but made the best guesses it could, Mr. Haseltine modestly admits. Then followed a round of visits to persons on the calling list, explaining what it was intended to do and the advantages of electric power. Meanwhile strong arguments were used to get prospective customers to agree to patronize the company if day service were given. It was discouraging work, however. Some said positively that they would not use it; a number thought they would like it, but had various reasons for putting it

off; this man would not put in a motor until he could sell his gasoline engine; another couldn't afford it just now, but the majority wanted to wait and see how the other fellow came out.

Not content with one call, the visits were repeated several times, but as the net result of several weeks' effort there had not been landed a single one of the larger "pros-

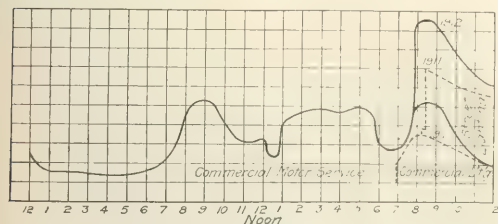


FIG. 2—JULY 6, 1912, STORES OPEN, LARGE FACTORY SHUT DOWN

pects," while the only customers positively booked were a meat market and a couple of printing offices. Almost ready to give up, the local sales staff, in the depths of its despair, remembered the rabbit that climbed the tree "because he had to!" With this inspiring example in mind the solicitors sallied forth again, having determined that this time they must get the business.

The first establishment tackled in this spirit was a creamery—a bad beginning on account of the large amount of steam necessarily used. In previous talks the creamery manager had declared that he would like to use electricity if it cost the same as steam or even a trifle more, but he seemed perfectly confident that "it couldn't be done." Besides, he had been actually convinced that he was getting his heat free. This creamery man was no exception, and, to make a long story short, he finally accepted the proposition that the electric company should lay out his installation of motors—their number, size and location—and that it would itself guarantee his satisfaction with the results. If dissatisfied, after a fair trial, the company even agreed to take out the motors without it having cost the customer a cent.

The creamery was then being driven by a single engine and two long parallel line-shafts. Individual motor drives were decided upon for the entire equipment, the total motor horse-power installed being about one-third that of the engine. After the plant had been running a month or six weeks the manager was approached and asked how he was satisfied. He replied that he liked the way the installation worked, but still believed that it was costing him more money than steam drive.

The company then suggested a two weeks' test, arranging to operate one week with steam and the next with elec-

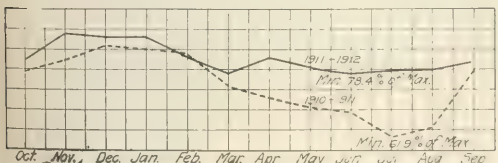


FIG. 3—COMPARISON OF STATION RATE LOADS, 1911 AND 1912

tricity. It was then winter, and during the week of steam operation the exhaust steam was used for heating the building, but in spite of this, the end of the test showed a substantial saving in favor of electricity. The company has been furnishing this customer's service ever since, and during the past summer he put in a motor-driven refrigerating plant. This installation was of incalculable benefit

in giving both prospective customers and the central station confidence in its product, and it proved of the greatest value as an example for securing other business.

The next problem was a washing-machine factory operated by steam. Here the manager was willing to put in motors for summer use, but "knew" that he could save money by operating by steam in the winter and using his exhaust steam for heating. He "knew" it because a friend of his who ran a machine shop in a neighboring city had told him so. Upon investigation it was found that this friend operated his extensive machine shop with one large motor and innumerable belts and line shafts.

The manager was, however, finally persuaded to permit motors to be installed in the fall, the argument being made that if his exhaust steam didn't save him anything in winter he was that much ahead in operating continuously by electricity. Here again individual drive was installed and on test won out well under the cost of steam. This firm is now building a new factory, which will be equipped with motor drive exclusively.

Other motor-service consumers came gradually—not without effort; but each installation helped the next—a steam laundry, a quarry, shops, garages, etc. Meanwhile the company was not idle with small heating devices. The management first picked out what it considered to be the best electric iron in the market, regardless of cost (for one has to live with an electrical device after it is installed), bought a quantity and proceeded to distribute them among the consumers. With each iron was sent a little folder offering a thirty-day free trial. If the customer

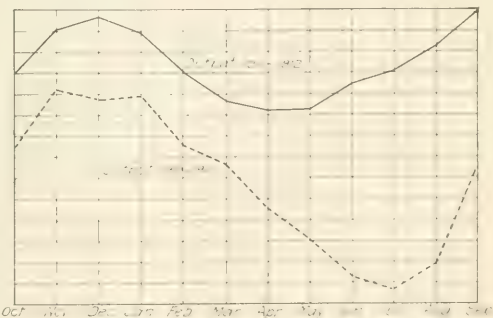


FIG. 4—COMPARATIVE STATION OUTPUTS, 1911 AND 1912

did not request that the iron be taken back at the end of this time, the company assumed he desired to retain it and billed it at net cost of \$3.75, the regular price being \$5.

A rather unfortunate time was selected for sending out this first consignment of irons, for it was October, with its lengthening days, and the company having just started twenty-four-hour service, people were already using service at hours to which they had never been accustomed before. These were two good reasons for expecting increased bills even without the irons, and since no very great success was anticipated the management was more than pleased when about 60 per cent were retained.

Next spring, when the irons were sent around again, a still larger percentage was retained. A little later the same plan was carried out with toasters, except that these were sold for list. While not as large a number of them were placed as in the case of the irons, more were put into service in this way than could have been done in any other. The three best-selling heating appliances in their order have been irons, toasters and warming pads.

Last summer was the first one with fan service available, but the results were not very satisfactory, due, perhaps, to the fact that the summer was exceptionally cool.

Meanwhile the company was advertising in various ways,

by circulars, newspapers, bill stickers, etc., and during the month of April a special thirty-day wiring offer for residences was made—\$1 per outlet for the first six outlets and 75 cents for each one over six. Fixtures were also sold during this period at reduced rates. Altogether the results broke a little better than even on these installations, and quite a number took advantage of this offer.

The local washing-machine company had planned to erect a new factory building and had received a number of offers to move elsewhere, but the owners, being Ripon men, preferred not to do so. After a conference of the local commercial club the factory owners suggested that a purchase of a hundred electric washers would please them greatly and would be good advertising for their company. In a few days the Ripon citizens had subscribed for these hundred machines, and when all were delivered 60 per cent of the local domestic consumers were equipped with these useful devices.

The accompanying curves show the effect of the first year of continuous service on the character of the station load. Fig. 1, taken June 27, shows the day peak to be considerably higher than the lighting peak. The stores closed at 6 p. m., as they do every day except Saturday during the summer, and, there being moonlight, there was little street lighting.

Fig. 2, July 6, shows the motor load not quite so high, since the washing-machine factory was not running. Here the commercial lighting peak and the motor peak are practically the same, the day being Saturday, when the stores were open. Superposed upon this commercial-lighting load, however, is the street lighting, bringing the total peak very much higher. Also indicated on this chart in dotted lines is the load curve for a corresponding day in 1911, showing the contrast.

Fig. 3 shows the peak-load curves for the respective years ended Oct. 1, 1911, and Oct. 1, 1912, these dates being selected since twenty-four-hour service was begun, Sept. 13, 1911. It will be noticed that last year's curve has flattened out considerably over that of the year before, the minimum being 78.4 per cent of the maximum, while for the previous year the minimum was 61.9 per cent.

Fig. 4 shows the comparative station outputs in kilowatt-hours, indicating perhaps best of all how the hollow due to the short lighting hours of the daylight months has been filled up.

For the year 1910-11 the minimum monthly output was 33 per cent of the maximum, while for the years 1911-12 it was 73.8 per cent. Even the minimum for 1911-12 was almost as great as the maximum for the previous year. The curves of income for the two years follow in a general way the output curves, except that the difference is not quite so great, since a large part of the summer load was in motors, taking a lower rate than the lighting. The equipment is also being operated to much better use, for while the increase in peak load shown on the charts is but 4 per cent, the station output in kilowatt-hours for the year increased 57 per cent and the gross revenue 40 per cent.

The greatest surprise of all, however, was the increase of both domestic and commercial lighting loads due to service being available at all times. In fact, the average increase in revenue per consumer was 11.6 per cent for commercial customers and 13.7 per cent for domestic users. When to that is added the income from new lighting consumers, the total from this source is 77.7 per cent of the entire additional cost of the continuous service.

Returning to a discussion of the best methods of getting new business, nothing, said the author, can take the place of personal solicitation. Next to that Mr. Haseltine recommended newspaper advertising, especially "locals" in small-town papers. Personal items to the effect that John Jones has just equipped his house with electricity or that Richard Smith has discarded his gasoline engine in favor of an electric motor at his garage are read with interest by all of

Jones' and Smith's friends, which usually include the whole population. Office displays help, too. People see them when they come in to pay their bills.

In closing his paper, Mr. Haseltine addressed pointed advice to all small-company managers hesitating at the thought of day service: "Do not be afraid of it! Results will not come by themselves, of course, nor will they in anything else worth doing, but I know of no department of public-utility service where the same amount of effort will reap a richer reward."

## Wiring and Illumination

### Effective Lighting of a Bank Counter

A feature of the north addition to the First National Bank of Boston, Mass., is the method of lighting the glass counters used by depositors in filling out slips, indorsing checks and making other memoranda. The bank employs Boston Edison service throughout for both lighting and motors and is a large user of electricity. A typical counter is shown in the accompanying illustration. The top surface is mounted 3 ft. 4 in. above the floor, its width being 23 in. and its thickness in solid plate 1.25 in. A glass rack 4 in.



FIRST NATIONAL BANK, BOSTON—COUNTER LIGHTING

high is fixed at the rear for holding slips and blanks. The lighting is provided by four 25-watt, 28-volt tubular tungsten lamps wired in series and placed inside a metal reflecting trough 3 ft. long, 4 in. wide at the top and 3½ in. deep, the bottom width being 5 in. The reflecting surface is lined with glass prismatic mirrors, and the lamps, which are concealed from the eyes of persons using the desk, are installed on horizontal axes 20 in. above the counter. The latter is 4 ft. 2 in. long, and the lamps are installed 18 in. between centers, each filament being centrally supported in a glass tube 10 in. long and 1 in. in diameter. The exterior of the reflector is painted gray to harmonize with the surrounding stone wall of the banking room. Entire absence of glare is a noteworthy feature of this installation. With an expenditure of only 100 watts inside the reflector, a lighting effect quite beyond the scope of the old style of carbon bulb lamps is produced, and although it is difficult to show the results of the installation in a photograph, the illumination is thoroughly soft and pleasing.



## Bell and Lamp Signal Systems—II.

BY SYDNEY F. WALKER

In the issue of the *Electrical World* of Jan. 18 the first instalment of "Bell and Lamp Signal Systems" appeared, giving a résumé of the early growth and development of the use of electricity in mine signaling. In the present

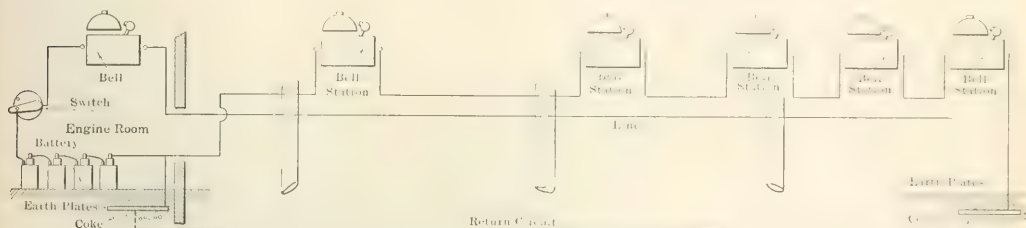


FIG. 4—CONNECTIONS OF THE OLD FORM OF ENGINE ROAD SIGNAL, WITH SEVERAL BELLS, ALL RINGING TOGETHER

issue are described some of the systems used in the well-known collieries of England.

With the development of mines over large areas, in consequence of the improvements that have taken place in mining methods during the last thirty or forty years, enormous changes have also been made in the haulage systems. In the early days of British mining, when the seams utilized were at small depth below the surface and when the areas worked were small, the haulage problems were very simple. As the depth of the seams increased, it became necessary to draw from larger and larger areas, and hence the haulage roads became longer and longer. The practice of sinking the shafts at the highest part of the seam, which is very frequently at a steep angle with the horizontal, and driving the roads from the shafts to the edge of the boundary, increased the length of the roads and increased the work which the haulage systems had to perform. Gradually the simple haulage rope with one drum was displaced by the

rails and two sets of cars. An endless rope is continually in motion on these roads, one part of the rope moving toward the coal face and the other part moving toward the mine shaft. The main haulage rope is being continually fed from what are termed secondary haulage roads, which are branch roads leading away from the main road to the working face. At first the cars on the branch roads were

pulled entirely by horses; in later years they have been operated by haulage ropes, and in a great many cases the secondary haulage systems are driven by electric motors. The arrangement of endless rope haulage provides for mine wagons being attached to the rope at any point of the road, so that one rope is being continually fed with full wagons from the branch roads, and at the same time working faces are being continually supplied with empty wagons from the other rope.

It will easily be understood that it is of great importance to the men who are employed in attaching and detaching the mine wagons from the endless rope to be able to stop the rope quickly in case of accident. It frequently happens that a mine wagon is not properly on the rails, or it is jerked off the rails when the haulage rope exerts its first pull. In such a case, unless the rope is promptly stopped considerable damage may be done on the road. This requirement is met by the above-mentioned signals; but there

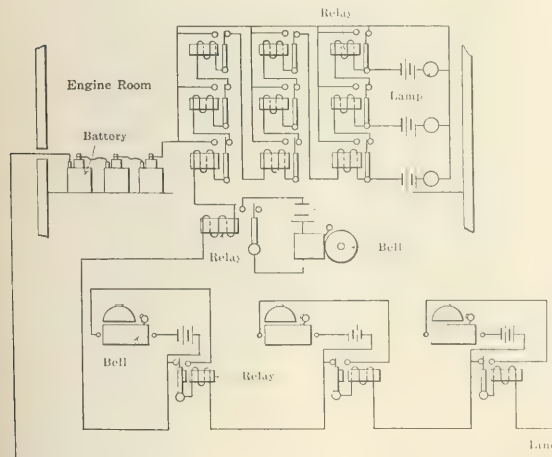


FIG. 5—DIAGRAM OF CONNECTIONS OF RELAY SYSTEM USED IN THE WILLIS METHOD

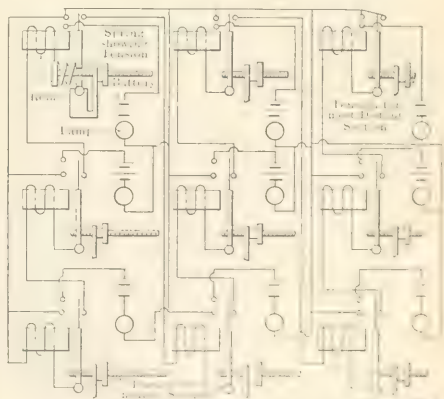


FIG. 6—CONNECTIONS OF INDICATOR OF WILLIS RELAY SYSTEM

main and tail haulage system, in which a train of mine cars was drawn from the neighborhood of the working face to the engine room; and later on this system gave place to the one that is very largely used in all extensive mines now, namely, the endless-rope system.

In most large mines there are one or two main haulage roads, made wide enough to accommodate two sets of mine

is another requirement, namely, that those who are employed on the road should know when the rope is stopped by signal and when it is going to start again. Stopping is, of course, void of danger, but if the rope is restarted when some of the men at the ends of the branch roads are attaching cars to it, or are doing anything else that brings them in contact with the rope, its sudden starting might

have a disastrous result. To meet this condition bells are installed at the ends of the branch roads, as shown in Fig. 4, and all the bells ring simultaneously when any one of the men employed in hitching the cars on to the rope signals. In practice a "hitcher" would signal to stop, and when his car is ready or he has overcome the trouble, whatever it may have been, he would give another signal to start.

In many collieries it was the usual arrangement for the man who stopped the rope to signal his number, showing where the trouble had occurred in case any assistance was required. Various difficulties arose in connection with this system, though it is still in use in a great many mines, and these troubles have led to modern developments. In the first place, the engine man did not know, unless the man who stopped the engine signaled his number, where the trouble was. In the second place, the sending of a number of signals occupied considerable time. If there were six stations on a main haulage road and the ordinary signals required three or four rings, the number of rings in the station signals must of necessity be high and have occupied considerable time. More trouble was caused by the inability of the listener to distinguish separate rings with the style of bell generally used in the collieries, especially after the battery had been exhausted by sending a long series of signals.

These troubles led to the development of the modern

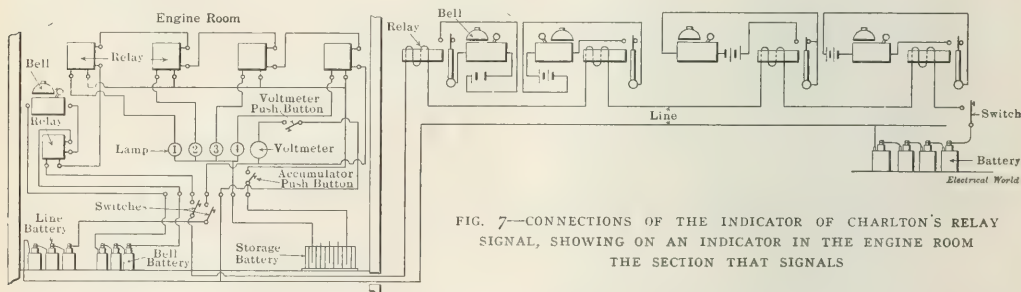


FIG. 7—CONNECTIONS OF THE INDICATOR OF CHARLTON'S RELAY SIGNAL, SHOWING ON AN INDICATOR IN THE ENGINE ROOM THE SECTION THAT SIGNALS

"relay signal." The first of these was introduced some years ago by Mr. Willis at the Lycett Collieries in North Staffordshire. He divided the road into sections of equal or unequal length, according to convenience. One bell was placed in the engine room and one at each station. There was also an indicator in the station which showed the section from which the signal came. The indicator, which was of the ordinary type employed in domestic work, although somewhat stronger than usual in construction, was operated by relays, and the relays were "tuned" to respond only to the current from the section to which they were allotted. Fig. 5 shows the arrangement of the bell stations, wire and indicator, and Fig. 6 shows the arrangement of relays and indicator. Between each two sections on the engine road was installed a relay, which performed the double office of connecting a local bell and battery and of adding resistance to the circuit when the naked iron wires were connected beyond it. By arranging the sensitiveness of the relays in the engine room to correspond with the current that existed in the circuit from the different sections, the current being weaker for the relays which are toward the end of the line, the necessary selection was obtained. In addition, the relay in the engine room performed the double duty of connecting its own indicator and of cutting out all those behind it. Thus, No. 1 indicator, arranged to correspond to a connection made in No. 1 section, required the strongest current to operate it. No. 2 required less current and soon passed when connection was made in No. 3 section, and so on, No. 6 relay in the engine room operating on the smallest current. In practice, when No. 6 section signaled No. 6 relay in the engine room operated and cut out all the other relays 1 to 5, and if No. 4

section signaled No. 4 relay operated and cut out all the others, and so on. The Willis signal, so far as the writer is aware, has not been adopted elsewhere.

Quite recently there have been further developments in this direction, and some of the Yorkshire collieries, notably the Ackton Hall Colliery, have adopted what is practically a modification of Mr. Willis' signal. Fig. 7 represents the arrangement of the signals at Ackton Hall Colliery, in which important improvements have been made over the Willis system. In the first place, the indicator in the engine room consists of a series of small incandescent lamps, the current for which is furnished by a small storage battery. After a signal the lamp remains lighted until the engine man extinguishes it by switching off the battery current. There is a system of relays in the engine room, placed inside a substantial iron case. There is one relay for each section of the engine road, and when a signal is sent from any one section a bell in the engine room rings and the lamp corresponding to that section is lighted. There are only two line wires on the engine road, and there is a relay between each two sections, the relay again performing the double office of adding resistance to the line and of connecting a local bell into the circuit. A separate relay in the engine room rings the bell. The coils on all the relays in the engine room are connected in series, and the selection is performed by practically the same operation of

"tuning" as that described in connection with Mr. Willis' signal.

Assuming that there are six sections and numbering them from 1 to 6, No. 1 being that nearest the engine room, No. 1 relay requires the largest current to operate it, No. 2 a little less, No. 3 still less, and so on. The relays are carefully made and calibrated, so that at the colliery in question the line between sections 1 and 3 has a resistance of 10 ohms, that between sections 2 and 3 a resistance of 20 ohms, and so on.

There is another feature in connection with the system in operation at Ackton Hall, namely, the arrangement of the line batteries. At each end of the engine room there are two Edison Lalande batteries of twelve cells each, and they are connected in parallel, but the connections of the two line wires, the line relays and the relays in the engine room are such that there is a closed circuit, with two batteries opposing each other, and therefore when no signal is being given no current is present in the circuit. When connection is made between the two line wires in any section, the batteries are placed in parallel, operating the relays in the engine room and the relays on the line between them. The relays on the line ring the local bells, with local batteries. A feature of this system lies in the fact that the batteries are maintained at a constant potential throughout their life by means of variable resistance and voltmeter in the circuit. The life of the batteries is stated as three weeks. It will be noted that in the latest development of the sectional relay signal the Edison Lalande battery has been employed, because it is possible to maintain a constant potential on the line by its use with the aid of a resistance. From information received from the mine the indi-

cations are that the constancy of potential of the Edison Lalande battery, under the conditions ruling, is greater than that of a storage battery. It would be possible for a storage battery, for instance, to maintain constant potential only in case somewhat frequent adjustments are made during the day. In a busy mine the employees do not have time to make frequent adjustments. One adjustment per day, after the work is done, or before it commences, is as much as can be expected from them. One adjustment per week at the week-end would be better. The Edison Lalande cell fulfils the first conditions at any rate; in the experience of colliery operation the average storage battery does not. There is also the possibility of using a motor-generator set, the motor taking energy from the storage battery and the generator furnishing direct current at a convenient voltage. The objection to this arrangement is that with the arrangement of two generators in parallel, one at each end of the line, it would be necessary to extend the supply cables to the end of the road, and in many collieries, particularly in parts of Yorkshire, the danger of igniting gas would be too great. There is also the more serious objection that unless the motor-generator set were very carefully designed there might be a considerable variation of pressure at the generator terminals, necessitating some form of compensating apparatus to keep the potential constant. In practice a battery of Edison Lalande cells is much more easily handled and requires much less attention than the motor-generator, and there is absolutely no danger from its use.

In a later instalment shaft signals as they were in the past and as they are to-day will be described and illustrated.

## Letters to the Editors

### Inductive Load for High-Voltage Transmission Systems

To the Editors of the *Electrical World*:

SIRS:—The article on "Highest-Voltage Transmission System in the World," on page 795 of Vol. 59 of the *Electrical World*, is of particular interest, as it shows very clearly the limit of voltage in transmission over long distances. It seems to me, judging from the encouraging and favorable conditions at Au Sable, that the building up of a large, steady inductive load should be the leading principle in the management of such plants in order to obtain good voltage regulation and high power-factor and efficiency.

Zwickau, Germany.

GUSTAV W. MEYER.

### Quick Patents for Inventors

To the Editors of the *Electrical World*:

SIRS:—The recent editorial review respecting the Patent Office shows an intimate acquaintance with the present slow process of securing actions on applications for patents. It is pointed out correctly that the examining force, etc., are insufficient. Such opinions of influential men have hastened progress in this direction before, and it is hoped that further improvement will follow. I can remember when most applications were pigeonholed for three or more months before the inventor could know what the office was willing to allow. Now, applications are acted upon in as few weeks as formerly there were months. The next step toward the attainment of quick patents is about to be undertaken, inasmuch as the investigating committee appointed by President Taft urges upon Congress an appropriation for an adequate force to conduct the examinations so that by increasing the force and its remuneration applications may receive more immediate attention.

It is as absurd for an inventor to wait a long time for a decision as it would be for him to wait for the *Electrical*

*World* several weeks after its publication. The only method of compensating for this loss of time is to rush applications into the Patent Office as soon as possible. We may expect soon to have a decision almost "by return mail," which has been approximated in a few instances.

Washington, D. C.

EDWARD P. THOMPSON.

### Measuring Temperature of Inaccessible Places

To the Editors of the *Electrical World*:

SIRS:—I have discovered a very simple method of taking temperatures in inaccessible places and think that other engineers will doubtless be interested in it. I have found the method most satisfactory in taking the temperature of oil in transformers at points where it is impracticable to insert or read a thermometer, but the method is applicable to ovens, refrigerators, distant rooms, etc. Although the principle is an old one based on the increase in resistance of a conductor due to temperature changes, I have not seen the formula used before.

Assuming that a commercial copper wire increases its resistance 1/234 for each Centigrade degree rise from zero, a coil of copper wire is wound which will have precisely 234 ohms resistance at zero C. (259 ohms at 25 deg. C.) and of a shape and size suited to the work. Using leads of negligible resistance and placing the coil in the medium whose temperature is desired, it is only necessary to measure the resistance of the coil by means of a bridge, ohmmeter or other method which will not cause it to heat, and its temperature may be instantly found by subtracting 234 from the value found. For rougher work, if the resistance is only 234 ohms, the determination of the temperature is as simple; while for more accurate work the error due to the resistance of the leads may be reduced by using a coil having a resistance of 2340 ohms at zero C.

Montclair, N. J.

EDWARD D. CARTER.

### Improvement in Prime Movers

To the Editors of the *Electrical World*:

SIRS:—I agree entirely with the sentiments expressed in the editorial in your first issue in 1912 bearing on the subject of prime movers, particularly that the demand of the age is for conservation of resources. I have read with pleasure the article on this same subject appearing in your issue of Jan. 4, 1913, in which you state that there has been no development along certain radical lines.

Believing that your readers will be interested in a phase of this subject, attention is called to United States patent No. 1,049,580, issued to me on Jan. 7, 1913, which aims at the delivery of practically the total heat generated by a fuel source to the cylinder of a prime mover. This method has recently been carefully considered by a number of prominent engineers, who have expressed the opinion that it is likely to prove successful and to be without practical disadvantage.

This method of generating a working fluid may be very briefly described by saying that the usual jacket water of a combustion engine is still further heated and vaporized and the products of combustion, after being cooled to a certain point, mix with the steam generated, probably superheating it. When desired, a diluent may be further supplied in the form of air or steam. There being no movable or working parts to the apparatus, much higher temperature can be maintained than requiring a relatively small unit for a large amount of power, which results in an increase in the theoretical efficiency. This type of apparatus is easily adaptable to change in load conditions. The Diesel oil engine is highly efficient, but it suffers from a jacket-water loss and an exhaust loss, both of which are recovered to a large degree in the machine designed by me.

New York, N. Y.

EDWIN G. HATCH.



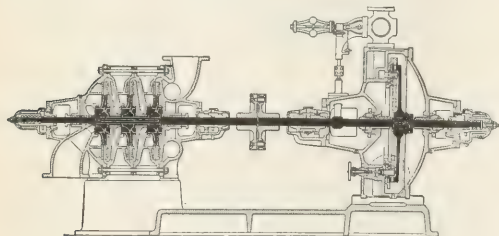
# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Boiler-Feed Pumps

By ALFRED WILLIAMS

In most of the small central stations throughout the country the time-tried and time-honored simple reciprocating pump for boiler-feed purposes still holds sway, although in newer stations the compound steam-end reciprocating pump is used for the higher boiler pressures employed; but even the latter is fast giving way before the steam-turbine-driven or motor-driven centrifugal pump. This change has not been forced owing to any superior economy on the part of the latter unit, but because of its easier operation and lower maintenance cost. There is considerable room for improvement in those stations equipped with the simple reciprocating pumps, especially where the latter call for some 200 to 300 lb. of steam per indicated horse-power. If steam must be used, it would be preferable to employ an independent steam engine which will operate at, say, 60 lb. of steam per indicated horse-power. An argument frequently brought out by persons who oppose the use of electric motors for driving boiler-feed pumps is that the motor does not offer sufficient variation in speed to meet ordinary conditions of practice without introducing resist-



TURBINE-DRIVEN CENTRIFUGAL FEED PUMP

ance in the circuit. It is possible that very much energy might be wasted in this manner, and yet a great saving can be shown over the inefficient direct-acting steam pump. It has been suggested that in place of the single direct-acting steam pump a triplex pump be installed and that this pump be driven by a constant-speed motor or belted from the main engines. The variations in the rate of pumping can be taken care of by placing a by-pass valve in the suction to the exhaust of one or two of the pump cylinders. Then to vary the rate of pumping it would only be necessary to open the by-pass valve more or less. With the by-pass valve shut the pump works at maximum output. By opening the two by-pass valves wide the rate of pumping in a triplex pump would be reduced two-thirds. Such a pump would be most economically driven from the main engine shaft. The advantages and economy of using motor-driven or turbine-driven centrifugal pumps for feeding boilers are, however, too great to be ignored.

Among the points in favor of the centrifugal pump are the following: It has neither suction nor discharge valves; it possesses only one moving part, which is in continuous rotary motion, and it delivers the water in a constant stream in contrast with the intermittent impulses of the ordinary duplex pump so widely employed for this class of service. Since the stream of water is constant and without impulses, there is no vibration in the pipes and there is little chance

for scale to deposit in them. The pump, moreover, possesses all the advantages of being valveless. There are, therefore, no plungers to be packed, no steam valves to reseat and no pistons to require new rings from time to time. A feature of the pump which is paramount is that when running at constant speed it delivers water at a certain pressure, which it cannot exceed by more than a few per cent, even though the delivery pipe be completely closed. With the reciprocating pump the latter calamity usually means a broken pipe or pump. This feature of the centrifugal pump makes it possible for a fireman to shut off the feed to any of the boilers or to all of the boilers without shutting off the pump, which in many plants would entail leaving the boilers and going to another part of the station. It is thus possible to feed the boiler automatically by installing a ball-float for each boiler, which would control a balanced valve in the feed pipe. This makes it unnecessary to have connections with a line supplying steam to the pump, as the latter runs continuously whether any of the boilers are being fed or not. This method of automatic feeding makes the boilers independent of each other and makes it unnecessary for the water line in all the boilers to be at the same level. This latter feature is important in stations containing several sizes of boilers or where some are of the vertical type and some of the horizontal type. It might be contended that the efficiency of a centrifugal pump operating under these circumstances would be very low when supplying only a small portion of its rated output, and that it would consume power when merely turning the water without delivering any. This objection in the case of a motor-driven centrifugal pump is of little moment when its many advantages are considered.

## Exploding Powder Blasts with Central-Station Energy

By ELLERY C. ARNOLD

For many years magneto generators of the plunger type have been used for exploding quarry blasts, but since the power of such "batteries" is always limited some powdermen have resorted to central-station energy supply lines for igniting the charges positively and safely. A charge that has missed firing represents not only a waste of so much explosive and labor but may be the source of considerable danger. Simultaneous or later blasts that are successful will scatter the unburned powder among the rocks and debris, and here it may be subsequently detonated by innocent workmen, with serious injury to themselves and bystanders. Observations in a single field where a good deal of blasting is carried on have convinced the writer that the loss of human life resulting from these "missed-fire" causes would be appalling if returns could be collected from the entire United States.

Some quarries are so located that 250-volt or 500-volt motor circuits are available. Where there are no such lines certain operators have preferred to install small generating sets, either engine-operated or turbine-operated direct-current outfits being generally used. It is a well-known fact that certain powders, like the gelatine explosives, lose the full effect of their power if not detonated properly. If several high-power fuses are employed, not only will the full effect of the explosive be realized but the danger of "missing" is minimized. For example, in a 5-in. hole 50 ft.

deep not less than three exploders should be used. The first fuse should be placed at the bottom of the hole. Then if a stone or piece of rock should fall in and block off the lower section of the dynamite provision will still have been made for detonating the isolated section of explosive. The other two charges should be placed respectively at the center and top of the bore, being covered with about 20 ft. of tamped earth. All three exploders are connected in parallel across the direct-current buses. As the cost of the extra exploders is only a small portion of the cost of the dynamite used, the extra units are well justified from the standpoint of material expense, even disregarding the potential danger of the possible "miss-fires."

### Maintaining Operation During Construction Work

At the January meeting of the Pittsburgh Section, A. I. E. E., Mr. G. N. Lemmon presented an illustrated paper on "Maintenance of Operation During Construction Work."

In enlarging a plant already in service the first consideration, he declared, must be the safety of the men. Work on "hot" conductors carrying 2300 volts or more is often required, and careful selection and training of the workmen is essential. Suitable shields and temporary insulation are constantly needed, and for this purpose dry wood and rubber floor matting are valuable, but they are useless without ceaseless vigilance.

Indeed, constant watching is necessary everywhere. On a certain occasion an exciter was to be moved and one of the men went downstairs to take down the wiring. Happening to go to the wrong foundation, he cut the shunt-field wire the first thing and so shut down the station. Such an incident is the exception, of course, for good men take a keen interest in the work, and the man in overalls deserves high respect. The best friend the construction man can have is the operating engineer whose nerves extend along every wire and pipe in his whole station.

Outside of the station the lines must be kept alive, and linemen learn to trust ordinary triple-braid weatherproof insulation for 2300 volts, although not standard practice according to the handbooks.

The best engineering is that which furnishes reliable service for the lowest expenditure, and a good construction man learns to utilize everything that is available. Avoiding duplication and temporary work when possible, the construction work should be energetically prosecuted, but always the paramount issue is continuity of service. The lamps must burn and the motors must turn for twenty-four hours a day, which means that every second is to be counted. The spirit of loyalty among employees is always an important factor in the completion of a job. Men are usually willing to work on risky tasks and under adverse conditions because of their interest in the work.

In the discussion following the paper Messrs. L. O. Vesper, of the Mahoning & Shenango Railway Company; G. C. Hecker, of the Pittsburgh Railways Company; J. S. Jenks, of the West Penn Traction & Water Power Company; K. C. Randall and P. M. Lincoln, of the Westinghouse Electric & Manufacturing Company; Henry Harris, of the Wilmerding Electric Company, and William Oschman, of the Oliver Iron & Steel Company, took part. Mr. Vesper recounted his experience on a job at Reading, Pa., mentioned by the author of the paper, and Mr. Hecker described the installation of some 11,000-volt units replacing 2200-volt sets at the Brunot's Island power house of the Pittsburgh Railways Company.

Mr. Lincoln said that, from seven years' experience as an operating man, he could appreciate their troubles. The first law and gospel of the operating man is to "keep the juice on the line." Loyalty is common among men of the staff; they are generally ready to jump in and help. While admitting never having given an order for men to work on

"hot" lines, Mr. Lincoln said he had sometimes found it convenient to accept volunteers for this work. Mr. Jenks said that financiers will usually approve any expenditure made for "continuity of service." During last season the West Penn company replaced 170 poles and 1800 cross-arms, with no interruptions. A twenty-two-panel switch-board was moved bodily from one part of the plant to another without interrupting service or so much as blocking a circuit-breaker. Leads of the proper length were spliced on and then the board was lifted by the crane. Such work, however, is very costly and is difficult to estimate accurately.

### Cause of Dirt-Marking Beneath Open Wiring

A friend asserts that the "dirt-marking" of walls or ceilings beneath lighting wire is traceable to the heat produced in the wire, which sets up convection air currents carrying dust and dirt to mark the surface. It had been my impression that dirt was produced by static phenomena. T. D. B.

Inspection of open wiring that has been installed even a short time will show this dirt-marking action to occur chiefly beneath the ungrounded wires of the group. Thus the neutral of a three-wire system, or the grounded side of a branch pair, will remain clean, while the "outside" wires become distinctly marked. In a pair one side of which is grounded the "live" conductor can usually be easily distinguished by the dust both on the insulation itself and on the wall beneath. Many wiremen depend on this little "kink" to pick out the grounded side, without other preliminary test. Even in an ordinary twisted-pair lamp cord, the wires will soon mark themselves unmistakably if flying dust is present in the room. The effect is clearly an electrostatic one, depending on the difference of potential between the charged wire and ground, which causes attraction of loose dust particles. Both wires of a pair are, of course, heated equally since they carry the same current, so that resulting air convection streams would affect each wire to the same amount. It is, moreover, unlikely that the heat that is produced in ordinary lighting conductors could set up distinguishable air movement to produce any such markings during the few hours daily that the circuit carries its load. The electrostatic action continues, of course, as long as potential is on the wires.

### Condenser Prevents Cross-Talk

Please inform me how a condenser placed across the bushbars of a storage battery supplying current to a common battery telephone system will tend to prevent cross-talk. Has the condenser any other purpose in this case? A. G.

A condenser placed across the terminal busbars of a storage battery supplying current to a common-battery telephone system is useful in preventing cross-talk because of the fact that the battery is not of negligible impedance. If the battery circuit could be made to have absolutely zero impedance, there would be no occasion for the use of such a condenser. Since the impedance is finite, however, there will be fluctuations of potential at the battery terminals corresponding to the talking currents in circuits receiving current from the battery. Thus when two or more cord circuits are connected to the same busbars it might be possible to "couple" some current to the communication going on in another circuit, although the two circuits would be connected only to the common battery terminal. Supplying current to the separate cord circuits of each. It is, therefore, desirable to draw a short-circuit current from the battery which will draw no current from the battery at the same time will afford the least possible impedance to telephone currents, whose frequency ranges from about 100 to 2500 cycles per second, with an effective average of about 800 cycles per second. A condenser meets the requirements most satisfactorily, and has no other function in this case than the one just described.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Synchronous and Non-Synchronous Reactance.**—J. REZELMAN.—The conclusion of his article, in which the author continues his investigations into the reactance of alternating-current machines. In this article he discusses fully the case of alternators having solid salient poles, both single-phase and polyphase. He now takes into account the effect of the changes of the exciting direct current in the magnet coils upon the reactance. A variation in the excitation is practically without influence on the impedance (and the reactance) in the antagonistic, but not in the transverse position.—*London Electrician*, Jan. 3, 1913.

**Transformer Formulas.**—J. K. CATTERSON-SMITH.—The author gives a simple dimensional formula for alternating-current transformers and discusses its derivation for single-phase transformers, three-phase transformers, autotransformers and the proportioning of shell-type transformers. Several examples are added.—*London Electrician*, Jan. 3, 1913.

### Generation, Transmission and Distribution

**Grounded and Ungrounded Neutrals.**—S. E. FEDDEN.—An account of the experience in Sheffield where the question of grounding was settled a year and a half ago. The two-phase and three-phase systems are interconnected by T-connected transformers, and the first point to be decided was to provide a ground connection when the transformers were supplying three-phase current. The rating of each transformer is 1000 kva, and at heavy loads the transformers supplied three-phase current to several feeders. It was undesirable to ground the three-phase system through the neutral connections of the transformers, the chief reason being that should a ground develop on any of the feeders the overload relays on the transformers would operate and thus cut off all the supply, including the ground connections, without indicating the faulty feeder. Up to the present, grounding through a resistance on alternating-current sys-

phone companies' property or to the distribution system. It was, therefore, necessary to adopt some other method of overcoming these difficulties. The arrangement adopted is shown in Fig. 1. It has the following advantages: The personal element of switching a working generator or transformer to earth is obviated. No expensive automatic selecting device is required. The earth current is limited to 51 amp, which is the current necessary to trip the Ferranti-Field discriminating device. The earthing device is in the form of a transformer arranged with the primary star-connected and the secondary delta-connected. Having the secondary delta-connected insures that the neutral point on the primary is always at earth potential, as proved by experiment. The grounding transformers are arranged to operate the trip coils of the respective switches in parallel with the overload and reverse-power relays. The power taken by the grounding transformer is 1250 watts.—*London Electrician*, Jan. 3, 1913.

**Safe Operation of Electric Winding Engines.**—A note on a discussion by G. K. Chambers of the problem of braking of high-speed electrically driven winding engines in South Africa. The failure of power may easily result from the opening of feeder circuit-breakers at the power station or in the transmission system or from the opening of circuit-breakers in the mine substation caused by heavy surges due to lightning discharges, mistake of the operator, short-circuit on the system, unusual overload or malicious injury to overhead lines. The reclosing of a circuit-breaker is a simple operation and one quickly performed if an attendant is on the spot, but usually the momentary opening of the circuit-breaker takes the control of his engine out of the driver's hands, and practically the whole responsibility of stopping the winder is thrown upon a safety device and mechanical brakes. It follows from this that mechanical brakes on electric hoists have to perform a duty rarely required of steam winders except in the case of overwind when the winding speed is usually much reduced—a duty, in fact, for which the latter may not necessarily have been designed. The mechanical braking of electric hoists must therefore be a more serious problem than that of steam hoists. This fundamental difference has not, perhaps, been sufficiently emphasized, and a proper appreciation of it is necessary not only in the case of existing steam engines which are converted to electric drive but also in the design of entirely new electric winding engines.—*London Electrician*, Jan. 3, 1913.

**Peat and Electrical Engineering.**—J. TEICHMUELLER.—The conclusion of his long paper read before the German Association of Electrical Engineers. The methods of making the peat deposits of the Wiesmoor in Ostfriesland available for electric power generation and opening the district for farming purposes are described. It is estimated that the deposit contains about 22,000,000 tons of peat with a content of 30 per cent of water. With a yearly production of 20,000,000 kw-hr., this peat deposit is sufficient for 450 years.—*Elek. Zeit.*, Dec. 26, 1912.

### Traction

**British Electric Traction Statistics.**—The annual statistical tables of electric traction systems in the United Kingdom. These deal with (1) tramways supplied with energy from "combined" power stations, (2) tramways with independent generating plant, and (3) electric railways. So

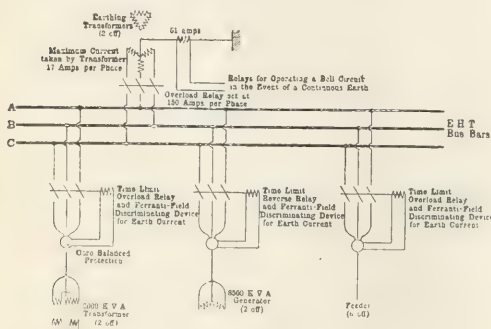


FIG. 1—CIRCUIT ARRANGEMENT

tems only follows a similar arrangement with a direct-current three-wire system at 500 volts. The use of limiting devices now generally employed on high-tension three-phase systems causes an abnormal rise in pressure in the neighborhood of the fault. On the other hand, to allow 500 amp to stray between the fault and the neutral point of the system is not beneficial either to gas, water and tele-



far as extensions and new routes are concerned, the year has not seen much change, but much work of an educative kind has been done, and the year 1913 will probably see great advances made in railway electrification. There is no room for much extension of electric tramways, most towns being already equipped, Edinburgh, with cable cars, forming a notable exception; but there appears to be a large field open for railless traction systems to outlying districts and as a means of linking up existing systems.—*London Electrician*, Jan. 3, 1913.

**Gasoline Electric Car.**—F. E. DRAKE.—A discussion of the use of the gasoline-electric car or "automotrice" on tramways with special reference to the Arad-Csanad railway in Hungary. "Within the limits of 40 tons total weight and a maximum speed of 45 miles per hour, the automotrice will be a most potent factor in making possible greater conveniences for the public and splendid economies for the lines operating." Within these limits 2.5 to 3 car-miles per gallon of combustible may be insured. At this economical point there is no danger of aggravated operating costs from threatened high price of combustible. So long as the mileage costs of crew are 50 per cent or more higher than the cost of combustible, the automotrice has an enormous field before it. The oft repeated query as to maintenance costs has been thoroughly answered by the Hungarian road, which has a mileage record total of 5,300,000 car-miles, covering seven years with maintenance costs of less than 3 cents per car-mile.—*Elec. Journal*, January, 1913.

**Direct-Current Locomotives for Interurban and Main-Line Service.**—S. T. DODD.—An article on the more important features of construction embodied in four sizes of locomotive for 600-volt direct-current operation. These are, broadly classified, the 25-ton, 50-ton, 75-ton and 100-ton units. After a general discussion of the four types as to their approximate field of application, the paper takes up their design in some detail under the headings of motor equipment, truck design, platform framing and superstructure.—*Gen. Elec. Review*, January, 1913.

### Installations, Systems and Appliances

**Ten Years of Electrical Industry in Japan.**—S. W. SCHMIDT.—During the last ten years the electrical industry in Japan has undergone rapid developments. In 1901 there were forty-nine electric-lighting companies. This number increased in ten years to 122, while the length of the lines increased sixfold. In 1901 electric lamps were used in 48,000 houses in Japan, in 1910 in more than 600,000. In the same time the number of lamps increased from 300,000 to 1,900,000 and the number in streets from 6400 to 59,300. A large number of electric-lighting plants also operate street railways. From 1901 to 1911 the number of cities with electric railways has increased from eleven to forty, the length of lines from 72 miles to 692 miles, and the number of passengers per year from 47,000,000 to 396,000,000. Data are given of the financial results obtained by various electric companies in Japan. The history of this development is full of serious financial difficulties due to insufficient capital being provided for most of the undertakings, but the general situation has now been improved. Japan has sent many electrical engineers to the United States and Europe to study the latest methods, but there is great difficulty in instructing the workmen. This is especially true of cable factories, which are otherwise operated under favorable conditions since they are usually connected with a large copper mine, from which they get the metal at lowest price, and are also protected by a high tariff. Nevertheless, they have been unable to get rid of competition from other countries because the quality of the imported cables is generally better than that of the cables made in Japan. The manufacture of lamps has increased considerably in Japan. Some of the Japanese electric companies import certain parts from Europe or the United States and assemble them in Japan. The value of electrical

exports to Japan in 1910 was \$1,660,000 from Germany, \$1,000,000 from England, and \$2,215,000 from the United States.—*Elek. Zeit.*, Jan. 2, 1913.

**Japan in 1911.**—A. A. BRANDT.—A review of the electrical industries in Japan in 1911. There are in Japan now 6731 factories in which the machines are driven mechanically. The total rating of machinery is 817,000 hp, of which 339,000 hp is steam engines, 69,000 hp gas engines, 7000 hp oil engines, 69,000 hp water turbines, 18,000 hp Pelton wheels, 247,000 hp generators and 67,000 hp electric motors. The number of workmen in Japanese factories is 717,000, of whom only 3145 are employed in electric factories and shops. Since 1900 wages have increased by 30 or 50 per cent, so that if the smaller capacity of work of Japanese workmen is taken into account, it is no longer true to speak of the extraordinary cheapness of Japanese labor for many industries. The new high tariff of 1911 has stimulated electric manufacture considerably. Carbon lamps are made to the extent of 5,000,000 per year in three factories and, with a tariff of 40 per cent *ad valorem*, imports have become impossible. Metallic-filament lamps are used only to a small extent in Japan. Most central stations have a flat rate and exchange lamps free of charge. However, the increase of load will cause the central stations to adopt a meter rate and to adopt metallic-filament lamps. At present about 500,000 metallic-filament lamps are made in Japan, the filaments being imported from the United States. In 1909 there were 111 electric lighting companies, with a capital of \$28,000,000. This increased in 1910 to 122 companies, with a capital of \$61,000,000. The reserve funds are in no proper relation to the invested capital. The reserve averages 5 per cent for central stations and 2 per cent for railways. The number of electric railway companies was thirty-four in 1910, with an invested capital of \$47,000,000, and forty in 1911, with an invested capital of \$80,000,000.—*Elek. Zeit.*, Jan. 2, 1913.

**British Central Station Account.**—An abstract of last year's financial report of the municipal electric supply station at Bolton. The coal strike has had considerable effect, the cost of fuel per kilowatt-hour increasing from 0.54 cent to 0.64 cent and the total generating expense from 0.86 cent to 0.96 cent. The distribution expense was 0.6 cent, the management expense 0.08 cent, the total cost exclusive of capital charges 1.24 cents, and the total cost including capital charges 2.18 cents (against 2.16 cents the year before). The net revenue per kilowatt-hour was 2.54 cents (against 2.68 cents).—*London Electrician*, Jan. 3, 1913.

### Wires, Wiring and Conduits

**High-Tension Cable.**—L. LICHTENSTEIN.—An illustrated description of the high-tension cables on the single-phase railway from Dessau to Bitterfeld. The energy is transmitted from the power plant to the substation at 66,000 volts, and for this purpose there are available not only the overhead line but two underground cable lines, one of the latter being built by the Siemens-Schuckert company and the other by the Felten-Guilleaume company. Each of these three lines is sufficient to transmit the whole energy so that two lines are always held in reserve. The operation was begun in April, 1912, and since that time energy has been transmitted alternately over the two cable lines for periods of a week each, while the overhead line has been held in reserve. The distance of transmission is 4.3 km (2.5 miles). Each cable line, therefore, consists of about 8.6 km (5.2 miles) of single-core cables. Fig. 2 shows the cross-section of the cable of the Siemens-Schuckert company. The dimensions are given in millimeters (1 mm = 39.4 mils). The conductor is an aluminum wire strand of 100 sq. mm (0.155 sq. in.) cross-section. The dielectric consists of impregnated paper and has a thickness of 13 mm (0.5 in.). Around the paper insulation is a lead armor covered with a layer of lime with a coating of asphaltum and lime. The permissible current is 240 amp; for this

current the increase in temperature, when stationary condition has been reached, is 25 deg. C. The cable can transmit continually 14,400 kva. The same heating conditions and the same voltage drop could have been obtained with cable using a copper conductor of 57 sq. mm (0.088 sq. in.) cross-section. Aluminum was chosen in order to increase the diameter of the cross-section of the conductor

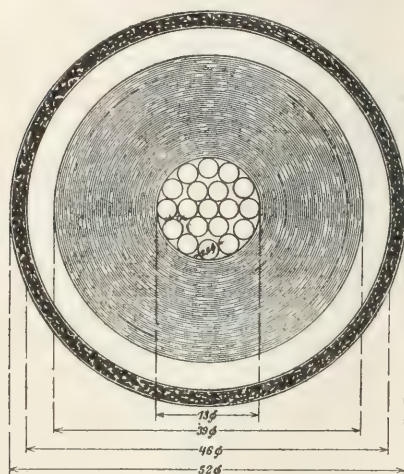


FIG. 2—CROSS-SECTION OF THE CABLE

for the purpose of decreasing the effective electric field intensity at the circumference of the conductor. This is with aluminum 4200 effective volts per millimeter, while with copper it would have been 4790 volts per millimeter. The difference is 14 per cent. Of course, when using the copper conductor it would have been possible to get the same value of the electric field intensity by increasing the thickness of the dielectric. If that had been done, the internal diameter of the lead armor would have been 42.9 mm instead of 39 mm. The cable was made in lengths of

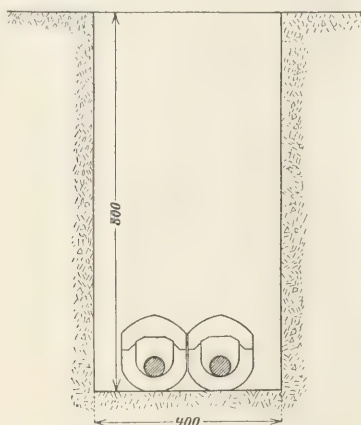


FIG. 3—METHOD OF LAYING CABLE

750 m (2460 ft.). Tests of the cable made in the cable works show the insulation resistances at 15 deg. C. to be 3000 megohms per kilometer, the resistance at 15 deg. C. to be 0.275 ohm per kilometer, and the capacity to be 0.169 microfarad per kilometer. From this it follows that the dielectric constant of the insulating material is 3.35. The method of laying the cables on the ground is shown in

Fig. 3. Each cable is placed in a stoneware pipe filled with sand. After the cables had been laid underground the capacity was found to be 0.1705 mf per kilometer, the insulation resistance 8620 megohms per kilometer and the resistance 0.265 ohm per kilometer. From this value of the resistance it follows that the temperature of the cables in the ground is 4 deg. C. (39 deg. Fahr.). This is in good agreement also with the high insulation resistance of 8620 megohms per kilometer (against 3000 in the test in the plant). After continuous use for a year and a half there was an accident to a high-tension transformer, and the use of the cable had to be discontinued temporarily. A fault was found in the transformer and in the cable. On this occasion the electric constants of the cable were re-determined and it was found that they had not changed at all in the year and a half they had been in operation and that the cable was otherwise in good condition. The fault must, therefore, have been due to external forces. This is also probable because the other cable developed a fault shortly afterward, while both cables have since operated to perfect satisfaction.—*Elek. Zeit.*, Jan. 2, 1913.

### Electrophysics and Magnetism

*Electrified Particles Passing Through Matter.*—N. BOHR.—A paper in which the theory of the decrease of velocity of moving electrified particles in passing through matter is given in a form such that the rate of the decrease in the velocity depends on the frequency of vibration of the electrons in the atoms of the absorbing material. It is shown that the absorption of alpha rays in the lightest elements can be calculated from the information about the number and frequencies of the electrons in the atoms which is obtained from the theory of dispersion, and that the values are in good agreement with experiment. For elements of higher atomic weight, it is shown that the number and frequencies of the electrons to be assumed, according to the theory, in order to explain the absorption of alpha rays are of the order of magnitude to be expected. It is further shown that the theory can account for the form of the relations between the velocity of the rays and the thickness of matter traversed, found by experiments with cathode and beta rays. The absolute agreement as to the magnitude of the constants entering in the relations in question is very good for the fastest beta rays, but not so good for slower beta rays and for cathode rays—a fact which may be due to the very difficult experimental conditions for these latter rays. Adopting Rutherford's theory of the constitution of atoms, it seems that it can be concluded with great certainty, from the absorption of alpha rays, that a hydrogen atom contains only one electron outside the positively charged nucleus, and that a helium atom contains only two electrons outside the nucleus. The latter was necessarily to be expected from Rutherford's theory.—*Phil. Mag.*, January, 1913.

*Non-Newtonian Mechanics.*—RICHARD C. TOLMAN.—A mathematical paper in which it is shown that the Einstein transformation equations and the other principles of non-Newtonian mechanics lead to a number of further transformation equations for acceleration, mass, rate of change of mass and force. The transformation equations of force are identical with those chosen by Planck. Two applications of the transformation equations are given. By combining them with Coulomb's law, the expected equations are derived for the force with which an electric charge in uniform motion acts on any other charge, and by combining them with Newton's law a new expression is derived for the gravitational force with which a particle in uniform motion acts on another.—*Phil. Mag.*, January, 1913.

### Electrochemistry and Batteries

*Storage Battery.*—A note on a recent British patent (No. 29,318, Dec. 27, 1912) of W. Clark (Compagnie Internationale des Accumulateurs Vedeka). Cells of high capacity and light weight are made by supporting the active material



by a foraminous structure of insulating material provided with conducting wires for distributing the current throughout the mass of active material. Each electrode is enveloped in a pyroxylin porous sheath, foraminous separators being interposed between adjacent plates of opposite polarity. The whole assemblage of plates and separators is maintained under yielding pressure applied normal to the contiguous surfaces of the electrodes and separators. The construction of the active parts of the plates is described, and in order to increase the mechanical strength nitrated cotton threads treated with acetone may be embedded in them, about 5 per cent of caustic soda or potash is added, and a treatment with ammonia to get porous lead, yet of increased hardness, is applied.—*London Elec. Eng'g*, Jan. 2, 1913.

**International Electrotechnical Commission.**—SILVANUS P. THOMPSON.—A paper read before the (British) Institution of Electrical Engineers on the aims and the work of the International Electrotechnical Commission. "It cannot but be admitted that the generous support which the commission is meeting with in the various countries and the cordial way in which the delegates are conducting their deliberations are bound to lead to useful and practical results. The promotion of a better understanding between electricians of various nations by general agreement as to terminology, symbols and the classification of electrical machinery is sure to foster the free development of international trade and to be a general benefit both to the purchaser and to the maker. Last, but by no means least, these regular international gatherings, during which national prejudices are laid aside and at which many lasting friendships are made between electricians of different nationalities, must undoubtedly be a not unimportant factor in furthering the peace of the world."—*London Electrician*, Jan. 3, 1913.

#### Units, Measurements and Instruments

**The "Kelvin."**—PERCY GOOD.—The British Board of Trade unit, or kilowatt-hour, is 3,600,000 joules, and it had been proposed to give it the name "kelvin." This has not been done, as it seemed unlikely that it would be universally accepted. The writer suggests that 10,000,000 joules be called one kelvin; so that 10,000,000 ergs = 1 joule, and 10,000,000 joules = 1 kelvin. The kelvin is thus a mechanical as well as an electrical unit. The effect in practice would be to convert a present price of 8 cents per kw-hr., or unit, to 22 cents per kelvin. In an editorial on the standardization of the terms it is thought that this would be hardly worth while. "We have ohms, but nobody seems to wish for a special name to indicate either megohms or microhms, and even the joule is not very popular." Kelvin's name might be used in connection with a thermodynamic scale of temperature, or "if Kelvin's name is to be honored electrically let it then be used to indicate a quantity for which a name is really desired. For example, there is no name in general use for conductance. The mho has never been popular, and everyone will admit that 'reciprocal ohm,' although correct, is cumbersome."—*London Electrician*, Dec. 27, 1912.

**Induction Balance.**—JOHN P. DALTON.—A mathematical notice on the energetics of the induction balance, giving a simple general formula for the case in which each arm contains resistance, inductance and capacity, the capacity being shunted across part of the arm only. The general formula derived by the author is applied to methods for comparison of inductances, comparison of capacities and comparison of an inductance with a capacity.—*Phil. Mag.*, January, 1913.

**Shop Testing of Electrical Apparatus.**—The first of a series of articles describing in detail present-day practice in the testing of various types of electrical apparatus. In the present instalment the use of meters and temperature tests are discussed.—*Elec. Journal*, January, 1913.

**Exhibition of Apparatus.**—The conclusion of a description of the various electrical exhibits at the recent annual

exhibition of scientific and technical apparatus of the Physical Society in London.—*London Electrician*, Jan. 3, 1913.

#### Telegraphy, Telephony and Signals

**Directive Wireless Telegraphy.**—F. ADDEY.—A paper read before the (British) Institution of Post Office Electrical Engineers. After a brief survey of different types of directive aerials, the author proceeds to discuss their chief uses—namely, (1) to increase the range of a wireless station; (2) to enable ships to obtain the bearings of wireless stations on shore. The methods of Marconi and of Bellini and Tosi are described. Two methods by which a ship can herself take her bearings by wireless telegraphy are given—(1) the telefunken; (2) the Marconi wireless compass. Some description is given of the equipment on the steamship *Onward*. Finally, the utility of the methods described and some of the conditions necessary for success are discussed.—*London Electrician*, Dec. 27, 1912.

#### Miscellaneous

**Lightning Protection of Buildings.**—E. J. BERG.—An article discussing the theory of protection of buildings against lightning. The author deals with the electric constants of lightning rods, the electric characteristics of lightning itself, the principal uncertainties in the theory, and gives some practical hints on installing lightning rods.—*Gen. Elec. Review*, January, 1913.

**Belt Accidents.**—W. O. HORSENAILL.—An article on belt accidents and their bearing upon individual electric drive.—*London Elec. Review*, Dec. 20, 1912.

## Book Review

**RADIOTELEGRAPHISCHES PRAKTIKUM.** By H. Rein. Berlin: Julius Springer. 214 pages, 170 illus. Price, 8 marks.

Engineers engaged in wireless telegraphy work have often felt the want of a laboratory manual which would cover more or less completely the subject of high-frequency current measurement. In this book the author has aimed to cover the subject, and it will form for wireless engineers a welcome addition to their literature. The author gives a number of methods for the determination of the various constants which are of importance in wireless telegraphy inductance, capacity, wave-length, damping, etc. He also gives a brief discussion of the various apparatus necessary for the equipment of a commercial station. He does not enter into a theoretical discussion of measurements, but gives only a brief description of each method, illustrated with diagrams and the final formula. We believe, however, that the book could have been made of much greater value if the author had pointed out briefly the relative advantages of each method, under what conditions any particular method is to be used in preference to others, and the degree of accuracy that may be expected from the different methods in the measurement of any particular constant. As it is, the experimenter will be obliged to consult other reference books to ascertain these points, and the uninformed experimenter will be somewhat at a loss to know which method to use in any particular case.

The book is fully illustrated, having a large number of diagrams and photographs of commercial apparatus, but the apparatus described is mostly of German make. The American work on subjects related directly or indirectly to wireless telegraphy has been ignored entirely. We note, for instance, that in the discussion of high-frequency alternators the work of Fessenden and Alexanderson is not considered, though it is well known that the General Electric Company has built several 200,000-cycle alternators which have been in actual operation for some time. In the bibliography on the subject of inductance the work of the United States Bureau of Standards is not mentioned.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Large Direct-Current Units for Cleveland Company

In the heart of the city of Cleveland lies a compact area in which there is a heavy demand for direct-current energy combined with a large market for steam heating during the winter months. In order to care for this special set of conditions the Cleveland Electric Illuminating Com-

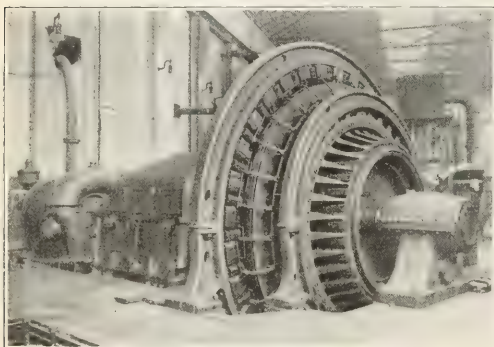


FIG. 1—3750-KW TURBO-GENERATOR SET

pany maintains a generating station in this district and uses the exhaust steam from the turbines for heating. The accompanying illustration shows the latest addition to this plant. This turbo-generator set, which was designed and manufactured by the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company, of

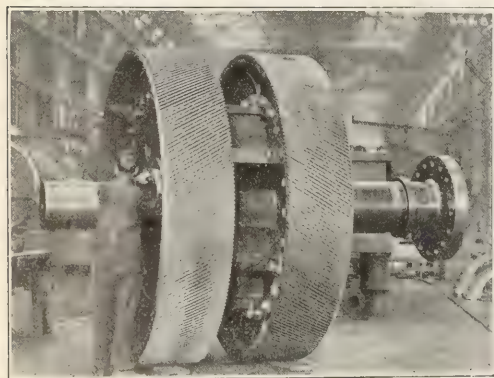


FIG. 2—LARGE REDUCTION GEAR OF 3750-KW TURBO-GENERATOR SET

East Pittsburgh, Pa., is the largest direct-current unit of the kind yet constructed, the rating of the generator being 3750 kw.

The operating speed of the turbine is 1800 r.p.m., and since it is impossible in the present state of the art to build a generator of this size which will be able to operate at high speeds a reduction gear has been interposed be-

tween the two machines. The reduction ratio of the gear is 1 to 10. The large gear of this speed-reducing mechanism shown in Fig. 2 is 100 in. in diameter and has 259 teeth. The pinion has twenty-six teeth, and the ratio of 26 to 259 gives the "hunting-tooth" feature which has been recognized as desirable in the design of toothed gearing. The speed of this gear at the pitch line is approximately 54 miles an hour. At full rated load of the generator the gear transmits 5350 brake-hp, and on several occasions during overloads it has carried 6000 brake-hp without giving any indication that its ultimate safe output had been reached.

The dynamometer feature of the floating-frame construction provides a check upon the accuracy of the electrical instruments that measure the generator output. In this

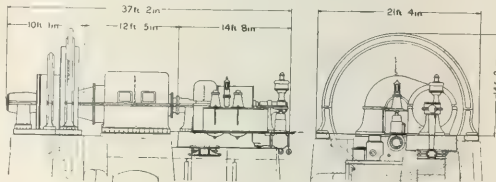


FIG. 3—SIDE VIEW AND END VIEW OF TURBO-GENERATOR SET

station a considerable error in the calibration of the wattmeter was detected by comparing its readings with those of the power indicator on the floating frame.

A second unit, which is an exact duplicate of the one that has been installed, is now being erected in the same station, and it is expected that it will be put into active operation in the near future. The line drawing shown in Fig. 3 gives a good general idea of the relative size and proportions of these units.

### Engine-Room Alarm Equipment

The accompanying diagram shows the circuit arrangement of an electric engine-room alarm system which has recently been put upon the market by the Acme Electric Company of Knoxville, Tenn. In this system electric thermostat units are employed in connection with contact alarms, the former being used on bearings and generator frame and the latter on engine governors and circuit-breakers. For the thermostat units a hole 0.5 in. by 1 in. is drilled in the castings of each bearing and at suitable places in the frame. A coil of insulated iron wire incased in a brass tube is sealed in each of these holes and the coils are then connected in series with each other and with an adjustable relay, a milliammeter and an adjusting coil and are supplied with energy from some constant-voltage source of direct current. The resistance of the circuit varies with the temperature of the iron wire coils and this changes the value of the current in the milliammeter. The relay circuit carries about 0.3 amp. continuously, and the relay is set so that when the current value falls to 0.25 amp the spring tension overcomes the relay and closes the alarm-bell circuit. It is claimed that the current taken by the thermostat coils is so small that the heating effect produced by it is negligible, and it is further stated that when the

millimeter has been once calibrated and the adjusting coil set the system requires very little attention.

A parallel circuit from the same source of direct current serves the contact devices which are connected to the main voltmeter, the engine governors and the circuit-breakers. These contacts have been so placed that the circuit is completed when the voltage or engine speed varies beyond set

operate either on alternating current or direct current and is designed for potentials of 100 volts and 250 volts.

The curves shown in Fig. 2 are plotted from the results of tests made with heaters of the different ratings operated in connection with a 40-gal. tank. These curves show the temperature of each succeeding gallon of water drawn off

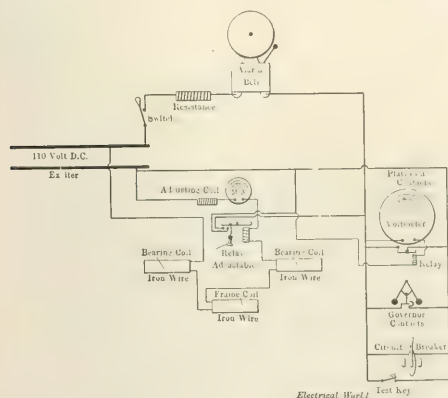


DIAGRAM OF CONNECTIONS OF ENGINE-ROOM ALARM EQUIPMENT

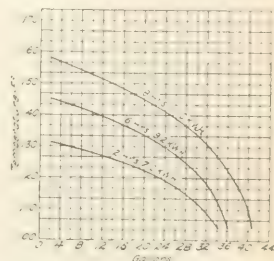
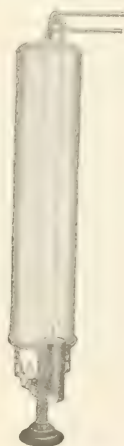
limits and when the circuit-breaker is thrown open. These contacts operate the same alarm bell as do the thermostat units. In order to preclude false alarms from the governor or voltage variations when stopping or starting the generator a single-pole single-throw switch has been placed in the alarm circuit. This switch is not closed until conditions have become stable after starting. It is claimed that this system may be used in factories and mills with a high degree of success as a detector of abnormal operating conditions.

### Domestic Electric Water Heater

The widespread use of electrically heated household utensils, and especially the introduction of electric ranges, has created the demand for a suitable means to provide hot water electrically. It is obvious that the simplest method of supplying this hot water in sufficient quantities for general purposes is to attach an electric heater to the usual 30-gal. or 40-gal. kitchen boiler, much after the fashion of the gas-heater attachments. The circulation water heater shown herewith is a small attachment applicable to any tank. The water circulates naturally from the bottom of the tank through the heater and up to the top of the tank.

The heater consists of a hollow, closed cast-iron cylinder, with a hole at the top and one at the side for the water-pipe connection and one in the bottom for the heating unit. A dead-end steel tube, inserted through the bottom hole, provides a receptacle for the heating unit. The unit can be readily removed by unscrewing the porcelain terminal block. This device is furnished in 600-watt, 1000-watt and 2000-watt sizes and can be used intermittently or left continually in the circuit. It is claimed that when used intermittently the 2000-watt size is most satisfactory, the 600-watt size being most suitable for continuous service.

To prevent the water from cooling rapidly it is well to cover the tank with magnesia asbestos slabs or hair felt about 2 in. thick and to apply a thin layer of magnesia cement to fill up the cracks between the slabs. A canvas covering which may be either sewed together or glued should be placed over the lagging. The pipes may be covered with standard pipe covering. The heater will



FIGS. 1 AND 2—ELECTRIC HEATER AND PERFORMANCE CURVES

after the heaters have been in operation for the various periods of time. They are based on the assumption that the water enters the tank at 50 deg. Fahr. and that the tank has a thermal insulation of 2 in. of hair felt. This heater is manufactured by the General Electric Company.

### Electrically Controlled Draft Regulation for Steam Boilers

In order to facilitate the operation of steam boilers using a very cheap grade of coal, the Diehl Manufacturing Company, of Elizabethport, N. J., has evolved a system for controlling forced draft and for acting in connection with the natural draft of the furnaces. The apparatus is electrically energized and automatically controlled and purports to be an economical addition to any boiler room. A multi-vane fan connected to a main shaft and driven by a vari-



FIG. 1—ENGINE-DRIVEN BLOWER

able speed motor furnishes the air for the forced draft. Arrangement is also made for connecting a relief motor or a steam engine to the shaft in times of emergency. The driving motor is a shunt-wound machine inclosed with wire screens to guard against the dust and dirt so prevalent in a boiler room. A contactor panel and an automatic motor starter are the other necessary adjuncts to this system.

When the steam pressure in the boilers has reached a point above normal pressure the regulator piston shown in Fig. 2 will be at the extreme end of its stroke. The piston in this position brings the contact levers into operation and stops the motor. As soon as conditions demand higher steam pressure the movement of the regulator is transmitted through chains to the two circular contacts, which close

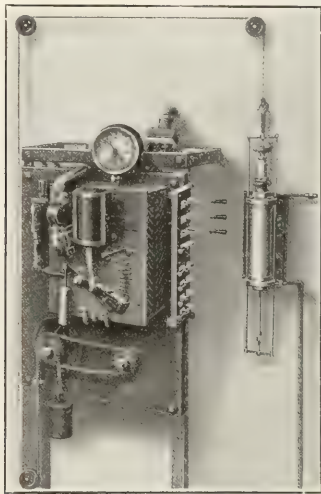


FIG. 2—REGULATOR PISTON AND ELECTRIC CONTROL APPARATUS

the clapper switch and operate the starter. The motor starts at the minimum available speed, and when the heavier draft is required a higher speed is attained by the automatic manipulation of the motor-field resistor, which is located behind the switchboard. A series of small limit switches attached to the panel allow the maximum and minimum speed adjustments to be made at will.

### Exhibits at Peoria Electrical Show

The general illumination for the Peoria (Ill.) Electrical Show held at the Peoria Coliseum Jan. 18 to 25 was furnished by fifty-six "urnolite" fixtures suspended from the roof girders of the building and underneath the balconies. These fixtures, made by the Holophane Works of the General Electric Company, consist of bowls or urns, 15 in. in diameter, of white Velaria glass, and each one contains a 400-watt tungsten lamp. The "urns" are of ornamental design, and, when lighted, present the pleasing appearance of softly glowing alabaster.

A handsome Rambler gasoline automobile was shown, particularly on account of the automatic electric equipment of the United States Light & Heating Company for self-starting, ignition and lighting.

Among the exhibitors were the Apex Appliance Company, Chicago (washing machines); W. B. Brown Company, Bluffton, Ind. (wooden lighting fixtures); Central Telephone & Electric Company, St. Louis; Chicago Fuse Manufacturing Company, Chicago; Holophane Works of General Electric Company, Newark, Ohio; International Correspondence Schools, Scranton, Pa.; Kinetic Engineering Company, Philadelphia (organ blower); M. Klein & Sons, Chicago (tools); C. S. Knowles, Boston (switches and sockets); Lindstrom-Smith Company, Chicago (heating devices); Mills Electric Company, Peoria; 1900 Washer Company, Binghamton, N. Y.; Palmer Electric Company, Peoria; Pass & Seymour, Solvay, N. Y. (sockets); Pelouze

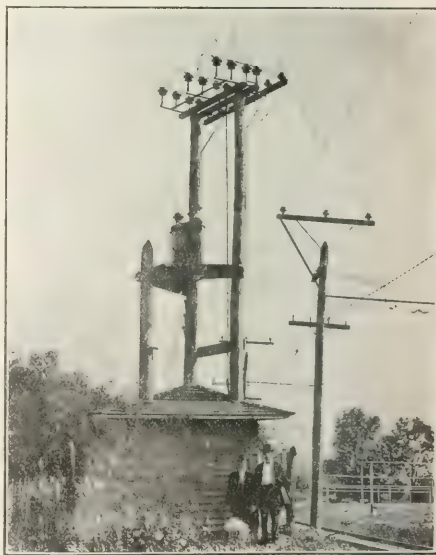
Manufacturing Company, Chicago; Retherford Brothers Company, Muncie, Ind. (fixtures); Robbins & Myers Company, Springfield, Ohio (fans and small motors); Thordarson Electric Manufacturing Company, Chicago.

The Peoria Gas & Electric Company and the Illinois Traction Company were the utility companies exhibiting, the latter, as mentioned elsewhere, showing an operating installation of electric block signals made by the Union Switch & Signal Company, of Swissvale, Pa.

A daily paper, the *Electrical Show News*, was printed in an exhibit space and distributed to visitors. Mr. H. E. Gates was the editor.

### Electricity on the Farm

Near the city of Marietta, Ohio, on the banks of the Muskingum River lies the 60-acre farm of Mr. W. W. Mills, a Marietta banker who is vice-president of the Parkersburg, Marietta & Interurban Railway Company. It has been the endeavor of the owner of this choice bit of river valley to make it one of the best equipped and most modern farms in the land. The interurban company's transmission line paralleling the river made the problem of obtaining electrical energy a comparatively simple one. It was only necessary to tap the 22,000-volt line, install a transformer and switching apparatus and distribute the energy at low voltage for various applications about the premises. The accompanying illustration shows the simplicity of the installation, which consists of a three-phase, 60-cycle, 15-kva standard outdoor-type transformer, giving 110 volts or 220 volts on the secondary. The small building contains the switchboard, a watt-hour meter and the auto-starter for a 10-hp motor, which is located about 1200 ft. away on the river bank. The motor is used for pumping water into a tank located



TRANSFORMER STATION FOR A FARM

just back of the house. When desired, the pump may also be used for irrigating the truck farm. This operation is accomplished by allowing the water to flow by gravity through piping which is perforated at intervals to spray the water over the land. For convenience in the home there have been installed electric toasters, stoves, irons, a vacuum cleaner, sewing-machine motor and washing machine.



Besides adding to the comforts and convenience of the owner this installation has proved to the officials of the railroad company that it is entirely feasible to tap the transmission line, which has been used only for supplying energy to the railway for motor and lighting service. By this means it is possible to supply energy in a number of small towns and to derive considerable additional revenue. The transformer for this installation was furnished by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

### Commercial Electric Vehicles at the New York Auto Show

At the dual automobile show held in New York during the week eight manufacturers of commercial electric vehicles have had their trucks on exhibition. The exhibits of these manufacturers were grouped on the first floor of the New Grand Central Palace and surrounded by their more numerous gasoline competitors. At the Madison Square Garden show the entire first floor was given over to gasoline trucks and the balconies were occupied by the displays of the manufacturers of automobile accessories. The features of the various commercial vehicles are outlined in what follows.

ATLANTIC VEHICLE COMPANY, of New York City, had on exhibition one 5-ton chassis. The trucks are made in 1-ton, 2-ton, 3½-ton and 5-ton sizes and are of similar construction as regards details, differing only as to dimensions. The "Exide" or "Edison" batteries are used, being carried in cradles suspended from the frame, thus permitting of loading or unloading from either side. The controller is arranged for four forward speeds and two reverse speeds. The motor is suspended from the side members of the frame by a steel cross member and drives the rear wheels through a Morse silent chain to the jackshaft and a double chain to the wheels. All wheels are mounted on roller bearings. The rear wheels are equipped with internal expanding brakes of the shoe type.

BAKER MOTOR VEHICLE COMPANY, of Cleveland, Ohio, showed one 500-lb. panel body service wagon, two 1-ton panel body trucks, two 1-ton delivery wagons and one 3½-ton truck with a post body. The accessibility of all working parts of the mechanism that need attention, adjustment or lubrication is a feature of this truck. The motor is of the four-pole series type rated at 4 hp. The standard battery equipment comprises forty-two cells of seventeen-plate lead battery. A silent chain drive is employed from the motor to the jackshaft and two roller chains from the jackshaft to the rear wheels. The wheels are fitted with Timken roller bearings and ball bearings are applied to the motor and the jackshaft. The battery is underslung to facilitate the operation of dismantling.

GENERAL MOTORS TRUCK COMPANY, Detroit, Mich., had a 3-ton chassis, a 0.5-ton delivery wagon, a 5-ton brewery truck and a 1.5-ton chassis on exhibition. The vehicles of this company differ in design from other commercial vehicles. The general differences lie in the method of mounting the battery and the drive. The battery box is a separate and independent unit of the chassis and is mounted in front of the car on top of the chassis. This arrangement renders the cells easily accessible by raising the seat and the battery cover. This method of mounting, it is claimed, gives better weight distribution. The controller, switches, meters, etc., are placed in the controller housing, where they can be instantly inspected by opening the door. A brake equipment of the double internal-expanding type is used on the rear wheels and on the driving shaft. A spring blade shaft has been used to connect the single ball-bearing motor to the driving gear, increasing the tire life and cushioning all violent strains on starting and stopping. Standard batteries and standard roller chains are used.

GENERAL VEHICLE COMPANY, of Long Island City, N. Y.,

had six machines on exhibition—a 1-ton truck with crane attachment for hoisting and a 2-ton panel-body truck, a 1-ton chassis, a 3½-ton express wagon, a 3½-ton brewery truck and a 5-ton keg truck. In all of these vehicles the battery is underslung and a double chain drive is employed from a single motor. The wagons of all sizes are built on a running gear of uniform design which has been standardized, while the bodies are adapted to the requirements of varied service. General Electric Company standard motors and controllers are employed and the battery equipment is ample for a full day's run. The countershaft consists of two short shafts connected by a differential of the spur-gear type, each shaft being connected to a rear wheel through sprockets and roller chain.

LANSDEN COMPANY, of Newark, N. J., exhibited a 750-lb. package wagon, two 1000-lb. delivery wagons, a 2-ton truck, a 3½-ton truck, the chassis of a 3-ton truck and a heavy ambulance. The feature of this exhibit was the light package wagon which this company has recently added to its line. The battery in this wagon is mounted under the driver's seat and in the front part of the wagon bed. It is stated that this car will operate at 15 miles per hour and consume only 2¼ amp-hr. per mile. The standard battery equipment consists of fifty Edison cells. The power unit has a three-point suspension and transmission is accomplished through inclosed gears from the motor to a live rear axle. This car has been designed to meet the demand for a reliable light delivery car that may be operated at high speed and low cost and has followed the general lines of the company's standard designs.

STUDEBAKER AUTOMOBILE COMPANY, of South Bend, Ind., is showing a 1000-lb. panel-body wagon, a 2-ton truck and a 1½-ton special worm-gear-drive delivery wagon which is just being put on the market. This special vehicle follows the general design of the former trucks of that company and has the single motor suspended from the chassis. The armature of the motor is directly connected to the worm of a worm and wheel drive, which transmits the power to the wheels through a short shaft and differential gearing. The car carries forty-two cells of battery and will develop a speed of 12 miles per hour. A very high efficiency is claimed for the worm and wheel drive.

WARD MOTOR VEHICLE COMPANY, of New York, had four vehicles on exhibition—a 1-ton wagon, a 1-ton wagon, a 2-ton truck and a 4-ton truck. The battery in all of these vehicles is underslung. The smallest wagon has a single motor with silent chain drive to the countershaft and double roller chain drive to the rear wheels. Two brakes and a continuous-torque controller are provided. The steering gear is of the lever type.

WAVERLEY COMPANY, of Indianapolis, had on exhibition a 1000-lb. chassis, a 1000-lb. delivery wagon, a 5-ton brewery truck and in addition to these a convertible roadster. In all of the lighter vehicles of this company the motor shaft runs parallel to the rear-wheel shaft and is connected thereto by herringbone gears. The battery is underslung. For the heavier types of cars final chain drive is provided.

### Ignition System for Gasoline Engines

The Western Electric Company has recently placed on the market a device known as a "synchronizer" intended to take the place of a magneto for gasoline automobile ignition service. With the synchronizer it is said to be possible to obtain either a vibrating or a non-vibrating spark, so that the engine may be started on the vibrating and run on the non-vibrating spark. A dash-back switch is used and all adjustments may be made from the driver's seat. There are no moving cables and no platinum points under the distributor, the circuit being broken in the switch. These features, the manufacturer claims, simplify the maintenance problem considerably.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Western Electric's Exhibition Conference.**—In order to afford its salesmen more intimate contact with the products they are selling, the Western Electric Company held an exhibition at the Masonic Hall, New York, Jan. 22 to 24, inclusive, at which samples of all of the materials which the company handles as a jobber were shown. Over one hundred salesmen from the New York, Boston, Buffalo, Philadelphia and Pittsburgh branches of the company were present. The exhibition was under the direction of Mr. E. W. Rockafellow, general supply sales manager of the company. The room in which the exhibit was held was well adapted for the purpose, being a corner one about 160 ft. long by 60 ft. wide, with many windows. Along the four sides were tables containing a complete line of the electrical supplies and apparatus sold by the company in its jobbing capacity, while on posts along the middle of the room were revolving panels bearing a large variety of small electrical supplies, all of these exhibits being under the immediate supervision of a representative of the manufacturing company that made them. The exhibition was opened on Jan. 22 at 9 a. m. by Mr. Rockafellow, who gave a short address outlining the purpose of the exhibit, and from 9:15 a. m. until noon the salesmen visited the exhibits. As only three salesmen were allowed at one booth at one time, all had ample opportunity to examine each piece of apparatus minutely and to discuss its merits and improvements in its design. From 12:30 p. m. until 1:30 p. m. luncheon was served in the Masonic Club restaurant, the privileges of which were extended to the company during the exhibition. After luncheon and until 5:30 p. m. visits were made at the various exhibits, and a lecture was delivered by Mr. A. F. Crosby, of the American Cross Arm Company. The program on Thursday was substantially the same, with the exception that from 4 p. m. to 7 p. m. the exhibit was open for the friends and customers of the salesmen. In this way the exhibition became a miniature electrical show, differing from the usual electrical show in that the exhibits offered something more particularly of interest to the electrical trade than to the general public. The session was brought to a close on Friday night with an informal banquet at the new Hotel McAlpin. During the three days the salesmen were obliged to do more than merely look at the exhibits. As each man entered the room on Wednesday, the opening day, he received an envelope containing some thirty-three cards. Upon each of these cards was the salesman's name and the name of one of the manufacturers whose products the Western Electric Company handles, together with the number of the booth at which this manufacturer's product was on view. Each man was required to visit each exhibit, submit to the manufacturer's representative the card bearing that manufacturer's name, and was then questioned by the manufacturer's representative as to his knowledge of the product. He also had his own questions answered by the representative. The card was then left by the Western Electric salesman with the manufacturer's representative, who marked upon it in a ruled space what part of the Western Electric sales department the salesman belonged to—whether telephone, supply or otherwise—together with his impression of the salesman's knowledge of that particular line. In other words, he noted whether, in his opinion, the salesman was well or only fairly well informed on this line of equipment. In this way a record was made of each man's visits to the various exhibits and of his knowledge of each class of material that the company handles. On Friday afternoon from 1 to 4:30 o'clock an oral examination was held by the exhibition committee, a list of whose members appears below. Each man was asked what each piece of equipment is for, how it works, etc. The replies and the opinions of the manufacturers' representatives, as obtained from the

cards, will be taken into consideration by the committee in determining each man's standing with the company. The exhibit will be taken next to Chicago so that the men from the central district can participate in its benefits, and will then be shown in the company's other districts. The committee consisted of M. A. Oberlander, P. L. Thomson, G. A. Knoche, Gregory Brown, W. A. Schnedler and H. R. King, the latter being chairman. Among the exhibitors were the American Electric Heater Company, American Ever Ready Company, American Washer Company, Benjamin Electric Manufacturing Company, Bryant Electric Company, Crouse-Hinds Company, D & W Fuse Company, Thomas A. Edison, Inc., Edwards & Company, Electric Storage Battery Company, Electroce Manufacturing Company, General Electric Company, Harvey Hubbell, Inc., Habirshaw Wire Company, Holophane Works of General Electric Company, Hubbard & Company, Mathias Klein & Sons, W. N. Matthews & Brother, National Metal Molding Company, Pittsfield Spark Coil Company, Phillips Insulated Wire Company, Stanley & Patterson, B. F. Sturtevant Company, Sunbeam Lamp Company, Taunton-New Bedford Copper Company, Tungstolier Works of General Electric Company, Western Electric Company (telephone apparatus), Westinghouse Electric & Manufacturing Company and Weston Electrical Instrument Company. Among the well-known men in the electrical trade who visited the exhibits were Gerard Swope, H. A. Halligan, W. P. Sidley, A. L. Salt, O. D. Street, F. V. Bennis and E. W. Rockafellow, of the Western Electric Company; L. W. Downs, of the D & W Fuse Company; J. B. Olson, Habirshaw Wire Company; B. H. Scranton, American Electric Heater Company; Claude Matthews, W. N. Matthews & Brother; W. C. Bryant, Bryant Electric Company; W. F. Hillis, Crouse-Hinds Company; R. Edwards, Jr., Edwards & Company; George L. Patterson, Stanley & Patterson, and Samuel A. Chase, Westinghouse Electric & Manufacturing Company.

**Going Ahead with Barcelona Hydroelectric Developments.**—Although progress has been retarded somewhat by the unsettled conditions that have prevailed in the foreign money markets in the past few months, construction is now going forward actively on the hydroelectric developments of the Barcelona Traction, Light & Power Company, Ltd., on the Segre River, a tributary of the Ebro River, about 100 miles from Barcelona, Spain. As has been noted in these columns, this company was organized in September, 1911, under Canadian laws, by the Pearson interests, to construct and operate central-station and traction systems in Barcelona and the northeastern part of Spain. The company has an authorized capital stock of \$25,000,000, all of which is outstanding. There are to be five hydroelectric stations along some 30 miles of the Segre River, each of which will have a rated output of between 50,000 hp and 60,000 hp. The heads under which they will operate will range from 50 ft. to 600 ft. Construction of the dam for the first development is now well under way, and foundation work on the dam for the second development has been started. Energy will be transmitted at 110,000 volts to Barcelona and the industrial territory surrounding it. The majority of the factories are using steam power at present. The cost of coal, it is said, is very high owing to the antiquated condition of the Spanish transportation facilities. The Pearson interests believe, therefore, that they will have very little difficulty in disposing of the low-cost energy from their hydroelectric stations under these conditions. The railroads have been a great handicap in the construction of the stations for the reason that the cars have not been large enough to transport generators, waterwheels and other heavy equipment to the developments, nor have the tunnels sufficient



clearance to permit passage of the latter had the cars been of adequate size. A large part of the equipment has been hauled by teams the greater part of the way from Barcelona. As is stated elsewhere in this issue, orders have been placed with several American steel firms for the transmission towers that will be used on this project.

**Boston Edison Earnings Increasing.**—The Edison Electric Illuminating Company of Boston reports gross earnings for December, 1912, of \$655,562, an increase of 12.6 per cent over the same month in 1911; net earnings of \$415,928, compared with \$376,593 for the same period, or a gain of 10.4 per cent, and for the last six months of 1912 a gain in gross of 9 per cent, or from \$2,770,126 to \$3,020,126. The gain in net for the last half of the year compared with the same period in 1911 was \$73,578, or 4.53 per cent, the net for the last half of 1912 being \$1,698,709. The company's operating expenses for the period increased 15.4 per cent. In the field of new service applications the company is making rapid strides and is doing much work along the lines of modernizing window lighting installations besides adding constantly to its connected load. All the daily newspapers in Boston and many of the suburban weeklies are now being supplied by the Edison company with energy for lighting and motor service. In the long-hour lighting field the company is supplying many steam railroad stations, all-night restaurants, public clocks and real-estate illuminated billboards with service, and the application of its new miscellaneous rates for energy, including off-peak service, is being favorably received throughout its 600 sq. miles of territory.

**English Bankers Making a Tour of American Utility Properties.**—Following their arrival in New York on the *Mauretania* last Sunday, a party of eight London bankers, including E. Mackay Edgar, the active head of Sperling & Company, of London, left on a special train on Thursday for a two weeks' tour of the country for the purpose of inspecting various public utilities, some of which have been financed in part by banking houses represented by the visitors. James Mitchell, president of the Alabama Interstate Power Company, who came over from London with the party, W. W. Freeman and F. Darlington, vice-president and consulting engineer respectively of the same company, have also gone with the visitors on the tour. The itinerary includes Montreal, Toronto, Niagara Falls, St. Louis, Joplin, Denver, Keokuk, Nashville, New Orleans and Birmingham. Among the properties to be visited are those of the Utilities Improvement Company, the Cities Service Company, the Mississippi River Power Company, the Consolidated Cities Traction, Light & Power Company, the American Cities Company and the Alabama Interstate Power Company. It is understood that after their return to New York the visitors plan to inspect the public utilities of Mexico and Cuba before leaving for home.

**Award Contracts for Transmission Towers.**—The Blaw Steel Construction Company of Pittsburgh has received an order calling for 3000 tons of steel transmission towers from the Pearson Engineering Corporation, 115 Broadway, New York, and an order for 575 tons of towers has also been placed by the same interests with the Ritter-Conley Manufacturing Company of Pittsburgh. Some of these towers will be shipped to Barcelona, Spain, where the Pearson company is constructing extensive hydroelectric developments, as noted elsewhere in this issue, and the rest will go to Brazil, where the purchasers have large central-station interests. The Blaw company has also received an order for 200 tons of transmission towers to be used by Stone & Webster at Keokuk, Ia., for the system of the Mississippi River Power Company. The Utah Power & Light Company has placed an order with Milliken Brothers, New York, for 4500 tons of steel towers.

**Control of Eastern Pennsylvania Power Company May Change Hands.**—A proposition to exchange their holdings for securities of the Atlantic Gas & Electric Company, a new concern that has been chartered under the laws of Connecticut with an authorized capitalization of \$37,500,000, has been made to the stockholders of the Eastern Pennsylvania Power Company, which controls the gas and electric-service companies of Easton, Pa., Phillipsburg, N. J., and those in a number of other cities. It is also stated that

Meikleham & Dinsmore, engineers and bankers, 25 Broad Street, New York, who have the controlling interest in the Eastern Pennsylvania company, have disposed of their holdings to the Atlantic Gas & Electric Company. A representative of Meikleham & Dinsmore said this week that the entire matter was in a formative stage as yet and that nothing of a definite nature was available for publication at this time. He admitted, however, that an exchange proposition had been made to the stockholders by the new company.

**Extensions for the Tri-City Company.**—The Tri-City Railway & Light Company, of Davenport, Ia., has purchased from the Westinghouse Electric & Manufacturing Company a 12,500-kw Westinghouse-Parsons horizontal turbo-generator. The generator is wound for two-phase, 4800-volt, 60-cycle current. A Westinghouse-LeBlanc surface condenser and other auxiliary equipment are included in the order. This unit is probably the largest in the country to be installed for the service of cities no larger than Davenport, Rock Island and Moline. The present rating of the company's station is 20,000 kw, and the new unit will take over a portion of the load, leaving a number of smaller machines in reserve. To accommodate the 12,500-kw machine an addition to the station will be necessary.

**Changes in J. S. & W. S. Kuhn, Inc.**—James S. Kuhn has resigned as president of the bond house of J. S. & W. S. Kuhn, Inc., which, as is well known, has extensive interests in the public-utility field. He has been elected chairman of the board of directors. L. L. McClelland has been elected president. W. S. Kuhn remains as vice-president, while A. B. MacCaughy, Western manager at Chicago, has been made an additional vice-president, and will continue in charge of the Western business. W. G. Audenried, manager of the Philadelphia office, has been made a vice-president, and will take charge of the company's foreign business, with headquarters in Paris.

**Westinghouse, Church, Kerr & Company Engagements.**—Among new work for which Westinghouse, Church, Kerr & Company are engineers and constructors is the design and construction of a power house for a hotel at White Sulphur Springs, W. Va. The building is of brick and concrete. Overhead coal bunkers, a 150-ft. steel stack and mechanical stokers are being erected. A large amount of general engineering work, including bridges, piers and railroad extensions, is being carried on at the present time by these engineers.

**To Consolidate Four Maryland Companies.**—Plans for the consolidation of the Frederick (Md.) Railroad Company, the Hagerstown (Md.) Railway Company, the Frederick & Hagerstown Power Company and the Frederick Gas & Electric Company are being completed. Between \$3,000,000 and \$4,000,000 will be represented in the merger. Extensive improvements are to be made to the various systems.

**H. W. Johns-Manville Company's Annual Meeting.**—A resolution reducing the number of directors from nine to seven was approved at the annual meeting of the H. W. Johns-Manville Company. The retiring directors, with the exception of George W. Gladwin, were re-elected. A vacancy that already existed on the board reduced its members to the required number.

**Central Colorado Power Reorganization.**—Announcement has been made by the reorganization committee of the Central Colorado Power that, since more than 85 per cent of the outstanding bonds affected by the reorganization plan have been deposited with it, steps will be taken immediately to foreclose on the mortgage, sell the properties and organize a new company.

**New Plant for Pacific Power & Light.**—Construction of a new 7500-kw hydroelectric station for the Pacific Power & Light Company has been started at Hood River, Ore., where the company now has a small station in operation. A transmission line will be built from The Dalles to Pendleton. The Pacific Power & Light is controlled by the Electric Bond & Share Company.

**Detroit Edison Stock Issue Approved.**—Directors of the Detroit Edison Company have authorized the issuance of \$3,000,000 new stock to stockholders at par to the amount of 30 per cent of their present holdings.



**Discredit New Rumor of Big Pacific Coast Merger.**—Negotiations have been in progress for some time between the city officials of Los Angeles, Cal., and the Southern California Edison Company, the Los Angeles Gas & Electric Company and the Pacific Light & Power Company to determine whether or not these central-station companies, which now serve that city, shall be allowed to purchase all of the energy to be generated by the hydroelectric station which has been erected in connection with the city's aqueduct project, or whether the companies shall sell their distribution systems in Los Angeles to the city so that the latter can distribute the energy generated at the aqueduct plant. It is understood that the municipal ownership of the electric-service properties is greatly favored by the people of Los Angeles. The City Council recently voted unanimously to reject several propositions submitted by the companies. Adoption of any of these propositions, the City Council held, would mean further delay in the establishment of a municipal system. Further efforts are to be made by the city to purchase the distribution systems outright. Founded probably upon this controversy, the old rumor in financial circles that the three companies are to be merged into one large concern capitalized at about \$100,000,000, with a view to thwarting by this amalgamation and its effect upon the bond markets any attempts that the city may make to finance its municipal project, has been revived. New York banking interests that have participated extensively in the financing of California public utilities did not take the rumor seriously when it was called to their attention this week. "This rumor is heard every so often upon the slightest provocation," said one man, "and, as you know, it has been heard frequently in the past few years. Sentiment in Los Angeles is very strong for municipal operation of the public utilities and the negotiations that are now being carried on between the city and the companies are undoubtedly the basis of the present revival of the merger rumor. I doubt very much whether such a merger would even be attempted now that California utilities are under commission regulation. Whether or not the companies have simply entered into some form of agreement in order to promote concerted action by them in the present municipal controversy, is, of course, a different matter."

**Geographical Distribution of Capital Stock.**—According to an analysis that has just been completed by Hodenpyl, Hardy & Company, of New York, the Commonwealth Power, Railway & Light Company, of Jackson, Mich., had 3363 stockholders on Oct. 1, 1912, who were distributed throughout thirty-five states and eight foreign countries. The name of this company appeared recently in a list of properties which, it was said, were controlled by J. P. Morgan & Company, and the analysis was conducted with a view to showing that control of the Commonwealth company is not vested in any individual or firm. The total amount of stock in the hands of the public is \$25,144,000, of which \$12,000,000 is common and \$6,000,000 preferred stock of the Commonwealth company, \$5,000,000 is preferred stock of the Consumers' Power Company, and \$2,144,000 is preferred stock of the Michigan Light Company, its subsidiaries. From the analysis, part of which is given below, it appears that nearly one-third of the capitalization is held in Michigan, that one-fourth is held in Pennsylvania, that about one-eighth is held in Rhode Island, and a similar amount in New York. In twenty-six states and the eight foreign countries less than 1 per cent. of the total capitalization is held. The distribution in the other nine states is shown as follows:

State.	No. of Stock-holders.	Per Cent.	Capitalization Held.	Per Cent.
Michigan	932	27.71	\$7,550,800	31.62
Pennsylvania	540	16.06	6,125,300	24.37
New York	346	7.31	3,844,600	15.29
Rhode Island	598	17.78	3,242,200	12.89
Kentucky	230	6.84	1,174,300	4.67
Ohio	158	4.70	792,700	3.17
Connecticut	247	7.35	646,500	2.57
Massachusetts	105	3.12	264,100	1.05
Illinois	43	1.28	192,300	.76

**Ozark Power & Water Development Nearing Completion.**—T. O. Kennedy, engineer in charge of the construction corps which is building the Ozark Power & Water Company's 15,000-hp hydroelectric station on the White River near Branson, Mo., says in a report to the Doherty

Operating Company that previous estimates as to the date of completion of the various portions of the work have been confirmed and that the power station, together with the transmission lines, will be ready for operation by May 1, 1913. The dam is now 98 per cent completed, the power house is 80 per cent completed, the power house equipment has been shipped by the manufacturers, and the 80-mile transmission line between Joplin and Springfield has also been completed, together with the substations at Joplin, Diamond and Springfield. The wood-pole line extending 30 miles south from Springfield is ready for wire and the private right-of-way for the remainder of that line, about 15 miles, is being cleared preparatory to the erection of steel towers which are now being delivered. Details of the plans of the Ozark Power & Water Company appeared in the *Electrical World*, Feb. 24, 1912.

**Kellogg Switchboard & Supply Declares Stock Dividend.**—Stockholders of the Kellogg Switchboard & Supply Company, Chicago, have authorized an increase in the capital stock from \$1,000,000 to \$2,000,000. The directors have authorized a stock dividend of 25 per cent and have also declared the regular quarterly dividend of 3 per cent, payable Feb. 3 to holders of record Jan. 31.

**Great Western Power Financing.**—Application has been made to the California Railroad Commission by the Great Western Power Company for authority to issue first mortgage 5 per cent forty-year bonds to an amount sufficient to yield \$3,971,731. The proceeds are to be used to extend its system. The Feather River dam is 40 per cent completed. The cost of work on it thus far has been about \$870,000.

**Doubling Output of Station at Sao Paulo, Brazil.**—The Sao Paulo (Brazil) Tramway, Light & Power Company, Ltd., is now installing equipment in its hydroelectric station that will double the present rated output of 30,000 hp.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Jan. 15	Jan. 22
Allis-Chalmers, 3d assess. paid.	\$17,151,100			1½	3½
Allis-Chalmers, pf., 2d assess. paid	14,034,700			4½	10*
Amalgamated Copper	153,887,900		O	72½	73½
American Tel. & Tel.	334,712,300	2 35	O	134½	135½
Electric Storage Battery Co.	16,074,425	1	O	53	53
General Electric	77,726,700	2	O	182*	142½
Mackay Cos., c.	41,380,400	14	O	85	85*
Mackay Cos., pf.	50,000,000		O	67½	67½
Western Union Tel.	79,943,400	1	O	71	71*
Westinghouse, E. & M., c.	31,685,300	1	O	73½	74½
Westinghouse, E. & M., pf.	3,998,700	1½	O	121½*	121½*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Copper:	Jan. 14		Jan. 21	
	Bid.	Asked.	Bid.	Asked.
Standard, spot	15.25		15.25	
London, standard, spot	£ s d		£ s d	
Prime Lake	69 17 6		68 17 6	
Electrolytic	16.75 to 17.00		16.25	
Casting	16.50 to 16.75		16.00	
Copper wire, base	10.25 to 16.50		15.87½	
Lead	19.00		18.00 to 18.25	
Nickel	45.00		4.35	
Sheet zinc, f.o.b. smelter	45.00		45.00	
Sheet zinc, spot	9.00		9.00	
1-lb. spot	7.35		7.25	
Aluminum:	50.80		50.00	
Prompt delivery	25.75 to 26.25		25.75 to 26.25	
Future	25.50 to 26.00		25.50 to 26.00	

## OLD METALS

Heavy copper and wire	15.50	14.25
Brass, heavy	9.50	8.75
Brass, light	8.00	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	6.12½

## COPPER EXPORTS IN JANUARY

Total tons to.....Jan. 15, 12,020 Jan. 22, 16,483

## Personal

**Mr. F. W. Insull**, general auditor of the Arkansas Valley Railway, Light & Power Company, Pueblo, Col., has resigned, to accept another position.

**Mr. Alban W. Mann**, of Elgin, Ill., has been appointed supervising engineer of the seventy-eight plants of the Central Illinois Public Service Company, of Mattoon, Ill.

**Mr. L. V. Webber**, chief of the meter department of the Toronto Electric Light Company, has resigned his position to become sales manager for the Metropolitan Engineering Company.

**Mr. P. A. Bertrand**, manager of the Jefferson City (Mo.) Light, Heat & Power Company, has tendered his resignation, effective Feb. 1, and will take up elsewhere his work of building up plants.

**Mr. Quincy W. Hershey** has resigned as president of the Avon (N. Y.) Electric Company and as general manager of the Livingston-Niagara Power Company and the Corporations Service Company.

**Mr. Albert C. Moore**, consulting engineer, of Joplin, Mo., has been retained as engineer to supervise the planning and erection of the new water-works and electric light plant for the city of Sulphur Springs, Ark.

**Mr. James B. Goodwin**, recently superintendent of construction and assistant general manager of the Mount Hood Railway & Power Company, Portland, Ore., has been appointed construction engineer for the city of Edmonton, Alberta.

**Mr. R. W. Williamson**, for the past three years city electrician of Shreveport, La., and local representative of the Louisiana Fire Prevention Bureau, has tendered his resignation and accepted a position with the Alabama Power Company.

**Mr. N. I. Garrison**, for many years auditor of the Fort Smith (Ark.) Light & Traction Company, has been transferred to a similar position with the Western States Gas & Electric Company, Stockton, Cal., which is controlled by the same syndicate.

**Mr. F. K. Woodring**, contract agent of the People's Incandescent Lighting Company, Meadville, Pa., and formerly connected with the Titusville (Pa.) Electric Light & Power Company, has resigned and accepted a position with the West Penn Electric Company, Connellsville, Pa.

**Mr. Heinrich Homberger**, consulting engineer, of San Francisco, has been appointed advisory engineer for hydraulic plant equipment by the Oro Electric Corporation, Oroville, Cal., in connection with its proposed 40,000-kva. power plant on the north fork of the Feather River.

**Mr. W. J. Barker**, second vice-president and general superintendent of the Denver (Col.) Gas & Electric Light Company, was elected a director of the Colorado Electric Club on Jan. 9. The club has 727 members and is identified with every large civic or commercial movement in Denver.

**Mr. P. D. Kline** has resigned as general superintendent of construction of the Falkenau Electrical Construction Company of Chicago to accept the position of general superintendent of the Ogden and Logan (Utah) Rapid Transit Companies, effective Feb. 1, 1913, with offices in Ogden, Utah.

**Mr. F. John Bell** has resigned as general manager of the British Canadian Power Company, Cobalt, Ontario, as the outcome of the amalgamation with the Northern Ontario Light & Power Company. He has been appointed general manager of the Canada Wire & Cable Company, Toronto, Ontario.

**Mr. R. T. Jeffery**, for some years associated with the electrical department of Messrs. Smith, Kerry & Chace, Toronto, Ont., has resigned to engage in general engineering work with the Hydro-Electric Power Commission of Ontario, in connection with its extensive work among the various municipalities.

**Mr. A. W. Bush**, of Mendota, Ill., has been appointed manager of the properties of the Illinois Northern Utilities Company at Sterling, Ill., to succeed Mr. T. R. Woulfe, resigned, effective Feb. 1. Mr. J. W. Lasher, who has been manager for the company at Morrison, Ill., has been transferred to Mendota.

**Mr. H. W. Soderling**, manager of the Wenatchee Valley Gas & Electric Company, has resigned his position and purchased stock in the Bliss Electric Company, of Wenatchee, Wash., becoming its vice-president and sales manager. Mr. Louis Shreve will succeed Mr. Soderling as manager of the Wenatchee Valley company.

**Dr. Carl Hering** delivered a lecture on Jan. 13 before the engineering students of the University of Virginia on electrochemistry and electrometallurgy, in the course of which he sketched some of the latest advances in these branches and dwelt on the great possibilities of the future, mentioning many problems awaiting solution.

**Mr. Edwin M. McClintock**, superintendent of stations of the Union Gas & Electric Company of Cincinnati, and Mr. William F. Vance, chief electrician of stations, have resigned to accept positions with the Superior Carbon Specialty Company, of that city. They have both been connected with the company more than nineteen years.

**Mr. W. N. Smith**, who last year was consulting engineer for the Washington & Old Dominion Railroad, Washington, D. C., and electrified that line, and who previously was electrical engineer with Westinghouse, Church, Kerr & Company, has just become connected with the construction department of the Edison Electric Illuminating Company of Boston, Mass.

**Mr. R. E. Bowen**, who for some time has been industrial engineer of the Livingston-Niagara Power Company, Avon, N. Y., has been appointed manager for the Avon Electric Company, Lima-Honeoye Light & Railroad Company, Livonia Light & Heat Company, Livingston-Niagara Power Company and the Corporations Service Company, succeeding Mr. Q. W. Hershey, resigned.

**Mr. H. G. Kislisbury**, formerly of the auditor's department of the Union Electric Light & Power Company, St. Louis, Mo., has joined the staff of the Hodenpyl-Hardy Company, Jackson, Mich., to study rate schedules and compile rate data for its various companies. Mr. Kislisbury was a 1908 graduate of the University of Wisconsin, from which he later received his E. E. degree.

**Mr. William C. Andrews**, of New York, who was recently appointed alternate statesman of the Jovian Order, is interesting electrical men in a new lodge of the Arabian Lords of the Arabian Desert now being organized in New York. The Arabian Lords is a fraternal organization whose members must also be members of some other recognized secret organization, and Mr. Andrews has secured for it the recognition of the Jovian Order.

**Mr. J. M. Dewberry**, who has been vice-president of the Birmingham, Ensley & Bessemer Railway, Birmingham, Ala., has severed all his official relations with the company, which is commonly known as the Tidewater line, but has not resigned from the Tidewater Power Company or retired from participation in the development of the other features of the general Tidewater enterprises, which include the construction of a power plant on the Warrior River to furnish electricity for light and power purposes in Birmingham and the construction of a railway from Birmingham to the Warrior River.

**Mr. John L. Fay** has resigned his position as superintendent of wire for The Milwaukee Electric Railway & Light Company to enter commercial and development work in connection with patents recently granted him. A farewell dinner was tendered Mr. Fay on his departure Jan. 14 by the electrical distribution department of the Milwaukee company, Mr. G. C. Post, electrical engineer for the company, presiding. As a token of regard the guest was also presented by his associates with a diamond-studded gold model of the clamp insulator device invented by him, mounted as a scarf-pin.

**Mr. John L. Putnam**, who for the past sixteen years has been in the telephone business and for nearly all of that time with the Bell system, has joined the banking organization of Kennett Cowan & Company of New York and Chicago. Mr. Putnam graduated from the electrical engineering course at the Massachusetts Institute of Technology in 1896, and because of his long connection with the Bell interests and his former association with the manufacturers of the Clark automatic system, is widely known



among telephone men throughout the country. He will make his headquarters in Chicago.

Mr. Claxton E. Allen, who has been closely identified with the transformer industry in various capacities for the past ten years, has been appointed assistant manager of the detail and supply department of the Westinghouse Electric & Manufacturing Company, having been previously head of the transformer division of that department. Mr. Allen is a Virginian and a graduate of the Virginia Polytechnic Institute. In 1901 he took the apprentice course of the General Electric Company and then entered the engineering department of that company, where he was engaged in the design of transformers. While there he invented the distributed-core-type transformer and then entered the commercial department of the company, where he remained until 1909, when he entered the employ of the Westinghouse Electric & Manufacturing Company as head of the transformer division of the detail and supply department.



CLAXTON E. ALLEN.

Mr. Thomas F. Kelly, contract agent of the Dominion Power & Transmission Company, of Hamilton, Ont., has been appointed sales manager of the Dayton (Ohio) Power & Light Company. Mr. Kelly is regarded as one of the best posted men in Canada on electrical matters, and his ability has won for him rapid advancement. He began as a junior clerk with the Dominion Power & Transmission Company in 1900, and after becoming experienced in various departments was appointed contract agent in 1908. Aside from his work with the company, Mr. Kelly has taken an active interest in all movements tending toward Hamilton's advancement. He was secretary of the Hamilton Ad Club, and is president of the local section of the National Electric Light Association and a member of the commercial committee of the Canadian Electric Association.

Mr. Charles R. Huntley, president of the Buffalo General Electric Company and director in the Buffalo & Niagara Falls Electric Light & Power Company and in the Cataract Power & Conduit Company, rounded out a quarter of a century of affiliation with the light and power interests of Buffalo, N. Y., on Jan. 15, and his associates tendered him a dinner at the Buffalo Club, where he was presented with a silver loving cup. In addition, Mr. Huntley was the recipient of numerous congratulatory telegrams from his many friends in the industry in all parts of the country. Mr. Huntley, who is one of the pioneers in the central-station field, was born in Winfield, N. Y., Oct. 12, 1854. He was graduated from the Utica Academy and after entering a hardware firm subsequently became identified with the firm of Remington & Sons, manufacturers of guns and typewriters. Late in the 70's he settled in Buffalo and in 1878 became general agent of the Standard Oil Company of Pennsylvania. From 1883 to 1888 he conducted a brokerage business in Bradford, Pa., and in 1888 he returned to Buffalo as the representative of the Standard Oil Company to look after its interests in the Brush Electric Light Company, which subsequently became the Buffalo General Electric Company. Mr. Huntley's success is attributable to his knowledge of human nature, his business keenness and his ability to



CHARLES R. HUNTLEY

handle men. He possesses a pleasing personality and has been identified with progressive movements in Buffalo, of which he is a prominent citizen. Of late years he has not enjoyed the best of health, but he is fast regaining his vitality. In 1891-1892 Mr. Huntley was president of the National Electric Light Association, in which he has always taken an active interest. He has also been prominent in the affairs of the Association of Edison Illuminating Companies.

## Obituary

Ralph Withington, president of the American Insulating Machinery Company, of Philadelphia, died at his residence in that city on Dec. 31, after a brief illness. Mr. Withington, who was born in Bolton, England, came to this country at an early age and had been engaged in the manufacture of machinery and appliances for the production of covered wire for many years, his experience in this line antedating the general use of insulated wire in the electrical field.

Francis Blake, inventor of the telephone transmitter bearing his name, died at Weston, Mass., on Jan. 19. He was a native of Needham, Mass., and was educated in the Brookline High School. In 1866, at the age of sixteen, he received an appointment to the United States Coast Survey, where he remained until 1878, when he resigned. The Blake transmitter was invented in 1878, and ever after Mr. Blake interested himself in the development of the telephone. He presented to the medical profession an improved form of the rotary microphone which has been adopted in many of the leading pathological and biological laboratories of the country. His telephonic inventions number nineteen, five relating to the original Blake transmitter, its details and refinements, five to improvements in transmitters with special reference to the granular carbon type, eight to forms of telephone switchboards, and one to selective signals for party-line service. The original transmitter patent of Mr. Blake was taken out as a result of his reading the deliberations of the Physical Society and the Royal Society upon the Hughes microphone at a meeting in 1878, a similar discussion having been held by the Society of Telegraph Engineers at about the same time, led by Sir William H. Preece. The essential feature of the Blake transmitter was the use of a light contact in a telephone circuit, which while remaining light would never break, and the fundamentals of the apparatus consisted of a platinum pin pressed by a light spring against a spring-suspended button of gas carbon. This transmitter was used solely by the Bell telephone interests until about 1886, when it was superseded by the granular carbon instrument of the Hunning type as refined and developed by the experts of the company. In the field of invention, however, Mr. Blake was always a "free lance," although he was a director of the American Telephone & Telegraph Company. His social affiliations were numerous, and he was a member of the American Academy of Arts and Sciences and the American Institute of Electrical Engineers, a fellow of the American Association for the Advancement of Science, a member of the National Geographical Society, a member of the corporation of the Massachusetts Institute of Technology, a trustee of the Massachusetts General Hospital and the Boston Museum of Fine Arts, a member of the Boston Society of Civil Engineers and various historical organizations. At the last meeting of the Association of Telephone Pioneers he was elected an honorary member, the only other member of this class being Dr. Alexander Graham Bell. Mr. Blake is survived by his widow, a son, daughter, sister and brother.



FRANCIS BLAKE



## Construction

**SULPHUR SPRINGS, ARK.**—The city of Sulphur Springs has engaged Albert C. Moore, consulting engineer, Joplin, Mo., to prepare plans and supervise the construction of the new electric-light plant and water-works system. The cost of the work is estimated at about \$40,000.

BEAUMONT, CAL.—The Southern California Edison Co. has filed a petition with the Board of Trustees of Beaumont asking for a franchise to operate an electric system here.

FRESNO, CAL.—The San Joaquin Lt. & Pwr. Co. has awarded a contract to J. G. White & Co., of New York, N. Y., to design and install a 5000-hp hydroelectric plant on the Tule River. A large part of the hydraulic work is completed.

FRESNO, CAL.—The contract for the construction of a power plant for the Fresno, Hanford & Summit Lake Interurban Ry. Co., of Fresno, has been awarded to the General Electric Co. The plant will have an output of about 3000 hp and will be located between Lone Star and Fowler. The cost of the plant is estimated at about \$100,000.

HOLLISTER, CAL.—Plans are being prepared by the Central California El. Ry. Co. to extend its electric railway from San Juan to Hollister, a distance of about 8 miles. Storage-battery cars may be used.

LODI, CAL.—We are informed that the Western States Gas & El. Co. does not contemplate the installation of a distributing system in Lodi as reported in the issue of Jan. 4. The company sells electricity to the town of Lodi, which is distributed by the municipal electric-light plant.

LOS ANGELES, CAL.—The Los Angeles Ry. Corpn. has applied to the City Council for a franchise to build a double-track electric railway on Mission Road.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for the construction of the "relief" line on San Pedro Street between Aliso Street and Ninth Street to the Pacific El. Ry. Co., for \$246,575.

LOS ANGELES, CAL.—The Pacific El. Ry. Co. has applied to the State Railroad Commission for permission to issue bonds to the amount of \$7,034,000, the proceeds of \$6,385,682 to be used for improvements already under way, the proceeds of \$1,724,230 to be used for new work. The projected improvements cover the principal lines of the company in southern California.

LOS ANGELES, CAL.—The Southern California Edison Co., of Los Angeles, has applied to the State Railroad Commission for permission to issue \$2,500,000 in bonds, the proceeds to be used for improvements, which include the enlargement of the Long Beach plant at a cost of about \$1,500,000, stations in Los Angeles, the construction of new substations, extensions to the distributing system and general improvements throughout the entire system.

ORANGE, CAL.—The City Trustees are considering plans for the installation of a fire-alarm system.

REDLANDS, CAL.—The Southwest El. Co., of Redlands, has been awarded the contract for the installation of an ornamental street-lighting system in Redlands, at \$9,668.

RICHMOND, CAL.—The Western States Gas & El. Co., of Richmond, is erecting an electric transmission line to connect with the Union Water Company's pumping station at San Pablo.

SAN FRANCISCO, CAL.—The City El. Co. has applied to the State Railroad Commission for permission to issue \$833,000 in bonds, the proceeds to be used for improvements.

UPLANDS, CAL.—The installation of an ornamental street-lighting system on Second Street is under consideration.

WILLOWS, CAL.—The Board of Supervisors of Glenn County has granted the petition of the Oro Lt. & Pwr. Co., of Oroville, for a franchise to operate in Willows.

**BOULDER, COL.**—All bids submitted Dec. 30 for the construction of a municipal electric-light plant were rejected. It has not yet been decided when new bids will be called. O. P. Clark is city clerk.

MONTROSE, COL.—The property of the Montrose El. Lt. & Pwr. Co. has been purchased by Carl J. Sigfrud and E. A. Plunney, of Orem, representing the Utah Pwr. & Lt. Co. This will form part of the light and power system, which is to extend from Durango to Salt Lake City. A branch will run from Grand Junction to Leadville and Salida.

**HARTFORD, CONN.**—The Hartford El. Lt. Co. has announced plans for the erection of a new seven-story office building, to cost \$200,000, on the site of its present small plant in Pearl Street. It will have a frontage of 130 ft. and a depth of 100 ft.

HARTFORD, CONN.—Prizes for the best design for ornamental lamp standards to be used in connection with the improved lighting system for the center of the city were awarded to Chelster B. Price, architect, New York, N. Y. There are three standards—one three-lamp standard, one two-lamp standard and single lamp wall bracket. The wall bracket is intended to be attached to buildings on narrow streets.

**MONTVILLE, CONN.**—The New London Gas & El. Co. has decided to extend its electric-lighting service to Montville and expects to supply electricity for lighting the town within three months.

trical engineer for the installation of a new street-lighting system on Pennsylvania Avenue from the United States Treasury Building to the Capitol.

WASHINGTON, D. C.—S. J. G. was assigned to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 11, 1914, to discharge his duties as a member and one storage battery truck, type M, on per se home.

WASHINGTON, D. C.—Proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Jan. 28 for construction of extension to ward building and dining room, including the installation of conduits, wires and fixtures for an electric-lighting system at the Home for Aged and Infirm at Blue Plains, D. C. Blank forms, specifications and other information may be obtained from the chief clerk, Engineer Department, Room 427, District Building, Washington. Separate proposals may be submitted for electric lighting system. A deposit of \$10 will be requested to guarantee the returns of plans.

WASHINGTON, D. C. Plans are being prepared by the office of the Chief Signal Officer, War Department, Washington, D. C., until Feb. 1, for furnishing material under proposal No. 635 as follows: (1) Three power switchboards and distributing frames for signal corps switchboard rooms, in accordance with specifications Nos. 571, 368-a and 560; (2) two telephone power switchboards, type No. 1, in accordance with specifications No. 560, 519-c and 403-a; (3) two telephone power switchboards, type No. 4, in accordance with specifications Nos. 560, 519-c and 403-a; (4) two cabinet terminals, as per specifications Nos. 435-b, 368-a and 560; (5) two panels, station switch, with six-pole switch, in accordance with specifications No. 415-c and addenda specification No. 368-a. Captain W. L. Clarke is disbursing officer.

**AMERICAN FALLS, IDAHO**—The American Falls Pwr Co has completed the construction of a dam across the Snake River at American Falls and will soon begin on the installation of a hydroelectric power plant which will develop 4000 hp. A. J. Wiley is chief engineer.

BUHL, IDAHO.—I. B. Perrine contemplates building an electric line from Buhl to Castleford, a distance of 11 miles.

CLARKSTON, IDAHO.—F. L. Strum has been granted a franchise to build an electric line from Clarkston to Asotin, via Vineland. Surveys are now being made and construction work will soon begin.

**SHELLEY, IDAHO.**—The Utah Pwr. & Lt. Co. has purchased the plant and holdings of the Gem State Lt. & Pwr. Co. in Shelley, for a consideration of \$200,000. The new company will increase the output of the plant to 10,000 hp. It will enter the Blackfoot field and extend its lines into the territory on the west side of the river.

BRYANT, ILL.—The Village Board has granted the Canton Gas & Lt. Co., of Canton, a franchise to operate an electric-light system in Bryant.

DUNDEE, ILL.—The Village Boards of East Dundee and West Dundee have entered into a contract with the Public Service Co. of Northern Illinois, of Chicago, for street lighting. The company will furnish 40-cp tungsten lamps on a moonlight schedule, at \$15 each per year. The Council at Carpentersville has also awarded a contract to the company for street lighting.

**GALVA, ILL.**—The Hayes Pump & Corn Planter Co. has applied to the City Council for a franchise to operate an electric-light plant in Galva. The Galva Gas Lt. & Coke Co. is also seeking a franchise to operate an electric light system here. In addition, a committee of citizens has become interested with Galesburg residents in a plan to transmit power from the dam of the Mississippi River Pwr. Co. at Keokuk, Ia.

HAMMOND, ILL.—E. B. Leavitt, owner of the city garage, is installing an electric-light plant to supply electricity for lighting the town. The equipment will include two oil engines, Olds and Fairbanks; General Electric generator, 4 miles of overhead material. The street-lighting system will consist of forty 100-watt incandescent lamps. Contracts have been placed for all equipment and material.

HANNA CITY, ILL.—The People's El. Service Co., which has a power plant at Framington, has applied for a franchise to operate an electric light system in this city. The line will also furnish power service in Trivoli and Eden.

EACON, Ill.—The Public Service Company of Northern Illinois is planning to rebuild its transmission lines in Lake County, which has been hit hard by the winds as seen as the weather reports. The company has good underground lines in the business section. New lines will run in the future.

MARINE, III. A new, compact, and light in weight, 100-watt, 110-volt, 60-cycle, 1- $\phi$  unit, of St. Louis, Mo., is being marketed by the General Electric Co. It is a self-contained, self-excited, self-cooled, self-protected, and self-regulating unit, which is designed to operate as an electric light system in Marine, or as a generator for the air conditioning pumps for gas turbine engines.

is reported, will erect a transmission line from Clinton, Ia., to Mendota next spring.

**METROPOLIS, ILL.**—The Water and Light Department has placed orders with A. L. & S. of Chicago, Ill., and the Westinghouse Electric & Mfg. Co. of Pittsburgh, Pa., for a 1,000-hp., three-phase, 2,300-volt generating unit, direct-connected. It is expected to have the unit ready for service by March 15, at which time a day service will be established. T. M. Roberts is superintendent of the Water and Light Department.

**MOLINE, ILL.**—Contracts have been awarded by the People's Pwr. Co. for the installation of an additional 12,500-volt generating unit at its power plant at the foot of Fourth Street. The power house will also be enlarged. The cost of the entire work is estimated at about \$200,000.

**MURRAYVILLE, ILL.**—The Village Board has granted the Central Illinois Pub. Ser. Co., of Mattoon, a franchise to operate an electric-light system here. Electricity is to be transmitted from Roodhouse and the system must be installed by Jan. 1, 1914. Residents of Manchester are circulating a petition to have the Central Illinois Pub. Ser. Co. erect a line to that place.

**OAK PARK, ILL.**—The Village Board is considering the question of improving the street-lighting system. August Einfeldt is president of the board.

**PEORIA, ILL.**—The highway commissioners of Groveland Township have granted the Peoria Gas & El. Co. permission to use the highways for an electric transmission line from East Peoria to Wesley City.

**THOMASBORO, ILL.**—The Village Board is contemplating the installation of an electric-light system here.

**TUSCOLA, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, is preparing to erect a transmission line between Tuscola and Arcola to supply the latter city with electricity for lamps and motors. The line will also supply electricity to the Reuple elevator and for commercial and residential lighting in Galton.

**TUSCOLA, ILL.**—The county officers of Douglas County and residents of Tuscola have presented a petition to Fred C. Rahn, chairman of the Board of County Supervisors, requesting him to call a special meeting of the County Council to consider the construction of a county electric-light plant. The Central Illinois Pub. Ser. Co. has been furnishing light and heat for the building.

**BROAD RIPPLE, IND.**—The Town Board has canceled its contract for street lighting with the Indianapolis Lt. & Ht. Co., of Indianapolis, alleging that the company has failed to live up to its contract. The town will contract with the Merchants' Lt. & Ht. Co., of Indianapolis, to light the streets of the town.

**COLUMBUS, IND.**—The Central Indiana Ltg. Co., of Columbus, has applied to the County Commissioners for a franchise to extend its transmission lines into East Columbus to supply electrical service there. F. D. Potter is local manager.

**ELKHART, IND.**—The Home Tel. Co. is planning to erect an exchange building in Elkhart, to cost about \$65,000.

**EVANSVILLE, IND.**—The electric plants in Evansville, Princeton, Petersburg and other towns along the Ohio, White and Patoka Rivers in southern Indiana have been badly damaged by floods. Extensive repairs will be necessary when the floods subside.

**GOSHEN, IND.**—The City Council has engaged Burns & McDonnell, of Kansas City, Mo., to prepare plans and specifications for the reconstruction of the municipal electric-light plant.

**RICHMOND, IND.**—The Board of Public Works has decided to make improvements to the municipal electric-light plant to cost from \$65,000 to \$70,000. The work will include a large addition to the power house and the installation of a generator, engine and boilers, with condenser, pumps, etc.

**SILVER LAKE, IND.**—The capital stock of the People's Mutual Tel. Co. has been increased from \$10,000 to \$30,000.

**WASHINGTON, IND.**—The City Council has notified the owners of the local electric-light plant of its intention to purchase and take over the plant at the expiration of the present franchise in June. It is understood that improvements will be made to the plant.

**WILLIAMSPORT, IND.**—The Town Board is contemplating improvements to the municipal electric-light plant, involving an expenditure of about \$10,000.

**CLINTON, IA.**—The Clinton St. Ry. Co. and the Clinton Gas Lt. & Coke Co., it is reported, will ask the City Council for a 25-year combination franchise. The extension of the franchise will carry with it, it is said, permission to build a line to the southwestern part of the city and one on Hickory Street.

**FORT MADISON, IA.**—The Stone & Webster Management Association has entered into an agreement with the Fort Madison El. Lt. & Pwr. Co. to purchase the property of the latter, provided the City Council will grant the company a new franchise covering a period of 25 years.

**GILBERTVILLE, IA.**—The officials of the Waterloo, Cedar Falls & Northern Ry. Co. have submitted a proposition to the town of Gilbertville offering to install an electric-light system and furnish electricity at 12 cents per kw-hr. This price is generally considered too high and a company may be organized by the local business men to install and operate an electric-light plant. M. Delagardelle, of Gilbertville, is interested in the project.

**IOWA CITY, IA.**—The Iowa City El. Ry. Co. has been reorganized under the name of the Mississippi Valley El. Co. and its capital stock increased from \$100,000 to \$1,450,000. Under the new organization the company has the right to extend its business to any part of the State. The new company will operate electric-lighting systems as well as street railways. J. O. Schulze is president of the company and D. A. Reese secretary and treasurer.

**MOUNT AYR, IA.**—The Mount Ayr Lt. & Pwr. Co. is planning to install a new boiler, engine and generator this summer.

**MUSCATINE, IA.**—Merchants on Second Street between Iowa Avenue and Chestnut Street have agreed to install ornamental street lamps.

**PRINCETON, IA.**—The voters of the village have approved a proposition to grant the Illinois & Iowa Ry. Co. a 25-year franchise to supply electricity for lamps and motors in Princeton. The company has purchased the municipal electric-light plant.

**SIOUX CITY, IA.**—The Sioux City Tel. Co. has announced that it will do a large amount of underground and aerial cable work and install additional plant equipment. Howard S. Baker is general manager.

**FORT SCOTT, KAN.**—The City Council has adopted a resolution advocating the installation of a municipal electric-light plant.

**PARSONS, KAN.**—The city commissioners have called an election to be held Feb. 11 to submit the proposition to issue \$75,000 in bonds to construct a municipal electric-light plant to a vote.

**HOPKINSVILLE, KY.**—Plans have been prepared by the Kentucky Pub. Ser. Co. for improvements to its local plant involving an expenditure of about \$100,000.

**LOUISVILLE, KY.**—The Louisville Ltg. Co. is contemplating extending its transmission lines to Fern Creek, a suburb of Louisville.

**SHELBYVILLE, KY.**—The Shelby fiscal court has approved the franchise granting the right to erect electric transmission lines along the roads and highways of Shelby County to supply electricity for lamps and motors to the farmers, which was applied for by John K. Todd, of Shelbyville, representing the Kentucky Utilities Co. This company recently purchased the plant of the Shelbyville Wtr. & Lt. Co. to be sold to the highest bidder on Jan. 25. The franchise is for a period of 25 years. It is said that the company proposes to extend its lines to all parts of the county.

**WILLIAMSTOWN, KY.**—J. M. Riley, of Williamstown, is contemplating the installation of an electric-light plant here, and plans have been prepared.

**BATON ROUGE, LA.**—The Baton Rouge El. Co. has accepted the franchise offered by the city for the extension of the street-car line out Florida Street, down East Boulevard to Railroad Avenue. Work will begin at once on construction of the railway.

**LAFAYETTE, LA.**—The electric light committee has authorized Engineer Raymond to prepare specifications for the installation of new boilers and generators and for changing the system from direct to alternating current. The cost of the work is estimated at about \$40,000. Bids will be called for as soon as plans are ready.

**LAKE CHARLES, LA.**—The Louisiana Trac. & Pwr. Co. is making arrangement to extend its interurban electric railway from Lafayette to Alexandria. The company is also said to be negotiating for the car lines of the Alexandria St. Ry. Co.

**NAPOLEONVILLE, LA.**—An election will be held Feb. 18 to submit the proposition to appropriate \$22,000 for the installation of a municipal electric-light plant to a vote.

**AUGUSTA, MAINE.**—The Fruitvale Land, Lt. & Wtr. Co. has been organized at Augusta for the purpose of developing land and owning and operating electric-lighting and power plants. The company is capitalized at \$200,000. E. M. Leavitt, of Winthrop, is president and treasurer.

**BARNSTABLE, MASS.**—Sealed proposals will be received at the office of the County Commissioners at the Court House, Barnstable, until Feb. 1 for lighting the court house, jail and county grounds at Barnstable by electricity. Alfred Crocker is clerk.

**BLACKSTONE, MASS.**—The plant of the Blackstone El. Lt. Co. has been sold by the Stone & Webster interests to C. D. Parker, of Boston, Mass. The new owners will take possession at once.

**BOSTON, MASS.**—The South Boston Citizens' Association is considering the question of installing a new lighting system on Broadway in South Boston. The cost of the system is estimated at about \$15,000.

**CARNEY, MICH.**—The State Railroad Commission has authorized the Nadeau Township Tel. Co. to organize and issue \$1,000 in capital stock. The company will operate in Nadeau Township and the exchange will be located at Carney.

**CHEBOYGAN, MICH.**—At a special election held recently the Cheboygan El. Lt. & Pwr. Co. was granted a franchise. The company has promised to expend several thousand dollars in improvements to its plant and to build an electric railway to Petoskey within five years. The company recently purchased the plant at Pellston, which will provide power for the western end of the proposed railway.

**COMSTOCK, MICH.**—The Commonwealth Pwr. Co. is extending its system to Comstock to supply electricity for lamps and motors.

**IMLAY, MICH.**—The Mutual Tel. Co. has secured an option on the system of the Bell Tel. Co. in Imlay City, the transfer to take place April 1. The two exchanges will be consolidated. The exchange building of the Mutual Tel. Co. is being remodeled to provide room for the new switchboard.

**KALAMAZOO, MICH.**—Preparations are being made for the construction of a municipal electric-light plant. Bids have been obtained on the installation of boilers and electrical equipment and contract for boilers has been awarded. Bids on construction of building will be







**MINOT, N. D.**—Sealed bids will be received by the State Board of Normal Trustees at the office of E. J. Taylor, president, Bismarck, until Feb. 4 for the erection of a fireproof dormitory building on the Normal School Grounds at Minot. Bids will be received at the same time and place for heating, plumbing, wiring, fan ventilation, heat regulation, etc., in accordance with plans and specifications prepared by Haxby & Gillespie, architects, Fargo, N. D. Plans can be seen at the following places: Builders' Exchange, St. Paul and Minneapolis, Minn.; Minot, Grand Forks and Fargo, N. D., and at the office of the architects. Plans can be obtained from the architect upon payment of \$10 per set.

**STEELE, N. D.**—The City Council has granted W. R. Hardy permission to erect transmission lines in Steele for the distribution of electricity for lamps and motors.

**BEDFORD, OHIO.**—The Cleveland El. Illg. Co., of Cleveland, has been granted permission to purchase the property of the Bedford El. Lt. & Pwr. Co., at \$22,500.

**CINCINNATI, OHIO.**—The Kentucky Motor Sales Co., Reading Road, has engaged Stewart & Stewart, architects, to prepare plans for an electric light and power plant, to cost about \$30,000.

**CINCINNATI, OHIO.**—Plans for an electric light and power plant in the new tuberculosis hospital in Cincinnati have been approved by the Hospital Commission. Tieig & Lee are the architects.

**CLEVELAND, OHIO.**—Proposals will be received at the office of W. H. Kirby, secretary to the director of public service, No. 104 City Hall, Cleveland, until Jan. 31 for furnishing, erecting and painting structural steel work for the municipal electric-light plant. W. J. Springborn is director of public service.

**COLUMBUS, OHIO.**—Sealed proposals will be received by B. L. Bargar, director of public safety, City Hall, Columbus, Ohio, until Jan. 29 for furnishing one two-position common-battery telephone switchboard in accordance with drawings and specifications, copies of which are on file in the office of the director of public safety.

**DEFIANCE, OHIO.**—The Northwestern Tel. Co. has been given permission to purchase the property of the Central Union Tel. Co. at Defiance, at \$17,050; also permission to issue \$52,540 capital stock, to be sold at par. Part of the proceeds will be used for purchase of the property and the remainder for the construction of a building in Defiance and extensions and improvements to the property.

**MARION, OHIO.**—Improvements will be made at once to the Marion plant of the Columbus, Delaware & Marion Ry. Co. involving an expenditure of about \$25,000. Frank Glosser, superintendent of the lighting department in this city, has been authorized to receive bids for the necessary equipment to increase the output of the local power plant and substation to over 2000 hp. The improvements contemplated include the installation of one 500-kw Curtis turbo-generator, three 250-hp water-tube boilers, with new feed pumps, piping and smokestack; 225-kva condenser driving a 25-kw exciter or a small auxiliary dynamo, 220-kw step-down transformers and an additional 300-kw rotary converter for furnishing power to railway system. Eli M. West, of Columbus, is receiver of the company.

**NEWARK, OHIO.**—Preliminary surveys are being made for the erection of a transmission line between Newark and Lancaster by which the Licking Lt. & Pwr. Co. will supply electricity for commercial purposes in Lancaster. The erection of a transmission line from Newark to Mount Vernon in the near future is contemplated. The Licking Lt. & Pwr. Co. is building a new power plant in Newark, which will furnish electricity in Lancaster, Mount Vernon and towns and villages along the route of the transmission lines.

**PIQUA, OHIO.**—The Western Ohio Ry. Co., of Lima, has applied to the City Council for a franchise to supply electricity in Piqua.

**RUSHSVLVANIA, OHIO.**—The purchase of the local electric-light plant, to be owned and operated by the municipality, is under consideration.

**CUSHING, OKLA.**—The Cushing El. Lt. & Pwr. Co. will erect an electric light and power plant to supply electricity for lamps and motors in Cushing and Bartlesville. The equipment will consist of one 175-hp Murray Corliss engine, one 150-kw, three-phase, 60-cycle, 2300-volt generator, switchboard, General Electric type transformers, 9 miles of overhead material (No. 6 wire) and tungsten lamps. Contracts have been placed for all equipment. All lighting service will be furnished on a meter basis. Tungsten lamps will be used throughout the system. H. Askin, secretary, has charge of the work.

**GOTEBO, OKLA.**—Plans are being considered for the installation of an electric-light plant at the Rainey Mount School, for which an appropriation has been asked.

**HINTON, OKLA.**—An ordinance has been passed authorizing an issue of bonds to the amount of \$10,000 for the purpose of installing an electric-light system in Hinton.

**PAWNEE CITY, OKLA.**—Negotiations are under way between the city officials of Pawnee City and Ralston with a view of furnishing electricity from the Pawnee City municipal plant in Ralston.

**BEND, ORE.**—The Central Oregon Pwr. Co., which owns the local water, light and power plants, has been granted a franchise by the County Court to erect electric transmission lines along the highways of Crook County. Kempster B. Miller, one of the stockholders of the company, was also granted the privilege of erecting telephones along the county roads.

**CORVALLIS, ORE.**—The Oregon El. Ry. Co., of Portland, is planning to build a branch from its main line to Corvallis, work on which will soon begin.

**EUGENE, ORE.**—Plans are being prepared by the Oregon El. Ry. Co. for the development of the Clear Lake project in the Cascade Mountains east of Eugene. The plant when completed will develop 30,000 hp.

**MEDFORD, ORE.**—J. A. Westerlund and C. Y. Tengwald have applied for a franchise to operate a trackless trolley system in Medford.

**MEDFORD, ORE.**—The M. P. McInney Realty Co., of Oakland, Cal., has applied for a franchise to construct and operate an interurban electric railway in Medford.

**PORTLAND, ORE.**—In his annual message to the City Council Mayor Rushlight urges it to make preparation for a municipal lighting system.

**PORTLAND, ORE.**—The Portland, Eugene & Eastern Ry. Co., of Portland, has announced that it will extend its electric railway to Molalla. The cost is estimated at about \$100,000.

**PORTLAND, ORE.**—A bill will be introduced at this session of the Oregon Legislature providing for developing the water-power of the Columbia River, 2 miles above the lower entrance of the Celilo Canal, where it is estimated that a minimum of 100,000 hp can be developed. The project is to be prosecuted and operated by the States of Oregon and Washington for the benefit of the municipalities of the two States. It is proposed to have the Legislature of the State of Washington appoint a commission to work with the Oregon commission in the development of the enterprise.

**ALTOONA, PA.**—The Penn Central Lt. & Pwr. Co. has been granted a new charter increasing its capital stock from \$1,500,000 to \$2,500,000.

**BERNVILLE, PA.**—The Bernville Lt., Ht. & Pwr. Co. has petitioned for a franchise to install an electric-light plant in Bernville to supply electricity for lighting and commercial purposes.

**CARLISLE, PA.**—The capital stock of the Carlisle Lt., Ht. & Pwr. Co. has been increased from \$5,000 to \$500,000.

**EASTON, PA.**—The City Council has adopted a resolution authorizing a committee to be appointed to secure data and information as to the cost of installing a municipal electric-light plant.

**HARRISBURG, PA.**—Notice has been filed that application will be made Feb. 3 for charters for the Conemaugh, Richland, Lower Yoder and West Taylor Light Companies by J. W. Blough, R. C. Saylor and H. E. Thompson. The companies, it is understood, are to be subsidiaries of the Citizens' Lt., Ht. & Pwr. Co., which will operate in townships surrounding Johnstown with a view of caring for further growth of its business and enlargement of activities.

**HUNTINGDON, PA.**—Sealed proposals will be received by the Borough Council until Jan. 31 for furnishing electricity for lighting the streets of the borough for a period of not less than five years or more than 20 years. Further information may be secured on application to the public property committee of the borough of Huntingdon. F. G. Grimison is chairman of the committee.

**JOHNSTOWN, PA.**—Surveys have been made and practically all of the right-of-way secured for the proposed high-tension transmission line of the Citizens' Lt., Ht. & Pwr. Co., of Johnstown, to supply electricity in Blairsville and Indiana and the towns along the route for lighting and mine operations. It is stated that branches of 5 to 10 miles will be made if necessary to furnish power where desired. The line will be completed by spring.

**LANCASTER, PA.**—The Governor has approved the merger of seven recently incorporated companies in Lancaster County under the name of the Northern Lancaster El. Co. with a capital stock of \$35,000. The companies in the consolidation are the West El. Co., Denver El. Co., Reamstown El. Co., Breacknock El. Co., East Earl El. Co., Terre Hill El. Co. and Ephrata El. Co. Dr. H. S. Dissler, of Denver, is president of the new company.

**LANCASTER, PA.**—Papers have been filed covering the merger of 13 recently incorporated electric companies of Lancaster County, to be known as the Edison El. Co. of Lancaster. The companies taken over by the new company are: Elizabethtown El. Co., Marietta El. Co., Martic El. Co., Conoy El. Co., Eden El. Co., Conestoga El. Co., Providence El. Co., Ephrata El. Co., Earl El. Co., West Earl El. Co., Upper Leacock El. Co., Strasburg El. Co. and Piqua El. Co.

**LANCASTER, PA.**—The Conestoga Transmission Co. has been chartered for the purpose of transmitting electricity from the power plant of the Pennsylvania Wtr. & Pwr. Co. at Holtwood, on the Susquehanna, to Engleisle, near Lancaster. The Conestoga Transmission Co. has an agreement with the Edison El. Co., of York, and the Conestoga Trac. Co. to erect a steel tower transmission line 15 miles long from the power plant on the river near McCall's Ferry to the Engleisle plant, to be completed not later than May 1, 1913. Upon completion of the line it will be taken over under a 999-year lease by the Edison El. Co. and the Conestoga Trac. Co. Contracts for towers and material have been awarded and most of the right-of-way secured.

**NEW BRIGHTON, PA.**—The Beaver County Lt. Co., a subsidiary of the Tri-State Ry. & El. Co., is planning extensive improvements to its system, involving an expenditure of approximately \$60,000 and increasing its output from 50 to 60 per cent. Orders have been placed with the Westinghouse El. & Mfg. Co., of Pittsburgh, for a 1850-turbine engine with consumers, exciters, etc. It is proposed to erect a subst-

DUNCANS, B. C., CAN.—Plans have been completed for the construction of a hydroelectric power plant in Duncans, to cost about \$45,000. Dutcher, DuCane & Co., Rogers Building, Vancouver, are engineers.



**KAMLOOPS, B. C., CAN.**—The city of Kamloops has authorized an expenditure of \$125,000 for a new steam power plant, \$20,000 for hydro-electric substation and equipment and \$10,000 for water-works. Dutcher, DuCane & Co., Rogers Building, Vancouver, are engineers. The contract for construction of new power plant has been awarded to C. C. Moore & Co., Mutual Life Building, Seattle, Wash., at about \$100,000.

**LADNER, B. C., CAN.**—The Vancouver Pwr. Co. will erect an electric transmission line from the water-works in East Delta to supply Ladner and this section with electricity for lamps and motors while the high towers for the wires over the Fraser River are being restored.

**NANAIMO, B. C., CAN.**—The Nanaimo El. Lt. & Pwr. Co. will apply for a license to take 150 ft. per second, in addition to its present record, from Mill River. The water will be used for generating electricity to be distributed in the city of Nanaimo and territory within a radius of 15 miles.

**REVELSTOKE, B. C., CAN.**—The City Council has decided to install an arc-lighting system, covering a distance of about 2 miles.

**VANCOUVER, B. C., CAN.**—The British Columbia El. Ry. Co. is contemplating making alterations to its transmission system on the lower mainland of British Columbia to provide for an improved central service covering its large territory in that section. At present its transmission lines carrying 40,000 volts run from the generating station on the north arm of Burrard Inlet to substations at Burnaby and Vancouver. The new plans contemplate the erection of a large receiving station near Esmond Avenue, Burnaby, along the route of the Burnaby interurban railway. Energy will be transmitted to this station from the North Arm power house at 60,000 volts and connections established from the central point with various substations, a loop system being formed so that alternate sources of power will be available at each point in case of accident to any part of the lines. The proposed work will involve the reconstruction of the present pole line from Lake Bunten, equipping the new lines with 60-ft. poles, carrying metal cross-arms and disk insulators of the suspended type.

**DAIHOUISIE, N. B., CAN.**—The by-law authorizing an appropriation of \$30,000 for the installation of an electric-light plant has been approved by the voters. Willis Chipman, of Toronto, Ont., has been engaged by the town to prepare plans and specifications for the proposed plant.

**YARMOUTH, N. S., CAN.**—The Yarmouth Lt. & Pwr. Co., recently incorporated, will take over the property of the Yarmouth El. Co. and the Yarmouth St. Ry. Co. The officers of the new company are: Willard M. Kelley, president; Edgar K. Spinney, vice-president; John T. Murphy, of Halifax, managing director, and James Graham, resident manager and general superintendent.

**ESSEX, ONT., CAN.**—The town of Essex has entered into negotiations with the Ontario Hydro-Electric Commission for a supply of Niagara power when the western transmission line is extended to Windsor. Several other towns along the route are expected to take action within a short time.

**NORTH BAY, ONT., CAN.**—The Hydro-Electric Power Commission of Ontario is negotiating with the Nipissing Pwr. Co., of Nipissing, with a view of taking over the plant of the power company on the South River, about 25 miles from North Bay, in behalf of the town of North Bay. Some time ago a by-law was passed by the town of North Bay authorizing an expenditure of \$60,000 for the installation of a municipal electric plant.

**PARRY SOUND, ONT., CAN.**—The ratepayers have passed a by-law authorizing an extension to the municipal electric-lighting system.

**WELLAND, ONT., CAN.**—The Town Council has given its approval of the purchase of the plant of the Ontario Pwr. Co. in Welland as part of the new hydroelectric lighting system. The cost of the distributing system and substation of the Ontario Pwr. Co. is placed at \$26,250.

**MONTREAL, QUE., CAN.**—The Laurentide Pulp & Paper Co. has recently purchased a water-power on the St. Maurice River, capable of developing 25,000 hp. The company now has an available development of 70,000 hp. Work has been started on developing the water-power adjacent to the company's plant.

**WESTMOUNT, QUE., CAN.**—Orders have been placed by the Municipal Electric Light Department with the General El. Co. for 50 magnette arc lamps. It is proposed to erect 100 additional lamps in the spring.

**PRINCE ALBERT, SASK., CAN.**—Tenders will soon be asked for construction of penstock, canal excavations, tailrace excavations and concrete work, etc., in connection with a hydroelectric power plant at La Colle Falls to develop 15,000 hp. C. H. and P. H. Mitchell are engineers.

**REGINA, SASK., CAN.**—Sealed tenders will be received by the City Commissioners of Regina, Sask., until Feb. 24 for furnishing track and trolley material for the municipal railway as follows: Contract D—For rails and miscellaneous track material. Contract E—3400 4/0 standard copper rail bonds, 10½-in. C.C.; 3400 4/0 standard copper rail bonds, 13-in. C.C.; 630 4/0 solid copper rail bonds, 62-in. C.C.; 60 4/0 solid copper rail bonds, 72-in. C.C. Contract F—10,000 standard sawn square British Columbia fir railroad ties, 6 in. by 8 in. by 7 ft.; 35,000 standard sawn square British Columbia fir railroad ties, 6 in. by 8 in. by 8 ft.; 1250 Western cedar poles, 30 ft. long, 7-in. top. Contract G—20,000 barrels Portland cement. Contract H—21 miles 2/0 hard-drawn trolley wire; 12 miles 4/0 D.R.W.P. 19-stranded copper wire; 4 miles 2/0

D.B.W.P. 7-stranded copper wire; 10 miles ¼-in. stranded soft-drawn iron wire. Contract J—Insulators, hangers, brackets, pullovers, turn-buckles, trolley frogs, crossovers, clinch ears, pole line, hardware, etc. All material to be delivered f.o.b. Regina and duty paid. Copies of specifications, schedules, delivery dates and form of contract and other information may be obtained upon application to H. Doughty, superintendent of the Regina municipal railway. R. Martin, Mayor; G. A. Mantle and L. A. Thornton are city commissioners.

**WILKIE, SASK., CAN.**—By-laws to appropriate \$10,000 for extensions to municipal electric power plant and \$2,250 for extensions to street-lighting system were passed recently.

**SAN LUIS POTOSI, MEX.**—The City Council is considering the question of installing a municipal electric-light plant. The city's contract with the Central Mexican Lt. & Pwr. Co. has expired and, it is said, will not be renewed.

**SAN LUIS POTOSI, MEX.**—Messrs. Hoogwhingel, Anthony, Brown & Co., of London, Eng., have acquired the street-railway systems of San Luis Potosi, Leon Guanajuato, Torreon and Tampico. This firm is said to be a subsidiary of S. Pearson & Son, Ltd., which has large holdings in Mexico. The street-car lines in all cities are to be reconstructed and converted for electric traction. The work has already been started in San Luis Potosi and preparations are being made to begin similar work in the other cities. G. H. Hoogwhingel is now here directing the work.

## New Industrial Companies

**THE ELECTRIC SALES COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$10,000 by Edwin L. Crosby, Alex Dow and John Breman.

**THE FEDERAL ENGINEERING COMPANY**, Ltd., of Toronto, Ont., Can., has been incorporated with a capital stock of \$500,000 to manufacture and deal in electrical machinery, appliances, plants, etc.

**THE RUTZEN POWER COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$100,000 for the purpose of controlling patents of the Rutzen motor and to manufacture said motor. The incorporators are: D. W. Colvin, Francis J. Peck, D. M. Tilden, Alonzo M. Snyder and M. I. Young.

**THE SHEFFIELD GAS ENGINE COMPANY**, of Kansas City, Mo., has been incorporated with a capital stock of \$150,000 by Fred D. Whiting, Freeman Field and Harris Robinson.

**THE SPECIAL ELECTRIC COMPANY**, of Chester, Pa., has been organized for the purpose of manufacturing a device for keeping trolley poles from slipping off the wire. The officers are: R. F. Coleman, president; C. W. Gorsuch, treasurer, and H. V. Smith, secretary.

**THE STATE ELECTRIC COMPANY, LTD.**, of Walkerville, Ont., Can., has been formed for the purpose of manufacturing electric commercial vehicles. The directors are: H. Timmins, N. A. Timmins, W. S. Hutchinson, C. E. Archibold and S. Carsley, all of Montreal, Que.; A. O. Tate, D. A. Dunlap, of Toronto, Ont. Albert Klatschmidt, of Detroit, Mich., has been appointed manager of the factory.

**THE C. H. WARNER COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$15,000 for the purpose of installing plumbing, steam and gas fittings, electric wiring and heating systems. The incorporators are: C. H. Warner, D. B. Sommers, M. A. Warner, S. C. Kellie and Julius P. Preyer, all of Cleveland.

## New Incorporations

**PRAIRIE GROVE, ARK.**—The Farmers' Mutual Tel. Co. has been incorporated with a capital stock of \$10,000. The officers are: J. M. Covett, president, and A. N. Dean, secretary and treasurer.

**DIETRICH, ILL.**—The Union Tel. Co., of Elliottstown, has been incorporated with a capital stock of \$5,000 to operate a telephone system. The incorporators are: F. M. Haynes, John W. Dobbins, W. H. Endbrook, J. S. Sipes and William Poe.

**ROSSVILLE, ILL.**—The Rossville Tel. Co. has been incorporated with a capital stock of \$40,000 by Perry M. Warner, Charles W. Warner and Fred L. Draper.

**ALEXANDRIA, IND.**—The People's Pwr. & Lt. Co. has been incorporated with a capital stock of \$500,000 by C. M. C. Shank and others.

**TERRE HAUTE, IND.**—The Springfield (Ill.) & Central El. Trac. Co. has filed articles of incorporation with the Secretary of State. The initial capital stock is placed at \$50,000. The company proposes to build and operate a traction line from the Indiana-Illinois State line to Terre Haute; also to supply electricity for lamps and motors to towns, cities and coal mines along the line. Isaac A. Smith, George W. White and A. C. Skillman, all of St. Louis, Mo., are directors.

**ELIZABETHTOWN, KY.**—The Tygett Valley Wtr. Pwr. & El. Co. has been incorporated with a capital stock of \$20,000 by D. H. Hall, W. F. Carter, George Snider and W. W. Carter.



**ST. LOUIS, MO.**—The Missouri Public Utilities Co. has been incorporated with a capital stock of \$1,000,000 to operate light, power, gas and ice plants and electric railways in Southeast Missouri. The company has acquired plants in Charleston, Sikeston, Ill., and Fomfelt, Mo., and is negotiating for several more. It will build a large central electric plant, to cost about \$500,000. The incorporators are: Hugo Wurdack, president of the Lt. & Devel. Co., Wright Building, St. Louis; H. W. Beck, W. A. Smith and others.

**ELKO, NEV.**—The Elko-Lamoille Pwr. Co. has been incorporated with a capital stock of \$100,000 by J. G. Scrugham, of Reno; Frank Fernald, Sr., Webster Patterson, H. S. Taber, L. J. Wintermantel and B. G. McBride.

**BRIDGEPORT, OHIO.**—The Belmont El. Co. has been incorporated with a capital stock of \$10,000 to supply electricity for lamps, heaters and motors. The incorporators are: J. C. Dent, A. C. Barnum, L. W. Heimlein, W. E. Thoma and J. E. Fox.

**EBENSBURG, PA.**—The Springfield Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of \$5,000. This company is promoted by parties who are interested in the Springfield Coal Co., operating at Nanty-Glo, and represents the incorporation of its electric plant so that it can furnish electricity for commercial purposes should it choose to do so.

**HARRISBURG, PA.**—Charters have been granted by the State Department to the Providence, Eden, Paradise and West Lampeter Electric Companies. Each company is capitalized at \$5,000.

**HERSHEY, PA.**—The Hershey El. Co. has been incorporated with a capital stock of \$5,000 for the purpose of supplying electricity in Derry Township. M. S. Hershey is president.

**CLARKSVILLE, TEX.**—The Clarksville Tel. Co. has been incorporated with a capital stock of \$25,000 by W. M. Bloxham, A. C. Stuart, R. B. Harrison and J. F. Rochelle, all of Texarkana.

**JEFFERSON, TEX.**—The Jefferson Ice & Lt. Co. has been incorporated with a capital stock of \$30,000 by D. C. Driskell, W. M. Driskell and M. M. Benfield.

**TEMPLE, TEX.**—The Temple El. Co. has been incorporated with a capital stock of \$4,000 by James Ferguson, C. A. Hughes and J. E. Love.

**BRISTOL, VA.**—The Electric Transmission Co. has been incorporated with a minimum capital stock of \$300,000; maximum, \$500,000. The officers are: Guy Darst, president; Fred Dulaney, vice-president, and S. E. Puckett, secretary, all of Bristol.

**TONASKET, WASH.**—The People's Tel. & Pwr. Co., organized by the stockholders of the Tunk Valley Tel. Co., has applied for a franchise in Tonasket for a period of 50 years. The company is capitalized at \$15,000. J. H. Green is president of the company.

**HUNTINGTON, W. VA.**—The Tri-State Pwr. & Milling Co. has been incorporated with a capital stock of \$600,000 by C. L. Stearnes, R. W. Kline, of Salem, Va.; H. M. Fox, of Roanoke, Va.; Z. T. Vinson and A. E. Bush, of Huntington. The company has purchased water-power rights along the New River in Summers, Mercer and Monroe Counties, West Virginia, and Giles County, Virginia, capable of developing from 50,000 hp to 60,000 hp. It proposes to build a hydro-electric plant and transmission system to distribute electricity in West Virginia, Kentucky and Ohio. Plans have not yet been decided upon. C. L. Stearnes is president of the company.

**VICTORIA, B. C., CAN.**—The Telkwa Lt. & Pwr. Co., Ltd., has been incorporated with a capital stock of \$50,000 to do a general light and power business, with head office in Victoria.

**BOTHWELL, ONT., CAN.**—The Florence Pwr., Lt. & Milling Co., Ltd., has been incorporated with a capital stock of \$5,000 for the purpose of generating and distributing electricity.

**TORONTO, ONT., CAN.**—The Venezuela El. Lt. Co. has been chartered with a capital stock of \$1,500,000 by J. S. Lovell and R. Gowan.

**WINDSOR, ONT., CAN.**—The Essex County Lt. & Pwr. Co. has been incorporated with a capital stock of \$500,000 by W. A. J. Case, J. B. Case and C. G. Lynch, of Toronto.

## Trade Publications

**DYNAMOMETERS.**—Bulletin No. 505, published by the Diehl Manufacturing Company, Elizabethport, N. J., illustrates and describes its electric absorption dynamometer.

**ELECTRIC DRILLS.**—High-power universal portable electric drills are made the subject of Bulletin U.7 recently issued by the Standard Electric Tool Company, Cincinnati, Ohio.

**CHURCH ILLUMINATION.**—The National X-Ray Reflector Company, Chicago, Ill., has issued a bulletin on scientific church illumination, illustrating installations of its "Eye Comfort" system.

**PNEUMATIC COMPRESSORS.**—The design and construction of "Chicago Pneumatic" compressors are dealt with in Bulletin No. 34 F, issued by the Chicago Pneumatic Tool Company, Chicago, Ill.

**FORGE BLOWERS.**—The Emerson Electric Manufacturing Company, St. Louis, Mo., is distributing Bulletin No. 3313, which supersedes No. 3311, referring to its directly connected electric forge blowers.

**COPPER.**—"Copper History" is the self-explanatory title of a four-

page folder being distributed by the Rome Wire Company, Rome, N. Y. It gives the monthly average of prices of copper from 1883 to 1913.

**COMMUTATOR CEMENT.**—Folder 4247, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers the use of commutator cement for repairing commutators and also directions for using it.

**ILLUMINATION.**—A new large pamphlet has been issued by the National X-Ray Reflector Company, 247 Jackson Boulevard, Chicago, entitled "Greatest Efficiency in Reflection of Light." It deals with the X-ray system of lighting.

**AUTOMOBILE SUPPLIES.**—"Light Your Way by Electricity" is the title of a folder issued by the Cleveland Storage Battery Manufacturing Company, St. Louis, Mo., which gives brief, illustrated descriptions of its lamps, storage batteries and other specialties.

**GALVANOMETER.**—A new type of portable galvanometer being placed on the market by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., is made the subject of Bulletin No. 240, which describes this instrument and gives directions for its use.

**MOTORS.**—Leaflet 3540, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., deals with its synchronous motors for 60 cycles, two-phase and three-phase circuits, various voltages, and from 30 hp to 250 hp in rating. A fully illustrated description of the various parts is given.

**FROM GAS TO TUNGSTEN-FILAMENT LIGHTING.**—Bulletin No. 11, a November publication of the Delta-Star Electric Company, 617 West Jackson Boulevard, Chicago, has for its subject "Gas Street Lighting Transformed to Series Mazda Lighting." It briefly describes the Pittsburgh Delta-Star series system of 80-cp units on gas-lamp poles.

**GLOBES.**—Adam Globes for direct and semi-indirect lighting are made the subject of Catalog No. 22, recently brought out by the Phoenix Glass Company, New York. The soft paper, free from glare, the brown ink and the dignified cover make a harmonious combination fittingly adapted to advertise the globes and bowls made by the company.

**ELECTRIC FANS.**—The General Electric Company has issued its 1913 catalogue of electric fans, known as publication A 4665. It shows the company's fixed and oscillating desk and bracket fans and also its ceiling and ventilating fans. Wiring devices for use in connection with fans, as well as a list of supply parts for all fans, are also enumerated.

**ELECTRIC LAUNDRY EQUIPMENT.**—The Hurley Machine Company, Clinton & Monroe Streets, Chicago, Ill., is distributing an attractive, illustrated catalog of thirty-two pages, describing its complete line of electrically driven clothes and laundry machines, including washing machines, ironing machines and clothes driers.

**LAMPS.**—The National Electric Lamp Association, Cleveland, Ohio, has recently brought out two new bulletins. Train-lighting lamps furnish the subject matter for Bulletin 10 C. Bulletin 8 D contains data on miniature and low-voltage lamps for automobiles and general battery, novelty battery and low-voltage lamps. Both publications are fully illustrated.

**MOLDED INSULATION.**—The Northern Industrial Chemical Company, 68 Northampton Street, Boston, Mass., after an investigation of more than two years has developed an insulating compound, "Rexolite," a heat-resisting insulating compound which can be molded into any form. In a recently issued booklet are shown illustrations of the various forms into which this new material can be molded.

**ELECTRICAL APPARATUS AND AUTOMOBILE ACCESSORIES.**—The Holtzer-Cabot Electric Company, Brookline, Mass., assembles in its Catalog No. 4151 various bulletins that have recently been issued on this company's electrical apparatus and automobile accessories. These include among other things interior telephones, wiring specialties, carburetors, lighting generators for automobiles, telephone and wireless telegraph receivers, lightning arresters, magneto generators and other equipment, which are illustrated and briefly described.

**LAMP STANDARDS, MAST ARMS AND BRACKETS.**—The Electric Railway Equipment Company, Cincinnati, Ohio, has issued a catalog of sixty-two pages, which illustrates one-lamp, three-lamp and five-lamp ornamental standards, combination railway and lighting poles, lighting fixtures arranged for incandescent lamps or brackets for supporting ornamental luminous are lamps, special columns for supporting ornamental luminous are lamps, railway poles for ornamental crooks for supporting are lamps, ornamental brackets for incandescent lamps, and mast arms.

**INDUCTION MOTOR OPERATION.**—The Fairbanks-Morse Electrical Manufacturing Company, Indianapolis, Ind., is distributing an ingenious device—called the Fairbanks-Morse Induction Motor Graph—which shows by means of the vector diagram the relation of the instantaneous values of an alternating current to the instantaneous values of the induced electromotive force. The device indicates how these vectors behave in the windings of a three-phase motor to produce the phenomenon of the revolving field. The device shows the rotation of the induction motor operates in a simple, graphical manner, and by a better method than that presented by textbooks. It consists of two pieces of celluloid, 3 in. by 3 in., in the center of which is a circular piece, with saw edges, on which are printed in colors various arrows for showing the direction and values of the currents, the whole being inclosed in a leather case.

## Business Notes

W. T. McCASKEY & COMPANY, of Lansing, Mich., engineers, builders and operators of electric-service and water-works plants, have opened an office in Chicago at 725 Monadnock Building in charge of Mr. Irwin D. Groak.

THE M. W. DUNTON COMPANY'S cash prize for the agent sending in the largest amount of orders for Nokorude soldering paste in the

last quarter of 1912 was won by Mr. W. T. McDowell, New York sales manager of the company. A similar prize has been offered for the current quarter.

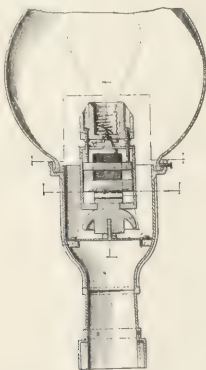
ALFRED GRAHAM & COMPANY, St. Andrews Works, Crofton Park Road, S. E., London, have mailed to many of their friends in this country a useful leather-bound desk pad complete with blotting sheets, calendar, memoranda space, etc. The Graham company manufactures patent loud-speaking telephones for communication in mines, collieries, fortifications, naval and mercantile vessels, etc.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 14, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,050,094. TROLLEY WHEEL; C. F. Bettmann, New Albany, Ind. App. filed Aug. 31, 1911. Lubrication of a multi-part wheel.
- 1,050,101. TELEPHONE SWITCHBOARD; P. C. Burns, Chicago, Ill. App. filed Jan. 18, 1909. Details of a jack and drop.
- 1,050,104. DIFFERENTIAL-MICROPHONE REPEATER; J. J. Comer, Chicago, Ill. App. filed Oct. 24, 1910. Variable leverage with adjustment.
- 1,050,105. ELECTRICALLY HEATED OVEN CONSTRUCTION; L. G. Copeman, Flint, Mich. App. filed July 28, 1911. Shield and drip trough.
- 1,050,143. TROLLEY; J. Kinzey, Pittsburgh, Pa. App. filed March 19, 1912. Lateral running wheels.
- 1,050,163. TELEGRAPHIC-TAPE-PERFORATING APPARATUS; J. P. O'Donohue, East Orange, N. J. App. filed Dec. 4, 1911. Intermittent feed.
- 1,050,189. ELECTROMETALLURGICAL FURNACE; J. Westly, Sultjelma, Norway. App. filed May 1, 1912. Resistance type with sloping bottom.
- 1,050,196. INSULATING SUPPORT FOR LAMP SOCKETS AND REACTANCE COILS; H. W. Young, Chicago, Ill. App. filed July 22, 1912. For attachment to a hollow pole or post.
- 1,050,203. CONTROLLER FOR ELECTRIC SIGNS; E. H. Bickley, Detroit, Mich. App. filed July 15, 1911. Controlled by a slotted ribbon.
- 1,050,211. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed Nov. 3, 1911. Push-button or door-operated.
- 1,050,223. SURFACE-CONTACT ELECTRIC TRACTION SYSTEM; E. A. Mitchell, Carshalton, Eng. App. filed May 19, 1908. Magnetically operated switch.



1,050,196.—Insulating Support for Lamp Sockets and Reactance Coils.

- 1,050,228. ELECTRIC ALARM SYSTEM; R. H. Olley, Syracuse N. Y. App. filed Feb. 20, 1911. Combination with residence lighting circuit.
- 1,050,239. ELECTRICALLY OPERATED SOUND PRODUCER; C. J. Schwarze, Adrian, Mich. App. filed July 28, 1911. Electromagnetically operated diaphragm.
- 1,050,250. ALTERNATING-CURRENT CABLE DISTRIBUTING SYSTEM; A. E. Tanner and E. A. Claremont, Manchester, Eng. App. filed April 8, 1910. Plural strand conductor.
- 1,050,255. PROCESS OF HYDROELECTRIC SMELTING; A. Tommasini, New York, N. Y. App. filed Aug. 1, 1912. Hydrogen reduction process.
- 1,050,260. OZONE GENERATOR; A. E. Walden, Baltimore, Md. App. filed Oct. 23, 1912. Concentric tube circulation.
- 1,050,280. THERAPEUTIC BELT; C. A. F. Krüger, Griefenhagen, Germany. App. filed Oct. 11, 1912. Has a plurality of electromagnets and a battery.
- 1,050,303. ARTICLE FOR ELECTROLYTICAL PURPOSES; B. Schweim, Frankfurt-on-the-Main, Germany. App. filed Feb. 17, 1911. The diaphragm of molded carbundum.
- 1,050,304. TELEPHONE TRANSMITTER; C. E. Scribner, Jericho, Vt. App. filed July 27, 1910. An electrode yieldingly held against the diaphragm.
- 1,050,328. IGNITING GAS BURNERS; C. F. Arnhorst, Chicago, Ill. App. filed Jan. 19, 1912. For igniting a series of burners.
- 1,050,372. ELECTRIC AIR-HEATING DEVICE; F. P. Mies, Chicago, Ill. App. filed Jan. 25, 1910. Electrically heated blower casing.
- 1,050,404. TELEPHONE FIXTURE; W. C. Ude, West Haven, Conn. App. filed May 3, 1912. Receiver hinged to the transmitter.
- 1,050,431. REGULATING APPARATUS; D. H. Darrin, New York, N. Y. App. filed Feb. 7, 1908. Damper temperature regulator.
- 1,050,444. ALTERNATE-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed Feb. 11, 1908. Starting and operating induction motors.
- 1,050,445. ALTERNATE-CURRENT MOTOR; V. A. Fynn, London, Eng. App. filed May 26, 1910. Commutatorless single-phase induction motor.
- 1,050,468. ELECTRIC TRACTION SYSTEM AND MOTOR TO BE USED THEREWITH; K. de Kando, Budapest, Austria-Hungary. App. filed May 25, 1905. Combination of direct-current and poly-phase motor with poleless field magnet.
- 1,050,493. AUTOMATIC HIGH-VOLTAGE CIRCUIT-BREAKER; E. O. Schweitzer and N. J. Conrad, Chicago, Ill. App. filed March 18, 1910. Oil-submerged fuse.
- 1,050,497. MOTOR-CONTROL SYSTEM; E. W. Still, Milwaukee, Wis. App. filed May 29, 1911. For urban and interurban cars. (Seventy claims.)
- 1,050,503. MAGNETO CONSTRUCTION; B. Whelchel, Indianapolis, Ind. App. filed May 12, 1911. Rigid framework.
- 1,050,513. BELL ATTACHMENT FOR PIANOS AND THE LIKE; D. W. Barton, Oshkosh, Wis. App. filed Oct. 25, 1911. Auxiliary keyboard.
- 1,050,514. TELEPHONE-CALL INDICATOR; B. L. Behrendt, Newark, N. J. App. filed Feb. 14, 1912. Indicator for telephone bell or buzzer.
- 1,050,520. KEY SHELF AND BASE; E. B. Craft, Hackensack, N. J. App. filed May 9, 1910. Longitudinally adjustable key base.
- 1,050,532. PARTY-LINE TELEPHONE SYSTEM; B. C. Groh, Trenton, N. J. App. filed March 21, 1904. Intercommunication controlled by the operator.
- 1,050,554. MOTOR-CONTROLLING APPARATUS; D. L. Lindquist, Yonkers, N. Y. App. filed July 6, 1907. Frictional-driving traction elevators.
- 1,050,563. ELECTRICAL MEASURING INSTRUMENT; F. W. Roller, East Orange, N. J. App. filed July 13, 1908. Ammeter shunt.
- 1,050,592. CIRCUIT CONTROLLER; J. M. Anderson, Boston, Mass. App. filed June 19, 1909. Wall-type breaker with auxiliary contacts.
- 1,050,643. OVERHEAD CONSTRUCTION FOR ELECTRIC RAILWAYS; E. E. Gilmore, Philadelphia, Pa. App. filed July 18, 1907. Balanced strain switching guying.
- 1,050,652. TROLLEY HEAD; R. F. Henne, Mamaroneck, N. Y. App. filed March 21, 1911. Transversely movable wheel.
- 1,050,662. METHOD AND MEANS FOR PRINTING TELEGRAPHY; I. Kitzee, Philadelphia, Pa. App. filed April 3, 1909. Group system with polarized relay and unbiased armature.
- 1,050,663. ELECTRIC TRANSMISSION OF INTELLIGENCE; I. Kitzee, Philadelphia, Pa. App. filed March 3, 1906. Combined telephone and telegraph.
- 1,050,664. TELEGRAPHIC TRANSMITTER; I. Kitzee, Philadelphia, Pa. App. filed March 31, 1909. Two polarized relays and transformers.
- 1,050,694. ELECTRICAL MEASURING INSTRUMENT; F. W. Roller, East Orange, N. J. App. filed July 15, 1907. Air-cooled shunt.
- 1,050,728. METHOD OF SIGNALING; R. A. Fessenden, Washington, D. C. App. filed July 27, 1905. Signals are produced by changes in frequency.
- 1,050,735. METHOD OF PRODUCING METALLIC PRODUCTS FROM IRON ORE; H. L. Hartenstein, Constantine, Mich. App. filed March 9, 1907. Carbon monoxide is used to aid the partial reduction of the following charge.
- 1,050,736. METHOD OF PRODUCING METALLIC PRODUCTS FROM IRON ORE; H. L. Hartenstein, Constantine, Mich. App. filed March 9, 1907. Fine dust or highly comminuted iron ore is reduced in stages.
- 1,050,740. ELECTRIC SWITCH; C. E. Knowlton, Rochester, N. Y. App. filed May 31, 1912. Flush wall switch.
- 1,050,750. ELECTRIC MOTOR; O. H. Pieper, Rochester, N. Y. App. filed Oct. 26, 1905. Series type alternating-current motor.
- 1,050,777. PHONOGRAPHIC WIRELESS TELEPHONE; A. F. Colby, Newark, N. J. App. filed March 18, 1909. Slot machine for public amusement.
- 13,510 (reissue). ELECTRODE; T. H. Dempster, Schenectady, N. Y. App. filed Dec. 9, 1912. (Original patent No. 976,990, Nov. 29, 1910.) Sectional flaming-arc construction.

# Electrical World

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No. 5

## The Hunt for a "Money Trust"

Public utilities figured so largely in the "money-trust" statistics presented to the Pujo committee that it is com-

forting to have the assurance of one of Mr. Morgan's spokesmen that there really isn't any money trust at all. Opinions on this point will probably continue to differ, notwithstanding this assurance, but clearer notions of the concentration of capital will prevail if the statement made to the committee by Mr. H. P. Davison is duly considered. The popular method of constructing a money-trust specter is to make up a list of "interlocking directors," add together the capital of the companies on whose boards they are represented, and then to declare that \$125,000,000,000, or some other mouth-filling amount, is under the exclusive control of a handful of men. The specter begins to look ridiculous when it is considered, as Mr. Davison pointed out, that the interlocking directors do not form a majority of the boards on which they sit, and that the capital they are supposed to control is not cash or its equivalent that may be juggled about at will, but is represented by investments in terminals, right-of-way, land, factories, machinery and other things not easily carried off in the directors' pockets. We did not need Mr. George F. Baker's admission that there is concentration of control of capital which in bad hands could be wrongfully used. This was already known. It has always existed everywhere. But if there is a "money trust" that need keep us awake nights, the Pujo committee, it is generally agreed, has failed to find it.

## Cost of Gasoline and of Electricity

While in a sense the fuel cost for operating a gasoline or an electric vehicle is not burdensome, the continued in-

crease in the price of the one as compared with the gradual decrease in the price of the other is becoming of international importance. So acute have conditions become in the gasoline automobile market that the consideration of cheaper distillates as fuel for internal-combustion engines is becoming imperative. Already a prize of \$100,000 has been offered for a substitute for gasoline because that fuel is increasing in price at the rate of a cent a gallon a month. Here is a situation which should cause builders of electric vehicles to sit up and take note. By the general law of supply and demand the increasing use of gasoline must of necessity cause its price to soar still higher, whereas an increasing use of electricity has the opposite effect. No such law affects the sale of electricity, and it is certainly gratifying to note that whereas nearly all other commodities have increased in price during the past decade by leaps and bounds, the cost of electricity has been steadily decreasing, even in the face of the fact that translating devices have been improved to a very considerable extent,

so that less electricity is needed to perform a given service. Increasing cost of fuel is not a theory but a condition now confronting the gasoline automobile industry, and the electric vehicle industry should make the most of the opportunity that this condition offers.

## Aid for the Unfortunate

Attention is called to the simple and sensible terms of the plan inaugurated by the Union Electric Light & Power

Company of St. Louis for loaning money to employees who might otherwise, to tide over an emergency, enter the snares of the loan shark. Every company executive has had personal experience with the need which exists for some means of alleviating temporary necessity in the case of deserving employees. And be it known, to the everlasting credit of such big-hearted administrators, the burden of furnishing the succor falls, more often than is ever suspected, on their own personal exchequers. The difficulty lies, however, in the reticence of the employee about consulting any one he has known concerning his troubles, and least of all his superior officer, who, he fears, might conceive a prejudice on this account. Instead, the borrower approaches the loan shark and enters into an iron-bound contract to pay to this social wolf an extortionate rate of interest which fastens him ever more securely in the money lender's clutches. The St. Louis plan contemplates allowing the employee to borrow, without interest, up to 50 per cent of his monthly salary, the amount to be repaid in at least 10 per cent instalments on the pay days following the loan.

## Electrical Coal Mining

One of our important articles this week describes the large and successful use of electricity in the Cape Breton mines.

As is well known to our readers, these mines in the vicinity of Glace Bay, Nova Scotia, have become of much importance, the field having a yearly output of 400,000 or 5,000,000 tons. The electrical installation in this territory began some half a dozen years ago with the installation of a 25-cycle alternating-current plant for one of the large collieries. The distribution in this territory over a comparatively moderate-sized territory at that date. The generators were engine-driven, and four years later in making a large addition to the plant a low-pressure turbine was put in place. The opening of new areas for mining has now shifted the center of the load and a second power house, as particularly described in the present article, is just been put into operation. This starts off as a 2000-kw proposition with the likelihood of considerable increase.



The most interesting feature of this new plant is the boiler equipment, in which finely pulverized coal is fed into the furnace with suitable air blast. Utilization of a low grade of coal is thus combined with the best possible combustion. The equipment is also very quick-steaming and can be pushed readily to meet the peak load. Energy for these plants is used for a wide variety of purposes, including pumping, conveying, operating fans, hoists and the like, besides the ordinary work of lighting. It is in hoisting, particularly, that electrical power shows best results, for no member of the steam-engine family is probably more hopelessly inefficient than the little hoisting engine. The electric motor doing the same work is, on the other hand, in itself a highly efficient machine and is fed with energy from a central-station plant operated under the best conditions of economy. And, for that matter, although less intermittent in operation, the use of pumps and fans driven by steam is almost equally bad, for the reciprocating pump in small sizes is notoriously a huge consumer of steam and few fans are large enough to permit the use of a really economical engine. Experience seems to have shown clearly that for the miscellaneous work of mining electric drive pays admirably, and there is no better evidence of this fact than the distributing system here described.

### Electricity in Coast Defense

The annual report of General Weaver, chief of the Coast Artillery Corps, outlined in this issue, is admirable evidence of the importance of close attention to matters of electrical engineering in connection with the operation of our coast defense. Every coast fortification requires a considerable amount of electrical service for ordinary lighting and motive power, for search-lanterns and the work of submarine mining, besides the intricate equipment demanded by the systems necessary for communication and range-finding. Concerning the major uses of electricity, especially those which have to deal with lighting and motor operation, there is a strong tendency toward a change of policy. Until very recently the scheme most favored has been to provide each group of fortifications with a central steam-driven plant, reinforced by auxiliary oil or gasoline-engine plants for emergencies and local service. Although the installation of such central isolated plants was recommended by the National Coast Defense Board, the present tendency is toward securing the ordinary supply of electrical energy from commercial central-station circuits, reinforcing this service by local isolated oil-engine plants.

The change of policy here indicated is a wise one. The ordinary electrical supply of a group of fortifications for lamps and motors can be just as well derived from a large commercial station as from a special plant, and it can generally be thus obtained more cheaply. It is absolutely necessary, of course, that each fortification be independent as regards its emergency source of supply. In other words, a complete duplicate system of generation must be furnished because it would be the height of folly to take the chance of a stray shell leaving an important battery without light or motor service, if it chanced to plow through a connecting cable, or putting a whole group of batteries out of service

by disabling the central station. The chance of crippling a commercial supply from a distance in time of war is certainly no greater than the chance of damage to a local system, since in the latter instance there is the element of danger to the plant itself in addition to the risk of interruption of the cable, which would exist in any case. Since it is at all events necessary to furnish each location with its own complete and independent supply, the ordinary source, for use in time of peace—and in time of war so long as it could hold out—can very properly be the central-station service of the locality.

One of the most important items in the coast-defense list is the search-lantern. General Weaver's report shows that it would take \$2,500,000 to complete fully the search-lantern equipment necessary for coast defenses. These search-lanterns are to be provided as rapidly as possible, for it is obvious that they cannot be purchased on the open market in an emergency. The mirrors, in fact, are not made in this country at all.

Likewise in the submarine mine service the systems of cables, mines and all the intricate apparatus for their control have to be provided and kept ready for installation, since it, like the search-lantern equipment, cannot be picked up on short notice. The brief experience of the Spanish War showed this only too plainly, and the facilities for getting this highly expensive material are even now little, if any, better than they were before. To handle all this electrical equipment it is necessary to have highly efficient, trained men for the coast fortifications, and one of the most important educational steps taken in the service has been the establishment of a course of training in the Coast Artillery School at Fort Monroe. The electrical equipment for the general defenses, as shown by the report, is making good progress and well-trained men are available for the purpose of handling it.

### Dielectrics in Alternating-Current Fields

It is coming to be recognized that in sending telegraph messages over long submarine cable lines by the usual electric signaling process with direct-current impulses governed by the dots and dashes of the Morse code, the dots having, say, plus polarity and the dashes minus, but all having equal duration, the conditions approximate those of low-frequency alternating-current operation. Whereas, however, in simple alternating-current operation the positive and negative impulses follow successively with unending regularity, in the operation of alphabet signaling any single positive impulse is as likely to be followed by a second positive impulse as by a negative impulse. However, the conditions may be regarded as embodying a righteous attempt to rise to the alternating-current sphere, with ever-apparent fallings away from grace. The devious imperfection of the alphabetical operation, regarded from the simple alternating-current standpoint, makes it necessary to apply alternating-current theory cautiously to practical signaling conditions and to treat the case as embodying a certain amount of deviation from the norm, the extent of such deviation being a matter for experimental determination.

The linear insulation resistance of submarine cables in good working order is very high. Its value is difficult to measure or to state with precision, since it depends upon the duration of the testing current and also, to some extent, upon the recent electrical history of the dielectric. If, for example, the linear insulation resistance of a submarine telegraph cable is measured, say, at the end of the second minute of direct-current application, it is likely to make a great difference whether the cable has been kept for a long time connected to ground at the sending end before applying the testing voltage or whether a testing voltage of opposite sign has been recently applied instead. These effects of time and of previous history are commonly included under the general influences of "electrification."

If the signaling process be regarded, however, as a rough approximation to alternating-current application, then evidently the proper method of measuring linear insulation resistance or its reciprocal, linear dielectric conductance, is with reference to alternating-current standards. It is found, in fact, that when an alternating emf of about the same frequency as that of reversal signaling—say, three or four cycles per second—is applied to the sending end of a very short cable, instead of a continuous emf, charging current enters the cable, and the component of this current in phase with the emf measures the power expended in the dielectric. Part of this power, ordinarily only a small part, is attributable to leakage conductance. The remainder is attributable to dielectric hysteresis. The leakage power develops Joulean heat in the dielectric. The hysteretic power develops hysteretic heat in the dielectric. Since the two thermal losses necessarily coalesce, they may be treated collectively as a simple leakage conductance. Whereas, however, a pure leakage conductance should be independent of the frequency, dielectric hysteretic power increases directly with the frequency, like magnetic hysteretic power. Consequently, an apparent leakage conductance due to hysteresis increases with the frequency. Expressed in another way, the power-factor of a very short submarine cable which has an alternating emf impressed on one end and is freed at the other end should be constant at all frequencies if the dielectric losses are hysteretic, but should diminish as the frequency increases if the dielectric losses are appreciably conductive or due to leakage.

At the very low frequencies of long submarine-cable signaling, the total alternating linear leakage, including hysteresis, is not of much importance, if the cable is in good working order. That is to say, the alternating-current leakage does not materially affect the working signaling speed. But at telephonic frequencies this leakage is likely to have a serious detrimental effect on the behavior of the cable.

In an article recently printed in the London *Electrician* Mr. G. L. Addenbrooke discusses some experimental observations of the apparent leakances of gutta-percha condensers at low frequencies. At any one temperature these leakances, when plotted as ordinates against frequency abscissas, follow approximately straight lines, in such a manner as to indicate a fairly constant conductive loss plus a fairly large hysteretic term. It is possible that in time insulation measurements of submarine cables, either short

or long, may come to be made with low-frequency pure alternating emf. Simple formulas are already available for separating the influence of the copper losses from the dielectric losses over any or all lengths of cable.

### The Grounded Neutral

A well-considered paper on the grounded neutral by Mr. J. S. Peck is referred to in the *Digest* in this issue. The author's discussion has largely to do with the matter of grounding in the case of high-voltage transmission circuits. In case of secondary distribution there seems to be only one answer to the grounding question, and that in favor of the practice. The mere question of danger to life in a low-tension distributing system of the character now generally employed is sufficient to settle this question once for all, any incidental objections dropping out of sight. In high-tension work, however, there are other matters to be considered.

Grounding materially increases the factor of safety in the insulation, and this result is extremely desirable. We do not think that the cheapening of insulation due to grounding is an important matter since the advantage is better applied to raising the factor of safety. The greater ease of protection against lightning due to the cause just mentioned is an additional advantage to be gained, since lightning is one of the few contingencies on transmission lines which cannot be easily guarded against. When an equipment is once arranged for grounded operation, there seems to be no adequate reason for eliminating the ground connection, and hence the objection which may possibly be raised, that trouble may be encountered on account of the inability to operate advantageously without ground connection a system originally designed for grounded work, is not a matter of great consequence. A well-planned transmission line must maintain its insulation, and it is certainly an open question whether it is not better to have a grounded line become inoperative immediately than to have it interfere with service for a brief period; the interference with service would ordinarily be of predominating importance.

An accidental ground on any phase of an underground supply system is pretty certain to lead to grave trouble. The main question is, therefore, whether the neutral should be grounded directly or through a resistance. In many instances it is desirable to use such resistance as to allow the circuit-breakers to trip before any further damage can be done. Practice tends toward low-resistance grounding. The one case considered by Mr. Peck in which grounding seems less important than everywhere else is that of generators of moderately high voltage connected directly to overhead lines. In this case the system is operated for some time in the minor grounds on a single wire if the system is ungrounded. On such systems the practical factor of safety in the insulation is generally considerably higher than in the typical high-voltage transmission system, so that there is less to gain relatively by limiting the tension between wire and earth. Mr. Peck's consideration of the matter forms a good summary of the present state of the situation.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Western Association of Electrical Inspectors

(By Telegraph)

The eighth annual convention of the Western Association of Electrical Inspectors opened at the Planters' Hotel, St. Louis, Mo., Tuesday, Jan. 28, for a three-day session lasting until Thursday of this week. Special cars brought a number of the delegates to St. Louis from Chicago, where on Monday afternoon interesting fuse tests had been made at the Underwriters' Laboratories.

An attendance of seventy marked the first day's session at St. Louis. In his opening address Mr. W. J. Canada, Denver, Col., retiring president of the association, directed special attention to the improved uniformity of inspection methods now obtaining in the field, an improvement which he traced largely to the association's active work during the last eight years.

Following President Canada, Mr. F. A. Driscoll, of Pass & Seymour, Chicago, spoke on the subject of "Electrical Porcelain, Its Manufacture and Uses." Mr. H. B. Gear, Commonwealth Edison Company, Chicago, presented a paper on "High-Voltage Transmission-Line Requirements," and Mr. B. H. Glover, associate electrical engineer Underwriters' Laboratories, Chicago, discussed "Electrical Laboratory Test Problems."

Mr. W. H. Blood, Jr., Boston, Mass., insurance expert for the National Electric Light Association, was to have presented a paper on "The 660-Watt Branch Circuit and Its Relation to Mazda Lamps," but being unable to attend he sent a letter to the St. Louis convention in which he urged the adoption of 10-amp fuses for final circuits and the granting of permission to use household devices up to 1000 watts on any socket. For devices above that rating he recommended the adoption of special plugs. Mr. Blood also suggested the advantage of substituting No. 12 wire for the No. 14 ordinarily used for final circuits in buildings. He considered the limitation of sockets to twelve per circuit unnecessary in building wiring for the sake of electrical safety, although he thought such a limit might prove advisable from the standpoint of public danger, since the blowing of a single fuse would under these conditions result in extinguishing a smaller proportion of the total lamps in the building.

On Tuesday evening the Jovian Chapter of the St. Louis League of Electrical Interests tendered a very delightful entertainment to the visiting inspectors.

### International Prize of \$100,000 Offered for Gasoline Substitute

At a recent meeting in Paris, France, of the International Association of Recognized Automobile Clubs, which represents the whole of Europe and the United States, an international prize of \$100,000 was announced for the best fuel other than gasoline capable of being used in an internal-combustion engine. The purpose of the prize offering is to interest chemists in the production of a fuel which cannot be monopolized by any nation or combination of national interests. Owing to the increasing price of gasoline, the substitution of a new fuel for gasoline motor drive has occupied the attention of many in this country. A few

tests have been made at the laboratory of the Automobile Club of America, but up to the present nothing of a substantial nature has developed. Evidently there is a world-wide demand for relief from the present situation, which ought to contain much of interest for the electric-vehicle industry.

### Electrification of Chicago, Milwaukee & Puget Sound Railroad

While nothing definite has been decided in relation to the engineering details of the electrification of the main line of the Chicago, Milwaukee & Puget Sound Railroad between Harlowton, Mont., and Avery, Idaho, it is said to be not unlikely that 2400-volt direct-current motors will be used on the electric locomotives, energy being supplied to them by means of an overhead system. As previously stated, electricity will be purchased by the railroad company from the Montana Power Company of Butte, which will generate it, normally, at hydroelectric plants. These generating stations are, or will be, located at Great Falls, on the Missouri River; at three sites on the same river near Helena, at a site on the Madison River, in the Rocky Mountains, and at Thompson Falls, on Clark's Fork. With a diversity of sources and excellent reservoir possibilities in some of the mountain sites, continuity of operation is anticipated.

The energy will be transmitted at 100,000 volts or thereabout and transformed to a lower voltage for distribution, and also probably changed to direct current, as mentioned. The electric zone of the railroad embraces 439 miles of single track with 11 or 12 miles of sidings. It embraces that portion of the railroad extending from the plateau of eastern Montana over the passes through the main ranges of the Rocky Mountains. The railroad is excellently built, but in some cases grades of 2 per cent are encountered. The electric locomotives will haul all classes of traffic, both freight and passenger. President A. J. Earling of the Chicago, Milwaukee & St. Paul Railway Company, which controls the Puget Sound road, is much interested in this electrification, which will be carried out under the direct supervision of Mr. C. A. Goodnow, vice-president.

### Association of Corporation Schools

Representatives of a number of large manufacturing corporations which conduct schools for training employees in the technical branches of their work met at the New York University law school on Jan. 24 and perfected organization of the National Association of Corporation Schools, whose aim it will be to co-ordinate the educational efforts of its member companies. Mr. Arthur Williams, general inspector of the New York Edison Company, was elected the first president of the association, the vice-presidents chosen being Mr. E. St. Elmo Lewis, of the Burroughs Adding Machine Company, Detroit, Mich., and Dr. C. P. Steinmetz, of the General Electric Company, Schenectady, N. Y. Mr. Frederick C. Henderschott, 424 Broadway, New York City, is secretary. Annual conventions will be held by the organization.

In the evening nearly 100 members and guests attended



the association's first banquet, which was held at Delmonico's, with Mr. Lee Galloway presiding as toastmaster. In his address at the dinner President Arthur Williams referred to the work of the public-policy committee of the National Electric Light Association in bringing about a clearer realization of the justice of workmen's compensation, service annuities and employees' profit-sharing. Dr. C. P. Steinmetz spoke briefly, urging the need for the development of corporation educational standards up to the degree of efficiency already attained in the branches of production and administration. Chancellor Elmer E. Brown, of New York University, and Vice-President E. S. Lewis discussed the aims of co-operative education and the results to be achieved through the newly formed association. At the close of the dinner President Williams was the recipient of a unanimous vote of recognition and appreciation of the valuable and important work done by the New York Edison Company in the organization of its employees' schools.

### Ratification of Wireless-Telegraph Treaty

Ratifications of the wireless telegraph treaty signed at London July 5, 1912, probably will be exchanged at the British capital within a few weeks by the thirty-one signatory powers. The Senate ratification of the treaty a few days ago paved the way for this formality, as practically all the other governments are understood to have approved the treaty, which will become effective July 1, 1913. By this convention the important maritime nations of the world have linked themselves together to attain the widest range of international usefulness of the wireless telegraph without restriction as to its further development. A full transcript of the London convention and the final protocol, together with an abstract of the regulations, was printed in the *Electrical World* for Sept. 28, 1912.

### Tariff Hearings on Schedules B and C

The tariff hearings before the ways and means committee of the House of Representatives, which have extended through the month of January, have been marked in many cases by testimony to the effect that conditions in various industries have materially altered since the making of the last tariff bill. Representatives of various industries connected with electrical matters were heard during the consideration of Schedule B—"Earths, Earthenware and Glassware"—and Schedule C—"Metals and Manufactures of."

#### RODS AND WIRE

Besides altering the phraseology of the present act, as it applies to "telegraph and telephone wires, coated, and cables," the John A. Roebling Sons Company, representing nine wire manufacturers, asked for a reduction of 5 per cent (from 40 per cent to 35 per cent) on this item, in a brief filed on the subject. The petitioners referred particularly to wire rods, round iron and steel wire, flat wire and steel in strips, and articles manufactured from wire. High-grade products were referred to entirely, thus excluding common or tonnage products, such as fence wire, bale wire, nails and other run-of-mill product. High-grade products require more operations, heat treatments, picklings, inspections, etc., and a larger proportion of labor. In the matter of machinery about the same methods are employed at home as abroad, and these are comparatively simple.

The act of 1909, paragraph 134, provides duties of 0.3 cent per pound on all rods valued at 4 cents per pound or less and 0.6 cent on rods valued at more than 4 cents per pound; it further provides 0.5 cent per pound additional duty on rods tempered or treated in any manner, or smaller than No. 6 wire gage. Objection was made to Bill

H. R. 18,642, which classifies finished products with rods and lowers the tariff. The suggested paragraph on rods was as follows:

"Wire rods, rivet, screw, fence and other iron or steel wire rods, whether round, oval, flat or square, or in any other shape, and nail rods, all the foregoing in coils or otherwise, 10 per cent ad valorem: Provided, That all the foregoing iron or steel wire rods, of whatever shape or section, which are cold-rolled, or cold-drawn, or cold-hammered, or polished in any way in addition to the ordinary process of hot-rolling or hammering, or that shall have been tempered or treated in any manner or partly manufactured, and all iron or steel wire rods smaller than No. 6 wire gage, shall be classified as wire and dutiable as such under the provisions of this act."

The proposed paragraph in relation to wire is next given:

"All wires composed of iron, steel or other metal, except gold or silver, whether rolled or drawn through dies or rolls, or otherwise produced, whether round or flat, oval, square, or in any other section or shape, in coils or otherwise, whether in long or short lengths; all flat wires, and steel in strips, whether in long or short lengths, in coils or otherwise, not thicker than No. 15 wire gage, and not exceeding 5 inches in width; all the foregoing valued at—

Per Cent  
Not over 2 1/2 cents per pound 15  
More than 2 1/2 cents per pound, not more than 2 3/4 cents per pound 25  
More than 2 3/4 cents per pound 35

"Provided, however, That all wires composed of iron, steel or other metal, except gold or silver, covered with cotton, silk, enamel or other material, corset clasps, corset steels and dress steels; all iron or steel flat wire, and steel in strips, whether in long or short lengths, in coils or otherwise, not thicker than No. 15 wire gage, and not exceeding 5 in. in width, and all iron or steel wire other than round, valued at 6 cents or more per pound; all round wire of iron or steel in long or short lengths, in coils or otherwise, valued at 8 cents or more per pound; telegraph, telephone and other wires and cables composed of metal and rubber, or metal, rubber and other materials; wire hobbles or heads; wire rope and all other articles manufactured wholly or in chief value of any of the foregoing or of any wire or wires provided for in this paragraph, on all the foregoing, 35 per cent ad valorem.

"Provided further, That iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin or other metal, and not otherwise specially provided for, shall pay, in addition to the rate imposed on the wire of which it is made, one-tenth of 1 cent per pound; provided that none of the foregoing or any of the articles provided for in this paragraph shall pay more than 35 per cent ad valorem."

Further provisions, not included above, relate to plain wire. "A plea was also made to maintain the present duty of 0.2 cent per pound, in addition to the duty on plain wire, for specially galvanized wire, known as double or extra galvanized."

A synopsis of other hearings relating to nonferrous lamps, carbon, aluminum, bauxite, mica and ferro alloys will appear in a later issue.

### Mexican Hydroelectric Development

Work on the hydroelectric station at the Mexican Northern Power Company on the Conchos River, about 17 miles from Santa Rosalia, Mexico, which was held up for a time owing to the activities of the rebels in that section of the country, is again under way, and it is expected that the project will be finished about July 1, 1913. The Mexican Northern Power Company is a Canadian concern, with its principal office in Montreal, and, in addition to furnishing energy to a subsidiary company, the Mexican Securi-

ties Corporation, Ltd., of Halifax, Nova Scotia, it will build transmission lines to Chihuahua, Parral, Jimenez and other cities, besides carrying on a central-station business in each of those cities on its own account. The dam now nearing completion at La Quoilá is stated to be one of the largest masonry structures in the world. Its height will be 261 ft. and its width at the crest 19 ft., the width of the bottom being 200 ft. The reservoir it will create will have a storage capacity of about 28,000,000,000 cu. m., which will flood an area of 58 sq. miles. Besides this main dam a subsidiary dam 2610 ft. long and 108 ft. high is being built about half a mile from the main dam.

The hydroelectric station, it is stated, will have a rating of more than 100,000 hp. The company has also in contemplation the irrigation of 200,000 acres of land in the valley of the Conchos River. Messrs. S. Pearson & Son of London, Eng., are the contractors for the enterprise. Mr. P. L. Bloston is the general superintendent, and Mr. William B. Buller is chief engineer of the work.

### Revision of Standardization A. I. E. E. Rules

Before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, Mr. B. G. Lamme, of Pittsburgh, on Jan. 27 delivered an address on "The Desirability of Revising the Rating and Methods of Testing Electrical Apparatus." He did not have a prepared paper, but spoke extemporaneously, with the aid of notes. He devoted himself to the proposed revision of the standardization rules of the American Institute of Electrical Engineers.

Mr. Lamme gave a brief history of the standardization rules, and said that the trouble with them has been that they have followed practice but have never led practice. He told of the work of the sub-committees of the Institute on revision and ratings, and outlined some of the important changes which it is proposed to make in the rules. The sub-committees have found many defects in the present rules and some of the changes offered are radical. It has been proposed to submit these changes to the electrical public before embodying them in the rules. An Institute convention will be held in New York for this purpose on Feb. 26 to 28. (See *Electrical World* of Jan. 18, page 128.) At this meeting there will be presented some forty papers relating to the general subject of standardization. Mr. Lamme gave a general forecast of the report of the sub-committee on revision prepared by Dr. C. P. Steinmetz and himself.

The speaker said that there should be no standardization in design. Standardization should apply to methods and practice; it should give a definite meaning to a contract or a guarantee, so that there may be uniformity throughout the country. One thing referred to was the rating for alternating-current generators. It is the present practice to rate them at 100 per cent power-factor. This is incorrect; the power-factor should be specified. The sub-committees are trying now to make rules for rating that will be as useful, perhaps, five or ten years hence as at the present time. The sub-committees hope for a wide discussion of their work. Constructive criticism is desired.

### TEMPERATURE AND INSULATION

Much of Mr. Lamme's address was devoted to the subject of temperature and insulation of electrical machinery. The old method of testing is held by the sub-committee on revision to be incorrect. Temperature rise in itself has no meaning. The temperature attained—the ultimate temperature—is what is important. The new rules make the ultimate temperature the basis of the rating, for it is the absolute temperature that is liable to damage the insulation; the rise is only an incident.

The effect of heat on insulating material is largely

mechanical. The insulation becomes brittle and mechanically unfitted for its purpose, as it is largely a separator to keep the conductors apart mechanically. Insulation may be heated until it is carbonized and still retain a good degree of dielectric strength, but its mechanical resistance is gone. Durability of insulation is a function of the temperature, but there is no such thing as a definite life to insulation. Insulation in electrical machinery has been withstanding higher temperatures than has been thought, because methods of measurement have been defective. Fibrous types of insulation will probably withstand 100 deg. C. continuously for ten years or more. The sub-committee has assumed 100 deg. as the highest temperature that can be applied continuously for a long life. Intermittent application of heat to insulation permits of higher maxima of temperature than steady application.

There is no direct method of determining the ultimate temperature of the hottest parts of insulation in a machine. The speaker described the commercial method of partly measuring and partly computing this temperature—measuring by thermometer and resistance and computing by the laws of temperature drop in insulation, which are pretty definite. In the conventional methods of measuring temperature the result attained is always lower than the temperature of the hottest part. It may be assumed, for instance, that if the conventional measurement is 90 deg. the temperature of the hottest part will be 100 deg. Taking 90 deg. as the conventional limit and 40 deg. as the temperature of the outside air, a rise of 50 deg. is permitted. However, if the customer using the machine desires to put in a method of cooling to run his generator at, say, 25 deg. C., he should have the advantage of so doing. The rating should still be at 100 deg. in the hottest part for continuous operation, or 90 deg. by conventional measurement.

As to the temperature of the "surrounding air," Mr. Lamme pointed out that what is to be taken into account is the temperature of the air going into the machine, not generally of the surrounding air. If a machine is in a pit or in an unventilated corner there is considerable difference between these two terms. The old rules are defective in this respect.

There may be difficulty in ascertaining the internal temperature of machines. This is particularly the case with a large high-voltage machine with a long core. Here it is not practicable to use ordinary fibrous insulation, and this has led to the use of mica insulation on the buried parts of such machines. Mica insulation in machines will withstand 125 deg., conventional measurement, for continuous operation, as well as fibrous insulation will withstand 90 deg., conventional measurement. In the new rules it is proposed that mica insulation in machines be allowed an ultimate temperature of 125 deg. by conventional measurement.

The proposed method of rating will permit of machines being loaded more closely to their limit than the present rules. In low-voltage machines the new rating will be determined when the hottest part is at 100 deg. C. for continuous operation. At that temperature the absolute rating of the machine will be determined. There will be no "peak" rating or "full-load-for-two-hour" rating; simply one absolute rating. Speaking of overload ratings, the speaker said that the idea here is generally a fallacious one. The designer of the machine must plan for the peak condition. There is no use in building a 3000-kw machine and calling it a 1500-kw machine to get 100 per cent overload for two hours. However, momentary peaks do not affect temperature materially; the time element must enter in.

### MEASUREMENT OF LOSSES AND EFFICIENCY

In relation to the method of measuring losses in electrical machinery and the determination of efficiencies, Mr. Lamme said that the input-and-output method is really not scientific. It involves the using of large units of measure-

ment to determine relatively small losses. A small error in observation or calculation may make a serious difference. The separate-loss method of measurement can be made more accurate than the other, but it requires a correcting factor. However it is better adapted to commercial conditions. It is expensive to make a good input-and-output test on a large unit, and the results are not accurate enough to be worth the cost. In the new rules the separate-loss method, with correcting factor, will be recommended. This method is particularly well adapted to the testing of induction motors and rotary converters. It is also very well suited to the testing of transformers.

#### Discussion

Mr. W. B. Jackson, Mr. Hugh Pattison, Prof. W. C. Bauer, Prof. P. B. Woodworth, Mr. B. H. Glover and others took part in the discussion. Mr. Jackson spoke in appreciative terms of Mr. Lamme's work and pointed out that the proposed rules will not only furnish a manual for testing but will have a deeper object in pointing out the most economical method of designing and operating electrical machinery. He said the committee should be encouraged and helped. Mr. Glover asked what the ultimate life of insulation for electrical machinery was. Mr. Lamme answered that in machine insulation fibrous and cellulose materials are in one class and mica and similar materials in the other. In the first case an ultimate temperature of 100 deg. in the hottest part of the machine would give a relatively long life, probably ten or fifteen years. In the mica class it is not known how long the life would be with an absolute temperature at a continuous rating of 125 deg. or even 150 deg. in the hottest part. Mica insulation has been operated at these temperatures for four or five years without showing any sign of trouble.

### Hydroelectric Development on the Connecticut River at Windsor Locks, Conn.

The Senate committee on commerce has reported favorably on the bill authorizing the Connecticut River Company to relocate and construct a dam across the Connecticut River above the village of Windsor Locks in the State of Connecticut. The interesting feature about the bill is the proviso authorizing the Secretary of War to impose a reasonable annual charge to be paid by the corporation for the privilege granted, these proceeds to be used for the development of navigation on the Connecticut River and the waters connected therewith. For years the federal government has been importuned to improve this portion of the Connecticut River so as to permit navigation to pass around the rapids which obstruct the river at Windsor Locks, but the board of engineers to which the project has been referred has uniformly reported that the expense of such an undertaking would be so great as to make it inadvisable for the federal government itself to assume the burden. Under the present bill this burden is assumed by the private company which is to develop the water-power.

A basis of agreement has been reached with the company under which its books, showing all the actual expenses of the enterprise, are to be open to the government and the profits from the sale of water-power are to be carefully tabulated and accounted for under standards subject to the approval of the board of engineers. The company is to receive the net profits derived from its investment to an extent of 8 per cent on the actual cash invested. Thereafter all further net profits are to be divided between the government and the company. Between 8 and 9 per cent they are to share equally, and beyond 9 per cent the government is to share in an increasing ratio. Furthermore, in order to provide for a possible increase in the profits of such business, as years pass and water powers may increase in value, the Secretary of War has insisted that

after thirty years under the present arrangement there is to be a readjustment of compensation by agreement between the government and the grantee, and that thereafter such readjustment is to take place at the end of every ten years, until the termination of the permit, the life of which is fifty years altogether.

A minority committee report, while favorable to the measure, suggests the elimination of the federal rental clause on the ground that it is an attempt, under the guise of regulating commerce, to invade the settled rights of the State for commercial purposes. This principle, it asserts, if established, will confiscate the natural resources and property of the States and of their citizen riparian owners, without a legal right or a moral right to do so. In the estimation of the minority the adoption of the principle will create a divided responsibility, causing two sovereign powers to attempt to regulate and control the same question at the same time, and will grant to the Secretary of War discretionary powers never contemplated under the commerce clause of the Constitution.

### Annual Conference of National Civic Federation

The thirteenth annual conference of the National Civic Federation was held at the Hotel Astor, New York City, Jan. 28 and 29. The speakers at the opening session were Messrs. Seth Low, president of the federation; Emerson McMillin, chairman of the department on regulation of interstate and municipal utilities; Alton B. Parker, William R. Willcox, Public Service Commission, First District, New York, and John B. McPherson, secretary of the New England Civic Federation, who read a paper prepared by Mr. August Belmont on workmen's compensation laws. The afternoon session was given over to a discussion of proposed pension laws, a three-cornered debate being held by Messrs. F. S. Baldwin, former chairman of the Massachusetts State Commission on Pensions, G. T. Morgan, chairman of the executive committee of the United Civil Service Annuities Association, and Arthur Williams, of the New York Edison Company.

In his opening address Mr. Low said that the present method of dealing with the trust question is merely playing with the situation. He suggested that there be a specific acknowledgment that all restraint of competition is not necessarily restraint of trade, and favored a federal license for state-created corporations, because that is the path of least resistance and because if it be successful it involves the least radical departure from what already exists. To an interstate trade commission such as he thought should be established Mr. Low would not give it first authority to fix prices. The commission would have power to decide what was legal under the Sherman act. He argued that if the details were criticised by the commission changes could be made to conform the commission's directions.

Mr. Emerson McMillin in his report said that the principle of public regulation of quasi-public undertakings is firmly established in this country. The Massachusetts Board of Gas and Electric Light Commissioners, created by the Interstate Commerce Commission and is little more than thirty years old, has been so far the only commission to regulate interstate utilities. In 1887, supported by the forty-eight states of the Union, public law created the first one kind or another of regulating authority over the railroads or local public utilities in each state.

The old idea that the purveyor of transportation, gas, water, electricity and other public services must conform conditions to be engaged in a private business, subject to the same rules of bargain and sale as the dry goods merchant, the butcher or the manufacturer, no longer prevails. Competition, relied upon in the earlier days to protect supposed public interests, has failed; competition in a public



service business is war. The furnishing of a transportation, gas, water, electric, telephone or other public service is, and should be, he said, naturally a monopoly. Unregulated monopoly in any field of endeavor is abhorrent to Anglo-Saxon people. While regulation of public utilities must be based on full recognition of the monopolistic character of the business, it is also true that recognition of monopoly invites public regulation or public ownership and operation. The department believes that not only public regulation is preferable to public ownership and operation, but that public ownership and operation may be deferred only by reasonable public regulation. The state owes it to its quasi-public agencies performing the transportation, gas, water, electric, telephone and other public services no less than to the public itself to free public utilities from the baneful influence of local politics. The state must see to it that the common-law rule of reasonableness and non-discrimination is applied fully and in all respects fairly to these industries. The efforts of the department have been directed to the drafting of a sample bill, which is now nearing completion, and will be available as a sample for use in all states in the country which have not as yet legislated on the subject and in other states which are proposing to revise existing legislation.

Public Service Commissioner Willcox's report on welfare work was read by the secretary of the welfare department of the federation. As signs of the advancement of welfare work, Mr. Willcox's paper pointed to the better sanitary conditions in many factories, particularly as regards medical inspection to ascertain tuberculosis; a generous introduction all over the United States of playgrounds, and the introduction by many firms of life-insurance funds for their employees. Efforts are under way, Mr. Willcox reported, to obtain a higher minimum wage for department store employees.

The discussions on Jan. 29 were devoted to the federation's proposed amendments to the Erdman railway conciliation act and upon a proposed model state mediation act. This discussion was led by Messrs. Marcus M. Marks, Samuel Gompers, Labor Commissioner Charles P. Neill, James M. Lynch, State Commissioner William G. Rogers, W. G. Lee and W. Z. Ripley. Mr. William Jay Schieffelin discussed the protocol in the local garment trades at the afternoon session. There were also a debate on "The Practicability and Desirability of Minimum Wage Required by Law," and a paper by Mr. Ralph M. Easley on "Industrial and Civic Progress in the United States."

### Society of Heating and Ventilating Engineers

The annual meeting of the American Society of Heating and Ventilating Engineers was held in New York City Jan. 21, 22 and 23, with Mr. John F. Hale, of Camden, N. J., first vice-president, occupying the chair in the absence of President John R. Allen, of Ann Arbor, Mich., who is in Turkey. President Allen nevertheless forwarded his presidential address, which discussed "Development and Present Problems of Heating and Ventilation." Reports by Secretary W. W. Macon, New York, and Treasurer J. A. Donnelly, New York, showed the flourishing condition of the society, with \$1,041 cash on hand, and a membership of 449, an increase of twenty-four over last year.

After hearing from various state chapters, the report of the committee on compulsory legislation was read. Prof. J. D. Hoffman, University of Nebraska, Lincoln, is chairman of this committee, which comprises twenty-one members. The ideal law outlined in the report is designed for the guidance of state legislators and provides for proper heating and ventilation of all buildings of a public nature (whether publicly or privately owned), containing rooms used as meeting places, study rooms, rest rooms, sick rooms or wards, laboratories, workshops, cloak rooms, etc.

The proposed law would require 65 deg. to 70 deg. Fahr. in offices, assembly halls, recitation and sick rooms, 60 deg. to 65 deg. in gymnasiums and 60 deg. to 70 deg. in corridors, workrooms, toilets, etc.; more than 5 deg. variation being in no case permitted. Where dust or other matter is likely to render the ventilating air impure filters or washers must be installed. Mechanical ventilation plants must also provide means for holding the humidity between 50 per cent and 70 per cent. Ventilation requirements given are as follows: In general, at least 200 cu. ft. of air space, or 15 sq. ft. of floor area, for each person. For sick rooms, contagious diseases, 3600 cu. ft. air per hour per person; non-contagious, 2500 cu. ft. Auditoriums, schools, etc., 1800 cu. ft. For each cubic foot of gas burned 1000 cu. ft. air per hour per person. Rooms not meeting the general minimum requirements, and having a window area less than one-eighth their floor space, must be ar-

#### REQUIREMENTS IN MOTION-PICTURE-THEATER VENTILATION.

	Single Machine	Two Machines	Three Machines
Exhaust ventilation, cubic feet per minute	60	90	120
Metal-screened inlet openings, with fusible-link dampers, area, square inches	150	210	240
Fireproof flue from booth, discharging outside, area, square inches	96	120	144

tificially ventilated during occupancy. Air velocities employed must not exceed 400 ft. per minute at registers, 700 ft. in vertical ducts or 400 ft. in mechanical air washers.

A paper by Mr. E. Beery, Rockford, Ill., described the use of downward ventilation in a local school building. "Improved Air Conditions in a Boston Residence" was the title of a paper read by Mr. Frank Irving Cooper in which he described an installation employing electric radiators, humidifying, air-washing and ozonizing apparatus. The author, as chairman of the committee on schoolroom ventilation, also presented that committee's report.

On Wednesday morning Mr. Frank Bussey read a paper, "Design of Indirect Heating Systems with Respect to Maximum Economy and Operation," prepared jointly with Mr. W. H. Carrier. Dr. M. W. Franklin, Schenectady, N. Y., next discussed applications of ozone for ventilation, deodorizing, water purification, etc.

The report of the committee on ventilation of motion-picture theaters was presented by its chairman, Mr. F. T. Chapman. The legislation recommended imposes a minimum of 4.33 sq. ft. seating area per occupant, exclusive of aisles; 80 cu. ft. of air space per occupant; air supply of 15 cu. ft. per minute per occupant, and a temperature of 62 deg. to 70 deg. Fahr. at the breathing line, the persons being seated. Inclosures for the projecting apparatus must fulfil special requirements, depending on the number of machines used, as shown in the accompanying table.

Mr. Frank K. Chew, New York, presented his paper, "An Analysis of a Combination Heating System for a Residence," on Thursday morning. The afternoon session was given over to a discussion of the report of the committee on legislation, its draft being returned with suggested changes. Mr. J. A. Donnelly, New York, also supplemented the report of the committee on tests.

At the Tuesday evening session the election of officers was announced as follows: President, Mr. John F. Hale, Camden, N. J.; vice-presidents, Mr. E. F. Capron, Chicago, Ill., and Mr. A. B. Franklin, New York; treasurer, Mr. J. A. Donnelly, New York; managers, Messrs. F. T. Chapman, Ralph Collamore, D. D. Kimball, W. W. Macon, J. M. Stannard, Theodore Weinshank, John R. Allen and R. P. Bolton. The annual banquet was held Wednesday evening at the Hotel Martiniere. Among the speakers were Mrs. Florence Kelley, secretary of the National Consumers' League, and Mr. John Martin, of the New York Board of Education.

### Ferranti on Prime Movers

The lines along which the prime movers of the future are likely to develop were discussed by Mr. S. Z. di Ferranti, the distinguished English central-station engineer and inventor, in his James Watt anniversary lecture, delivered at Greenock, a suburb of Glasgow, Scotland, Jan. 16. Referring to the Diesel or heavy-oil engine, the speaker expressed the opinion that for large powers this is the wrong principle to employ, insisting that any reciprocating machine is probably only a makeshift pending the solution of the problem by a rotary engine. Mr. Ferranti also gave an account of his new high-temperature re-superheating turbine and dealt with the fuel problem of the British Navy as a matter of national domestic economy.

Sebastian Ziani di Ferranti, twice honored with the presidency of the Institution of Electrical Engineers of Great Britain, is well known as one of the great pioneers in the development of the electrical industry. He was the first to advocate the central-station idea in Great Britain, using high-tension transmission and distribution, and in 1889 built a 10,000-hp, 10,000-volt alternator which gave satisfactory service in the Deptford station, London. This installation employed 10,000-volt underground cables with concentric conductors, the outer being grounded. Mr. Ferranti is a director in the firm of Ferranti, Ltd., Hollinwood, Lancashire, and had recently accorded to him one of the few honorary memberships ever granted by the American Institute of Electrical Engineers.

After tracing the development of the steam engine from the days of James Watt and his patron, Matthew Bolton, up to the invention of the steam turbine by Sir Charles Parsons, the speaker referred to the principles involved in the operation of internal-combustion engines. Practically all of the power of steam is available for useful work, for the power required to pump water into the boiler, the "negative work" of the cycle, is small. Explosive-mixture engines, in which the charge is compressed before being fired, belong, however, to the class of prime movers with "high negative work," since the engine friction and the work of compression must be subtracted from the energy of the explosion. These negative quantities are very serious and would render this class of motor useless were it not for high mechanical efficiency. In the gas engine the negative work is high but not so high as to form a serious difficulty. In the more economical Diesel engine, in which very high pressures are used to get a temperature high enough to burn the oil as sprayed into the cylinder and give large expansion, the negative work is more serious.

Had the engines of high negative work been invented in the days of James Watt they could never have been made workable, for the materials available at the time would not have stood the temperature, and mechanical knowledge and construction were not sufficiently advanced for that high degree of mechanical efficiency necessary with engines of this class.

At the present time the internal-combustion engine and the steam turbine are competing for premier place in furnishing the world's power. The turbine, though less economical in actual fuel consumption, has many great advantages and for large powers is to-day practically unassailable. For small powers the turbine is naturally uneconomical.

From a careful and dispassionate consideration of the subject, said the speaker, it seems, according to present knowledge, to be clear that for small powers the internal-combustion reciprocating engine is in every way the best. At the other end of the scale the turbine is the only means of filling our requirements to-day. Between these two extremes there is a doubtful dividing line where either form of engine may best serve the purpose according to the conditions of the particular case.

As the turbine gets bigger it becomes easier to construct and is also more economical. As the gas or oil engine gets

larger the natural economies increase. On the other hand, as the turbine is reduced in power its economy falls off badly and it is difficult to make of a satisfactory design. The internal-combustion engine, however, becomes a most satisfactory and economical machine in small sizes, as witness the thousands of gas engines in use all over the world and the beautiful engines working on the Diesel cycle which are small enough to avoid water-cooling of the pistons.

This division of the means of power production by large and small units between the rotary and reciprocating machine, according to Mr. Ferranti, seems to be almost a natural law, and those who seek to evade it must either invent some new principle or court endless trouble, expense and failure. To-day, with a complete disregard of the above principles, the advocates of the Diesel engine for marine propulsion are spending vast sums of money on its development, but even this usually all-powerful force, he insisted, may not prove enough to make a wrong principle right. Few people, indeed, have any conception of the failures and breakdowns which have occurred and which are repeatedly occurring with the big experimental engines that have been constructed.

Referring to his own interest in prime-mover development and his work on the rotary-turbine principle, Mr. Ferranti pointed out that it is, of course, well known that the higher the temperature of the working fluid the higher the economy that can be obtained. High temperatures have, however, proved very difficult to work with, as is instanced by the low working temperatures of marine turbines. Seeing, however, that the difficulties were mechanical and that great advantage could be derived if these troubles were overcome, the author commenced experimenting some years ago, and now, after many failures and the expenditure of much money and time, has produced a turbine which, at the highest temperatures and with great and rapid variations of temperature, he feels is quite free from mechanical troubles. Indeed, he believes that this turbine is perhaps the strongest from a mechanical point of view that has yet been produced. Moreover, contrary to what might have been expected with a high-temperature machine, it runs with certainty with a blade-end clearance so small as to be almost negligible in point of leakage loss. Fear of possibility of stripping appears also to have been effectively removed.

In this turbine the steam is superheated initially, and then after the first expansion and while still superheated it is re-superheated before it does its work in the second stage of the turbine. After this it is exhausted in a superheated condition through a regenerator to the economizer. The whole of the blading is electrically welded, avoiding strains due to calking at the high temperatures, and also any loosening due to the same cause. The housing is of mild steel with a thin coating of pure steel, nickel electrically welded onto the surface. The turbine is most accurately finished to shape by a process of successive step pressing under very heavy pressure and is worked in position with accuracy by an automatic machine, giving every opportunity for realizing the best results. Although the turbine is of the reaction type, a balancing device is used. The whole of the end head is a smoothly constructed flange, thus saving steam losses.

The steam is worked at a constant high temperature throughout the turbine, and this, coupled with the many improvements above referred to, has given very good results.

A 5000-hp machine, after prolonged operation, has, when tested at a load of two-thirds full rating, given a shaft-hp on 7 lb. of steam. Supplied by an oil-fired boiler superheater system, 85 per cent efficiency already exceeded in central-station practice, the turbine would therefore consume less than 0.25 lb. of oil per shaft-hp.

From many tests already made it appears that when the turbine is run at full load under favorable conditions it



will take less than 6 lb. of steam per shaft-hp, and that the system under the conditions named will have a thermal efficiency of over 24 per cent, corresponding to an oil consumption of about 0.55 lb. of oil per shaft-hp. Tests are now being carried on, although the turbine is run continuously in supplying power to large works. With a constantly varying load, according to Mr. Ferranti, this system when applied on a large scale will be capable of giving an overall thermal efficiency of 29 per cent.

When the advantages of the turbine system in the way of lightness, simplicity and certainty are borne in mind, and when they are compared with what is known of the complicated reciprocating oil engines now being introduced for marine purposes, the possibilities of the new system of high-temperature gas-steam turbine become of great interest. With the high-temperature steam turbine of large size generating electricity to supply power for all purposes on land, one gains the advantage of a machine of the highest efficiency which is not limited to oil for its fuel. It is probable that as improvements are made the whole of the coal used for firing these large units will be gasified and the by-products recovered. When this result is brought about we shall have not only an ample and cheap supply of fertilizer for the land, but also a great quantity of tar oils for naval purposes and an ample supply of benzol for small-motor requirements. This, the author feels, is the solution of the fuel problem for these motors rather than the production of alcohol on a large scale from the land, as has lately been advocated.

The electric motor which gives its output in rotary form and which is supplied with energy from very large stations is displacing all forms of small engine. It is therefore probable that in the future small prime movers will be required only to propel cars and boats, and that all stationary motors will be electric. The electric motor with its one running part so easily and conveniently applied to all purposes is a good illustration of the desirability and even the necessity of the rotary principle of engine. Reciprocating forms of engine will no doubt be used for a long time, but they can only be regarded as makeshifts, and so soon as an equally efficient machine for any particular purpose is developed it must surely displace the reciprocating motor. It is difficult to predict the form of the prime mover of the future, but in search of the highest economy and with the limitations of temperature imposed by known materials, one is inclined to look to electricity, converting the energy of the fuel at low temperatures and giving its power in rotary form, as the most likely eventual solution.

### Merz Meter Patent Upheld by Court Decision

Judge Day, of the United States District Court for the Northern District of Ohio (Eastern Division), handed down a decision on Jan. 15 in the case of the Mineralall Electric Company of Chicago, complainant, against the Cleveland Electric Illuminating Company and Mathias E. Turner, defendants. The suit was brought for alleged infringement of the first four claims of the Merz patent, No. 722,030, assigned by the patentee to the complainant. The patent in suit is designed to provide for an instrument which will not only integrate and register the entire amount of energy used by a consumer of electricity during the entire period charged for, as one month, but which will also integrate and register the maximum amount of energy consumed in a definite shorter interval of time, which should be one of a certain number of equal intervals of time into which the long or charged-for interval is divided. The court says that it appears plainly from the record that if the first four claims of the Merz patent are held to be valid, the defendants' device is an infringement.

In his opinion the judge gives an interesting history of the development of that class of meters which not only

integrate and register the entire amount of energy used by a consumer during the time charged for, but also integrate and register the maximum amount of energy consumed in a definite, shorter interval of time. The Merz instrument is then described, and the court finds that the defendants' structure and the complainant's structure are alike in their mode of operation and their result. Brown & Williams, of Chicago, were the attorneys for the complainant, and Hull & Smith, of Cleveland, and Howson & Howson, of New York, were the attorneys for the defendants.

### Annual Meeting of American Museum of Safety

On Jan. 23 the American Museum of Safety held its annual meeting in the Engineering Societies Building, New York. In opening the meeting President Arthur Williams read several communications, including one from Dr. Rathenau, of Berlin, expressing appreciation of Edison's services to humanity; an announcement of the new E. H. Harriman memorial gold medal, offered annually by Mrs. Mary W. Harriman through the Museum of Safety to the American steam railway making the best record in accident prevention and industrial hygiene, and a message from the director of the Museum of Social Service, of Budapest, congratulating the American Museum on its work.

President Williams then delivered the annual address, describing the field and the activities of the Museum, which was organized in 1908 and incorporated in 1911. He dwelt at length on the needs of the Museum, both in financial support and in respect to larger quarters than those at present occupied in the Engineering Societies Building.

Mr. Andrew Carnegie was then presented and spoke briefly of his personal pleasure over the work being done in promoting industrial safety. He was profoundly impressed, he said, with Mr. Williams' facts and statistics and voiced his belief that the general progress of humanity is improved, as evidenced, among other things, by the work of the Museum.

Mr. T. C. Martin, chairman of the executive committee, made a stirring appeal for support of the cause, emphasizing the great need for much larger and more pretentious quarters and additional funds to widen the scope of the work. The annual budget last year was about \$25,000.

Dr. N. E. Ditman then spoke briefly on occupational disease and hygiene. Other speakers were Dr. G. F. Kuntz, chairman of the plan and scope committee, and Mr. A. A. Anderson, chairman of the educational committee.

The award of medals was made by Prof. F. R. Hutton, who spoke briefly of the achievements of each of the four recipients. The *Scientific American* medal was awarded to the Draeger Oxygen Apparatus Company for the pulmotor, as an agency for saving life which without it would be forfeited. The recipient was Mr. F. F. Morris, president of the company. The Travelers' Insurance medal was awarded to the New York Edison Company for persistent effort and success in minimizing the dangers of employment in electric generating plants and distribution systems. Mr. John W. Lieb, vice-president and general manager, received the medal in behalf of his company. The Louis Livingston Seaman medal was awarded to the National Cash Register Company for achievement and success in securing factory hygiene and sanitation. The Rathenau medal was awarded to Mr. Thomas A. Edison for achievement in electrical devices to make safe the lives of workers in atmospheres charged with combustible or deadly gas. On account of Mr. Edison's unavoidable absence the medal was received by Mrs. Edison, who was greeted with prolonged applause. The Edison electric safety lamp, primarily for miners' use, which was the specific achievement for which the medal was bestowed, was described in our issue of last week.

The meeting closed with an interesting illustrated lecture



by Dr. W. H. Tolman, director of the Museum, on safety devices and appliances now in actual use in various industrial plants. Two days after the meeting announcement was made public that Mr. Carnegie had given the Museum the sum of \$5,000 to carry on its work.

### Control and Regulation of Niagara River

Hearings were held on Jan. 22 and 23 before the House committee on foreign affairs on the new bill controlling the diversion of water on the American side of the Niagara River and the importation of electricity from Canada. The Burton act expires by limitation on March 4, and a fight is in progress to take from the federal government the control of the diversion of water in navigable rivers and, in the Niagara Falls case, invest it in the State of New York. The Secretary of War has appointed a board to report upon the problem of diversion of water from Niagara Falls, consisting of Lieutenant-Colonel Mason M. Patrick, Colonel Francis J. Kernan and Major Charles Keller.

The treaty between Great Britain and the United States authorizes the United States to permit the diversion of not more than 20,000 cu. ft. of water per second, while the Canadian government is empowered to authorize the diversion of not more than 36,000 cu. ft. per second. At present the diversion on the American side of the Niagara River aggregates 15,600 cu. ft. per second. The bill now before Congress does not permit the diversion of any more than that amount, and whereas the Burton act permitted the importation of a maximum of 350,000 hp from Canada, the present bill limits the amount to 200,000 hp. It also makes it obligatory for the generating companies to utilize the water at its maximum efficiency and stipulates that the companies receiving permits for the transmission or delivery of electrical energy shall be regulated as to rates, etc., by the Public Service Commission of the State, or where such a commission is lacking by the Governor of the State.

At the hearing on Jan. 22 the State of New York through its Attorney-General claimed that, after the government has decided how much water may be diverted from the Niagara River, it is entitled to control the diversion of the water and to decide the parties to whom it shall go. It was contended that while the federal government has a right to determine the quantity of water that may be diverted from a boundary stream in the exercise of its constitutional rights to control navigation, that power is exercised pursuant to that constitutional right only for the purpose of regulating and controlling navigation and for no other. Moreover, it was asserted by the State of New York that the federal government has no right to say how much power shall come into the State of New York from Canada or what shall be done with it, any more than it has the right to say how many bushels of wheat shall come in from Canada or to regulate the price or amount of imports.

The junior Senator from New York said that the State in its sovereign capacity remains the owner of all its property, subject only to the exercise of all of those rights or provisions which the State voluntarily transfers to the federal government, such as, for instance, to promote navigation, make treaties and provide for the common defence. The president of the New York State Conservation Commission expressed opposition to any legislation which will permit the existing generating companies to get any additional water from Niagara Falls. He said that the present policy of the State is to utilize all the undeveloped water-powers for the benefit of the people generally, and to utilize whatever water is available at Niagara Falls for the generation of electricity which is to be transmitted to the various municipalities and through them to the ultimate consumer at practically the cost of its development. He also maintained that true conservation presupposes the utilization of all water at its maximum efficiency.

It was brought out at the hearing that the taxes of the Niagara Falls Power Company to the State and municipalities aggregate \$3 per hp, while the Canadian government charges practically \$1 per hp. The Cataract Power & Conduit Company, which distributes Niagara energy in Buffalo, pays the Niagara Falls Power Company \$16 per hp-year and sells it at practically \$25 per hp-year, the difference being used to pay all the charges of transformation and transmission to Buffalo and its distribution in that city. It was pointed out that whereas the Hydro-Electric Power Commission of Ontario pays \$9.40 per hp-year for energy to the Ontario Power Company as against the \$16 charged by the Niagara Falls Power Company, the latter charge is for energy transmitted to Buffalo while the former charge is for energy delivered at the terminals of the transforming apparatus, or practically at the power house. It was said that by limiting the amount of energy that can be imported from Canada into the United States Congress has glutted the Canadian market with cheap energy. The secretary of the Niagara Falls Power Company stated that his company had had offered to it by the Hydro-Electric Power Commission of Ontario the same opportunity as the Ontario Power Company and refused to sell energy at \$9.40 per hp-year, claiming that it would be unprofitable even at approximately \$14 per hp-year. He also pointed out that the Ontario Power Company generates 17 hp for every cubic foot of water per second that is used, whereas the Niagara Falls Power Company is able to generate only about 11½ hp for every cubic foot of water per second used.

The counsel for the New York State Conservation Commission asked the committee on foreign affairs to consider the following three propositions: First, to render available for use all of the water granted by the treaty; second, if Congress has the power to do so, to compel the companies to submit themselves to the jurisdiction of the controlling powers of the State of New York; third, to have Congress give that controlling power in New York an opportunity to say what shall be done and what price shall be given for the energy after it comes into the State. The member of the committee on foreign affairs from Texas pointed out that as a matter of conservation the companies which are already in possession at Niagara Falls and have the machinery and equipment are in a very much better position to give cheaper energy to the people than others that have no equipment whatever.

As the result of a protest from New York state officials who declared that the passage of the bill, instead of conserving the falls, would practically place them in the hands of water-power sharks, the favorable report on the bill by the House foreign affairs committee has been postponed from day to day and another hearing will be held before the bill is sent to the House for action.

### New Patent Bills Before Congress

The first attempt made to carry out one of the official recommendations in the report of the Economy and Efficiency Commission on the Patent Office has been made by Representative Buckley of Ohio, who has introduced in the House of Representatives a bill to appropriate land in Washington, now owned by the Government for the construction of a new building for the Patent Office.

It is the intention of Washingtonians to make a strong fight on the bill, for the present building occupies a corner lot which has already been set aside by the Government for park purposes into a building site. There would be no objection otherwise to the bill, it being well understood and realized that a new Patent Office is a necessity.

Representative Buckley has also introduced in the House two other bills dealing with patent matters. One is a substitute for the other in that it combines the provisions of both bills. It is known as H. R. 28,280, and amends Sec-

tion 4931 of the Revised Statutes so that design patents may be granted for the term of seven years, or for fourteen years, as the applicant may elect. Section 4934 of the Revised Statutes is also amended so that the fees will be as follows: On filing each original application, except in design cases, \$20, and upon issue, \$20; in design cases, \$15 for a seven-year grant and \$30 for fourteen years; for applications for re-issue, \$30; upon filing disclaimer, \$10; on first appeal from primary examiners to examiners-in-chief, \$10; on every appeal from examiners-in-chief to the commissioner, \$20; for certified copies of patents, 10 cents per 100 words; for recording assignments, agreements, power of attorney or other paper relating to a single invention, 300 words or less, \$1; over 300 and under 1000 words, \$2; for each additional 1000 words, \$1, and for each additional invention included in one writing, 25 cents; drawings at the reasonable cost of making them.

Representative Buckley is of the opinion that a small bill of this character stands a better chance of early passage than do the more voluminous and comprehensive bills now before the House and in the patent committee.

### Hydroelectric Power Negotiations at Westfield, Mass.

The Amherst Power Company, operating a high-tension transmission system in the Connecticut Valley of Massachusetts, is negotiating with the municipal lighting commission of the town of Westfield for the shutting down of the existing municipal steam plant and the purchase and distribution of energy generated at the Turners Falls hydroelectric and Easthampton steam turbine stations of the company. Westfield is a town of about 16,000 inhabitants and is noted as the chief whip-manufacturing town in the world. The Amherst company originally proposed to supply the municipal electric-light plant with whatever energy was required for its present lighting and small power business, and to secure a franchise to sell energy in a wholesale manner to the manufacturers of the community, quoting the usual schedule to the latter and selling to the municipality at a low rate. Following the presentation of this program, the plan was suggested of having the town purchase the entire supply of energy required from the Amherst company, and negotiations are now proceeding on this basis. The company proposes to sell energy to the town at a rate which will save the latter many thousands of dollars yearly, permitting the writing off of the value of the existing municipal plant and enabling the town to quote low rates to the manufacturing interests and to other classes of consumers. The company is prepared to co-operate with the manager and municipal plant commissioners in building up a large business in the supply of electricity and in locating new industries in the town. It is agreed that the town cannot produce electricity in its own plant at a cost which will permit it to offer attractive rates to consumers.

### Requirements for Successful Timber Treatment

Dr. Herman von Schrenk, of St. Louis, consulting timber engineer, presented a short paper at the recent Chicago convention of the American Wood Preservers' Association on "Requirements for Successful Timber Treatment." He said that in order to get good results from treated timber the following points must be observed: (1) Only perfectly sound timber should be treated; (2) properly seasoned material should be used; (3) a good preservative is essential to long life; (4) proper injection as to quantity and penetration is essential, and (5) proper subsequent handling of the timber is essential.

In reference to the relations that should exist between a wood-treating company and its customers, Dr. von

Schrenk said: "I wish to protest against the tendency which requires the actual treating operation to be conducted in accordance with any demands which may be made by the customer, not only because this gives disappointing results so far as any particular piece of work is concerned, but also because it reacts on the company doing the work and on the industry as a whole."

### Public Service Commission for Texas

A bill creating a State public utilities commission has been introduced into the Texas Legislature by Mr. Dwight L. Lewelling. The measure, which has been patterned largely after the public utilities laws of the State of Wisconsin, provides that the public utilities in Texas shall be placed under the control of a separate commission composed of three persons, to be elected by the Senate and House of Representatives in joint session. The commission is to have adequate powers, and the proposed law provides for appeals from its orders to the courts but forbids the setting aside of any order or suspension thereof by injunction pending the decision of the court. One of the most important features of the proposed law is the placing of every franchise within the State under the public service commission and so altering or amending any franchise as to make it in effect an indeterminate one. All franchises are, of course, granted by local authorities, but should the measure become effective none can be hereafter granted for any definite length of time.

### Public Service Commission News

#### NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has dismissed the complaint filed by Gately & Hurley, Camden, against the rates charged by the Delaware & Atlantic Telegraph & Telephone Company, holding that such were not excessive nor productive of more than moderate revenue on investment. In its decision the board states: "A return of 8 per cent on the fair present value of the company's investment seems to us fairly equitable, when consideration of all conditions is had. The proper allowances for depreciation are still of necessity largely conjectural. An 8 per cent annual return or profit on \$5,338,000 (taken as fair present value of the company's investment) is \$427,040. Earnings and expenses indicate that in 1908 the corporate deficit was augmented by \$198,085.56, and in 1909 by \$43,123.97; that the net earnings for 1910 were \$160,756.32 and for 1911 \$170,196.13. The net profits at present are clearly not excessive, but demonstrably moderate so far as this company is concerned. It follows that its rates as a whole cannot be assailed as unjust or unreasonable and that the petition so far as it alleges extortionate or undue rates should be dismissed." The decision affects Camden and the entire neighboring territory, including toll rates to Philadelphia.

#### NEW YORK COMMISSIONS

The Public Service Commission for the First District, by orders just served upon the companies, has established gas-pressure regulations for all companies furnishing gas for light, heat or power in the boroughs of Brooklyn and Queens, with the exception of the Thirty-first Ward of Brooklyn. This ward embraces Coney Island, where the consumption of gas is largest during the summer, and for this reason it is excepted from the order, but only until the commission can make observations of the conditions prevailing during the summer season, after which suitable regulations will be established for that ward. The orders in the main provide for the establishment of pressure gages and thereafter for the maintenance generally of a minimum pressure at the consumer's end of the company's service pipe of not less than 2 in. water column and for a maximum



pressure not exceeding 6 in. water column. Limitations are also placed upon momentary and pulsating pressure variations.

The Long Acre Electric Light & Power Company has filed with the commission an application for a certificate approving the construction of its plant. This company has been before the commission for several years in various applications for permission to issue stocks and bonds. These applications were taken to the courts and long litigation followed. In December, 1912, the Court of Appeals decided that the company had not obtained from the proper authorities consent to the construction of its plant. The present application is made to get the approval of the commission for that construction.

#### MARYLAND COMMISSION

The report of the Maryland Public Service Commission for the year ended Dec. 31, 1912, shows that the commission disposed during the past year of 442 cases and in 203 of these cases there were formal hearings. Reference is made in the report to the gas and electric rate case, which required forty-seven days for trial and the study of a great mass of testimony. The telephone case was also referred to and the steps in the fight were recounted. The Governor is advised that while the measured service is in effect under an agreement between the parties concerned, the question of measured versus flat-rate service is still open, and those contending for the latter will have until April to file data in support of their argument.

#### MASSACHUSETTS COMMISSION

The Massachusetts Gas and Electric Light Commission has issued a report upon the proposed codification of laws relating to electric and gas companies, including the question of extending the board's regulatory powers to so-called electric transmission organizations and the consideration of changes in the laws now bearing upon the gas and electric service industries and the need of additional legislation. A majority of the board favors the extension of its regulatory powers to so-called "power companies," covering such corporations as are primarily engaged in the manufacture, transmission and in some cases the distribution of electricity on a wholesale basis, as distinguished from the ordinary central-station organizations now under the jurisdiction of the commission. In the hearings it was urged that on account of the value which has attached to the right to subscribe to additional stock at the prices fixed in several instances by the most prosperous companies the board should have a more complete control over the issue price and that increases in stock should be offered to savings banks for investment in preference to the stockholders. The commission states that under the present method of fixing the issue price there may be a conflict between the personal interest of the directors or stockholders and the interest of the corporation in having its needed funds provided on as favorable terms as the market and other conditions will warrant. The board believes that the present method has not yet been shown to work such disadvantage to the public as to require a change.

The commission was asked to seek authority to make physical valuations of the properties under its supervision, but considers that the existing law provides amply for this. The commission feels that no public advantage would be obtained to justify the cost of making such physical valuations of all the properties under its supervision.

Regarding consolidations, the commission recommends that the combination of a gas or electric company with a transmission company or the organization of a combined gas and electric company should receive the approval of the board before becoming valid. It believes that it is desirable to preserve such measure of competition as may continue to exist by the independent operation and ownership of local distributing companies and so-called "power

companies." The necessity for giving power companies the right of eminent domain has not yet become apparent.

In the case of discriminating rates, the commission does not deem it wise in the present development of the business of supplying gas and electricity to interfere actively with differential rates which are fixed solely to meet conditions competitive in their character and to that extent beyond the company's control, provided that the companies are thereby aided to give the community as a whole lower rates and better service. Restriction of security issues to actual needs and such control over rates and service as conditions require are advised.

The commission reviews at length the rise of transmission companies in the State, with particular reference to the hydroelectric systems of the Connecticut and Deerfield Valleys, and in an extended discussion shows that these are in large measure public-service corporations selling electricity for various uses and in some instances in territory already occupied by local central stations. It points out that the distinctions between power and central-station companies are to a large degree artificial, and considers that the extension of regulatory powers to cover the former is in the public interest.

## Current News and Notes

**PEORIA SEEKS GREATER POWER TO TAX PUBLIC-UTILITY CORPORATIONS.**—The City Council of Peoria, Ill., has adopted a resolution requesting the Illinois Legislature to give to the city of Peoria power to tax and license public-utility corporations doing business within its limits but which have been heretofore, to a considerable extent, outside of the scope of the municipal taxing power.

\* \* \*

**X-RAY SOLVES COLLAR-BUTTON MYSTERY.**—The disappearance of collar buttons is a perpetual subject for masculine oburgation and one of the stock jokes of the era of civilization. Thanks to the X-ray, one of these elusive articles has recently been located in the lung of its pursuer after a hunt which began sixteen years ago and terminated in a Pittsfield (Mass.) hospital in connection with an obstinate case of bronchial disturbance. Missouri papers please copy.

\* \* \*

**BATTERY OPERATED TRAC FOR THE SWITZERLAND CARS.**—The Pennsylvania Railroad Company recently completed at its Altoona shops a 14-ton battery-operated tractor to be used for switching freight cars in the Hudson Street yards at Jersey City, N. J. The heavy body, measuring 22 ft. long by 8 ft. wide, is carried on four 5-ft. double wheels which span the standard-gage track so that the tire rests directly on their traction from the ground surface itself. The tractor is equipped with standard couplers enabling it to push as well as to push cars. As the tractor is independent of both rails and any fixed source of energy, it can be used on any around occupied tracks and move from place to place.

\* \* \*

**MILWAUKEE CITIZENS MAY VOTED ON A MUNICIPAL LIGHTING PROPOSITION.**—It is probable that the citizens of Milwaukee may have a chance, for the third time, to vote on the proposal to establish a municipal electric-lighting plant in that city. The matter will probably be submitted to the voters at the next election in April. In 1900 the city lighting plant was established by a vote of 10,645 to 6,701. In 1906, when the project was again submitted to the referendum, the vote was 10,645 for and 6,701 against the proposition. Now the Milwaukee City Council, which is well established in the regulation of public utilities in the State, has the opinion of the citizens has changed.



**CRUDE-OIL PRICES ADVANCE.**—Pennsylvania crude oil has rapidly advanced in price of late, being quoted at \$2.26 on Jan. 29 by the South Penn Oil Company, the highest price since 1895. Mercer Black, New Castle and Corning were quoted at \$1.79, Cabell at \$1.86, Somerset at \$1.32 and Ragland at 70 cents. It is predicted that old-time activity will soon return in the oil fields of Pennsylvania, Ohio and West Virginia.

\* \* \*

**CHARGED WIRE A BURGLAR TRAP.**—While groping about in the dark in a small fruit store in Hoboken, N. J., Jan. 25, a midnight burglar came into contact with a charged wire and received a fatal shock. When the proprietor came to open the store for business next morning he discovered the dead body of the thief, his pockets stuffed with cigarettes, candies and fruit, and his hand badly burned, indicating the manner of his end.

\* \* \*

**HEALTH BOARD FOR 200,000 TELEPHONE EMPLOYEES.**—A system of medical supervision and sanitary instruction to preserve the health of the 200,000 employees of the American Telephone & Telegraph Company, the Western Union Telegraph Company and the Western Electric Company is announced by President T. N. Vail, of the first-named company. The new department will be under the direction of Dr. Alvah H. Doty, formerly health officer of the Port of New York, and will supervise hospital and first-aid provisions in the various plants of the allied interests, besides taking up preventive measures for the protection of employees' health.

\* \* \*

**MAINE UTILITY COMMISSION BILL.**—State Senator I. G. Hersey, of Houlton, Aroostook County, Maine, has presented a bill before the Maine Legislature to establish a utility commission formulated on the plan of the Rhode Island act. The commission proposed would comprise three members, appointed by the Governor, who could also remove his appointees at pleasure. Obstruction to corporation investigations by agents of the commission is made punishable by a fine of from \$200 to \$500. Control of all franchises granted to public utilities by towns or cities is placed under the commission's control, and corporations can appeal to the commission from orders of municipalities.

\* \* \*

**TO DETERMINE "WIRELESS" REACH OF NEW WASHINGTON STATION.**—The fast scout cruiser *Salem* has been ordered on a voyage across the Atlantic to test the transmitting capacity of the United States government's new wireless-telegraph station at Fort Myer, near Washington, D. C. This station was described on page 145, *Electrical World*, Jan. 18. Continuous tests are to be made throughout a radius up to 4000 miles, although it is expected that even this range will be exceeded. Eventually it is hoped that the powerful new station will be able to communicate with any ship of the United States Navy, using intermediate vessels as relays for distances above 3000 miles.

\* \* \*

**CAROLINA BILL TO TAX WATER-POWERS.**—A bill now before the South Carolina Legislature provides for the taxation of the developed water-powers of the State, at the rate of 20 cents per hp-year, if the energy is utilized locally, and 30 cents per hp-year for hydroelectric power transmitted or sold outside the State. It is further provided that the Governor shall appoint an electrical engineer at a salary of \$3,000 per year, to be known as the commissioner of natural resources, whose duties shall include inspection of water-power plants and auditing of reports filed by the companies, collection of water-power taxes, investigation of service complaints against water-power companies, etc.

\* \* \*

**UNIVERSITY OF ILLINOIS ELECTRICAL SHOW.**—On Feb. 6, 7 and 8, 1913, in the electrical laboratory, the students of

the department of electrical engineering of the University of Illinois will hold their triennial electrical show. Although under student management, it will be by no means wholly a student show, as many manufacturing and sales companies in the electrical trade will offer exhibits. Among the exhibits will be isolated lighting plants, heating and cooking accessories, telephones, telegraph and wireless apparatus, lifting magnets, motor controllers, high-frequency machinery and a complete electrically operated café. A business organization composed of graduates and undergraduate students is carrying on the entire work incident to the show, under the general direction of Dr. E. J. Berg, head of the department of electrical engineering.

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## SOCIETY MEETINGS.

**OHIO ELECTRIC CONVENTION.**—The nineteenth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, on July 15, 16, 17 and 18. Mr. D. L. Gaskill, Greenville, Ohio, is the secretary of the association.

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**PRIME MOVERS COMMITTEE IN SESSION.**—A meeting of the committee of the National Electric Light Association on prime movers was held in Chicago on Jan. 22. The members present were Messrs. I. E. Moultrap, Boston, chairman; W. L. Abbott, Chicago; E. D. Dreyfus, Pittsburgh; John Hunter, St. Louis, and W. N. Ryerson, Duluth. The forthcoming report to be presented at the Chicago convention was discussed.

\* \* \*

**MEETING OF THE EASTERN NEW YORK SECTION OF THE N. E. L. A.**—Mr. E. M. Bassett, former member of the Public Service Commission from the First District, New York, was the speaker at the meeting of the Eastern New York Section, N. E. L. A., at Schenectady, on Jan. 23. Mr. Bassett's topic was "Public Utilities Here and Abroad," and his address dealt largely with the municipally owned plants in this country as compared with the municipal plants of other nations. The paper proved very interesting and was discussed by Messrs. M. O. Troy, W. L. R. Emmet, C. W. Stone, H. W. Peck and A. Anderson.

\* \* \*

**TRANSMISSION COMMITTEE OF OHIO ASSOCIATION.**—The electrical transmission committee of the Ohio Electric Light Association, consisting of Messrs. M. H. Wagner, of the Dayton Power & Light Company, chairman; S. M. Rust, superintendent of the Greenville Light & Power Company, and P. Barnhard, manager of the County Electric Company, met at the Beckel House, Dayton, Jan. 22, to formulate its report for the 1913 convention, which will be held at Cedar Point, July 15, 16, 17 and 18. Messrs. O. H. Hutchings, superintendent, and O. B. Reemelin, chief inspector, of the Dayton Power & Light Company, joined in the discussion. A second committee meeting will be held at Columbus April 23.

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**ILLINOIS ELECTRICAL CONTRACTORS.**—At the recent mid-winter convention of the Illinois Electrical Contractors' Association, held in Peoria, a resolution was adopted, at the request of Mr. Ernest Freeman, president of the National Electrical Contractors' Association, placing the Decker system of bookkeeping for electrical contractors at the disposal of the national association. A committee of mediation and arbitration, consisting of Messrs. C. E. Stapp, of Peoria; J. T. Marron, of Rock Island, and A. M. Knauber, of Chicago, was appointed to visit any locality in the State where disputes may arise between members of the association. A vote of thanks was extended to the Peoria association for its arrangements for the convention in Chicago in June.

## Electrically Equipped Coal Mines in Nova Scotia

**Application of exhaust steam turbine and pulverized fuel in the stations of the Dominion Coal Company—  
Operation on 25-cycle current. By C. H. Wright**

THE coal deposits of Cape Breton were known to the early navigators who frequented the waters in the neighborhood of the mouth of the St. Lawrence River, and many a ship was coaled in a primitive fashion from the outcroppings of soft coal near the various harbors not far distant from the Sydneys. The present workings of the coal areas extend far inland and out under the Atlantic to a distance which can only be estimated, as they go beyond the limits of mechanical haulage. These Sydney coal fields, as they are called, have at present a known area of 250 sq. miles, extending some 35 miles from Mira Bay to Cape Dauphin. The major portion of this field is the property of the Dominion Coal Company, which is at present operating sixteen collieries, with a yearly output of 4,500,000 tons of coal, and is employing about 9000 people.

The installation of electrical equipment in the mines and power houses of this company began in the year 1906, when Colliery No. 2 (Fig. 1), near the town of Glace Bay, was equipped with a generating plant which contained three Westinghouse revolving-field alternators. These machines were rated at 550 kw, 6600 volts, 25 cycles, three-phase, and were directly connected to 700-hp compound reciprocating engines operating at 125 r.p.m. These units are shown in the foreground of Fig. 1. As the machinery in this mine was in a large measure air-driven, a number of air compressors were also installed which gave a total output of approximately 16,000 cu. ft. of air per minute at 100-lb. gage.

At the outset 25 cycles was chosen as the correct frequency to be used largely on account of the low speeds and small motor dimensions required, and 6600 volts was thought to be sufficiently high to give satisfactory transmission over the territory then covered. The distributing

circuits were all overhead lines and were carried on a cedar pole line. To provide in part for future extensions, all line insulators were designed for 25,000 volts on these circuits. Later, in 1910, when the plant growth called for an additional power unit, a low-pressure steam turbine of the English Ratteau type, directly connected to a 1000-kw, 6600-volt Brown-Boveri generator operating at 1500 r.p.m., was installed. This turbine utilized only part of the exhaust steam coming from the engines which were driving the air compressors and operated condensing. The condenser for this equipment was of the barometric type with electrically driven auxiliaries. The fresh water for cooling was obtained from a nearby pond. An exciter mounted on the main shaft supplied the necessary energy to the generator field coils. This unit is shown in Fig. 6.

### LAKE WATERFORD POWER HOUSE

The opening of the new areas near the Lingan collieries resulted in shifting the load center and necessitated the erection of a new modern power house at Lake Waterford to handle the load in that district and to operate in parallel with the station at Glace Bay. Special precaution had to be taken in providing for the operation of each plant separately since a part of the interconnecting line was built along the Atlantic seaboard at Lingan Bay and is sometimes in trouble because of storms and wave action. The Lingan power house is equipped with a battery of Beddington boilers, a type little known in this country, shown in Fig. 2. The fuel for these boilers is pulverized in grinders, mixed with air and fed under pressure at the bottom of the boilers. The vertical flame rises, then returns from the top encircling the boiler tubes and the superheaters. Although a very low grade of coal is used, excellent combustion is obtained. This equipment is quick steaming and meets the

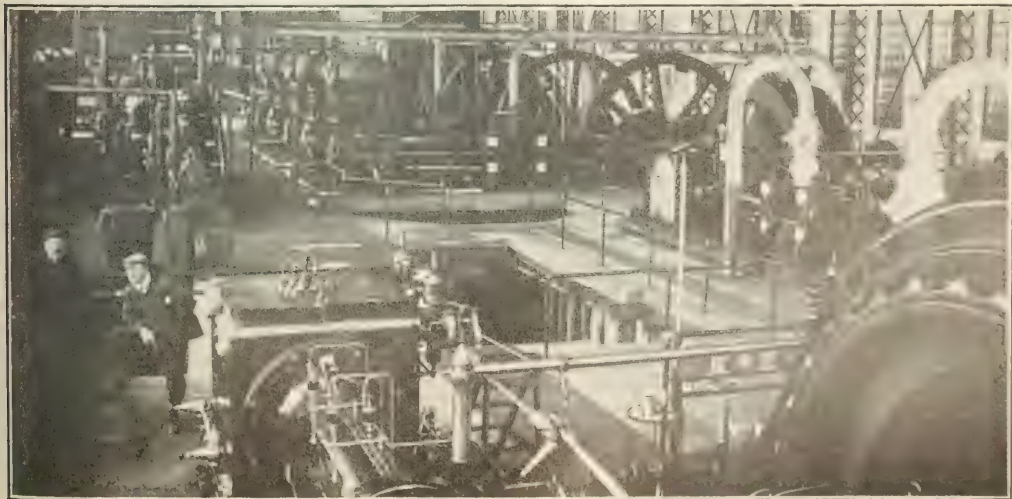


FIG. 1—POWER HOUSE AT COLLIERY NO. 2

peak loads so common in colliery work in a very admirable manner. These boilers are at present operating under a pressure of 175 lb. per square inch and are delivering steam at 150 deg. super-temperature.

The first turbine for this plant is now installed and in operation. It is a General Electric 2000-kw, 6600-volt, 25-cycle, three-phase horizontal high-pressure-type machine

arranged that any of them may be easily reached in case repairs are necessary. The leads from these transformer stations to the underground pumping motors are taken down through 6-in. conduit placed in bore holes, and are generally of No. 4-0 copper, insulated with paper and protected by a lead sheath. The motors which serve these pumps are usually rated at 100 hp, 550 volts, and operate



FIG. 2—DOMINION COAL COMPANY'S PIER

taking steam from the boilers mentioned above and exhausting into a barometric condenser giving a 28-in. vacuum. A second unit is now being installed, and it is thought that a third will be required to operate the additional motors which the company contemplates installing. The switchboard, of modern European design, using remotely controlled oil switches, is being installed with the idea of future additions. The situation of the power house near



FIG. 3—BANKHEAD AND POWER HOUSE COLLIERY NO. 2

the mine entrance and near the lake has made fuel and water problems comparatively simple.

A typical transformer station for supplying energy to motor-driven pumps, belt conveyors, fans and similar apparatus usually contains three delta-connected, 75-kw, 6600-550-volt transformers, together with the necessary control apparatus, disconnecting switches, etc. All parts are so

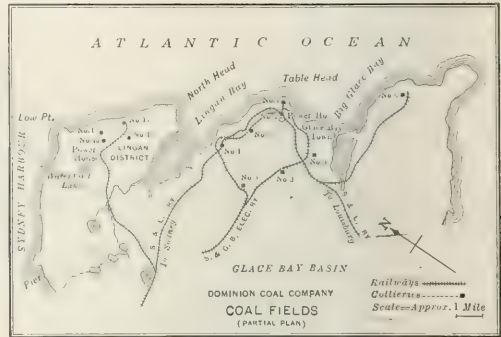


FIG. 4—MAP OF COAL FIELD REGION

at 1500 r.p.m. The pumps are capable of operating against a 600-ft. head.

Since so many of the motors in the system are operating on light loads during a large portion of the day, the power-factor of the plant would fall if means were not taken to correct it. This correction is accomplished by field adjustment on the 600-hp, 6600-volt synchronous motors which drive the air compressors. The motors have been specially



FIG. 5—BEDDINGTON BOILERS

designed for this work and are arranged to avoid hunting and to give an 80 per cent power-factor with leading current. They are started as induction motors from auto-transformers, with high voltage oil switches having a large overload capacity. All of these motors operate at full line voltage without transformers.

The economy of electrical energy over steam probably



shows most plainly in the coal hoists. Here the central station with its high steam pressure and good vacuum takes the place of the small, inefficient steam hoisting engines and does their work in a very creditable manner. The company's first large electrical coal hoist was located at Colliery No. 14, near the Waterford power house, and the constant output handled by that hoist is 1200 tons in every ten-hour

### Electric Freight Handling at the South Station in Boston

A noteworthy feature of the freight-handling facilities at the Kneeland Street terminal yard of the Boston & Albany Railroad at Boston, Mass., is a 40-ton Niles electric traveling crane located near the South Station and serving

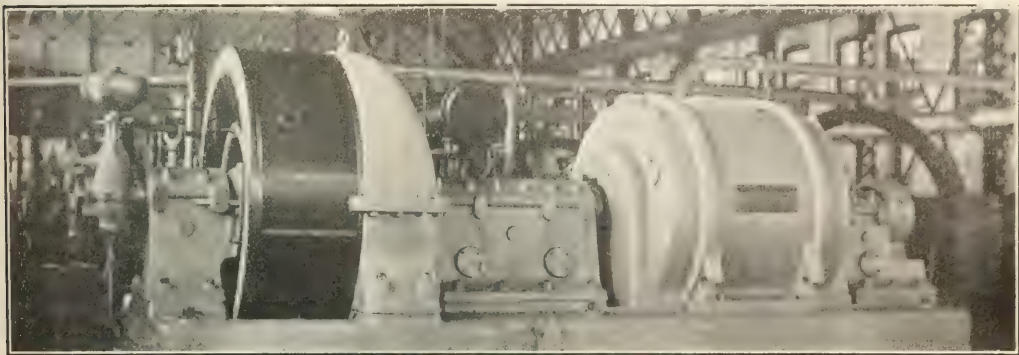


FIG. 6—TURBO-GENERATOR SET

day. The haul is made on a 22.5 percentage grade which is 4500 ft. long. The total gross weight of thirty cars per trip is 82,500 lb. For this work use is made of a direct-current motor mounted on the winding drum shaft and supplied with energy from a motor-generator set (Fig. 7) which takes its energy from the 6600-volt alternating-current mains. This motor has an intermittent load rating of 1600 hp and operates normally at 50 r.p.m.

In the near future two more electrical coal hoists of the same character will be installed near the Waterford station, and will haul twenty-four cars up a 32 per cent grade at a maximum speed of 30 ft. per second. The gross weight per car will be 2900 lb. and the length of the slope between 3000 ft. and 5000 ft., with an output of 1200 tons in eight hours. In order to diminish the load at starting the cars in this mine will not be started on the grade but from a level stretch of track laid at the working face of the mine for this purpose.

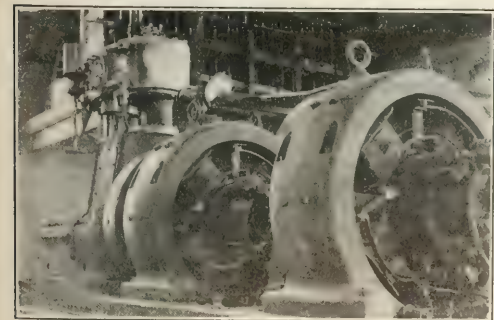


FIG. 7—MOTOR-GENERATOR SET AT COLLIERY NO. 14

At present the Dominion Coal Company has five large collieries in which all operations are performed by electricity with the exception of the heating, which is done by steam. In the older collieries nearly all of the screen pumps and fans are motor-driven, and a number of the underground haulage systems are operated by large motors on the surface.

trains, trucks and teams in both loading and unloading service. The crane is operated by three-phase energy supplied by the Edison Electric Illuminating Company of Boston and is carried on 60-lb. T-rails placed 26.5 ft. above the ground and supported on a steel framework as shown in the accompanying photograph. The framework consists of eight columns 21 in. deep carrying two horizontal built-up I-beams 31 in. in depth, tied together at the top with cross-framing. Concrete foundations are used at the bottoms of the columns.

The crane spans two tracks and a paved roadway utilized by electric trucks, teams and other vehicles, the roadway being about 30 ft. wide. It has a span of 51 ft. 4 in., the length of the runway being 80 ft. and the maximum lift 25 ft. The crane is of the box girder type, the maximum depth of the principal members being 44 in. It runs upon four 24-in. wheels, the wheel base being about 13 ft. 4 in., each wheel carrying a maximum load of 55,000 lb. Besides



ELECTRIC FREIGHT HANDLING AT BOSTON MINING

the main hoist an auxiliary hoist of 5 tons rating is in service, and the former has a speed of 15 ft. per minute, the auxiliary running 30 ft. per minute. The main hoist is driven by a 75-hp, 440-volt induction motor running at 545 r.p.m., and the auxiliary hoist is operated by a 22-hp motor running at 650 r.p.m. The bridge travel, effected by a 37-hp motor running at 1115 r.p.m., is 250 ft. per minute

under full-load conditions, and the trolley travel, handled by a 15-hp motor running at 780 r.p.m., is 100 ft. per minute. All the motors are equipped with controllers permitting 25 per cent regulation of speed.

Energy from the system of the Edison Electric Illuminating Company of Boston is brought to the installation at 2300 volts by an overhead line terminating on a pole as shown in the photograph, the emf being reduced to 440 volts by a 100-kw oil-cooled transformer of the three-phase type mounted on a wooden platform about 14.5 ft. above the ground. An oil switch is provided on the primary side of the transformer, and the secondary leads are carried to a meter located in an adjacent wharf house, from which a pipe conduit leads to the craneway. Two switches are provided in the 440-volt circuit, one being located in the wharf house and the other on one of the crane columns to provide ample protection against accident. The transformer is installed upon 2-in. planking laid on 6-in. by 10-in. stringers carried on blocks which are fastened together by  $\frac{5}{8}$ -in. bolts extending through the pole, and the stringers are also bolted to the pole structure in each case. The crane contacts are made in the usual manner from horizontal copper leads carried along the runway. The crane is located near the most important passenger tracks entering and leaving the South Station and illustrates to many thousands of travelers daily the advantages of central-station service in terminal hoisting work.

## Electricity in the United States Army and Coast Defence

Brigadier General E. M. Weaver, chief of the Coast Artillery Corps, U. S. A., had much to say in his annual report this year which will be of general interest to the electrical industry. His report, which is made to the chief of staff, has been approved by Major General Leonard Wood, by direction of the Secretary of War. General Weaver said, in part:

### POWER PLANTS

It is estimated that it will require \$4450,333 to complete the electrical installations for coast forts in the United States. The estimates for the fiscal year 1914 will include \$50,000 under this heading, this amount being required chiefly to provide for the replacement of certain worn-out local power plants now in use.

From past appropriations central power plants of a modern oil-burning type have been installed at Forts Winfield Scott, Stevens and Casey. Forts Baker and Barry have central plants made up of groups of 25-kw gasoline sets. Apart from these central-plant installations, fifteen independent local 25-kw gasoline sets were purchased from the appropriation for the year 1909 and were installed as follows: One each at Forts Rodman, Michie, Whitman, Foster, du Pont, Armistead, Moultrie, Dade and Canby, and three each at Forts Terry and Taylor. Eight of the same type sets were purchased from the appropriation for 1910, and these have been installed as follows: One each at Forts Williams, Andrews, Standish, Banks, Totten and Canby, and two at Fort Hamilton.

After a careful consideration of the conditions existing at the date of its report, the National Coast Defense Board recommended as follows:

"1. That the electrical power for fortification and defense purposes be furnished by an adequate steam-driven, direct-current-producing central power plant, all machinery to conform in type to approved commercial standards.

"2. That each battery or group of batteries, depending upon local conditions, be equipped with direct-current generators, gas or oil-engine driven, installed as a reserve to the central plant.

"3. That searchlights, except such as are in close prox-

imity to the central plant, be provided with and operated by self-contained units."

Notwithstanding the fact that the National Coast Defense Board recommended the central-plant system as the fundamental one to be considered, it had in mind the dangers that might come to the whole defensive system from injury to that system, and therefore supplemented this recommendation by the further recommendation that each battery or group of batteries, depending upon local conditions, be supplied with an independent local reserve generating set, as indicated in the second paragraph quoted above.

At the date of the report of the National Coast Defense Board the steam-driven central plant afforded the most reliable and satisfactory method of producing power for fortification purposes, especially where the fortification plant was required also to provide light and power for post purposes. Since that time, however, the rapid extension and development of commercial power transmission lines have greatly simplified the question of the economical provision of power for post lighting and power purposes, in many cases eliminating the necessity for a central plant altogether. The development of oil and gasoline engines has at the same time progressed to a remarkable degree, so that, having in mind the special conditions which obtain at coast fortifications, including the danger to the fortifications resulting from interruption of power from a central source, and having in mind also the varying and infrequent loads required of generators for coast fortifications, the real advantage is considered to lie decidedly with the separate local plants. Following this line of analysis, a 25-kw direct-connected gasoline engine set has been developed especially to meet the needs of coast fortifications, which has in general proved very satisfactory. Approximately 160 of these sets have been installed for both power and searchlight purposes in the national fortifications.

For the foregoing reasons it is believed that the necessity for central-fortification plants, as recommended by the National Coast Defense Board, no longer exists, except in some special cases—for example, where power from outside commercial sources cannot be obtained. It is believed that in future the adopted policy should be:

1. To provide all batteries requiring power for fortification purposes (or, in certain cases, groups of batteries), and in general all searchlights, with suitable local direct-connected direct-current generating sets, preferably driven by oil or gasoline engines, these local plants to be so interconnected and provided with suitable reserve sets as to insure continuity and flexibility in service.

2. In general, in time of peace, to purchase the power for the post lighting system and for other similar post purposes, when it is in the interest of economy to do so, from commercial sources, and in such case to separate the post lighting system from the fortification system.

3. To install a central plant in case it is impracticable advantageously to purchase power for the post service, and in case the fortification system is insufficient for that purpose, such plant to constitute a reserve for fortification purposes.

4. To employ direct current for the post service systems in all cases except where transmission conditions are such as to render the use of direct current decidedly uneconomical.

5. The quartermaster corps to install a suitable reserve plant, in case the fortification system does not provide such a reserve, in all cases where power is purchased from a commercial source, the object of this arrangement being to provide for the actual necessities of the post in time of hostilities in case the source of commercial power be interrupted.

6. In general to provide, whenever practicable and advantageous, for interchangeability between the post and fortification power systems, including the introduction of



suitable converters whenever these may become necessary.

7. A.1 power plants to be operated under the supervision of the coast artillery authorities, employing, whenever practicable, coast artillery enlisted personnel for that purpose, the object of this being to insure co-ordination and to prevent a division of responsibility in case of emergency.

It is believed that the system above outlined will provide for maximum reliability for fortification power in time of war and for maximum economy in time of peace.

It is estimated that it will require \$2,536,600 to complete the search-light equipment for the United States forts. The estimates recommended for the fiscal year 1914 will include \$250,000 under this item, to be expended in the artillery districts of southern New York and Boston. It is expected that this sum will complete so much of the search-light installation in these districts as is practicable in time of peace. Twenty-three 60-in. lights are required. Fourteen have been purchased. Of these four have been installed tentatively.

These districts are provided with complete modern armament and the most modern fire-control installations. It is essential that the armament and fire-control equipment shall be supplemented by a permanent searchlight equipment if the fortifications are to be effective in night action. It should be kept in mind that searchlights of the power necessary for coast-defense purposes cannot be obtained in open market on the outbreak of war or when war is imminent. They are a special article of manufacture and require normally approximately one year to supply. The mirrors cannot be obtained in the United States.

#### SUBMARINE MINES

Recent war has demonstrated the value of submarine mines as an element of harbor defense. If a harbor be defended by an efficient system of mines provided with the requisite guns and searchlights for their protection against countermining, sweeping or other methods of removing them, it is not believed that any enemy, however enterprising, will ever attempt to force an entrance into a harbor with large ships. It is a matter of satisfaction that severe tests have proved the American system of mines to be exceptionally efficient as a war weapon. The necessity for completing at once the submarine mine equipment has been frequently urged in past reports. In the annual report of the chief of coast artillery for 1910 it was stated that "We cannot afford to wait for war before completing our mine defense, but must be prepared beforehand; for unless we are thus prepared no amount of money made available at the outbreak of war could procure mine material in time to be of service in mine defense against an active, enterprising enemy. Essential parts of this material, such as cables, mine cases and electrical apparatus, cannot be bought in open market but must be manufactured to order, and after having been ordered it requires months to fill the orders. If confronted suddenly by war, only such material as is on hand can be utilized for immediate mine defense, and if any essential part of the mine system is lacking, the whole mine defense must fail. The complete mine equipment of every harbor to be mined should be kept on hand ready to be planted, and it should be made possible to mine effectively every harbor within forty-eight hours."

With the exception of the cable, the supply of the essential parts referred to above has been practically completed for all of the existing home ports except for the artillery districts of Galveston and New London. The need of making immediate provisions for the additional cable absolutely required to enable the mines, which are already provided, and for which all the principal accessories are also provided, to be planted at all home ports in case of emergency, is an urgent one.

The powerful and costly coast guns, mortars and mines provided for the defense of the coast cannot be operated

to the fullest measure of their effectiveness except in connection with certain other costly, complex and scientific equipment installed for the coast fortifications, accessory to the service of the guns, mortars and mines. This accessory equipment includes range and position finders, plotting boards, range and deflection computers, telephones, steam and gas engines, electric generators for developing power for moving ammunition, traversing carriages, elevating guns and mortars; lights, both illuminating and searching; signals, including visual, telephonic and wireless; devices for loading and planting mines, and elaborate mechanical and electrical apparatus connected with operating submarine mines. A coast fortification should have all of this equipment provided and installed therein before its manning body is assigned to duty. The effectiveness of the fortifications with all this equipment regarded as a unit, depends at all times upon the consideration that the armament and accessories must be maintained constantly in a condition of thorough serviceability. It will be understood that this can be done only in a highly trained and specialized body of officers and men.

#### TRAINING THE MEN

The War Department, having in mind the principles set forth as to the necessity of having officers and men of the coast artillery personnel specially trained to maintain and operate the steam, mechanical and electrical engineering features of coast fortifications in a condition of highest serviceability, some years back provided courses of instruction for officers and enlisted men at the Coast Artillery School at Fort Monroe, Va., that had for their object precisely the training of selected officers and enlisted men for these technical duties. Accordingly there are among the commissioned personnel of the coast artillery officers who are designated as "artillery engineers," and among the enlisted personnel non-commissioned staff officers with the grades of "engineer," "fireman," "master electrician," "electrician sergeant" (first and second class) and "master gunner," whose duties relate particularly to the care, preservation and maintenance of the electrical and mechanical equipment of coast fortifications in condition of thorough serviceability.

Based on the estimates of the National Coast Defense Board, the percentages of completion of electrical installations necessary for full protection of home ports are as follows: Search-lamps, 41 per cent; power plants, 50 per cent, and submarine mines and structures, 81 per cent.

#### POWER-PLANT OPERATION

The power plant at Fort Monroe is operated entirely by enlisted men of the Coast Artillery Corps under the supervision of the head of this department of the school. It is used for instruction purposes by both the officers' and the enlisted men's divisions. The results obtained in the operation of this plant have been very satisfactory, as they are daily power and lighting output of 200 kw. In the twelve months ended Feb. 20, 1912, being the period at a cost per kilowatt hour at the switchboard of 2.8 cents, including all supplies, repairs, fuel and lubricants, in or out of costs excluding labor and depreciation costs. It is estimated that the installation of this plant and its present use for post lighting, pumping, heating, ventilation and heating purposes has resulted in a saving of \$10,000 in annual maintenance cost in the power and heat at Fort Monroe. It is estimated that the saving in the cost of maintenance of the labor of all enlisted personnel required and the depreciation cost of the plant in an annual period is about \$10,000. It is interesting to note that the high efficiency of this plant is compared with the cost of the coast power plant at the United States Navy Yard at Washington, D. C., which is estimated to be about \$10,000 per kilowatt hour. The United States have and it is exemplifying in a noteworthy manner the efficiency that can be obtained with isolated plants of comparatively small capacity.



## Performance Similarities of the Direct-Current Shunt Motor and the Polyphase Induction Motor

BY WILLIAM G. MEROWITZ

The average user of electric motors is unaware of the striking similarity between the performance curves of the direct-current shunt motor and the polyphase induction

current machine on the lighter loads. On overloads the efficiency curve of the polyphase machine shows it to be less efficient than the direct-current motor, but as a matter of fact the alternating-current motor is better adapted to overload operation than is the direct-current machine, since the latter is subject to commutation troubles when operated above normal load.

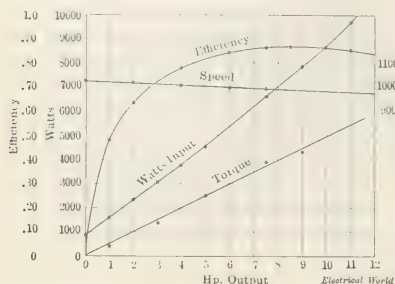


FIG. 1—PERFORMANCE CHARACTERISTICS OF A 7.5 HP, 220-VOLT DIRECT-CURRENT MOTOR

motor and is generally prepossessed with the idea that the work which either of the two machines can be made to do is widely different from the field of operation of the other. With the intention of pointing out more clearly the similarity in the output characteristics of these types, two machines were taken from the stock of a prominent New England manufacturer and subjected to performance tests over wide ranges of load. These two motors were of as nearly the same rating as it was possible to procure, each being a 7.5 hp, 220-volt machine. However, there was the slight difference that the direct-current shunt machine operated at 1000 r.p.m. and the three-phase squirrel-cage induction motor was designed for 60 cycles and operated at 1120 r.p.m. The results of a brake test on each of these machines are shown graphically in Figs. 1 and 2. In order that these results may be more easily compared, the three most important characteristics of the two machines have been plotted on the same sheet and are shown in Fig. 3. From this illustration it may readily be seen that the torque, watts input and efficiency for the two machines are nearly identical within the limits of practical operation. In regard to starting torque it may be said that the two machines perform equally well for commercial purposes, but the starting

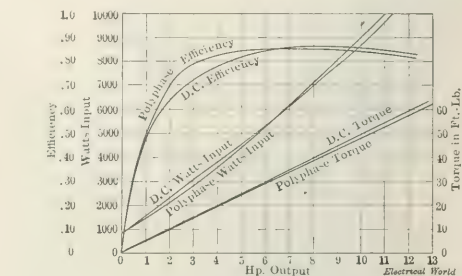


FIG. 3—COMPARATIVE PERFORMANCE CHARACTERISTICS OF DIRECT-CURRENT AND INDUCTION MOTORS

The curves marked "speed" in Figs. 1 and 2 show the speed regulation of the direct-current machine to be considerably better than that of the induction motor. Both of these types of motors are considered to be constant-speed machines, the direct-current motor on account of the constant value of field flux and the induction motor because of the constant value of line frequency. The poorer speed regulation of the induction motor manifested in these curves is not inherent in this type of machine but is due to a comparatively high resistance rotor used in this machine for the purpose of producing greater starting torque. It should be said in this connection that racing is never experienced with the polyphase motor, as it is impossible for the machine to run above synchronous speed. The direct-current machine, however, may in event of a weakened field reach speeds which are dangerous to the armature windings from the high centrifugal stresses.

To supplement the foregoing performance tests a large number of data were collected on the relative weights and costs of these two types of machines, and curves have been plotted to show these facts. From the graphic comparison of weights shown in Fig. 5 it may be seen that for a 7.5-hp output the weights of the machines are most nearly alike,

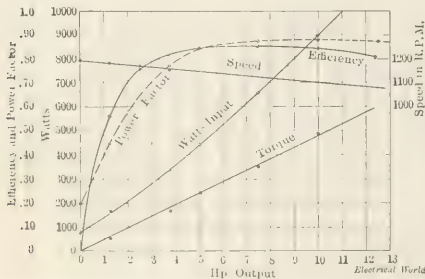


FIG. 2—PERFORMANCE CHARACTERISTICS OF A 7.5-HP, 220-VOLT, 60-CYCLE INDUCTION MOTOR

torque of the alternating-current machine may be materially increased by inserting additional resistance in the rotor circuit.

It has been observed that the losses at intermediate loads are less in the polyphase machine than they are in the direct-current motor, which in a large measure accounts for the slightly higher efficiency of the alternating-

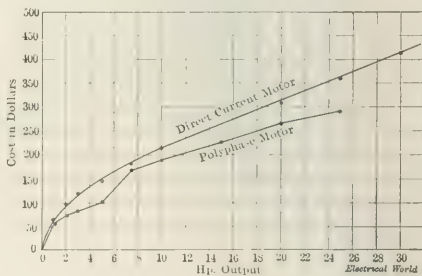


FIG. 4—COMPARATIVE COSTS OF THE TYPES OF MACHINES

and that above this point as the output increases the curves diverge. The rapid increase in weight per horse-power of the direct-current machine is due almost entirely to the commutator, which must be made large in order that it may remain within the specified limits of temperature rise. The weight per unit output for inclosed motors is higher than for the open machines shown in these curves.

The curves of Fig. 4 show that for the same output the polyphase motor is the cheaper machine. This result is to be expected, for the commutator is an expensive part of the direct-current motor, not on account of the cost of the copper alone, but because of the high cost of its construction. As is characteristic of the weight curves, the cost curves show that for increasing outputs the cost of

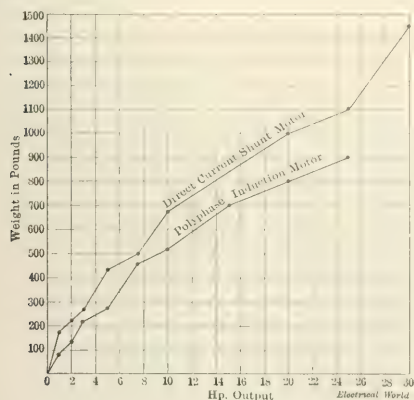


FIG. 5—COMPARATIVE WEIGHTS OF THE TWO TYPES OF MACHINES

direct-current machines increases more rapidly than does the cost of the polyphase machines. It rarely happens, however, that the prospective buyer concerns himself with the comparative costs of alternating-current and direct-current motors as he is compelled by existing circumstances to employ one or the other without choice. For this reason it is the writer's opinion that the competition between these two types of machines will never be of a very keen nature, even though it has been shown that the two machines are very well adapted to do the same work.

### Electric Arc Used for Igniting Gas in Tunnel

In boring the municipal aqueduct tunnel through the Santa Ynez Mountain range in California for the water supply of the city of Santa Barbara, gas was encountered in large quantities. In order to guard against and safely dispose of this inflow a system of electric arcs was installed in the tunnel and used to ignite the gas after firing a round in the heading. The specially made arc lamps were placed in high points along the tunnel about 200 ft. apart, the first one being located about 150 ft. back of the heading. Thirty minutes after the blast was fired the arcs were switched into circuit and an ammeter at the switch indicated whether the lamps responded or not. After obtaining results of arcing from the portal the fire boss and helper would advance to another arcing station 3500 ft. from the portal, and electricity would be again applied. If no gas explosion ensued, the entire tunnel ahead was explored with safety lamps. If no pockets were discovered, the inspectors returned to the station, where the arcs were again switched into circuit, and with the arc lamps burning the inspectors returned to the heading and placed torches at intervals of 100 ft. through the gas section, which were kept burning during the next shift. Four hours were consumed in testing before the next heading crew were permitted to go on shift. Two heading shifts were maintained, and aside from the two four-hour periods of fire-boss shifts the work was uninterrupted. Water was also encountered in large quantities. The tunnel is 19,560 ft. long.

### Progress of Keokuk Water-Power Development

During the three months covered by Progress Bulletin No. 8, issued under date of December, 1912, by the Mississippi River Power Company, which is building the 200,000-hp hydroelectric plant at Keokuk, Ia., work on the dam, power house and locks has gone forward rapidly.

The main dam was connected with the power house structure in October, and this has enabled carloads of machinery to be delivered directly to the plant without being re-handled. Three turbines have already been received and completely erected. The runners weigh 65 tons each and measure 16.5 ft. in diameter and 12 ft. in height. One manufacturer cast his runners in four quarters, to be fitted together at the site. The other built his wheels in a single piece, for the transportation of which a special 75-ton car was required. The car followed a route carefully selected with respect to bridge clearances and was allowed to travel only during daylight as a safeguard against accident. Eight days were consumed in making the trip from Akron, Ohio, to Keokuk.

Concrete for the ship lock is now complete, and the huge 300-ton gate leaves, each 50 ft. by 67 ft., are already in place. Construction of the sixteen draft tubes in the south or second half of the power house has been pushed rapidly during the fall and winter months. The north half of the structure, housing the first group of machines, is now practically completed and the building is rapidly assuming its final appearance. Even the concrete barriers and soap-stone slabs for the 11,000-volt bus structure are partly in place. To date five of the generator stators have been wound, four rotors have been assembled, four bases are in place, and one has had its stator sections mounted in position.

Owing to a change in the plans, it has now been determined to extend the piers and arches of the dam around the north end of the power house and thence diagonally



INSTALLING KEOKUK DAM. WORK ON THE MAIN DAM AND THE NATURAL BRIDGE.

across the river. The bridge will have a span of 100 ft. and will be a steel drawbridge. The bridge will be used for the passage of railroad trains, a steel drawbridge crossing the river through. About sixty spillway sections at the center of the main dam have been left open to permit the discharge of the river's flow, but will later be closed in some cases with the 10 ft. dam piers and locks.

## A New Method of Timing Watt-Hour Meters

BY GORDON THOMPSON

The percentage accuracy of watt-hour meters is experimentally determined by comparing the watt-hours or watt-seconds represented by a certain number of revolutions of the meter disk with the watt-hours or watt-seconds computed from the indications of power-measuring instruments and the speed of the meter. In precision work, such as the calibration of rotating standards and the testing of watt-hour meters under the Meter Code of the National Electric Light Association and the Association of Edison Illuminating Companies, it is necessary that this speed be determined with an accuracy of at least 0.1 per cent.

Up to the present the accurate measurement of time in watt-hour-meter testing has been generally accomplished by means of stop-watches. An approach to the degree of accuracy stated above has been sought by using the average of a number of determinations of a long period of time; for example, it is customary to take the average of six readings, each 100 seconds long, for a single test on a rotating standard.

The errors of the stop-watch are, however, large and variable. First, there is the error which is produced at the starting of the recording mechanism. The toothed wheel on whose shaft the second hand is mounted usually has 120 teeth, each tooth thus corresponding to one-fifth of a second. The even chances therefore are that the time of engagement of the gear train as indicated by the second hand will be one-fifth of a second ahead of, coincide with or be one-fifth of a second behind the actual moment that the impulse is given to the stem of the watch. In commercial testing the testers usually take readings only 40 seconds in length; in these cases there is a possible error of 0.5 per cent. Of course the probabilities are that this starting error will be reduced to a negligible quantity if the tester use the average of a number of readings of a long period of time. But the uncertainty is ever present.

A second starting error is found in watches not of the highest grade, caused by the impulse given to the light second hand by sudden and imperfect meshing with the moving gear train. This "throw" often amounts to one-half of a second and constitutes a serious source of error.

The remaining error found in the indication of a stop-watch is the time error of the watch's movement.

Finally, the stop-watch method is subject to the personal error of the observer; he may not correctly determine the time of transit of a mark on the meter disk past a fixed point which he has selected. It is reasonable to believe, however, that he will make the same error at the end of his determination as at the beginning.

Before passing from the stop-watch method, attention should be called to the corrective tendency of a comparison check of the stop-watch with a standard clock. If the number of readings made in this comparison is not small and the time period involved is long, the starting errors will be reduced to a minimum, the time error will be determined, and it is probable that the personal error of the observer will be evaluated. However, having in mind these errors, their probable values and the means of determining and eliminating them, it is not wise to place the probable accuracy of the stop-watch method above 0.2 per cent.

The large amount of "code" testing of watt-hour meters being done at the Electrical Testing Laboratories, New York City, has emphasized the need of a more accurate means of measuring time than the stop-watch. The first method tried consisted in the substitution of an ordinary chronograph such as is commonly used in physical and astronomical work. Simultaneous records were made on a chart by a standard clock beating seconds and by a key pressed by the observer at every revolution of the meter disk. This method gave an accurate measurement of time, but the observer's personal error remained. Obviously the

next step was to make the meter record its speed automatically. Here the work done by Messrs. J. B. Seaman and Burleigh Currier was followed. In the method devised by them contact was made between two platinum-tipped wires or between a platinum wire and a mercury cup at every revolution of the meter. The times of contact were recorded on a specially designed chronograph with six pens which has been named an "errometer." This method of making the meter self-registering has been superseded in the testing at the Electrical Testing Laboratories because the contacts are not permanently reliable and a new method of fastening them to the meter must be devised for each new type tested.

The latest step is represented in the apparatus described below, which was devised by the writer and has been in use at the Electrical Testing Laboratories since Sept. 1, 1912. The scheme is to cause a high-voltage spark to pass from a stationary point to a point on the disk or other part of the meter's rotor at each revolution and by its passage to operate a relay which in turn produces a movement of the pen of a chronograph. The meter itself thus makes a reliable record of its speed without bringing anything into contact with its moving element.

The high voltage necessary for the spark is furnished by a small 10,000-volt testing transformer ( $T$  in the sketch), connected across a variable alternating-current supply. A limiting resistance  $R$  is placed in series with its primary, and the voltage applied to the circuit is varied by means of an auto-transformer  $A$ . One terminal of the high-tension or secondary winding of the transformer is connected to the meter register. The other terminal of the secondary winding ends in a well-insulated needle-point  $P$ . This is so placed that a moving point on the meter's rotor passes near it at each revolution. With rotating standards the large pointer of the recording mechanism constitutes the moving point, the stationary point being a piece of wire held beneath the glass cover near the dial. In the case of house-type watt-hour meters a piece of wire weighing about 10 milligrams and bent into a U-shape is sprung onto the edge of the meter disk to form the moving point  $S$ .

When the moving point comes opposite the needle-point a spark will pass. This practically short-circuits the transformer secondary, and the load current which flows will greatly increase the voltage across  $R$ . The electromagnet  $M$  of an alternating-current relay is shunted across  $R$ , and this increased voltage operates the relay. A copper rod attached to the armature is thereby caused to dip into a mercury cup  $L$ ; this completes a local circuit through the electromagnet of a chronograph  $K$ , and a record of the passage of the spark is thus made. A standard clock  $C$  sends seconds signals, which are recorded on the chart by means of the same pen.

The insulation of the meter coils is never subjected to a higher potential than 120 volts, and the tester can receive a shock only by deliberately touching the high-tension needle-point, which is incased in a tube of high insulation.

A liquid contact used in the chronograph circuit gives a record of nearly constant length at all speeds of the meter disk. The moving element of the relay is large and heavy and is controlled by gravity; vibrations are damped out by means of a spring. The chronograph employed at the Electrical Testing Laboratories was made by Mr. William Gaertner, of Chicago, and has two pens mounted on a rolling carriage which is moved the length of a recording drum by means of a screw thread. The speed of the drum is maintained at a constant value by a centrifugal governor. When the chronograph is correctly adjusted the record drum makes one revolution in exactly thirty seconds. Since the diameter of the drum is 6 in., a one-second interval is represented on the record by two marks about  $\frac{5}{8}$  in. apart. Fractions of a second are read with the aid of ten radial lines etched on a microscope cover-glass. Even 0.05 second may be read with the greatest ease.



The presence of two pens permits the simultaneous testing of two meters. Red and black inks are used.

The method of working up the chart is simple. A meter mark near the beginning of the record is selected as the zero revolution. The second mark immediately preceding the meter mark is taken as the zero of time. A line is then drawn through the second marks in the same vertical row. Since the marks on this line are thirty seconds apart, as explained before, the number of any particular second is easily determined. The meter revolutions are counted in the same way by means of inclined lines drawn through marks on adjacent rows. From the time of a given number of revolutions the speed of the disk is computed and then the meter accuracy is determined in the usual way.

The possible inherent errors of this method—that is, neglecting errors made in working up the charts and in holding a wrong load value, which are not peculiar to this method—are the following:

1. Variation of the spark.
2. Acceleration and deceleration of the rotor due to electrostatic attraction.
3. In alternating-current meters the current from the spark, traversing the disk, may produce a torque by reaction with the fluxes from the pole tips.

1. In successive revolutions the spark may not always jump the air-gap when the two points are in the same relative position. This variation has a maximum value of not more than  $1/32$  in. and is of frequent occurrence only at high speeds. In a disk 3.5 in. in diameter (modern small alternating-current meter) this variation would produce an error of about 0.3 per cent in one revolution. To reduce the possible error to 0.1 per cent it would therefore be necessary to take at least three revolutions in a test, assuming that only the first spark overlaps and all the others are normal, which, of course, is the extreme case.

2. There is always electrostatic attraction between two bodies maintained at a difference of potential. In this method, however, it is usually the case that we have only a point projecting  $1/16$  in. from a surface of comparatively large area; hence the electrostatic field between the fixed point and the meter disk is appreciably changed only for the short time that the moving point is sweeping past the needle-point. It is reasonable to assume, therefore, that any acceleration due to electrostatic attraction with the approaching point will be entirely counterbalanced by the deceleration with the receding point. This matter has been investigated by carefully noting the speed of rotation of a rotating standard having a "creep" of one revolution in about twenty seconds. Here we have the pointer of the register constituting the moving point and the extreme case is set up of a great change in the field between the two electrified bodies for about one-tenth of a revolution. In this particular case, however, no change in speed whatever could be detected either before or during or after the passage of the spark.

3. In certain types of alternating-current meters the electromagnetic windings are on the front side of the rotor shaft. In testing meters of this particular type it is conceivable that the "spark" current in traversing the disk below the pole pieces might exert a torque affecting the rotation of the moving element. This effect can be eliminated by using for the spark a current of another frequency than that on which the meter is operating. In the "code" testing done at the laboratories this method has been followed. Some tests have been made by them, however, in which the same source was used for both the meter and spark; that is, the same frequency was used for both. The results obtained showed negligible differences even at light loads from those obtained using two frequencies.

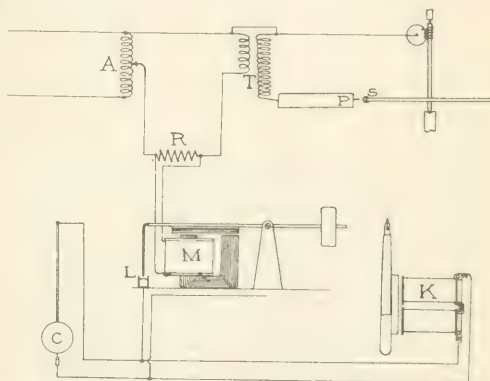
The third error is therefore apparently negligible and may always be eliminated by the use of different frequencies for the test and spark currents.

A large number of tests have been made in which the test

meters were timed by this method and the results obtained have in every case been perfectly uniform and consistent, as distinguished from previous tests where stop-watches were used and frequent rechecking was necessary.

A meter test bench is now being built having in view the application of this method of timing in all classes and types of watt-hour meters of the motor principle. The high-tension transformer is to be mounted above the test board beyond striking distance. The high-tension needle-point will be placed on an insulated carriage running on a metal track in front of the meters so that it can be placed in operation on any one of the meters in a few seconds. The needle-point will be connected to the transformer by means of a heavily insulated flexible cable. Only a few tenths of an inch of the needle-point will be exposed, so that the tester cannot deliberately reach his hand around and touch the point to get a shock. Even then the shock received will not be dangerous, since the secondary current is limited to about 0.008 amp. The chronograph is to be placed at the end of the table in a convenient position.

The advantages of this method of timing watt-hour me-



SPARK GAP AND CHRONOGRAPH CIRCUITS FOR TIMING WATT-HOUR METERS

ters with a view to obtaining a result accurate to 0.1 per cent are the following:

1. The method requires only one observer, whose sole duty is to maintain a constant load, as contrasted with the stop-watch method, where two observers are necessary.
2. The inherent errors are negligible and the final accuracy depends only on the precision with which the load is maintained. With the stop-watch method there are variable errors due to watches and to the observer.
3. The meter records its own speed in a permanent form on a chart which may be preserved indefinitely for future reference. This is of importance in "code" testing in particular. The stop-watch method furnishes no permanent preservation of the test's results.

4. In "code" testing and in time testing used when a few meters are subjected to a large number of tests, a large saving in expense results from the shorter length of time required to perform the test. Moreover, many meters may be tested in one time and in a shorter length of time than is required in the stop-watch method. At a chronograph with two pens is used the space of twenty watt-hour meters at one load may be easily obtained in twenty-five minutes. By the stop-watch method, using two testers, three of whom are using meters, at least forty minutes would be required.

In case of testing single meters the expense represented by the time required to "work up" charts is offset by the saving in expense resulting from the use of only one observer.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Wiring Old Houses in Nashville

One of the important and ever-present problems of the central-station manager is devising means to bring about the wiring of old houses. In many of the older cities the proportion of residences wired for electric service is far too small. As the result of a recent energetic campaign Mr. James E. Carnes, contract agent of the Nashville (Tenn.) Railway & Light Company, reports that during a period of eight weeks 142 old houses have been wired for electricity. This is a good record for a city of the size of Nashville, and should be emulated in many places where there has been little or no recent old-house-wiring effort.

## Discouraging the "Loan Shark" in St. Louis

Effective Feb. 1, a loan fund has been created by the Union Electric Light & Power Company of St. Louis. Deserving employees who may need money temporarily to meet emergencies such as arise from sickness, death in their families or other unforeseen contingencies may borrow from the company, without interest, subject to the provisions of the plan governing the loan fund. The maximum amount to be loaned to one employee must not exceed 50 per cent of his monthly salary. The amount of the instalment repayable each pay day shall represent at least 10 per cent of the loan. Application for a loan shall be made to the company by the employee through the chief of department, superintendent or foreman, and be approved by the head of the department in which the applicant is employed. The total amount of money outstanding on loans at one time shall not exceed \$5,000.

## Fifty Cents Increase in Monthly Rent Pays for Wiring Dwelling

By first getting tenants of unwired property to agree to an increase of from 50 cents to \$1 in their monthly rent, provided that the modern convenience of electric wiring is installed, the commercial department of the Tri-City Railway & Light Company, of Davenport, Ia., has succeeded in obtaining house-wiring contracts from a number of local landlords who would not have been likely to authorize such construction if approached along the usual lines.

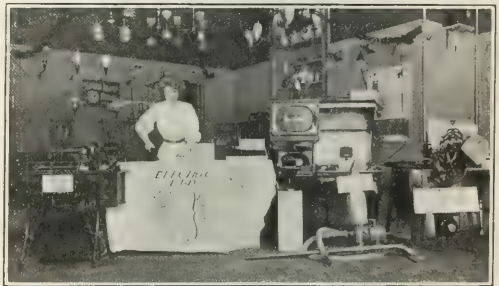
Such an increase of \$6 to \$12 per year in rental income easily covers the interest cost on the average outlay for wiring, besides leaving a comfortable surplus to retire the original expenditure in a few years, so that the property is soon left with a substantial improvement at practically no cost to the owner. Almost any tenant, of course, would willingly submit to an increase of from 50 cents to \$1 a month for the convenience and comfort of living in a modern, wired dwelling, while for renting the same premises to the next tenant the appreciation in rental value may well be several times this amount.

The Davenport company's experience, like that of other central stations, had been that a simple request from the tenant was hardly sufficient to bring the landlord to spend the amount necessary to have the house wired. "But when the owner is presented with a written agreement on the part of the tenant to pay more rent it becomes a different matter," according to Mr. H. C. Blackwell, vice-presi-

dent and general superintendent of the Davenport company, "and in this way we have succeeded in wiring houses which otherwise never would have been wired." The business department also keeps in close touch with local real-estate men, attending their meetings and taking up with them the matter of soliciting their tenants to adopt electric lighting and energy-consuming devices.

## An Automatic Appliance Demonstration

The value of office displays in creating interest among customers was demonstrated in particular by the Ripon (Wis.) company which during a recent appliance campaign installed the automatic apparatus demonstration herewith illustrated. At one side of the office space Mr. W. E. Haseltine, local manager, set up the life-size pasteboard figure of a woman who, flatiron in hand, presided over an ironing board. Surrounding her were various motor-



APPLIANCE DEMONSTRATION AT RIPON, WIS.

driven devices, such as electric washers, sewing machines, buffing and grinding motors, vacuum cleaners, fans, etc. Overhead numerous small Christmas-tree lamps were festooned, and, it being the holiday season, an electrically lighted tree blazed at one side. By means of a hand-made flasher in the basement, the different devices and lamps were alternately started and stopped, one after the other, giving a mysterious and striking effect. This exhibit attracted to the office many who would not otherwise have come, and each had some question to ask about some device or appliance so that much desirable publicity was created.

## Commercial Growth at Louisville, Ky.

The Louisville Lighting Company, of Louisville, Ky., announces an increase of 100 per cent in the number of new customers it secured during December, 1912, as compared with December, 1911. December, 1911, in turn, had shown an increase of more than 100 per cent in the number of customers secured over the corresponding month of 1910. As the result of two years of strenuous business-seeking, the commercial department of the company is in a position to show more than 200 per cent increase, a record of which it may be justly proud. An increase of from 18 to 25 per cent in the station load of the company was also noted during December, 1912.

### Giving Church-Fair Sales Profits to Charity

The question of the best way in which to contribute to the many local charitable movements, such as church bazars, hospital fairs, etc., for which the aid of central stations is solicited is one that has to be decided frequently by the management of these companies.

One way to help worthy causes and at the same time to secure desirable publicity is the general scheme followed



BOOTH AT A BROOKLYN CHURCH FAIR

by the Edison Electric Illuminating Company of Brooklyn. The exact plan varies somewhat with each case, depending on the urgency of the need, but the general idea is to purchase space for a booth at such functions, exhibit a full line of appliances and give some part of the proceeds, usually the profits, to the cause. This has been found to be more satisfactory and also more effective in placing the appliances in service than the customary plan of donating a smaller number of devices to be sold by the ladies in attendance. Regular demonstrators from the company's appliance department, the "Edison Shop," are in attendance. The accompanying illustration shows the company's exhibit at a recent church fair.

### Central Station Offers Services of Lecturers

As already mentioned in an editorial comment in these columns, so many requests have been received by the Edison Electric Illuminating Company of Boston for lecturers to talk on electrical subjects before different local organizations that a series of lectures has been arranged for this winter, speakers to be furnished without charge by the central station's advertising department.

Lectures will be delivered before men's clubs, boards of trade, improvement societies, church societies, women's clubs, schools and colleges, Y. M. C. A.'s and lecture classes near by—in fact, before all representative organizations among the million people in the 600 sq. miles of territory served by the company. Manufacturers have been requested to furnish samples of appliances which it would be practicable to exhibit at lectures of this character. The committee on lectures also has in mind the preparation of moving-picture films which can be used in the smaller types of Edison machines. These are manufactured expressly for home use and can be used to excellent advantage in any ordinary hall.

Requests for dates have been coming in rapidly since the announcement. Addresses were made in November at the Men's Club, Christ Church, Hyde Park, and at the Men's Club, Episcopal Church, Watertown, by Mr. L. D. Gibbs,

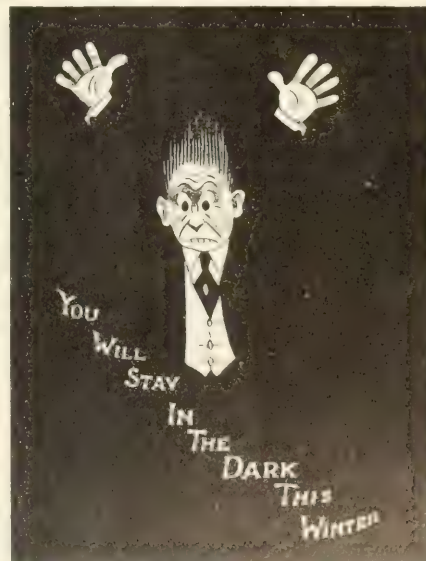
and at the Phillips Brooks Club, St. Mary's Episcopal Church, and Tremont Street Methodist Episcopal Church, by Mr. La Rue Vredenburg. During December Mr. Gibbs lectured at Watertown and Mr. Vredenburg at Roxbury.

### Window Display Operated by Motor-Driven Blower

An ingenious moving display with something of mystery about it has been attracting attention in a window of the Kentucky Electric Company, of Louisville. A barely perceptible slit was cut in the floor of a small dais erected in one of the Fourth Avenue windows, and beneath this slit was mounted the discharge of an air pump, the nozzle being carried on a traveler so as to traverse, back and forth, the length of the aperture. Mounted on the jet of air produced was a big red ball, which bounced up and down or revolved in a mysterious manner, apparently unsupported by any visible means. Surrounding the moving attraction were signs advertising various features of "Ky-El-Co" service. The air pump was, of course, driven by an electric motor.

### Window Cards in Kansas City Campaign

Interest in some of the clever cartoon advertisements of which the Kansas City Electric Light Company is making use has proved contagious among neighboring central-



#### IF YOU ARE CAUGHT WITHOUT ELECTRIC LIGHT

BETTER have your house wired now, while you can, still have a chance to take advantage of our Special Wiring offer, including a 25% reduction in cost, with twelve months to pay in.

LET us estimate the cost of wiring that house of yours.

KANSAS CITY ELECTRIC LIGHT CO.

PHONES: BELL 50 AND 51 WEST 10TH GRAND AVENUE

A. H. S. & CO. FROM KANSAS CITY

have since found their way into various cities and towns in Missouri, Kansas, and other states. The pictures, which are the first of their kind reproduced here, with, were got up as timely reminders of the "light that will bring the natural gas shortage this winter, the



lesson being that unless the consumer exercised foresight in having his house wired for electric lights, he might be caught "in the dark." Much amusement has been caused by the sketches, which were mailed as postal cards and were also used as window placards.

### Central-Station Results at Holland, Mich.

The municipal light and water plant at Holland, Mich. (described in the *Electrical World* of Feb. 2, 1911), enjoys the double distinction of having had competent management during a number of years and of being one of the few

should be the standard of comparison on items relating to the utilization of apparatus. This suggestion seems well made, as the peak load of a system usually has a more fundamental relation to other items of operation and finance than the kilowatts of station rating. In the case under consideration in Table I the reader can obtain the investment and gross income per kilowatt of maximum peak load by using the figure given for maximum load, namely, 825 kw, and the investment and income figures from Table II.

Other interesting information concerning the Holland plant is given in the second table. This traces the history of the investment since the plant was started in 1894, and

TABLE I—"FACTS AND FACTORS" OF HOLLAND (MICH.) MUNICIPAL PLANT

	1910-11	1911-12		CONNECTED LOAD	Kw.
Population	10,490	10,760	Incandescent lamps		1,856.30
Consumers per 1000 population	17.3	19.0	Commercial arc lamps		25.55
Station rating, kw	925	925	Street arc lamps		92.50
Station rating per employee, kw	48.68	48.68	Two-phase motors		825.00
Station rating per capita, watts	33.3	29.2	Single-phase motors		19.00
Ratio of station rating to connected load, per cent	222.1	238.0	Flatirons		344.50
Average load during operation, kw	24.0	25.6	Total load		3,162.85
Ratio of average load to station rating, per cent	29.2	28.8	Metered services for lighting		1,967
Annual load factor, per cent			Metered services for motors		80
Investment per kw of rating	\$208.00	\$219.00	Full-load rating of plant, kw		925
Investment per capita	18.40	18.88	Maximum load, kw		825
Gross income per kw of rating	70.57	70.18			
Gross income per consumer	6.11	31.85			
Gross income per capita	6.24	6.06			
Gross income per \$100 invested	34.00	31.79			
Gross income per kw-hr. generated	0.0337	0.0312			
Ratio of expense to gross income, per cent	84.7	54.6			
Net earnings per \$100 invested	\$10.67	\$10.38			
Total hours' operation for the year	8,760	8,760			
				TRANSFORMERS	Kw.
				Light (88)	488.8
				Motors (42)	703.5
				Total transformer rating	1192.3

Commencing with the month of May, 1911, a discount of 15 per cent was allowed on lighting rates. Rates for motor service remained net.  
 \*Full load capacity of plant.  
 †Entire force, station, distribution, clerical and general.

municipal stations in which complete records are kept of the essential factors of the business. The annual report of this plant, in its published form, is an interesting little booklet to those in the central-station business because of the operating and financial facts given. One portion of the report is entitled "Facts and Factors," and contains items computed in accordance with the standard "facts and factors" form which has been used by the *Electrical World* and by the Iowa Electrical Association. This arrange-

shows how the cost of equipment, size of plant, gross earnings and operating expenses have increased from year to year during the eighteen years of plant operation. The water-works investment, earnings and operating expenses are kept separately and analyzed systematically.

The statement is one which shows what can be done by consistent good management, with few mistakes, in a period of eighteen years. The figures should serve to quiet the claims sometimes made concerning the large profits of the

TABLE II—RESULTS OF OPERATION DURING LIFE OF PLANT, HOLLAND, MICH.

	PLANT			OPERATION		
Year Ending Third Monday in March	Added	Total Cost	Rating, Kw	Gross Earnings	Cost of Product, Interest on Bonds, Loss of Taxes	Gross Profits
1894-95		\$15,690.25	67.5	\$5,508.86	\$4,859.38	\$649.48
1896	\$15,886.26	30,576.51	137.5	8,736.98	7,715.23	1,021.75
1897	2,901.51	33,478.02	137.5	11,119.25	10,294.30	824.95
1898	1,134.46	34,612.48	137.5	9,010.80	8,035.56	975.24
1899	6,661.58	40,753.06	192.5	10,945.60	7,792.88	3,152.72
1900	3,411.96	44,165.02	192.5	13,608.73	9,878.15	3,730.58
1901	8,091.85	49,256.87	192.5	11,873.07	10,707.96	4,166.01
1902	8,118.95	57,375.82	230.0	17,646.10	11,985.74	5,660.36
1903	21,481.22	78,856.74	350.0	21,484.41	14,267.81	7,216.60
1904	19,267.07	98,063.81	350.0	26,983.86	17,812.34	9,171.52
1905	7,046.74	105,110.55	350.0	28,753.66	21,242.72	7,510.94
1906	4,996.32	110,096.77	350.0	31,174.68	18,148.30	13,026.38
1907	14,977.40	125,076.17	350.0	39,807.00	27,811.30	11,995.70
1908	12,554.91	137,631.08	350.0	44,698.96	29,364.63	15,334.33
1909	28,642.24	166,273.32	425.0	53,316.50	39,976.33	13,340.17
1910	40,430.30	206,703.62	425.0	61,487.71	36,461.17	25,026.54
1911	10,417.79	217,121.41	425.0	65,556.00	35,855.37	29,700.63
1912	10,074.49	203,168.90	425.0	65,194.23	44,451.91	20,742.32
Total	\$293,168.90		425.0	\$529,877.12	\$356,631.08	\$173,246.04
Total profits at beginning of year						\$84,846.77
Profits added during year						21,093.48
Total net profits at end of year						\$105,940.25

ment, which puts much information about the plant in condensed form, is given in Table I.

Since the *Electrical World's* form was originally adopted a number of central-station men have suggested that kilowatts of peak load rather than kilowatts of station rating

business and, on the other hand, to keep unscrupulous central-station owners and promoters from concealing facts as to the profits of the business.

The Holland plant is under the control of a board of public works, with Mr. R. B. Champion as superintendent.

# Illumination and Wiring

## Electric Fountain at San Diego, Cal.

A small park at San Diego, Cal., has an electric fountain which is unusual in its design and arrangement. Even by daylight, before the water is turned on at noon, the fountain presents a very beautiful appearance as a monument of classic design, for it was important to have the structure in keeping with the architecture of the large hotel in the background.

At 12 o'clock each day the water is set in motion by an electric pump concealed in a chamber under the fountain. This forces the water up through the marble columns to the base of the bronze lantern above the dome. From this point it flows over the prismatic glass of the dome, whose protruding framework of bronze sets the water rushing and seething. Although the fall is thence straight down in a shower to the granite pedestal, the illusion is given of water rising from the base and terminating in a dome-shaped roof of foam. Eight jets of water are also shot at an angle from the sides of the basin to meet the shower between the columns, and together they rush downward



ELECTRIC FOUNTAIN AT SAN DIEGO, CAL.

into the basin in a number of small cataracts. The water is returned to its starting point and is pumped over again and again.

At night the fountain, of course, is at its best. Colored lamps with reflectors are placed under the jets and cascades, and a flasher is operated automatically. Clusters of colored tungsten lamps are arranged under the prismatic glass dome, which subdues their brilliance. The fountain was installed at a cost of \$15,000, and the running expenses are said to be not more than \$5 a day, as only the services of the park caretaker are required. Mr. Irving J. Gill was the architect for the fountain.

## Lighting for Boston Subway Approaches

The Cambridge subway, which is the latest underground rapid-transit line to be placed in service in Greater Boston, is notable among other features for the artistic and efficient character of its electric-lighting equipment. A typical installation of entrance lighting is shown in the accompanying photograph taken on the surface above the Central Square station. The stairway connecting the sidewalk and the out-bound platform below is surmounted by two posts, each carrying two 40-watt tungsten lamps in a spherical globe of translucent glass. Between the posts is a sign transparency containing ten 55-volt, 15-watt tungsten lamps, wired in series from the railway feeder circuit. At the right is a double reflector sign, containing two sets of five

15-watt lamps similarly wired ten in series, which shows the connections made by surface cars and trains at the Harvard Square terminal station. The post lamps are connected in series with a stairway lamp of the same wattage. The installation furnishes a good example of recent



LIGHTING FIXTURES AT BOSTON SUBWAY ENTRANCE

tendencies in ornamental and utilitarian exterior lighting and adds another to the many instances of what public-service companies have accomplished along this line.

## Bell and Lamp Signal Systems—III

By SYDNEY F. WALKER

In the issues of the *Electrical World* of Jan. 18 and Jan. 25 the former instalments of "Bell and Lamp Signal Systems" appeared. The first instalments gave a résumé of the early growth and development of the use of electricity in mine signaling and a description of some of the systems

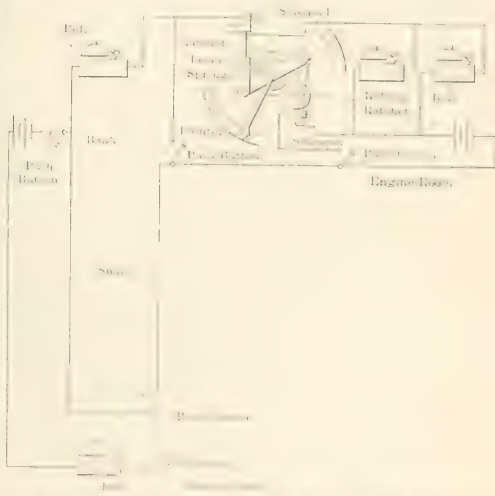


FIG. 8. DIAGRAM OF SHANNON'S SHAFTE SIGNAL SYSTEM, USED IN MINE SHAFTS

used in well-known systems on land. The present article deals with signals used in the mine shafts.

### SHAFT SIGNALS

Shaft signals have not been very extensively employed in the past, partly on account of the heavy first cost as

compared with the old stranded wire knocker and partly on account of the great trouble in keeping them in order. The vanguard mining engineers have tried them with success, and their adoption is becoming more general. There were two great difficulties in keeping shaft signals in repair during the early days, trouble with the wires in the shaft and trouble with the contactors in the pit and on the surface. All mine shafts without exception have water running down their sides, and if insulated wires are used and are stapled to plugs or anything of the kind, as was the practice in the early days of signaling, the water invariably takes its course over the staple, which becomes badly rusted at that point. Conduits were tried at the collieries of Derbyshire and were found to give fairly satisfactory service, but even where this precaution was adopted

the modern tendency toward iron conduit and waterproof cases has done much to eliminate this trouble.

In metalliferous mines, where efficient shaft signals would be of the very greatest service, the greatest difficulties arise in connection with their operation, owing to the presence of large quantities of water in the shafts and the greater number of levels. In this class of mines the shafts are nearly always inclined, they follow the "dip" of the lode, and levels are run out on each side of the shaft at certain intervals, so that in deep mines there are a very large number of them. Special arrangements are made in the winding engine on the surface, to enable the "skip," as the cage used in metalliferous mines is called, to be stopped at any level. Thus communication between each level and the surface and between individual levels would be of the

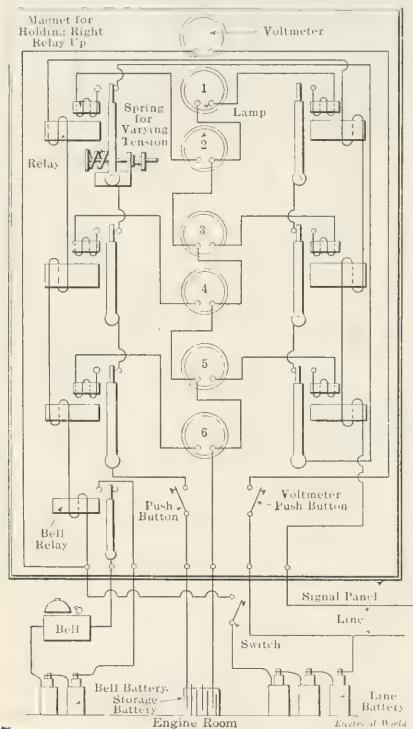
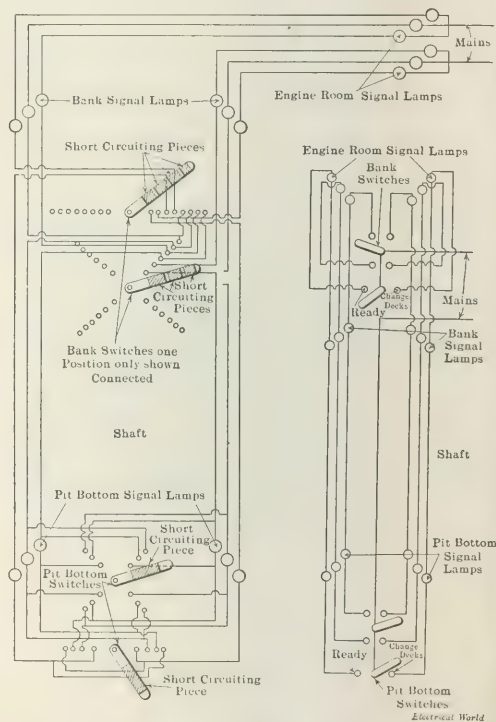


FIG. 9—CONNECTIONS OF INDICATOR OF CHARTON'S RELAY SIGNAL

trouble sometimes occurred, owing to the fact that the conduits were not entirely waterproof.

The trouble with the contactors was even more serious. The delicate design of the switches and other apparatus made them unable to withstand the rough handling to which they were subjected by the miners, nor could the contact points be kept free from dirt. This trouble, coupled with the need for economy in insulated wire, led to the adoption of double-contact ringing keys, which operated the local bell circuit and the engine-room signal simultaneously. These keys required constant attention to keep the spring tension high enough and to keep the points from corroding. It appeared to be practically impossible to prevent water from following the wires into the contactor case. This trouble was partly obviated by bringing the contactor terminals to the outside of the case. This left the connection in a position where it was easily accessible for repairs. Difficulties in maintaining contactors are still present, but



FIGS. 10 AND 11—DIAGRAMS OF CONNECTIONS FOR SHAFT SIGNAL LAMP INDICATORS

greatest service. In the Rand mines, where there are usually three divisions of the shaft, one devoted entirely to pipes and conduits, the difficulty of repairing the wires is not so serious.

#### MODERN SHAFT SIGNALS

Modern shaft signal systems are installed with all wires inclosed in iron conduits, which follow very closely the conduit system used in wiring buildings for electric light and motor service. All apparatus is fitted with water-tight cases and all joints between the conduits and their cases are carefully made. Then by opening the contactor boxes only when it is absolutely necessary the amount of moisture which reaches the delicate working parts is reduced to a minimum. The iron conduit is sometimes replaced by armored cable. The latest development comprises two complete sets of signals, namely, the bell signals and the visual signals. The bell signals are operated by batteries in the



usual manner and differ very little from the bell signals already described, except that the wiring is carefully protected.

A modification of the simple bell-shaft signal which is illustrated in Fig. 8 has been introduced by Siemens Brothers. The principal feature of the system is a numbered indicator in the engine room, which registers the number of rings given, either by the "banksman" or by the "on-setter" at the pit bottom or level. It is obvious that there may be one or two indicators, one attached to the signal from underground, the other to that from the pit bank. In either case, pressing the contactor at either the pit bottom or the bank rings the respective bell in the engine room and moves on the pointer of the indicator one space. This is brought about by an electromagnet operating a ratchet which moves forward one tooth for each ring.

The visual signals consist of small incandescent electric lamps, placed behind windows in the indicators, and are supplied with current either from a storage battery placed conveniently for the purpose, or, as is more usual, by current from the electrical supply mains of the colliery. For the lamps alternating current is preferable to direct current owing to the reduced wear and tear on the contacts due to arcing. It is very convenient, therefore, to reduce the emf to a convenient voltage for lighting the lamps. In the latest form, which is that introduced by Siemens Brothers and which is shown diagrammatically in Figs. 10 and 11, there are visual indicators in the engine room, on the pit bank and at each of the levels. In each of the indicators there are four separate windows upon which are marked in large lettering the words "Shaft," "Coal," "Men" and "Stop." The indicators are controlled by special switches connected in the line at the pit bank and at each level. The lamps corresponding to each visual signal, in the engine house, on the pit bank and at each level, are connected in series, and they are all lighted simultaneously when the "on-setter" at the level from which the cage is being lifted and the "banksman" have both set their indicator switches for the same window and have also both set a second switch to "Ready." In the ordinary operation of a colliery drawing from one level the indicator switch at the pit bank and at the level below would be placed at "Coal." This would mean that only coal was being drawn, and the lamps opposite the "Coal" indicators only would be lighted up. Below the indicator, at the pit bank and at the level, is a two-point switch. The "on-setter" or the "banksman" turns the switch to "Ready" when he is ready, and if the switch indicators at the pit bank and at the level are both pointing to the same indicator—for instance, "Coal"—when both switches at the pit bank and at the level point to "Ready," the lamps opposite "Coal" light up at the level, at the pit bank and in the engine room. The engine man receives his ordinary bell signal, but he does not move the cage until he receives the visual signal from the lamp opposite, say "Coal." If men are being carried, the engine man has to be especially careful and coal is not to be raised on one cage while men are being lowered on the other. When men are to be lowered or raised the indicator switch is set at "Men," and the remainder of the procedure is practically the same. When the engine is started an automatic trip gear breaks the lamp circuit and extinguishes the light. When more than one level is being operated or two deck cages are run the two-point switch, which is put to "Ready" when the "on-setter" is ready, is turned to "Change deck," and the engine man then knows that he is either to raise or to lower the cage to enable the other deck to be unloaded or loaded, or is to run the cage to another level.

An emergency signal is provided to be used when the shaft is being examined. It is connected to the lamp window marked "Stop." This signal can be operated from any level, or by the "banksman" at any moment, and is used only in extreme cases.

## Recent Telephone Patents

### PARTY LINE SYSTEM

Mr. C. A. Bals has had a second patent granted to him which describes a party-line system. It is a common-battery lock-out system having at each station a high-resistance relay which is connected across the line when the switch hook rises. This relay must operate to connect the instrument. However, it will operate only when the line is not shunted by another station. Thus a lock-out is effected.

### ATTACHMENT FOR TELEPHONES

Among the patents granted for attachments on telephones are a receiver supporting arm, patented by Mr. S. C. Sladden, of New York City; an auxiliary mouthpiece for transmitters, patented by Mr. S. S. Williamson, of Philadelphia, and a telephone lock, patented by Mr. C. H. Bard, of Mount Vernon, N. Y. The receiver arm may be clamped to the throat of a desk stand. It consists of a horizontal fixed link and a movable link attached to the first through an adjustable ball-and-socket joint. The movable arm carries the receiver and also a cam adapted to depress the hook-switch lever when the instrument is not in use. The mouthpiece is of sheet metal, and its base is shaped to fit over the front of the transmitter. In this position an internal elastic ring grips the lip of the regular mouthpiece at the front. The metal is well turned in to form a core which leads within the regular mouthpiece, the folded or front edge being shaped to fit the face of the user. The telephone lock consists of a wide band to surround the upright of a desk stand between the hook and the cap at the top of the upright. The band just fills the space with the hook down, and when it is secured in this position by a clamp nut and padlock the use of the telephone by unauthorized persons is prevented.

## Letters to the Editors

### Invention of the Dynamo

*To the Editors of the Electrical World:*

SIRS:—I am herewith attaching a copy of an article from an old magazine, dated 1838, describing an early attempt at making an electric motor. Thinking perhaps it might interest your readers, I am sending you this copy for your own use.

I have the original magazine containing this article to settle all disputes that might arise.

*Detroit, Mich.*

J. B. DAILEY.

### DAVENPORT, THE AMERICAN BLACKSMITH—THE ELECTRO-MAGNETIC DISCOVERY

Thomas Davenport, a native of Vermont, where he has resided as a blacksmith at Brandon, Rutland County, until within a few months past, in July, 1834, after a year's experience in electro-magnetism, procured for the first time ever known a rotary motion, with that power, the machinery of which is now exhibiting in New York, and exciting the astonishment of every individual who has seen its operation.

Of the origin of this wonderful discovery, which threatens to make as entire a revolution in the mechanical world as that of Fulton in steam navigation, which it may possibly entirely supersede, the public are naturally curious to learn some particulars. We communicate them in a more authentic and detached shape than they have hitherto appeared.

In the first place it is necessary to premise that neither the works of Faraday and Sturgeon of England, who have made much advance in electrical science, nor those of Orsted of Copenhagen, nor Molle of Sweden, nor of Hare and Henry of America, nor those of Ampere of France, can

convey any notion of the extraordinary development and application of electro-magnetic power discovered by our native American Mechanick, Davenport. His name probably in a few years will stand out upon the annals of history as much more prominent than Watt, Arkwright, or Fulton, as they do now above the most ordinary inventors.

Nor, let us add, can even the interesting and well written descriptions in Silliman's Journal, and elsewhere in our newspapers, make intelligible the nature of Mr. Davenport's discovery. In fact, the technical language of science requires an entire new glossary to furnish words to express the thoughts which have sprung up in this new world, whose door has been burst open by the genius of one of our citizens.

Up to the age of thirty Mr. D. steadily followed his profession of blacksmith. In the summer of 1833, he went as was his custom from Brandon to a forge at Crown Point, on Lake Champlain, where he was in the habit of purchasing his iron. He there saw a revolving cylinder with magnetized points, for the purpose of separating the particles of iron from the pulverized ore. "How is this magnetized?" said Mr. D. to the owner. "By Professor Henry's horseshoe magnet, which you see there," was the answer. It was one of a very small description, weighed about three pounds, and had been purchased of Professor Henry himself at Albany. On an exhibition of its powers, in connection with the galvanic battery (Hare's), Mr. D. was so struck with this, to him, entirely novel agent that he immediately demanded the price of the whole apparatus, and purchased the same, and went home absorbed with the useful purposes to which he immediately conjectured it might be applied, and too much engrossed with this dominant thought to remember the load of iron he had come in pursuit of. It is proper to say that previous to this Mr. D. had become acquainted with the nature of the permanent magnet in his excursion with that and the compass among the iron regions of his native state. On his return, he explained to a friend his conviction that the magnet could be made to procure a rotary motion. This friend engaged with him in a series of experiments, which proved abortive, and Mr. D. was shortly after abandoned as a visionary. The same results precisely soon followed with two other persons. He was thus finally and fortunately thrown upon his own resources and himself was the sole discoverer of this great invention, and the architect of his own reputation.

While prosecuting his researches he read nothing but went onward boldly, under the strong impulses of his own native genius, till he struck out the light which, as we believe, will eternize his name and that of his country.

In alluding to his want of all preliminary education and book knowledge, we are convinced, with him, that had his thoughts been entangled and entrammelled with the ideas of other men, his mind never would have been emancipated into the regions of boundless discovery where it has now reached.

The discovery took place in July, 1834. He first went to Middlebury College, Vermont, and exhibited his production, where it met with general approbation. Thence he came to Troy and exhibited it to Professor Eaton; to Princeton and showed it to Professor Henry, who had himself, without Mr. Davenport's knowledge, procured a short time before a vibratory motion up and down with his horseshoe magnet. Mr. Davenport now made some marked improvements in the construction of his machine—principally in changing the poles of the magnets. He then came to exhibit it at Saratoga during the summer of 1836. There he met with Mr. Ransom Cooke, a native of New Haven County, Connecticut, who, taking a deep interest in the magnitude of the discovery, immediately became associated with Mr. Davenport in advancing it to perfection and obtaining for it the approbation of the publick.

In concurrence unanimously we believe with all who

have witnessed the operation of this extraordinary and simple apparatus and listened to the eloquent and lucid explanation of Mr. Cooke, we confess our utter amazement at the prodigious change which it manifestly foretells in the immeasurable agent of mechanical power and at the same time, while we see and admire, acknowledge ourselves, for want of language to sustain us, utterly incompetent to impart any correct conception of this marvellous invention to our readers. All we can say is, "Go and be convinced."

*Description.*—If we were to attempt to give our readers some faint notion of this machine, we would say that it consists of a wheel composed of two iron semicircular arcs, cut across so as to interrupt their formation into a complete circle. That within these are two iron bars or shafts, crossing at right angles, bearing smaller segments of circles on their extremities, nearly touching, as they revolve, the above outer circle, which is fixed. The whole of these are horizontal and covered with silk, and then wound round closely and spirally with copper wire, the wire itself covered with cotton and varnished. On the upright shaft below are two small corresponding semicircular arcs, cut as above. Now these are all connected by two flat copper wires, which lead to Hare's galvanic battery of concentric copper and zinc plates, in a solution of sulphate of copper. Those generate the electric stream, like fuel to a fire engine, and it is by the two upright wires that touch, then circle below, as their ends alternately rub in the rotary motion against the inside of the two semicircular arcs into which the fixed circle is divided, that the extremities of the semicircular pieces above are alternately made to change their positive and negative poles by the ascending current of galvanism—and thus the principle of repulsion and attraction made to act in concert on the four segments of the shafts above described—keeping up by the magnetization produced a swift rotary motion, which in this machine raises two hundred pounds one foot in a minute. So rapid is the change of poles and the electric velocity of the stream of galvanism that it makes thirty-two thousand revolutions around the wires in a minute. It is a sublime but not wild idea of Mr. Cooke, that a ship's bottom covered with suitable plates and the ocean for its bath, may drive herself along with incredible velocity, at the same time generating abundance of hydrogen to light her onward on the deep.

[An account of the exercises at Brandon, Vt., on Sept. 28 and 29, 1910, in commemoration of the invention of the electric motor by Davenport, was given in our issue dated Oct. 6, 1910.—Eds.]

## Steam Railroad Electrification

*To the Editors of the Electrical World:*

SIRS:—In your recent editorial on "Energy for Railroad Electrification" you state that "it is known too well to need comment that most American railroads have been, first and last, very heavily capitalized, and that in pursuing the reckless policy of buying up competitors at any price many large systems have put themselves on the very last limit of their possible borrowing capacity." Although the railroads may not be in a position to electrify their systems because of their past financial misdeeds, yet your statement is not true in anything like the general way in which it is made. The measure of an undertaking or investment is: What was put into it? What does it produce? With a capitalization of \$60,000 a mile, American railroads move more than twice the density of traffic handled by English railroads, which are capitalized at \$275,000 a mile. If you will permit me to say so, I think the present difficulty of the steam roads in raising capital for electrification or other improvements is due not so much to their over-capitalization as to reckless misrepresentation and oppressive regulation.

Washington, D. C.

GARRETT PARK.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Rapid Repair of a Water Power Flume

Friday, Dec. 13, 1912, was indeed an unlucky day for the Virginia Railway & Power Company, which suffered on that day a serious washout on its Appomattox water-power canal, two miles west of Petersburg, Va. The north bank and bottom of the channel were carried away for a distance of 200 ft., the damage extending in places to a depth of 35 ft. By quick work, however, the flume was again in service twenty-seven days later. Twenty of these days were required for the actual reconstruction, while seven were lost waiting for lumber. Thirty to 100 men were employed continuously, although the problem of holding labor on the job was one of the major difficulties confronting those in charge of the repairs. Rains which persisted during a number of days made the roads so muddy that the supply wagons sank to their hubs in the mire.

In repairing the washout a new structure 600 ft. long, extending 200 ft. on both sides of the ravine, was built, consuming 100,000 ft. of lumber besides 400 12 in. pine-tree girders cut from the company's woods. Other material required included 22,000 ft. of rubber roofing, which was used between the lumber making the sides and bottom of the trough; three cars of crushed stone; three cars of sand; 1380 bags of cement for lining the bed and tying in the flume to the solid earth at the ends; 3700 cu. yd. of dirt, and several barrels of bolts and nuts, spikes and nails.

The labor expended on the work averaged that of 60 men for twenty-seven days. From one to twelve teams were used in the hauling. The average length of haul on the dirt for filling in the lower 15 ft. of the great hole was 500 ft. The haul on the lumber and other materials was many times longer. Every class of labor, from common laborers and teamsters to skilled carpenters, was used in the work.

The cost of the new flume will approximate \$10,000. This outlay is but a part of the expense to which the company was put while the canal was being restored, for while the

being required there. The force at the power house under normal conditions is twelve.

The new trough of the canal, but 24 ft. in width at the bottom, was built on a bed of stone, it rises to the ground. This space will be filled in with earth and the wooden supports and bracing reinforced later on. The capacity of the flume when filled with water to the depth of 8.5 ft. will



FIG. 2—THE RECONSTRUCTED FLUME

make possible the development of 6000 hp, about twice as much as it will be called upon to furnish for some time yet.

The work of replacing the canal washout in the short time in which it was accomplished was carried out under the general direction of Mr. H. R. Palmer, superintendent of light and power for the Virginia company. As evidence of the confidence in which the company is held in the community affected by the recent interruption and the good-will felt for it, it is of interest to note that during the period when the service was not up to standard, the local superintendent, Mr. J. E. Harvill, was able to renew a five-year contract for street lighting for another equal period, including also the lighting of public buildings. In addition a "white way" was created on Sycamore Street from Oak to Old Street, requiring the installation of forty arc lamps in addition to the regular street lighting.

## Plant Chimneys for Burning Crude Oil

The necessary heights for chimneys for burning crude oil are much less than ordinarily supposed, since the latter are operating at lower and considerably greater than usually supposed when there are better methods. A chimney, of which height is pointed out in the paper by Weymouth, of San Francisco, Cal., in a paper before the American Society of Mechanical Engineers, New York, Dec. 5, will take an excessive quantity of air for combustion and permit a considerable loss of heat in the flue gases. A large waste of fuel.

When the furnace is limited in size and the supply for economical air supply at the desired rate of load, it will be impossible for the most partless life and to cause material loss of economy, either by overloading or excess air supply in the flue at boilers due to overheat. In this sense the



FIG. 1—LARGE EXCAVATION MADE BY WATER

canal was out of commission the steam-power plant at the station furnishing Petersburg with its light and power was in operation. The cost of coal alone during the first eighteen days of the operation of the steam plant was \$3,075. Coal used in the last nine days will run up the expense proportionately. The payroll at the steam plant was almost doubled during this period, twenty-two men



chimney may become an important and inexpensive means for boiler-plant regulation and in many ways a safeguard against careless firing. Such usage is, of course, of greatest effect in plants operating at uniform load. The San Francisco earthquake of April 18, 1906, considerably reduced the height of most masonry chimneys and led to an active collection of chimney data. Many of the results apparently were contradictory. Certain chimneys reduced to a height of 30 ft. gave the usual boiler capacity, and others reduced to a height of 75 ft. showed under certain conditions of service a decrease in boiler capacity.

Altitude also effects a considerable difference in the results. The error commonly made in the consideration of stack capacities at altitudes is to assume that a given grade of fuel at a fixed boiler rating will require at an altitude the same draft, measured in inches of water, at boiler damper as at sea level. It is evident that to develop a given boiler horse-power requires a constant weight of chimney gases and air for combustion. Hence as the altitude is in-

TABLE OF APPROXIMATE MAXIMUM CAPACITIES (ACTUAL BOILER HP) FOR OIL-BURNING CHIMNEYS (BOILERS 150 PER CENT RATING)

Diam- eter, In.	Area, Sq. Ft.	HEIGHT IN FEET ABOVE BOILER-ROOM FLOOR LINE							
		80	90	100	110	120	130	140	150
18	1.77	63	75	84	91	96	101	104	108
21	2.41	90	108	121	131	139	146	151	156
24	3.14	123	148	166	180	191	201	208	215
27	3.98	161	195	219	238	253	265	276	285
30	4.91	206	249	280	304	324	340	354	366
33	5.94	256	310	349	381	405	426	444	459
36	7.07	312	379	427	466	497	523	545	564
39	8.30	376	455	514	561	599	631	657	681
42	9.62	443	539	609	665	711	749	782	810
45	11.05	518	630	713	779	834	879	918	952
48	12.57	599	729	827	904	967	1,020	1,070	1,110
54	15.90	779	951	1,080	1,180	1,270	1,340	1,400	1,460
60	19.64	985	1,200	1,370	1,500	1,610	1,710	1,790	1,860
66	23.76	1,220	1,490	1,700	1,860	2,000	2,120	2,220	2,310
72	28.27	1,470	1,810	2,060	2,260	2,430	2,580	2,710	2,820
78	33.18	1,750	2,150	2,460	2,710	2,910	3,090	3,250	3,380
84	38.49	2,060	2,530	2,900	3,200	3,440	3,650	3,840	4,000
90	44.18	2,390	2,950	3,370	3,720	4,010	4,260	4,480	4,670
96	50.27	2,750	3,390	3,880	4,290	4,630	4,920	5,180	5,400
102	56.75	3,140	3,870	4,440	4,900	5,290	5,650	5,930	6,190
108	63.62	3,550	4,380	5,020	5,550	6,000	6,390	6,730	7,030
114	70.88	3,990	4,920	5,650	6,250	6,760	7,200	7,590	7,930
120	78.54	4,440	5,490	6,310	6,990	7,560	8,060	8,490	8,890
126	86.59	4,930	6,100	7,020	7,770	8,410	8,970	9,460	9,900
132	95.03	5,450	6,740	7,760	8,600	9,310	9,900	10,300	11,000
138	103.90	5,990	7,420	8,530	9,460	10,300	10,900	11,600	12,000
144	113.10	6,550	8,090	9,350	10,350	11,200	11,900	12,700	13,000
150	132.70	7,760	9,630	11,100	12,300	13,400	14,300	15,100	15,800
168	153.90	9,060	11,300	13,000	14,400	15,700	16,800	17,700	18,600
180	176.70	10,500	13,000	15,100	16,700	18,200	19,000	20,000	21,000

creased the density is decreased and, correspondingly, the velocity through the furnace, the bed of coal or the firebrick checkerwork and the boiler passes must be greater at altitude than at sea level. The mean velocity, therefore, for a given boiler horse-power and constant weight of gases will be inversely proportional to the barometric pressure. And the velocity head, measured in column of external air, will be inversely proportional to the square of the barometric pressure.

For chimneys operating at altitude it is necessary to increase not only the height but also the chimney diameter. Corresponding to the increase in height, there is an added resistance within the chimney owing to the friction of the additional height. This frictional loss can be compensated by a suitable increase in the diameter, and when so compensated it is evident that the chimney height must be increased at a ratio inversely proportional to the square of the normal barometric pressure.

Based on 150 per cent as the ratio of actual boiler hp to rated boiler hp, and assuming sea-level atmospheric pressure and 80 deg. Fahr., the author presented the accompanying table of approximate maximum capacities measured in ac-

tual boiler hp. These data apply to steel chimneys with short flues, the chimneys being centrally located over stationary B. & W. boilers. Other conditions are: Draft in inches at boiler outlet, chimney side of damper, 0.30; corresponding excess air through boiler, per cent, less than 50; assumed excess air supply for determining boiler efficiency, chimney diameter and draft resistance of chimney and breeching, per cent, 50; assumed temperature of gases leaving boiler, 525 deg. Fahr.; assumed temperature of gases entering chimney, 500 deg. Fahr.; assumed boiler efficiency, working, not test conditions, 73 per cent; assumed pounds of chimney gases per actual boiler hp, 54.6.

## Sparking and Burning of Commutator

I have charge of an old two-pole lighting machine which is rated at 100 amp, 115 volts and 1500 r.p.m. It has been giving trouble for some time. For several days it runs all right, but will then begin to spark and to blacken two or three bars. In two nights it will blacken all the way round, the whole armature getting hot. After smoothing the armature it again runs all right for a night or two. The load never exceeds 60 amp, and I have tested the machine for shorts and grounds.

W. M. G.

This trouble may be due to a defective brush-holder which is loosened by a high bar on the commutator. After the machine has been in operation the brush-holder permits the brush to spark, following which the burned place on the commutator contributes to this progressive destructive action. Proper brush mounting should avoid this trouble.

## Fusing the Neutral at the Service Cut-Out

A large Western central-station company now insists that in installations connected to its lines the neutral shall not be fused at the service cut-out, but that solid copper connection be used instead. Is this omission of the middle fuse desirable in the case of both grounded and ungrounded neutrals?

A. L. S.

In case the three-wire load is unbalanced, blowing of the neutral fuse may impose excessive voltage conditions on the lightly loaded side of the circuit. Again, a short-circuit occurring between the neutral and one of the outside wires of the circuit, inside the service cut-out, might cause the neutral fuse to blow first, leaving the outer fuse intact, but imposing the full 220-volt pressure across the 110-volt apparatus in the remaining side. On the other hand, consider a system which is operated with all wires normally clear of ground and the neutral unfused at the house cut-outs. If the neutral accidentally becomes grounded inside a house, as may easily happen without warning, and later one of the outer wires becomes grounded outside on the line somewhere, a dangerous short-circuit condition will exist in the neutral wiring inside the house, without the intervention of any fuse protection whatever. Such a contingency as that last described seems unlikely, but is nevertheless possible, and in such a case the mission of the neutral fuse might cause serious damage and expense. In determining on the use or omission of the neutral fuse, one is confronted with some such dilemma as presents itself in certain problems of grounding transformer secondaries. In the present inquiry, however, the duty of the company seems clear, as long as the neutral is to be securely grounded at its station, to insist on solid neutral connections at customers' cut-outs, thus securing the important protection to apparatus mentioned in the first part of this reply. However, the large proportion of instances in which grounded neutrals are employed makes this construction practically the standard, whereas ungrounded systems are to be regarded largely as exceptions to the general rule, particularly with present three-wire direct-current circuits. Of course, if each individual branch circuit is properly fused at its indicated amperage, a measure of protection will be afforded unbalanced 110-volt apparatus, even in the case of the opening of the neutral circuit by the blowing of the middle fuse at the customer's service cut-out.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Improving the Power-Factor.*—MILES WALKER.—A paper read before the British Institution of Electrical Engineers on the design of apparatus for improving the power-factor of alternating-current systems. The principles involved in the design of apparatus for improving power-factors are discussed. Leblanc's phase advancers are described, and the design of a phase advancer is considered in detail. Some details are also given illustrating the performance of phase advancers.—*London Electrician*, Jan. 10, 1913.

*Single-Phase Commutator Motors.*—M. LATOUR.—Some further notes on the design of single-phase commutator motors. Among the difficulties which the construction of the repulsion motor would offer at higher speeds the greater thickness of the magnetic circuit should be mentioned. The efficiency of the series motor approaches the efficiency of the direct-current motor when the frequency is reduced. With increased speed and increased number of poles the same series motor tends to operate at the same efficiency with direct current and with alternating current. If a larger amount of iron is admitted the iron losses become less with low frequency; it is, therefore, incorrect to say that the repulsion motor has inherently higher iron losses than the series motor for a frequency of fifteen cycles per second.—*Elek. Zeit.*, Dec. 26, 1912.

*Transformers.*—HENRY.—A review of present tendencies in the design of transformers with special reference to French practice. The author deals with the design of the magnetic circuit, the winding, the insulation, the general design, the methods of cooling, and finally gives the following rules for the choice of a transformer type. For emf above 30,000 volts oil transformers are recommended. For cooling of transformers in central stations with large units water cooling is always to be recommended if this method is commercially practicable. The circulation of the oil should be considered only when water cooling is found to be impracticable. In central stations of medium size with smaller transformers air cooling with natural or forced draft is recommended. With single pieces of transformers natural cooling may be relied on. If the emf is less than 30,000 volts, the recommendations are as follows: In large central stations water cooling should be used when possible; if this is not the case, use should be made of air cooling with artificial draft. In central stations of medium size with smaller transformers air cooling with natural or forced draft is recommended. With single pieces of transformers natural cooling may be relied on. If the emf is less than 30,000 volts, the recommendations are as follows: In large central stations water cooling should be used when possible; if this is not the case, use should be made of air cooling with artificial draft. In central stations of medium size dry transformers are recommended with natural or forced draft according to the circumstances. In the case of single transformers the natural air cooling is sufficient. Recent advances have been made not only in the increase of rating but also in greater robustness of the construction and in reduction of the losses.—*L'Industrie Elec.*, Vol. XXI, 1912, pages 5, 17, 31, 55, 81; translated in abstract in *Elek. Zeit.*, Dec. 26, 1912.

### Lamps and Lighting

*Ductile Tungsten and Molybdenum.*—A note on a recent British patent (No. 12,869, Jan. 2, 1913) of the Westinghouse Metallfaden Glühlampenfabrik. The metal or alloy

to be treated is first heated and then cooled slowly while under pressure. This is effected by embedding the body in a molten mass or heated mold, which cools slowly and so exerts the required pressure.—*London Elec. Eng'ing*, Jan. 9, 1913.

### Generation, Transmission and Distribution

*Energy Supply in South Africa.*—A. VAN DER HAM.—A historical review of the developments of electrical supply of the Witwatersrand in the Transvaal. Two stations, one for 2500 kw and the other for 3700 kw, were erected as early as 1895, but were not very successful on account of the Boer war. In 1906 great interest was aroused by a scheme to develop the Victoria Falls, where from 300,000 hp to 600,000 hp was available. But, for financial reasons, the scheme was not carried out, especially as sufficiently large contracts for power could not be obtained in advance to justify the very large outlay of money. It was then decided to erect steam stations since coal is rather cheap in the Transvaal. The gradual development of different companies and their final consolidation into the Victoria Falls & Power Company is sketched. The erection of new plants was turned over by the English company to a German firm, the Allgemeine Elektrizitäts Gesellschaft. In 1903 there were on the Witwatersrand 307 generators with an aggregate rating of 20,000 kw. In 1909 there were 506 generators with 76,000-kw rating. The number of motors increased at the same time from 724 to 3022. The increase in the next years should have been still greater. When the new stations of the Victoria Falls & Transvaal Power Company are finished it will be able to sell 500,000,000 kw-hr. per year to the different gold mines in the district. According to the Transvaal power act of 1910, 25 per cent of the net earnings of an electric station must be distributed among the consumers, while the station is also obliged to revise the tariff from time to time and to make changes when necessary. The Victoria Falls & Transvaal Power Company furnished up to January, 1911, electrical energy at 1.5 cents per kw-hr. During 1911 the price was 1.12 cents per kw-hr. On Oct. 1, 1912, it was to be reduced to 1.05 cents per kw-hr. The central stations expect to get a load-factor of at least 70 per cent, while the gold mines expect to save from 16 to 24 cents in the expense for energy per ton of ore.—*Elek. Zeit.*, Jan. 6, 1913.

### Installations, Systems and Appliances

*Oil Circuit-Breakers.*—MAX VOGELSANG.—An article on high-power oil circuit-breakers. Details are given of a short-circuit test in which a three-pole oil circuit-breaker for 10,000 to 20,000 volts and 200 amp was subjected to a short-circuit test with 23,000 hp, the voltage being 12,000 and the frequency 25 cycles. The circuit-breaker operated with perfect satisfaction. It is emphasized that the speed with which the contact is broken is of greatest importance and that this must be one of the leading considerations in the design. In order to get greater safety it is sometimes recommended to install circuit-breakers for a larger current than is necessary, but for this reason more heavy construction, and therefore greater inertia and less speed in breaking the circuit, this practice is a mistake. A properly designed and properly handled oil circuit-breaker is a quite reliable piece of apparatus.—*Elek. Zeit.*, Jan. 13, 1913.

*Switchboards for Alternating-Current Stations.*—C. H. SANDERSON.—There are three distinct classes of switch-



boards which are suitable for alternating-current stations: the "self-contained" panel type, the "remote mechanically controlled" type and the "electrically operated" type. The principal factors influencing a choice of one over the other two classes are the power to be handled, the essential operating features, the space required and the permissible cost. The author gives a comparative discussion of the three classes of switchboards as regards these factors. The article is profusely illustrated by diagrams.—*Elec. Journal*, January, 1913.

**Storage Batteries.**—D. BASCH.—In a continuation of his serial on storage batteries in modern electrical engineering the author discusses storage-battery installations for isolated lighting plants, with reference to ratio of generator and battery and charging and lighting requirements of different installations; private and public garages for charging the batteries of electric vehicles, with reference to the various kinds of charging source; ignition battery outfits, and automatic cut-outs for battery charging.—*Gen. Elec. Review*, January, 1913.

**Electricity on Board Ship.**—An illustrated account of the electrically driven auxiliary machinery on the steamship *Fauvette*, including the generating plant, controlling gear, a windlass, winches and cranes.—*London Electrician*, Jan. 3, 1913.

**Grounded Versus Ungrounded Neutrals of Alternating-Current Networks.**—An account of the continued discussion in Newcastle of J. S. Peck's paper abstracted in the *Digest*, Dec. 21, 1912. (See also the *Digest*, Jan. 4, 1913.) C. Vernier said that he is a firm believer in grounding everywhere, and most certainly in the case of high-tension overhead lines. He instanced a case of an overhead line, where the neutral was left ungrounded, on which one of the lines grounded on a bracket insulator and all went well until another ground occurred on another phase in a motor in a neighboring pit, with the result that some switch gear at the power station was wrecked and a serious shut-down followed. He could not see the advantage of disconnecting the neutral in certain cases in order to make telephone circuits workable, because telephone disturbances are mostly due to electrostatic causes, and with one phase grounded the whole electrostatic balance of the system is upset. He attributed the freedom from accidents in England to the practice of grounding the neutral in distributing networks. He agreed with the author that it is not worth while to ground the neutral merely for the sake of being able to cut down the insulation, at least up to 50,000 volts, but for very high line voltages, say between 80 kilovolts and 120 kilovolts, it might be worth while to do so, especially where corona effects are present to take care of pressure rises. It was suggested at the Manchester discussion that a high-tension line should not necessarily be cut off, on a fault, in order to maintain continuity of supply, but he most strongly disagreed, as it savored of balancing the cost of a duplicate supply against danger to human life. The latest development on protective gear, namely, the "split conductor" system, promised to be of the greatest importance in regard to the question of safety, as it can be made to operate on small ground faults, and, in the event of a line breaking, in the most positive manner. W. M. Thornton remarked, with respect to surges, that the real oscillations which break down the insulation of a system originate in the flame of the arc between phases by reason of its capacity, incandescent metallic vapor being an excellent example of a conducting dielectric and the capacity for a given size in such a condenser being relatively very large. The combination gave a condenser of appreciable capacity in series with the line, and such a system could resonate with great violence. P. V. Hunter said that his experience of ungrounded neutrals had been gained on the Dur-

ham collieries system, and he had noticed the tendency for faults to occur at more than one place at a time. He thought that being able to run with the neutral insulated tended to slow repair work, and as a fault on such a system took some time to locate there was always the danger of another fault occurring and thereby causing a shut-down. He had known several cases where high voltages had occurred on quite small systems with insulated neutrals.—*London Electrician*, Jan. 10, 1913.

### Traction

**Spanish Single-Phase Railway.**—An illustrated description of the Pamplona-Aoiz-Sangüesa railway in the province of Navarre in Spain. The railway is operated by sin-

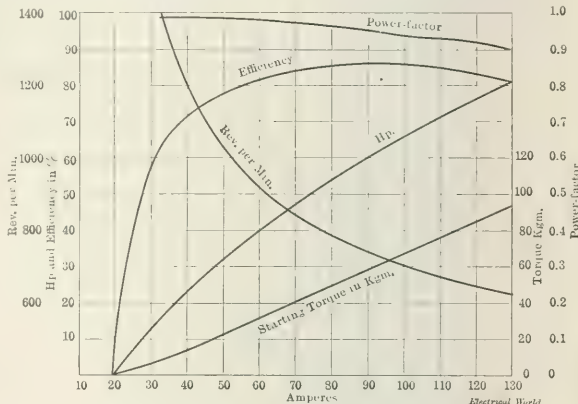


FIG. 1.—CURVES SHOWING RESULTS OF MOTOR TESTS

gle-phase energy generated in a water-power station. The emf of the trolley line is 6000 volts with the exception of part of the line inside the city of Pamplona, where the trolley line emf is 600 volts. There are two kinds of motor cars, larger ones with four motors of 60 hp each and smaller ones with two motors of 60 hp each. The cars contain, besides the motors, the transformer, which reduces the emf from 6000 volts to 600 volts. The motors are designed according to the patents of Latour. They have four poles and a rating of 60 hp at 735 r.p.m. and 600 volts. The curves for efficiency, power-factor, horse-power, revolutions per minute and starting torque are given in Fig. 1. The curves are the results of tests made with a constant emf of 600 volts. The frequency is 25. This is the first single-phase railroad in Spain, and it has been in successful operation for two years.—*Elek. Zeit.*, Jan. 9, 1913.

### Electrophysics and Magnetism

**Radiation.**—S. B. McLAREN.—A highly mathematical paper on the theory of radiation. To save the "ether" it is necessary to give up the classical mechanics. This paper shows that the theory of radiation can proceed without using the principle of minimum action. The author accepts Einstein's atomism for matter but not for radiation. The hypothesis that radiation is a continuous wave motion appears to him indispensable.—*Phil. Mag.*, January, 1913.

**Excitation of Gamma Rays by Alpha Rays.**—J. CHADWICK.—In a preliminary account of experiments which establish the fact of the excitation of gamma rays when alpha rays impinge on matter.—*Phil. Mag.*, January, 1913.

**Radiation of Alpha Particles.**—E. MARSDEN AND H. RICHARDSON.—An account of an experimental investigation of the retardation of alpha particles by metals by means of the scintillation method.—*Phil. Mag.*, January, 1913.

**Ionization.**—S. J. PLIMPTON.—An account of an experimental investigation of the recombination of ions produced by Roentgen rays and the law according to which this re-



combination takes place at varying pressures in the gas.—*Phil. Mag.*, January, 1913.

**Photo-Electric Properties of Thin Films of Platinum.**—J. ROBINSON.—It was shown by Stuhlmann that the photo-electric effect of thin films of different metals deposited on quartz depends on the thickness of the film and on whether the film is on the side of the quartz facing the source of light (incident effect) or on the side away from the source (emergent effect). He measured the ionization currents in air and found that when the films are thin enough the ratio of emergent to incident ( $E$  to  $I$ ) currents is greater than unity, and for thicker films less than unity. For thin films the ratio is constant and equal to 1.14 for platinum. In a former paper by the present author it was shown that this dissymmetry can be separated into two quite distinct effects, as regards (1) the velocities of the electrons emitted and (2) the actual numbers of electrons emitted. The films were deposited at low pressure, and then a liquid-air vacuum was established and measurements made as quickly as possible afterward. In this way it was hoped that true values for the velocities would be obtained. For both the photo-currents and the maximum velocities of the electrons similar curves to that of Stuhlmann for the ratios ( $E$  to  $I$ ) of ionizations were obtained, as the thickness of the film was altered; that is, for thin films the emergent velocities and currents were larger than the incident velocities and currents, and vice versa for thick films. It was also found that the dissymmetry for the velocities was not so marked as for the currents. The present investigation was undertaken to get more knowledge of these effects. There is a certain thickness of film for which the ratio of  $E$  to  $I$  currents equals unity, and also a thickness for which the ratio of  $E$  to  $I$  velocities equals unity. Experiments show that for the same source of light these two thicknesses of film are the same. The dissymmetry for velocities is not so strongly marked as for currents. As the thickness of film increases through  $10^{-7}$  cm, the photo-current increases suddenly. The ratio of  $E$  to  $I$  currents is constant for films thinner than  $10^{-7}$  cm and begins to diminish after the sudden increase in current has set in. Radiations from the spark produce much quicker electrons than those from the arc. The dissymmetry is more strongly marked the quicker the electrons are produced. It is shown that it is possible that photo-electrons possess sufficient energy to ionize molecules of platinum, and that it is this which leads to the best explanation of the sudden rise of photo-current at  $10^{-7}$  cm. The thickness of film which gives the sudden rise in current is the same for slow and quick-moving electrons. The orientation of the plane of polarization of the light has no influence on the dissymmetry.—*Phil. Mag.*, January, 1913.

#### Units, Measurements and Instruments

**Moving-Coil Instrument.**—An illustrated description of a new moving-coil instrument designed by J. W. Record for

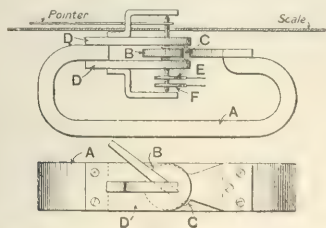
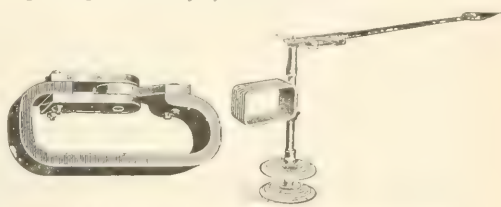


FIG. 2—DIAGRAM OF GENERAL ARRANGEMENT

direct currents in which the scale and range of the instrument is greatly enlarged beyond 90 deg. while the scale is practically evenly divided throughout its entire length. The coil moves not about its axis as usual, but about one of the vertical sides, which is taken through a hole in the core. The two horizontal sides of the coil are used for cutting the

flux. This is rendered possible by the construction indicated in Fig. 2, when the magnet is seen to be in the form of a C. One pole carries the core B. The coil C passes through the center of the core and thus embraces half of it, and it is so shaped that the coil may swing over an arc of about 300 deg., being limited only by the neck. The other limb of the



FIGS. 3 AND 4—THE MAGNET AND THE MOVING COIL

magnet is fitted with pole-pieces D, which are brought above and below the core, so that the flux through the latter divides and passes upward and downward into these pole-pieces. The coil is carried by jeweled brackets, and connection is made by two spiral springs, E and F, wound in opposite directions to eliminate errors. A view of the magnet is shown in Fig. 3. It serves as a girder or foundation for supporting the lighter portions of the instrument. To this magnet are bolted the pole-pieces. The double air-gap is bounded by flat surfaces. The two air-gaps are not in series, which would make a total gap equal in length to twice one of them, but are in parallel; thus the magnetic reluctance is reduced by the addition of another air-gap. Great permanence of the magnet is, therefore, secured, together with freedom from external interferences and a strong working field. The active conductors of the coil are at right angles to its axis of rotation, and the idle length of conductor is exceptionally short compared with the useful length. This results in a very low resistance coil, enabling the instrument to work with shunts having the usual drop of 0.075 volt. Other advantages also arise from the extreme smallness of the moving coil (see Fig. 4). The resistance of the frame itself is low, and as the instrument is damped by eddy currents produced in it, these currents are correspondingly high and the damping marked. The scale is approximately three times the usual length for an instrument of the same size. Variations in current which cannot be read with an ordinary instrument produce considerable deflection on this pattern. If, on the other hand, such high accuracy is not required, then the advantage of a long scale can be felt in other ways, namely, that one shunt of the instrument is equal to three shunts of the ordinary type, and in calibrating commercial instruments the avoidance of repeatedly changing the shunts is a gain in time. This instrument gives three times the deflection of an ordinary instrument for the same expenditure of energy, or one-third of the shunt losses for equal deflection.—*London Electrician*, Jan. 10, 1913.

**Electrolytic Condenser.**—K. SIMON.—In his recent German paper on an electrolytic condenser and its application to a sparkless type of contact-breaker. The paper is the outcome of experiments made on electric circuits with a view of devising a sparkless contact-breaker for connection to the seconds pendulum. The best results for that purpose were obtained with iron electrodes in alkaline solutions.—*London Electrician*, Jan. 10, 1913.

#### Telegraphy, Telephony and Signals

**Dielectrics in the Moving-Current Fields.**—G. L. ADDENBROOKE.—An account of an experimental investigation of the properties of dielectrics in alternating-current fields (currents). The author gives figures for the dielectric loss in gutta-percha when subjected to very low frequencies, such as those used in submarine cable work. The temperature coefficient is found to be much less for alternating

than for continuous pressure.—*London Electrician*, Jan. 10, 1913.

**Resonance in Wireless Telegraphy.**—W. H. ECCLES.—A paper illustrated by diagrams on a comparison between spark systems and continuous wave systems. The various methods used in wireless telegraphy are compared from the point of view of the degree in which they respectively utilize the principle of resonance. Formulas are developed which show how nearly the modern spark methods approach the ideal resonance that would be attained by a perfect high-frequency alternator. The conclusion is that there is not much room for improvement over the modern spark methods in respect of transmission of energy from the sending antenna to the receiving antenna.—*London Electrician*, Jan. 10, 1913.

**Impedance and Attenuation of Cables.**—CHARLES E. HAY.—An article illustrated by diagrams describing a method of measuring the characteristic impedance and the attenuation constant of cables with apparatus available in any laboratory.—*London Electrician*, Dec. 20, 1912.

**Radiogoniometer.**—An illustrated description of the latest form of radiogoniometer exhibited at the recent exhibition of the Physical Society in London. It is the wireless direction finder on the Marconi-Bellini-Tosi system. When installed on board ship it enables the direction from which signals are received to be determined within a few degrees, a matter of great importance in time of fog or when seeking a vessel in distress. It can also be used for directive signaling over a moderate range. The special aerial em-

tion of the signals and receive signals of corresponding intensity, the resultant effect of which is communicated to the exploring coil. When the latter is in the position which gives the maximum strength of signals the pointer attached to the spindle indicates the direction of the sending station, if the instrument has been properly fixed with regard to the aerials. A simple testing instrument is used to verify the orientation, resistance and insulation of the aerials.—*London Elec. Review*, Jan. 10, 1913.

#### Miscellaneous

**Yearly Report.**—The last yearly financial report of the Siemens-Halske company discusses in a general way the present commercial situation in Germany. The scientific and technical character of the extended pioneer work of the company is emphasized. Financing of other companies has been undertaken only in cases where technical pioneer work was to be undertaken. The competition between the various firms in the German electrical industries had led to a difficult situation. With respect to engineering regulations and standardization the German Association of Electrical Engineers has done very effective work, but with respect to the commercial situation there is no such ruling influence, "although much could be done to relieve essential troubles. But one should not think of monopolies."—*Elek. Zeit.*, Jan. 2, 1913.

**British Patents.**—A list of British patents of interest to electrical engineers which are to expire during 1913.—*London Electrician*, Jan. 3, 1913.

**Organization.**—A. TREVOR DAWSON.—His presidential address to the Junior Institution of Engineers in London on staff officers in industrial works, their scientific training and duties.—*London Electrician*, Jan. 3, 1913.

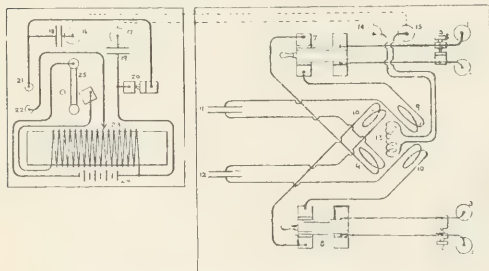


FIG. 5 CONNECTIONS OF THE RADIOGONIOMETER

ployed consists of two equal loops suspended in vertical planes and crossing one another at right angles. Each of these is connected in series with a coil and condenser. The coils are of equal size and cross at right angles; the condensers are also equal and can be simultaneously adjusted for tuning the aerials. A third coil inside the crossed coils, called the exploring coil, is mounted on a vertical spindle. It is connected with a detector consisting of a pair of telephones and a crystal rectifier. The connections are shown in Fig. 5, in which 1, 2 are the terminals of the first aerial loop, 3, 4 the terminals of the second aerial loop, 5 the protecting gap for the first aerial, 6 the protecting gap for the second aerial, 7 the switch for the first aerial circuit, 8 the switch for the second aerial circuit, 9 the fixed coil of the first aerial circuit, 10 the fixed coil of the second aerial circuit, 11 the condenser for the first aerial circuit, 12 the condenser for the second aerial circuit, 13 the exploring coil, 14, 15 the terminals for connection to detector, 16, 17 the terminals for the connection to the direction finder, 18, 19 the blocking condensers, 20 the crystal holder, 21, 22 the terminals for connecting to telephones, 23 the potentiometer, 24 a battery of dry cells, 25 a battery switch. The principle of the instrument is as follows: Each aerial loop is a directional aerial, which receives best when its plane is in the direction of the sending station and receives nothing when its plane is at right angles to that direction. Usually both aerials are more or less inclined to the direc-

## Book Reviews

**MAGNETO AND ELECTRIC IGNITION.** By W. Hibbert. New York: Macmillan Company. 154 pages, 90 illus. Price, 70 cents.

A very practical little handbook on ignition of gaseous mixtures in engine cylinders by magnetos, batteries and induction coils, especially in relation to British automobile engines. The eight chapters of the book cover respectively: an introduction, the high-tension magneto, faults and their remedy, gearing, other magnetos, ignition by battery and coil, faults in cells, combinations. The book will be useful to all who operate automobiles or are interested in them. The descriptions are clear and the diagrams simple.

**ELECTRICITY, ITS HISTORY AND DEVELOPMENT.** By William A. Durgin. 176 pages. Chicago: A. C. McClurg & Company. Price, \$1.

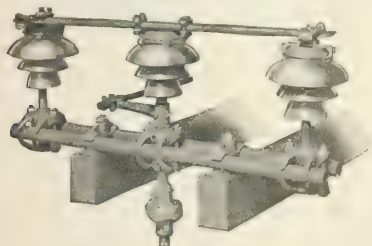
An attractively written little volume, easily carried in an overcoat pocket, and addressed to the man in the street rather than the electrically trained man. It briefly describes in simple and untechnical language the development of electric appliances from the days of ancient Greece until the present time, especially the last twenty years and in the United States. There are fifteen chapters, and their titles are as follows: The occasional discoveries of twenty-three centuries; the American Prometheus; the convulsed frog-leg and what came of it; the electric conflict; an anchor ring and what it held; the units; the sympathetic needle; from telegraph to telephone; the electric arc; the heat of Niagara; the bamboo light; the electric revolution; a blacksmith and his dream; the mystery of the iron box; the spirit of electricity. The book offers easy reading to all interested in the evolution of electrical applications, and incidentally conveys much elementary electrical information.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Open-Air Disconnecting Switch

A type of switch which may be mounted on a pole top and used for opening branch lines, for disconnecting transformer banks or for sectionalizing transmission lines, or which may be installed on the roof of a substation for diverting energy past the station, or for disconnecting a portable substation from the line, has recently been put upon the market by the Electrical Engineers' Equipment Company, of Chicago, Ill. The switches are built with clamped pipe arms affording a construction which is rigid yet adaptable to standard pole framing. Three designs are now being built for use on lines of different voltages. The single-pole type shown in the illustration presented here-

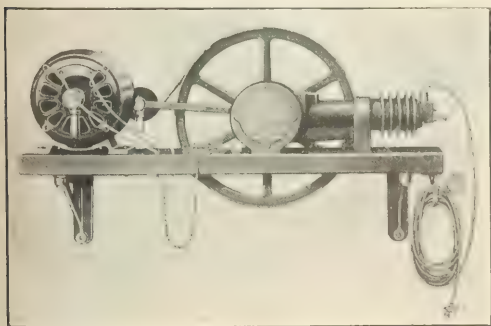


DISCONNECTING SWITCH FOR 30,000 VOLTS

with is designed for operation on a 30,000-volt, 150-amp circuit. The switches are also made for operation on 22,000 volts and 15,000 volts at 100 amp, with either one, two, three or four poles arranged for single or double break.

### Motor-Driven Tire Pump

The Vaile-Kimeo Company, Dayton, Ohio, has recently placed on the market a new type of motor-operated tire



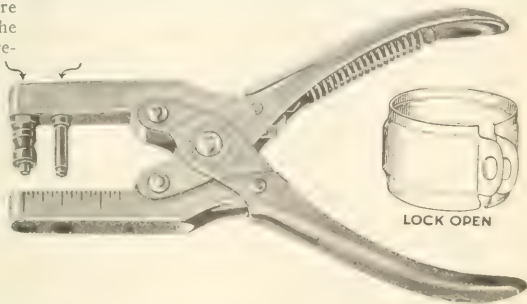
ELECTRICALLY DRIVEN FIRE PUMP

pump for use in private garages. The outfit is light and compact and is designed for mounting on the wall, entirely out of the way. The cost of operation is insignificant, since, at ordinary rates for electricity, it is said it will operate for less than 1 cent an hour.

The operating parts of the pump are inclosed in an oil-tight, dust-proof casing, so that practically no attention is required. A pressure gage registering up to 150 lb. is provided as part of the outfit. The pump is operated by a small Westinghouse motor.

### Lamp-Locking Device

A simple device that can readily be attached to any standard brass-shell socket or receptacle, which securely locks



SPECIAL TOOL AND LOCK

the lamp and which cannot be removed without a special tool, has been placed on the market by Mr. Frederick Rall, 19 Park Place, New York City. To attach the so-called E-L Mazda lamp locks, the open lock shown above is slipped over the base of the lamp and the latter is screwed into the socket, the eyelet being inserted in the holes in the flange and clinched by means of the tool shown. To remove the lamp the plunger part of the tool is inserted in the eyelet and the latter forced out.

The locks are made in one piece, are insulated with heavy fiber washers and are said to be practically indestructible. They are made for all sizes of lamps and for use with or without shade holders.

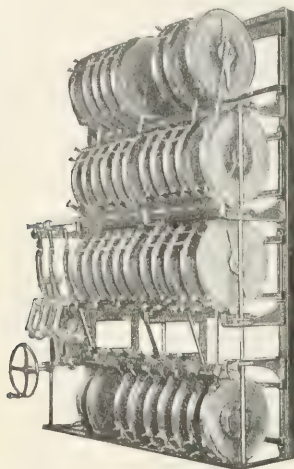
### Dimmer in Grand Opera Theater, Chicago

The total rating of lamps controlled by the dimmer in the Grand Opera Theater of Chicago amounts to 105,400 watts, the equivalent of 2033 50-watt or 406 100-watt lamps. Duplex plates having nearly double the number of steps of the regular simplicity plates are used on the dimmer shown in the illustration. This type of plate made it possible to meet the peculiar requirements of the installation and provide the large number of steps needed to secure very fine gradations of light and smooth uniform dimming effects. It was desired to operate this dimmer bank in connection with a two-wire 110-volt system for a period of several months, but it also was decided that the same bank should be capable of being used in connection with a three-wire system to be installed later. The new style of plate can be made with entirely independent windings on each side so that it was possible to lay out the dimmer bank for either a two-wire or a three-wire circuit without increasing the number of plates. The con-



tact levers, riding over the two separate sets of contact buttons, can be arranged to operate independently, each under the control of a separate operating lever or in unison under the control of one operating lever.

Three rows of operating levers are provided, one for the white, one for the red and one for the blue light dimmer, and each row of levers is under the control of a master



VIEW OF THE DIMMER

lever. These levers are located side by side at the left of the bank, making operation very convenient. By means of the special link motion connecting a hand wheel with the master lever, extreme refinements in control are obtainable. Any one row or group of dimmers in that row can be operated in one direction to dim or brighten the lamps, while one or both of the other rows are operated in the opposite direction. This control is secured by means of the hand wheel alone, making very realistic stage-lighting effects possible. The equipment was installed by the Cutler-Hammer Manufacturing Company of Milwaukee.

### Twelve-Pole, 1000-Kw, 60-Cycle Rotary Converters

Typical of the successful and reliable operation of 60-cycle rotary converters embodying modern departures in design for non-commutating-pole machines of this frequency are two 1000-kw units installed in Substation No. 1 of the Housatonic Power Company at Waterbury, Conn., for the supply of energy for railway service. Former standard practice for rotary converters of this rating and frequency involved the construction of machines having twenty poles and operating at a speed of 360 r.p.m., but through refinement of design later machines have been developed with twelve poles and operate at a speed of 600 r.p.m.

These 1000-kw rotary converters are six-phase machines and operate in parallel with four 500-kw, 60-cycle, six-phase converters previously installed in the same station, all of the apparatus being of the General Electric Company manufacture. Three-phase current at a potential of 33,000 volts is received from the main power station of the Housatonic Power Company and transformed by six 350-kva oil-cooled transformers to 430 volts. The rotaries are started from the alternating-current side only and deliver direct current at 600 volts. The transformers have two 2.5-per cent full-load taps below and above 33,000 volts, in the primary and one-third and two-thirds voltage starting taps in the secondary. They are designed with 15 per cent

inherent reactance. The rotaries are compound-wound and are built for standard carrying capacities of 150 per cent load for two hours or 200 per cent load momentarily.

The armature winding is made up of formed bars, which are insulated before being assembled in the slots. No binding bands are placed over the core, the winding being retained by wooden wedges. Any unbalancing in the mag-

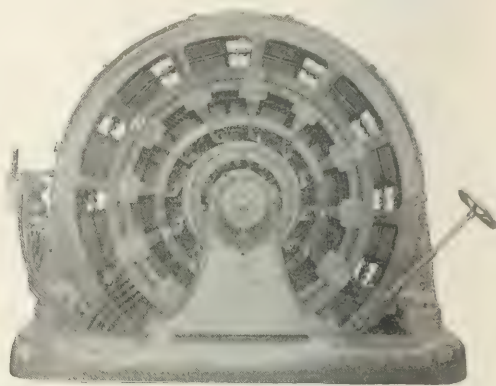


FIG. 1—1000-KW TWELVE-POLE ROTARY CONVERTER IN SUBSTATION OF HOUSATONIC POWER COMPANY

netic circuits is corrected by equalizer rings, mounted on the armature flange at the collector ring end. They cause the direct-current brushes to take their proper proportion of current, thus helping to keep the commutator in good condition and to prevent "spotting."

The brushes and brush-holders on the direct-current end of these machines are similar to those on other types of large direct-current apparatus. They are arranged so that they can be adjusted individually or collectively while the machine is in operation. Those employed on the collector rings are of improved design. So-called "Metite" brushes are used, made by combining fine copper and graphite with suitable binders.

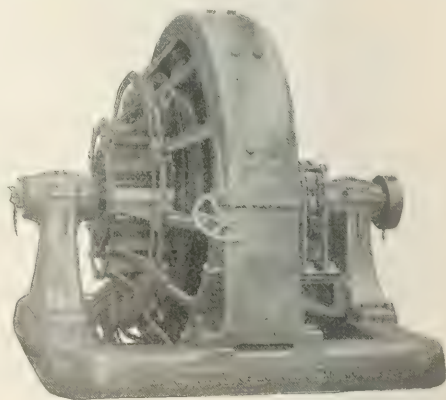


FIG. 2—DIRECT-CURRENT END OF CONVERTER

The machines are equipped with automatic magnetic end-play devices, which give a slight reciprocating motion to the armature in a direction parallel to the shaft and thereby cause the brushes to wear the commutator and collector rings more uniformly. Energy for the operation of the device is obtained from the direct-current side of the rotary converter. A condenser is connected across the

make-and-break to facilitate the opening and closing of the circuit.

For safe operation these converters are also equipped with speed-limiting devices for opening the circuit automatically in case the speed becomes too high. The device consists of a switch operated by a centrifugal governor. The centrifugal weight is mounted on the shaft and re-

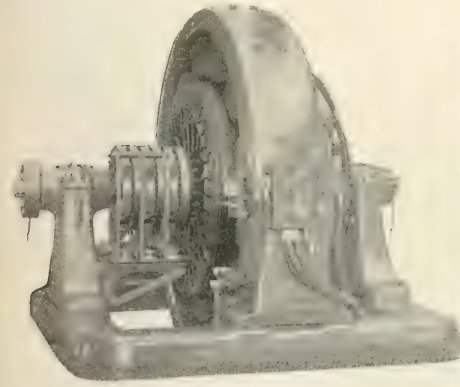


FIG. 3—ALTERNATING-CURRENT END OF ROTARY

volves with it, while the switch is stationary and is mounted on the collector-end pillow block. This weight is so designed that it operates at practically the same speed irrespective of the acceleration. The switch can be adjusted to operate at any predetermined speed, and is arranged to de-energize the low-voltage release coil on the direct-current circuit-breaker and open the circuit.

On the side of the frame is mounted a four-pole, double-throw, field-circuit break-up switch for the shunt-field coils. This opens up the field circuit in several places to reduce the strain on the insulation caused by the high potential induced in the coils during alternating-current starting and also provides a means of obtaining the proper polarity. The normal operating position of the switch is up, while the down position is used for reversing the polarity of the machine when it builds up magnetism in the wrong direction during alternating-current starting. A single-pole, single-throw equalizer switch and a double-pole, single-throw negative switch are also mounted on the magnet frame. Alternating current is applied directly to the armature winding at a reduced voltage obtained from the one-third and two-thirds voltage taps on the low-tension side of the transformers. After the machines have reached synchronous speed, the proper polarity has been obtained and the field-coils have been connected to the first starting tap, two-thirds and then normal voltage is applied.

### Calculating Chart

An interesting time-saving device for arithmetic calculations is the circular chart devised and published by Mr. George M. Purver, 146 East Eighth Street, Brooklyn, N. Y. With a little practice, it is asserted, one can quickly find the product of multiplying a four-digit number by one of two digits, or extract the integer square root of an eight-digit number. Use of the chart avoids long multiplication and long division, and reduces considerably the work of squaring, cubing, finding squares and cube roots, determining areas and circumferences of circles, etc. Results are given correctly to all places, and with a facility equal to that of the slide rule, although the latter affords only approximate results. The chart is based on a polar-coordinate arrangement of factors.

### Drive-and-Twist Anchors in Service

The use of drive-and-twist anchors made by the Voté Berger Company, of La Crosse, Wis., is illustrated herewith. These anchors are especially adapted for use in confined places and on lawns. In Fig. 1 it will be noticed that the anchor has been installed in the small space left between a building and the brick pavement in an alley. This space is not over 6 in. wide, and the anchor was



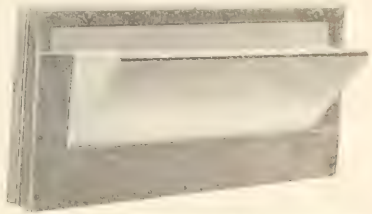
FIGS. 1 AND 2—DRIVE-AND-TWIST ANCHOR INSTALLATIONS

driven in less than a minute without trouble. In such a position it would be difficult, perhaps, to install an anchor of any other type. To put in a "dead-man" would mean the tearing up of a part of the pavement at considerable expense.

In Fig. 2 the drive-and-twist anchor is represented as installed in front of a public institution where the ground connections receive considerable care. To install a "dead-man" in this case would have involved some digging and an unsightly disturbance of the lawn. Disputes are often occasioned by the desire of electric-service and telephone companies to install anchors or "dead-men" on private property. The manufacturer of the drive-and-twist anchor contends that in cases where disputes are apt to occur the use of its device is often to be recommended because it does no damage, or only very slight damage, to the property.

### Advertising Sign

An effective advertising sign with a varying color scheme has been placed on the market by the Foster Engineering Company, Ltd., Wimbledon, London. On the front plate are painted the words or other matter to be brought before the public, and behind this is a crinkled mirror set at an



BACK VIEW SHOWING CRINKLED MIRROR AND FRONT VIEW

angle. Above the mirror is a light box. As the front plate is a glass mirror coated with strips of transparent colors, the light coming from the light box is reflected in the mirror onto the front plate. As a person passes by and the viewpoint changes the colors change accordingly, owing to the uneven surface of the mirror reflecting the light.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Annual Report of Siemens & Halske.**—The report of Siemens & Halske, Berlin, for the year 1912 is a record of continued expansion in the application of electrical equipment for industrial and agricultural pursuits. Considerable growth was shown in the company's Russian business as well as in its German business. The year ended with 77,000 employees on the payrolls as compared with 66,000 at the end of the preceding year. The rapid growth of business at the Werner works necessitated increasing the manufacturing facilities. Automatic and semi-automatic telephones, the report says, are continually finding greater favor. During the year a loaded telephone cable was laid between Berlin and Magdeburg and this will probably be lengthened in the future. The company's lamp factory was very busy. There was also a growth in railway signaling equipment. The report of the Siemens-Schuckert works for 1912 states that orders were received much faster than the company's new factories could be placed in operation, making it very difficult to keep promises of delivery, and that further handicap was caused by inability to obtain raw materials. The company manufactured 134,539 motors during the year, with an aggregate rated output of 3,737,674 hp. Further increase was made in the ratings of transformers and other equipment. Speeds for prime movers were also increased. Steam turbo-generators rated at 6000 kva for operation at 3000 r.p.m. were among the products, as were waterwheel-type generators rated at 12,500 kva. Activity resulted from the increase in long-distance power transmission projects and electrification of railways. The company is increasing its office space at Berlin. As was noted in these columns in the issue for Jan. 11, 1913, the Siemens Company of Canada, representing the associated Siemens companies of Europe, has its head office in Montreal with branch offices in Toronto and Winnipeg. Since commencing operations in Canada three years ago, the company has carried out a large amount of important work for many of the principal cities and for a large number of private corporations in the Dominion, and its apparatus is distributed from Dawson City in the Yukon district to the large steel and coal companies in the eastern part of Canada. Among the work done by the company may be mentioned the installation of the complete equipment for the 6000-hp, 20,000-volt station at Port Arthur, Ont., where there are two banks, each consisting of three 750-kw, 22,000-volt transformers, an eighteen-panel switchboard, lightning arresters and two 750-hp motor-generator sets, the second bank of transformers, part of the switch gear and one of the motor-generator sets being repeat orders after the first part of the plant had been in successful operation for eighteen months. Fifteen turbo-generators have either been supplied or are on order, the largest being a 5000-kva machine for Edmonton, Alta. The city of Regina gave a repeat order for a 1500-kw turbo-unit after the first set had been in operation for nearly twelve months, together with a repeat order for a 400-kw street railway unit. Much important work as regards the furnishing of electric hoisting engines, a class of equipment which has been especially developed by the company for many years, has also been accomplished. These installations include electrically operated hoisting engines with maximum ratings as follows: One of 1430 hp and one of 750 hp for the Canadian Collieries Company; one of 1320 hp for the Dominion Coal Company, all on the Ward-Leonard system; two of 450 hp for the Arcadia Coal Company, for operation on the three-phase system, and one of 400 hp for the Dominion Coal Company, for operation on the Siemens-Ilgner system. Two of the foregoing are said to be the largest electrically operated hoisting engines on this side of the Atlantic. Another field which the company has successfully developed is that of lightning protection. The

Ontario Hydro-Electric Commission originally installed arresters of the electrolytic type, but later placed orders for twenty sets of 13,000-volt Siemens arresters. The company has also supplied 12,000-volt, three-core cable to the Ontario Power Company and to the Ontario Hydro-Electric Commission, where the same has been in continuous operation for nearly three years.

**Annual Sales Conference of Pass & Seymour, Inc.**—With B. E. Salisbury, vice-president and general manager, presiding, the annual sales conference of Pass & Seymour, Inc., manufacturers of electrical specialties and supplies, was held Jan. 15 to 18 inclusive, at Solvay, N. Y., where the main office and works are located. Many interesting papers were read and discussed, and on the evening of Jan. 16 those in attendance at the conference were guests of Mr. Salisbury at dinner at his home, followed by a theater party. The sentiment of all of the company representatives at the conference was extremely optimistic as regards the business outlook for 1913. Substantial increase was made in the company's business in 1912, and further improvement is expected in the current year. Among those who attended the conference were: L. John Bergman, credit manager; John W. Brooks, secretary and director of exports; F. S. Baldwin, district sales manager at New York; V. R. Despard, district sales manager at Chicago; W. Brewster Hail, district sales manager at San Francisco; Frank T. Haffner, Frank Driscoll and John D. Raymond, Chicago office; George L. Hatheway, C. C. Hebl and W. E. Gould, New York office, and James S. Crossley, general superintendent.

**The Broader View of Advertising.**—C. L. Benjamin, advertising manager for the Cutler-Hammer Manufacturing Company, is vice-president of the Advertisers' Club of Milwaukee, and on the occasion of a recent dinner in that city given in honor of George W. Coleman, president of the Associated Advertising Clubs of America, Mr. Benjamin was toastmaster. At that time he gave some of his views on the broader aspects of advertising. He showed how the attitude of the business man toward advertising has changed during the last twenty years, and among other things he said: "We don't look on advertising now as a sop to the newspaper or trade-paper publisher. We don't look on it as a gamble. We know now that it is an investment—that the money spent in popularizing a trade name is as tangible an investment as the money spent for real estate, factory buildings or machinery." Further on Mr. Benjamin added: "The advertising man is progressing because he is taking a higher view of his own work. I believe, as the years go on, he will take a still higher view. The work we are engaged in is a worthy work. It is the work of molding the opinions of our fellow-men."

**Bankruptcy Petition Against Iowa Power Company.**—A bankruptcy petition against the Iowa Power Company, operating water-power plants along the Skunk River in southern Iowa, was filed on Jan. 20 in the United States District Court in Chicago on behalf of the Western Electric Company and another creditor. It is said that in addition to insolvency the bill alleged that preferential payments were made to certain creditors. The petitioning creditors' claims amount to about \$7,000, and the total liabilities are given as \$10,000.

**Planning to Merge La Crosse (Wis.) Utility Companies.**—It is understood that the protective committee acting for the bondholders of the La Crosse (Wis.) Water Power Company has exercised the option which it has had on the property of the La Crosse City Railway Company, and that plans that have been under consideration for some time to merge these two utility companies and the Winona (Minn.) Railway & Light Company will now be consummated.



**Operations of New York Lighting Companies in 1912.**—For the year ended Dec. 31, 1912, the Consolidated Gas Company of New York, which controls, in addition, to its gas subsidiaries, the New York Edison Company, the United Electric Light & Power Company and the Westchester Lighting Company, earned a surplus of \$1,536,699, which is a decrease of \$26,188 as compared with that for 1911. This was after payment of \$5,988,990 in a 6 per cent dividend on the \$99,816,500 capital stock and of \$479,430 in fixed charges. Total net earnings available for dividends, as shown in the 1912 report, which was submitted by President George B. Cortelyou at the annual meeting on Jan. 27, 1913, including the net returns of the company's gas business, the surplus earnings of the Astoria Light, Heat & Power Company, dividends and interest received on stock and bonds owned, together with advances made to affiliated gas and electric companies operating in the boroughs of Manhattan, Queens and the Bronx and Westchester County, and after deduction of \$479,435 interest on funded and other debt, were \$7,525,689, which is equivalent to 7.53 per cent on the company's capital stock and compares with 7.56 per cent in 1911. Of the New York Edison Company, the report says that during the year 1912 there were added to the generating stations of that company fifty-six automatic stokers, twenty superheaters, centrifugal boiler-feed pumps and new feed-water heaters, and that the installation of three 20,000-kw turbines was completed. Rotary converter equipment to the extent of 20,000 kw, together with 8650 kw in storage batteries, was added to substations on the direct-current system. On the alternating-current system 4000 kw was added to the substation transformers and 12,000 kw in 16,000-volt, 60-cycle transformers. Reference is also made to the twenty-one-year agreement made with the Third Avenue Railway Company, New York, through which the New York Edison Company has undertaken the operation of the former's 30,000-kw station at Kingsbridge and is supplying all of the electrical energy required by the railway company. A reference to this contract appeared in the *Electrical World* for Aug. 3, 1912, page 231. The report also speaks of the progress that is being made in the construction of the West 201st Street plant of the United Electric Light & Power Company, of which mention was made in these columns Feb. 3, 1912. The equipment thus far contracted for includes three 19,000-kva turbo-generator units. An estimate covering the completion of the building and equipment for its ultimate output indicates a total cost of about \$6,200,000 for the station. It is expected that the setting of the boilers will be started early in February and that the station will be ready to be placed in operation with at least two of the units early in the fall of this year.

**Says Close Affiliation of Chicago Elevateds Favors Economical Operation.**—On May 20, 1912, the City Council of Chicago passed an ordinance directing the elevated railway companies to give universal transfers from one elevated railway line to another. The companies denied the right of the city to exact this requirement and the matter was taken into court. Judge Baldwin has now decided that the position of the elevated-railway people is well founded and has entered a permanent injunction against the enforcement of the ordinance. The court held that the city has no statutory right to fix rates for steam and elevated railroads. It is probable that the city will take an appeal to the Supreme Court. The judge found that the companies were incorporated under the general railway act and that the Legislature had not delegated to the City Council the power to regulate rates. He did, however, find for the city on the contention that the properties are practically owned and operated by one syndicate. On this point, relating to the interesting situation created by the "association" which controls the elevated railways, Judge Baldwin said: "Four persons—Insull, Blair, Budd and Cobe—are directors in all three companies [South Side, Metropolitan West Side and Northwestern], and the relations which these men, with others, bear to the enterprise, as disclosed by the testimony in this case, leaves little doubt that they dominate the situation, and that the properties are practically owned, operated, managed and controlled by the same persons, syndicate, managing trustee or trustees, committee or association, within the meaning of the ordinance. It is easy to see that such an arrangement tends

to economical management and reduces appreciably the expense of operating the properties nominally owned by these three companies."

**Cedar Rapids Manufacturing & Power Output Contracted For.**—Stockholders of the Montreal Light, Heat & Power Company and the Shawinigan Water & Power Company of record Feb. 20 are to have the right to subscribe until 3 p. m. March 20 for \$8,400,000 first-mortgage 5 per cent forty-year bonds of the Cedar Rapids Manufacturing & Power Company, of Montreal. These bonds are part of the new issue of \$15,000,000 recently authorized by the stockholders of the Cedar Rapids company, to which reference was made in these columns Jan. 11. They are offered to the Montreal and Shawinigan stockholders at 90, with a bonus of 25 per cent common stock, in the proportion of 30 per cent of their holdings in their respective companies. According to the circular describing the offering, contracts have been made by the Cedar Rapids company with the Aluminum Company of America and the Montreal Light, Heat & Power Company for the delivery of 80,000 hp of a total of 120,000 hp already under contract, to be generated at the hydroelectric station of the Cedar Rapids company now under construction on the St. Lawrence River, about 30 miles from Montreal. These contracts will not only provide the interest on the full issue of bonds now offered, but will also furnish a substantial surplus applicable for dividends on the common stock. These results, it is stated, will be substantially increased later by sale of additional energy from the initial development and by the sale of 50,000 hp of electrical energy to be generated at the second development.

**Revive Philadelphia Electric-United Gas Improvement Merger Rumor.**—It is stated that after the meeting of the directors of the Philadelphia Electric Company on Jan. 28 members of the board said that while a proposal to merge with the United Gas Improvement Company had not come before the board, it would be received eventually and would have careful consideration. It is further stated that this proposal is expected within a month and that it will probably come before the Philadelphia Electric board at the February meeting if a special meeting is not called before that time. At the directors' meeting the installation of a 30,000-kw generating set at the company's main station was authorized, together with the erection of a 7500-kw unit at the Tacony plant.

**Ends Time for Depositing Allis-Chalmers Securities.**—The reorganization committee for the Allis-Chalmers Company announced this week that it would receive additional first-mortgage bonds for deposit until noon Feb. 3, 1913. Deposits of preferred and common stock with accrued assessments will also be received until that time. Upon purchase by the reorganization committee of the mortgaged property at the foreclosure sale that is to be held Feb. 3, a voting trust of the new preferred and common stock will be created for a term of five years. The following have been appointed voting trustees: James Wallace, Charles G. Davies, Alexander H. Thompson, Emlen Roosevelt and Henry F. Whitcomb.

**Nine Companies Organized in Pennsylvania.**—With H. M. Smith, of Brooklyn, N. Y., named as treasurer in each case, and F. V. Shannon, New York; R. A. Lankworthy, Harrisburg, Pa., and H. M. Smith, of Brooklyn, N. Y., as directors, electric service companies have been incorporated at Harrisburg. The names of the new companies are: Delaware Valley Power Company, Iroquois Power Company, Mohawk Valley Power Company, Onondaga Power Company, Powhatan Power Company, Susquehanna Power Company, Seminole Power Company, Seneca Power Company and Susquehanna Power Company.

**Gas Engines for Hotel Service.**—The Brunswick Hotel, Pittsburgh, has ordered three 150-hp gas engines for the Fort Pitt Hotel, Pittsburgh. The engines are to be mounted on a common base and will be operated in parallel with steam engines. The engines are equipped with automatic governors and gas economy interlocks with the gas supply valves, and are being consumed per kilowatt-hour by each engine.

**New Canadian Company Incorporated.**—According to advices from Ottawa, the Dominion Traction & Lighting Company has been incorporated with a capital stock of \$1,000,000 to develop and sell electrical energy and gas.

**Kentucky Company Plans Extensions.**—Early in the spring the Kentucky Southwestern Railway & Light Company will begin construction of its initial line from Paducah, Ky., southwest to Murray, about 40 miles distant. The plans of the company include construction of a number of electric-service systems for both railway and lighting purposes in the southwestern part of the State, aggregating about 210 miles. H. C. Rhodes, of Paducah, is president of the company, and F. M. Smith, of the same city, is general manager. Bonds to the amount of about \$1,500,000 are to be issued shortly by the company, it is said.

**Boston Edison Stock Quotations.**—In our issue of Jan. 11, in the Table of "Electric Securities," we stated through a typographical error that the capital stock of the Edison Electric Illuminating Company of Boston was quoted at 239 and that the quarterly dividend rate was 2½ per cent. It should have been stated that the quarterly dividend rate was 3 per cent and that the market price on the day that the table was made up was 284.

**United Service Company Enlarges Its Holdings.**—The New Midland Power & Traction Company, of Cambridge, Ohio, has been purchased by the United Service Company, of Scranton, Pa. Plans are being made to erect a transmission line to connect Cambridge, Coshocton and New Philadelphia, in which places the United Service Company controls the public utilities.

**Diehl Manufacturing Company Acquires More Manufacturing Space.**—Title to 12½ acres of property fronting on Newark Avenue, Elizabeth, N. J., has been taken by the Diehl Manufacturing Company, of Elizabethport. In the spring the company will proceed with construction of a second factory upon this site.

**New England Power Increases Its Capital.**—Stockholders of the New England Power Company, Shelburne Falls, Mass., have voted to increase the capitalization of the company from \$1,500,000 to \$3,250,000 through issuance of 6 per cent cumulative preferred stock.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Jan. 22	Jan. 29
Allis-Chalmers, t. r., 3d pd.	\$15,501,800	.....	.....	3½	4½*
Allis-Chal., pt. t. r., 3d pd.	13,475,200	.....	.....	10*	9½
Amalgamated Copper.....	153,887,900	1½	Q	75½	72½
American Tel. & Tel.....	334,852,900	2	Q	134½	13½
Electric Storage Battery, c.	16,074,425	1	Q	53	53½
General Electric.....	101,203,000	2	Q	142½	142½
Mackay Cos., c.....	41,380,400	1½	Q	85*	84*
Mackay Cos., pt.....	50,000,000	1	Q	67½	67½
Western Union Tel.....	99,745,400	¾	Q	71½	72*
Westinghouse, E. & M., c.	33,737,350	1	Q	74½	74½
Westinghouse, E. & M., pt.	3,998,700	1½	Q	121½	119½*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Copper:	Jan. 21		Jan. 28	
	Bid	Asked	Bid	Asked
Standard spot.....	15.25	15.50	15.50	15.50
London, standard, spot.....	68 ½	69 ½	68 ½	69 ½
Prime Lake.....	16.25	16.37½	16.25	16.37½
Electrolytic.....	16.00	16.25 to 16.35	16.00	16.25 to 16.35
Casting.....	15.87½	16.05 to 16.15	15.87½	16.05 to 16.15
Copper wire, base.....	18.00 to 18.25	18.00 to 18.25	18.00 to 18.25	18.00 to 18.25
Lead.....	4.35	4.35	4.35	4.35
Nickel.....	45.00	40.00 to 45.00	45.00	40.00 to 45.00
Sheet zinc, f.o.b. smelter.....	9.00	9.00	9.00	9.00
Spelter, spot.....	7.25	7.00	7.25	7.00
Tin, spot.....	50.00	50.75	50.75	50.75
Aluminum.....	.....	.....	.....	.....
Prompt delivery.....	25.75 to 26.25	26.00 to 26.50	26.00 to 26.50	26.00 to 26.50
Future.....	25.50 to 26.00	26.00 to 26.50	26.00 to 26.50	26.00 to 26.50

## OLD METALS

Heavy copper and wire.....	14.25	14.25
Brass, heavy.....	8.75	8.75
Brass, light.....	7.75	7.75
Lead, heavy.....	4.15	4.15
Zinc, old.....	6.12½	6.12½

## COPPER EXPORTS IN JANUARY

Total tons to..... Jan. 22, 16,483 Jan. 29, 21,050

## Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding	DIVIDEND		LAST QUOTATION	
		Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	\$9,500,000	.....	.....	19	21
Adirondack Elec. Power, pt.	2,500,000	.....	.....	59	61
Amer. Gas & Electric (\$50), c.	2,500,000	1½	Q	82	85
Amer. Gas & Electric (\$50), pt.	1,537,500	1½	Q	44½	46½
Amer. Light & Traction, c.....	10,395,400	2½	Q	405	415
Amer. Light & Traction, pt.....	14,236,200	2½	Q	108	111
Amer. Power & Light, c.....	5,631,400	.....	.....	63	67
Amer. Pwr. & Lt., 6% cum. pt.	5,631,400	1½	Q	83½	85
Amer. Pwr. & Lt., opt. warr.	1,604,000	.....	.....	13	15
Amer. Pwr. & Lt., 6% notes.	21	.....	.....	.....	.....
.....	2,199,100	3	S	98	100
Appalachian Power, c.....	6,000,000	.....	.....	23	24
Appalachian Power, pt.....	2,180,000	.....	.....	73	74½
Arizona Power, c.....	3,000,000	.....	.....	12	13
Arizona Power, pt.....	850,000	.....	.....	50	55
Asheville Light & Power, 1st S. 1, 5s, 42	1,100,000	2½	S	93	96
Augusta-Aiken Railway & Electric, s. f. 5s, 35	2,588,000	2½	S	90	94
Augusta-Aiken Ry. & Elec., c.	2,250,000	.....	.....	23	25
Augusta-Aiken Ry. & Elec., pt.	1,500,000	1½	Q	75	85
Augusta Railway & Electric, 1st 5s, 40	967,000	2½	S	101	103
Central Maine Power, 1st 5s.....	2,502,000	2½	S	97	99
Cities Service, c.....	5,499,430	¾	M	119	122
Cities Service, pt.....	10,195,360	¾	M	87½	89½
Columbus Railway Gas & Electric, 1st 5s, 36	2,454,000	2½	S	93	95
Columbus Ry., G. & Elec., c.....	2,000,000	.....	.....	60	65
Columbus Ry., G. & Elec., pt.	840,000	1½	Q	85	95
Commonwealth Edison, cap. stock	32,964,800	7	A	142½	.....
Consolidated Gas, Electric & Power (Baltimore), 4½s.....	11,564,000	2½	S	90	90½
Consum. Pwr. (Mich.), 5s, 30	10,088,000	2½	S	95½	97½
Consumers Power (Minn.), 1st 5s, 29	9,528,000	2½	S	89	92
Dallas Elec. Corp., 5s, 22	3,659,000	2½	S	95½	97½
Denver Gas & El. Lt., c.....	7,001,300	¾	M	220	.....
Denver Gas & El. Lt., gen. 5s	6,000,300	2½	S	93	95
Edison El. Ill. of Boston, cap. stock	15,603,700	3	Q	280	.....
Empire District Electric, 5s.....	1,925,000	2½	S	84	88
Federal Light & Traction, c.....	4,750,000	.....	.....	30	33
Federal Light & Traction, pt.	2,500,000	1½	Q	80	83
Gas & Electric Securities, c.....	1,000,000	.....	.....	125	135
Gas & Electric Securities, pt.....	1,000,000	7	A	92	96
Harwood Electric, 5s, 39	1,000,000	2½	S	100½	102½
Lincoln Gas & Electric, c.....	2,250,000	.....	.....	27	27
Lincoln Gas & Electric, 5s, 41	796,000	2½	S	87	90
Niagara Falls Power, 5s, 32	10,000,000	2½	S	101½	102½
Northern States Power, c.....	5,975,000	.....	.....	24	25
Northern States Power, pt.	8,386,700	11	Q	84½	86
Pacific Gas & Electric, c.....	31,908,750	1½	Q	62	62½
Pacific Gas & Electric, pt.....	10,000,000	1½	Q	91½	92
Philadelphia Electric (\$25).....	24,987,750	1½	Q	24½	.....
Portland General Electric, 5s	8,000,000	2½	S	100	102
Republic Railway & Light, c.....	5,200,000	.....	.....	24	26
Republic Railway & Light, pt.	6,360,000	1½	Q	78	80
St. Joseph's R. L., H. & P., 5s	4,637,000	2½	S	99	99½
Seattle Electric Co., c., 5s, 29	7,417,000	2½	S	98	100
Southern Calif. Edison, 5s, 39	10,043,000	2½	S	96	98
Southern Power, S.....	4,000,000	2½	S	99½	101
Standard Gas & Elec. (\$50), c.	9,344,150	.....	.....	21½	22
Standard G. & Elec. (\$50), pt.	10,977,950	2	Q	49½	51
Tennessee R. L. & Pwr., c.....	20,000,000	.....	.....	22½	24½
Tennessee R. L. & Pwr., pt.	10,250,000	1½	Q	77½	78
Tri-City Railway & Light, c.....	9,000,000	.....	.....	56	60
Tri-City Railway & Light, pt.	2,826,200	1½	Q	93	95
Tri-City Ry. & Lt., 5s, 23	8,207,000	2½	S	97	98
Virginia Railway & Power, 5s	10,345,000	2½	S	94	96
Western Power, c.....	14,670,000	.....	.....	.....	50
Western Power, 6% cum. pt.....	6,000,000	6	A	.....	23
Western States Gas & El., c.....	3,503,000	.....	.....	53	59
Western States Gas & El., pt.	1,800,000	1½	Q	93	98
Western States Gas & El., 1st and ref. 5s, 41	3,400,000	2½	S	92½	95



## Personal

**Mr. E. J. H. Thieme**, electrical contractor of Brooklyn, has been re-elected president of the Electrical Contractors' Association of Long Island.

**Prof. Daniel W. Mead**, of the University of Wisconsin, Madison, has been appointed a member of the N. E. L. A. committee on prime movers.

**Mr. S. Tupper** has been placed in charge of the plant of the Salem Electric Light Company at North Salem, Mass., succeeding the late H. S. Woodbury.

**Mr. G. Wilbur Hubley**, chief engineer of the Louisville (Ky.) Lighting Company, was recently elected a member of the directorate of the Louisville Engineers and Architects' Club.

**Dr. Edward G. Acheson**, the inventor of carborundum and deflocculated graphite, has been made an honorary member of the Imperial Technological Society of Russia. He delivered a lecture before the society at St. Petersburg Jan. 22.

**Mr. E. B. Korst**, until recently manager of the new-business department of the Ottumwa Railway & Light Company, Ottumwa, Ia., has resigned to accept a position as district superintendent of the Central Illinois Public Service Company of Matttoon, Ill.

**Mr. D. C. Greene**, of Marshfield, Ore., manager of the Oregon Power Company and also president of the Marshfield Chamber of Commerce, represented the latter body at Washington recently in an effort to secure an additional appropriation for the improvement of Coos Bay Harbor.

**Mr. L. R. MacBroom**, who for four years was a general superintendent for the Rutland (Vt.) Railway, Light & Power Company and more recently connected with the General Electric Company at Birmingham, Ala., has been made superintendent of the municipal electric light plant at Burlington, Vt.

**Mr. John W. Lieb, Jr.**, vice-president of the New York Edison Company, has accepted reappointment as chairman of the street-lighting committee of the National Electric Light Association. He has already organized his committee with the following members: Dr. C. P. Steinmetz, Dr. Louis Bell, Prof. A. F. Ganz and Mr. Preston S. Millar.

**Mr. Van Dusen Rickert**, general manager of the Eastern Pennsylvania Light, Heat & Power Company, of Pottsville, Pa., and president of the Pennsylvania Electric Association, addressed the members of the Metropolitan Electric Company Section, N. E. L. A., Reading, Pa., on Jan. 15, on the subject of welfare work and central-station practice.

**Mr. R. C. Dwyer**, district manager of the Idaho Railway, Light & Power Company at Caldwell, Idaho, has been transferred to the engineering department of the company at Boise. He is succeeded by Mr. B. H. Wayne, formerly connected with the Nampa office of the company. Mr. J. D. Orr, local manager of the Nampa office, will have general supervision of both the Caldwell and Nampa systems.

**Mr. Alton M. Frost** has resigned from the engineering department of the Crocker-Wheeler Company to accept a position with the General Electric Company at Harrison, N. J. He will be connected with the Moore light department of the development laboratory. Prior to his connection with the Crocker-Wheeler Company Mr. Frost was an engineer with the Moore Light Company, of Newark, N. J.

**Mr. G. H. Caffrey**, formerly superintendent of the Norwalk (Conn.) district of the United Electric Light & Water Company, has accepted the position of engineer of the Havana (Cuba) Railways & Light Company. Mr. Caffrey is a graduate of the Stevens Institute of Technology and was connected with the engineering department of the New York & Hudson River Central Railroad Company before going to Norwalk. His successor at Norwalk will not be Mr. G. F. Atwater, as stated in the Jan. 18 number; but Mr. F. H. Wade. Mr. Atwater will remain in charge of the Greenwich division of the United Electric Light & Water Company.

**Mr. A. C. Linzee**, formerly president and chief engineer of the Imperial Electric Company, Akron, Ohio, has resigned to engage in consulting engineering. Mr. Linzee

was with the General Electric Company as designing engineer and went from that company to the Akron Electrical Manufacturing Company. When the latter company was reorganized four years ago as the Imperial Electric Company he was made president and superintendent. Mr. Linzee was one of the first to bring out a strictly intermittent-service elevator motor, which permitted his company to put on the market a low-cost elevator motor with high commutating capacity and starting torque. He is also the designer of the present line of interpole, ventilated commercial motors and interpole elevator motors manufactured by the company with which he was formerly connected.

**Mr. C. G. Baird**, formerly manager of telegraphs and telephones of the Pennsylvania Railroad in New York City, has been promoted to the position of division operator of the Manhattan division, with headquarters in the new Pennsylvania station. Mr. Baird first entered the service of the Pennsylvania Railroad on March 9, 1893, as messenger at Philadelphia. On May 21, 1894, he was made extra telegrapher, a position he held for seven years. He severed his connection with the Pennsylvania Railroad on Sept. 25, 1901, to enlist in the Signal Corps of the United States Army, and was honorably discharged as a first-class sergeant on Sept. 23, 1904. The following year he re-entered the employ of the Pennsylvania Railroad and filled several important positions at the general offices in Philadelphia until he was transferred to New York on March 1, 1910, to supervise the installation of the extensive telephone and telegraph systems at the Pennsylvania station.

**Mr. Sigmund Bergmann**, formerly at the head of the Bergmann Electricity Works, of Berlin, Germany, which during the last year was absorbed by the Siemens-Schuckert company, is at present on a visit to this country. Mr. Bergmann came to this country for the first time in 1870 and was subsequently associated for several years with Mr. Thomas A. Edison. In 1892 he organized the New York Electric Equipment Company, becoming president and principal owner of this concern. This interest, however, he soon sold out to return to Germany, where he established the concern bearing his name, which for nearly twenty years held a prominent place in the electrical industries of Europe. Mr. Bergmann is credited with many achievements in connection with the early developments of electrical machinery, the incandescent lamp, storage batteries and telephone and telegraph apparatus.

**Mr. Fred W. Abbot**, who was in successful charge of the large construction operations of the Electric Bond & Share Company's interests prior to Oct. 15, 1912, has been placed in charge of Dr. L. S. Pearson's extensive operations in and around Barcelona, Spain, which involve the construction of six hydroelectric plants, high-voltage transmission systems and large irrigation works. It is understood that Mr. Abbot now has about 7000 men on the work in Spain and expects to have a force of 12000 by June 1. In the last year alone Mr. Abbot has carried to successful completion ten big electric generating stations, which in most cases involved high-voltage transmission systems. These were the Central Colorado Power Company's Shoshone and Boulder generating stations and high-voltage transmission system; a hydroelectric plant at Bunny Creek, Idaho; the Hiram Falls (N. C.) plant of the Yadkin River Power Company, involving the construction of 13 miles of transmission lines; and a hydroelectric plant at Yungu, Spain, with additions of a cable car, irrigation and transmission lines and also a number of other smaller projects.

**Mr. George L. Knight**, head of the engineering department of the Edison Electric Illuminating Company of Brooklyn, was recently elected a member of the board of directors of the Brooklyn Engineers' Club. Mr. Knight was born in Haddonfield, N. J., in 1865, and was graduated from Drexel Institute, Philadelphia, in 1900. He began his career in the electrical world as a switchboard operator for the Philadelphia Electric Company and afterward became wireman for the D'Olier Engineering Company. In 1902 Mr. Knight entered the equipment department of the New York Navy Yard as an electrical draftsman, and in the following year he became mechanical draftsman and surveyor for the New York Edison Company.



where he was engaged in laying out boilers, piping, coal-handling machinery, blowers, etc., for additions to the Waterside station, as well as turbine foundations, including the layouts for the auxiliaries. As chief draftsman of the New York Edison Company's Waterside station in 1903-05 Mr. Knight was in charge of the mechanical and civil engineering design for the completion of the station and the installation of apparatus, etc. He entered the service of the Brooklyn Edison company as chief draftsman in 1905 and in 1907 became the designing engineer for that corporation. His work there covers all electrical, mechanical and civil engineering design, and he is also superintendent of building construction. Mr. Knight is a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the New York Electrical Society, the National Electric Light Association and for the past three years he has served as a member of the committee on electrical apparatus appointed by the last-named organization.

Mr. Frank F. Fowle has severed his connection with the McGraw Publishing Company as one of the editors of the *Electrical World*, and has resumed his electrical engineering practice with offices at 68 Maiden Lane, New York City. From 1899, when Mr. Fowle was graduated from the Massachusetts Institute of Technology with the degree of electrical engineer, up to 1908, he was connected with the American Telephone & Telegraph Company. He served in the engineering department in New York from 1899 to 1903, and in the railway department from 1903 to 1906. From 1906 to 1908 he was with the operating department of the American Telephone & Telegraph Company as manager of the Chicago territory of the long-distance department. Mr. Fowle was engaged in consulting engineering work in Chicago from 1908 to 1912, during which time he was appraisal and rate expert for the city of Beloit, Wis., in connection with the Beloit case heard before the Wisconsin Railroad Commission, examined St. Paul water mains to determine the extent of damage from electrolysis, appraised telephone property, investigated isolated-plant economy, gave expert testimony, made extended investigations into the properties and economic uses of copper-clad steel wire, and advised in reference to rates and standards for street lighting. He also made miscellaneous practical investigations and reports for public service corporations, railroads, manufacturers and municipalities. Mr. Fowle has contributed about fifty technical papers and articles to engineering societies and publications. He is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the National Electric Light Association, the Railway Signal Association and the Technology Club of New York. Mr. Fowle is a member of the telegraphy and telephony committee and of the patent committee of the A. I. E. E.

Mr. S. R. Inch, whose appointment as general superintendent of the Utah Power & Light Company, Salt Lake City, Utah, was noted in the *Electrical World* of Dec. 21, 1912, was apprenticed in accordance with the English system to the Electricity Supply Works, Taunton, England, and received his technical education at Finsbury Technical College, London. He was for a time associated with the Litanode Electric Storage Battery Company of London, but in 1900 he entered the employ of the Montana Power Transmission Company. Later he was associated with the Butte (Mont.) Electric & Power Company and in 1904 accepted the position of manager of the Missoula (Mont.) Light & Power Company. Various extensions and consolidations have built up these properties to include the Clark-Missoula Power Company, the Missoula Light & Water Company and the Missoula Street Railway, and it was the management of these combined properties that Mr. Inch relinquished in order to take up his present position. He was the originator of the Missoula one-man prepayment car and read a paper on its operation before the Chicago convention of the American Electric Railway Association last October. Mr. Inch was associated with the Missoula properties, which are owned by former United States Senator W. A. Clark, for nearly ten years, and the company with which he is now connected is a consolidation of a number of companies which operate in Utah, Idaho and Colorado, the most important of which is the Telluride Power Com-

pany. The properties have about 1000 miles of high-tension transmission lines and develop more than 100,000 hp. Water-power resources sufficient to yield 100,000 hp additional are owned by the combination, which will furnish energy for the operation of the mountain section of the Denver & Rio Grande Railroad, plans for the electrification of which were referred to recently in the *Electrical World*.

Mr. Samuel Macaw Kennedy, who contributes frequently to electrical periodicals on matters relating to rate making, business building and public policy, was born in Toronto,



SAMUEL M. KENNEDY.

Can., June 20, 1864, and was educated in the Model School, Collegiate Institute and Upper Canada College, in that city. After leaving college he entered his father's business and began studying the problems of "buying in the cheapest market and selling in the dearest" from the wholesale importer's standpoint. In due course he was appointed one of the firm's foreign buyers and for ten years made frequent trips to and from Europe, crossing the Atlantic forty-two times before he had completed his thirtieth year. During the latter portion of this period he had entire charge of the European end of the business and made regular visits to the manufacturing centers of Great Britain, France, Switzerland, Germany and Austria. Primarily as the result of a sunstroke his health broke down, and for five years he traveled in search of a congenial climate, eventually going to California, where he regained his strength. In 1901 he became identified with the electrical business as assistant to the president of the United Electric Gas & Power Company of Los Angeles, which company was absorbed in 1903 by the Southern California Edison Company. Since that date Mr. Kennedy has acted as general agent of the Edison company and has guided the commercial end of the corporation's growing business. He is also a director in and secretary of the Santa Barbara Gas & Electric Company and the Long Beach Consolidated Gas Company. Mr. Kennedy is an active worker in the National Electric Light Association and is also a member of the American Institute of Electrical Engineers, the Electric Vehicle Association of America and the Pacific Coast Gas Association.

## Obituary

William J. Denver, for twenty-seven years assistant general manager of the New England Telephone & Telegraph Company, died recently at his home in Florence, Mass. He retired from active connection with the company in the summer of 1912 on account of failing health. Mr. Denver was born in Springfield, Mass., in 1841, and at the age of sixteen became a telegraph operator at Bellows Falls, Vt., later going to Northampton and New Haven and then to Springfield, where he became local manager of the Western Union Telegraph Company in 1864. In the late seventies the Bell Telephone Company sought to enter Springfield. Mr. Denver had held the rights of the company in Hampden and Hampshire Counties, but was compelled to release them because of conflicting interests with the Western Union organization. He persuaded the latter company to establish exchanges in Springfield, Boston, Providence and Worcester, and upon the sale of its telephone interests to the Bell company he resumed work in the telegraph field, continuing until 1885, when he became assistant general manager of the New England company. He was affiliated with many social organizations, belonged to the Telephone Pioneers of America and was a past-president of the Telephone Employees' Association.

## Construction

**GADSDEN, ALA.**—The Alabama Pwr. Co. is preparing to extend its transmission line across Sand Mountain to Guntersville, Huntsville and Decatur.

**TEMPE, ARIZ.**—The reclamation service has announced the erection of a transmission line to tap the Water Users' transmission line from the Arizona Falls plant at the cross-cut plant. The work will include the erection of a span power line 1625 ft. long, suspended on towers from 75 ft. to 90 ft. high, from the town of Tempe across the Salt River, just above the new bridge to tap the line from the Arizona Falls near the new cross-cut power house.

**SEARCY, ARK.**—U. S. Bratton, of Little Rock, and associates have submitted a proposition to the City Council offering to purchase the municipal electric-light plant. They ask for a 25-year franchise and propose only to pay the outstanding indebtedness and accrued interest. It is proposed to operate the plant by electricity generated at the proposed hydroelectric power plant, to be located on the Red River above Searcy.

**SPRINGDALE, ARK.**—The City Council is considering a proposition submitted by Albert C. Moore, civil engineer, of Joplin, Mo., for the installation of a municipal electric-light and water plant.

**BAKERSFIELD, CAL.**—Bids will be received until Feb. 10 by the Board of Supervisors for a 50-year franchise to erect transmission lines across certain highways in Kern County, application having been made by the Southern Sierra Pwr. Co., of San Bernardino.

**COVINA, CAL.**—The City Council has authorized the city engineer to prepare plans and specifications for the installation of an ornamental street-lighting system to include Center Street, Badillo Avenue and Citrus Avenue. The Council is also investigating the entire lighting system.

**DOWNIEVILLE, CAL.**—Albert C. Agnew, attorney, of Oakland, has asked the Board of Supervisors to advertise for sale a franchise, covering a period of 50 years, to erect and maintain transmission lines for the purpose of transmitting electricity for lamps, heaters and motors along certain highways and public roads in Sierra County. The franchise will be advertised for sale.

**HEMET, CAL.**—The successors to the Ramona Pwr. Co. expect soon to begin on the construction of a large dam and reservoir at the foot of Strawberry Valley, 2 miles below Idyllwild, in the San Jacinto Mountains. A high-tension transmission line will also be erected to San Jacinto Valley to connect an irrigation pump load.

**LINDSAY, CAL.**—The Tulare County Pwr. Co., of Lindsay, has applied to the State Railroad Commission for permission to issue bonds to the amount of \$500,000 to be used for extensions and development work.

**LIVE OAK, CAL.**—The Board of Supervisors has adopted a resolution calling for bids for furnishing electricity for lamps and motors for the town of Live Oak and for the installation of a lighting system. A bid for furnishing electricity for Sutter County has been submitted by the Oro Lt. & Pwr. Co., of Oroville.

**LOS ANGELES, CAL.**—The Southern California Edison Co. will build substations at Whittier, Monrovia, Torrance, Katella, Puente, Chino and Slauson. The stations will cost from \$16,000 to \$56,000 each. Additions will be made to existing substations, at a cost of about \$136,000.

**NEWPORT, CAL.**—The Board of Trustees has decided to build a distributing system and purchase energy from one of the large power companies. The city recently voted to issue \$25,000 in bonds to acquire the local plant owned and operated by C. H. L. Christ. The trustees considered the price placed on the plant prohibitive, and have decided to build a system. Bids will soon be asked for material for the proposed plant.

**RIVERSIDE, CAL.**—Paul Shoop, president of the Pacific El. Ry. Co., has announced that the company will extend the railway from Riverside, via Arlington, to Corona, a distance of 15 miles.

**RIVERSIDE, CAL.**—Plans and efficiency report have been completed on municipal lighting plant at Riverside. Plans call for an expenditure of \$429,112 on a hydroelectric plant and \$100,351 on a steam reserve plant, or for an alternate oil-engine plant of 2000-kw capacity, \$200,000. Burns & McDonnell, of Kansas City, Mo., are engineers. H. L. Greer is city clerk.

**SACRAMENTO, CAL.**—No bids were submitted to the City Commissioners in connection with the work of installing electric conduits for the electricians of the city. The work will probably be done under the direction of the commissioner of public works. The cost of the work is estimated at about \$10,000.

**SAN FRANCISCO, CAL.**—The Great Western Pwr. Co. has applied to the State Railroad Commission for permission to issue approximately \$4,000,000 in bonds for the purpose of completing the large dam and reservoir at Big Meadows on Feather River.

**DOLORES, COL.**—Plans are under consideration for the construction of a large hydroelectric power plant on the Dolores River, a few miles above Dolores. The proposed plant will supply power and water for the irrigation of 200,000 acres of land extending north to the southern limits of Paradox Valley and west into Utah. E. P. Ripley, president of the Santa Fe railroad, is to be president of the irrigation company, which is installing the project on the Dolores; Fred L. Lucas, of Denver,

engineer in charge. The Colorado Pwr. Co. has been negotiating for the purchase of the Redlands power plant, near this city.

**GRAND JUNCTION, COL.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 5, for the construction, including plumbing, gas piping, heating apparatus, electric lighting, etc., of a new building for the office and approaches, of the United States post office at Grand Junction, Col. Drawings and specifications may be obtained at the above office or from the custodian of site at Grand Junction. O. Wenderoth is supervising architect.

**NEW HAVEN, CONN.**—The United Ill. Co. is considering plans for the transfer of its generating station in George Street to another section of the city.

**WASHINGTON, D. C.**—The municipality of Chalons-sur-Marne, France, invites tenders for electrically operated pumps at the city water works. Particulars may be obtained at the Marine. The further information address No. 10,284, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

**WASHINGTON, D. C.**—The American Electric Light & Power Co. has been awarded a contract by the Federal Power Commission to construct and equip a generating station at Astoria, to cost approximately \$2,500,000. The further information address No. 10,273, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

**WASHINGTON, D. C.**—An American consul reports that an electric street railway will be built in his district. The contract has been undertaken by a local company and work will probably begin in the fall of 1913. Further information may be secured by addressing No. 10,267, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

**WASHINGTON, D. C.**—The American Electric Light & Power Co. has been awarded the contract and transmission of a full capacity station for the state monopoly of electric light and power in that country. It is stated that numerous bids have been received for the power house needed. There are to be 15 power houses, plans for which have already been prepared. The approximate cost of each is given as from \$25,000 to \$31,000. Copies of the complete report and specifications will be sent on application No. 10,273, Bureau of Foreign and Domestic Commerce, Department of Commerce and Labor, Washington, D. C.

**ARCADIA, FLA.**—The Arcadia El. Lt. & Tel. Co. is planning to enlarge its plant and install additional machinery.

**JONESBORO, GA.**—At a recent board meeting of the corporation, it was entered into a contract with the Central Georgia Transmission Co. for electricity, with a cash advance and work to the amount of \$10,000 to be used for building and equipping a transforming station in Jonesboro, was carried.

**BRUNEAU, IDAHO.**—The Great Shoshone & Twin Falls Mr. Pwr. Co., of Twin Falls, does not contemplate the construction of a plant in Bruneau, as published in the issue of Jan. 18, but has under consideration the extension of its transmission line to this place. J. H. Seavier is assistant general superintendent.

**ALTON, ILL.**—The Alton, Granite & St. Louis Trac. Co. has decided upon a site for its proposed new power house in Alton to furnish electricity for the East Side system. A site of 17 acres has been secured on the riverbank. The new power plant will have an output of 6000 kw and will supply electricity to a large territory, including the present power house at Shaw and Third Streets and the new plant at Alton, when the new plant is completed.

**ARIZONA, ILL.**—The Central Illinois Pub. Ser. Co. is now seeking a franchise to construct and operate an electric-light plant at Arizville.

**BARDOLPH, ILL.**—The Village Board of Bardolph, Ill., has awarded a contract to the Central Illinois Pub. Ser. Co. of Mattoon, a franchise to construct a lighting system in Bardolph. A tender of \$10,000 is to be made by the company for lighting the streets, including the purchase of 1000 lamps, at \$5 each, and 1000 watts.

**BEARDSTOWN, ILL.**—The Central Illinois Pub. Ser. Co. of Mattoon, has purchased the property of the Beardstown El. Lt. & Pwr. Co. It is reported that the company will construct a new power plant and the contract for the construction of the new plant will be awarded to the Beardstown El. Lt. & Pwr. Co. The estimated cost of the new plant is \$100,000. The company will supply the power to the city of Beardstown. The city of Beardstown is now seeking a franchise to construct and operate an electric-light plant at Beardstown.

**CLINTON, ILL.**—The Clinton El. Co. has been awarded a contract by the Clinton El. Co. to construct a new power plant and the contract for the construction of the new plant will be awarded to the Clinton El. Co. The estimated cost of the new plant is \$100,000. The company will supply the power to the city of Clinton. The city of Clinton is now seeking a franchise to construct and operate an electric-light plant at Clinton.

**ELLSVILLE, ILL.**—The Ellsville El. Co. has been awarded a contract by the Ellsville El. Co. to construct a new power plant and the contract for the construction of the new plant will be awarded to the Ellsville El. Co. The estimated cost of the new plant is \$100,000. The company will supply the power to the city of Ellsville. The city of Ellsville is now seeking a franchise to construct and operate an electric-light plant at Ellsville.



renewed for five years. The contract calls for a minimum of 25 arc lamps at \$65 each per year and tungsten lamps at \$21 per lamp per year.

**LA PRAIRIE, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has applied to the Village Board for a franchise to operate an electric-light system in La Prairie. The company recently purchased the electric plant in Augusta and proposes to erect a transmission line to Golden by the way of La Prairie.

**LIVINGSTON, ILL.**—The village of Livingston is installing a distributing system and street lamps. Electricity for operating the system will be purchased from the Twin City Lt., Ht. & Pwr. Co., which operates a transmission line from the power plant of the Madison County Lt., Ht. & Pwr. Co. at Worden to a substation in Livingston. S. M. Westwood is president of the company and D. E. Aylward secretary. The Dixon-Smith Engineering Co., Wright Building, St. Louis, Mo., has charge of the work.

**MARINE, ILL.**—The electric-light plant proposed by local capital may be combined with the ice plant of the Marine Packing Co.

**MARSHALL, ILL.**—G. A. Hallauer, who is building an ice plant here, has submitted a proposition to the City Council offering to purchase the municipal electric-light plant. He asks for a 25-year franchise, promises to pay off the present indebtedness of \$8,500 and to pay \$500 per year for the franchise and to furnish 150 street lamps at \$2,700 per year. In addition, he offers to furnish electricity, free of charge, for lamps about the public square if the city will furnish the ornamental lamps. It is estimated that it will require an expenditure of about \$20,000 to put the plant in shape to give adequate service.

**MOKENA, ILL.**—The Village Board has awarded a contract to the Gould Pump Co., of Chicago, for the installation of an electrically driven pump at the water-works station.

**PAWNEE, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has asked the Village Board for a new franchise to operate an electric-lighting system in Pawnee.

**QUINCY, ILL.**—The City Council has decided to employ an electrical engineer to prepare plans for the installation of a fire-alarm system and then to advertise for bids. Estimates submitted for the system vary from \$16,500 to \$28,000.

**SPRINGFIELD, ILL.**—Property owners headed by Mayor John S. Schnepf have asked the city commission to install ornamental lamps on Adams Street, between Tenth Street and Forest Park, a distance of about 15 blocks.

**SPRINGFIELD, ILL.**—With the installation of a generator and motors at the city water-works pumping station on the Sangamon River the municipal electric-light plant which supplies electricity for lighting the streets will gradually be dismantled and within a year all energy will be furnished from the water-works station.

**SPRINGFIELD, ILL.**—The plans for the proposed extension to the ornamental street lighting provide for about 135 ornamental standards, cast iron or concrete, to be maintained by underground wires. In the business district the standards will carry one 60-watt and four 40-watt Mazda lamps and in the residential district one 100-watt Mazda lamp. Contract for installing the system will probably be awarded in March. The cost of the system is estimated at about \$12,000. J. E. Dalby is superintendent of the municipal electric-light plant.

**WHITE HALL, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased the electric light, heating and power department of the White Hall Sewer Pipe Co. for \$100,000.

**WINCHESTER, ILL.**—The property of the Winchester El. Co. has been purchased by the Central Illinois Pub. Ser. Co., of Mattoon.

**FRANKFORT, IND.**—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1 for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Frankfort, Ind. Drawings and specifications may be obtained from the above office or from the custodian of site at Frankfort. O. Wenderoth is supervising architect.

**MONTICELLO, IND.**—The Monticello Hydraulic Co. has completed its transmission line as far as Walcott. It is now extending the line on to Goodland and Remington and will also supply these towns with electricity for lamps and motors.

**WILLIAMSPORT, IND.**—The purchase of a 133-cycle alternating-current generator and exciter for the municipal electric-light plant is contemplated. Charles E. Brooks is city clerk.

**AMES, IA.**—A special election will be held Feb. 10 to submit a proposition authorizing the City Council to expend \$25,000, or as much as is needed, from the accumulated and future earnings of the Electric Light Department for building a new electric-light plant.

**CEDAR RAPIDS, IA.**—The Iowa City Ry. & Lt. Co. is negotiating with the City Council for the city's right in dam and water rights and proposes to build a combined dam and bridge at Avenue B.

**CEDAR RAPIDS, IA.**—The Cedar Rapids & Marion St. Ry. Co. has applied to the City Council for a franchise to cross the new Third Avenue Bridge and announces that it proposes to build 5 miles of new road and reconstruct 3 miles of track.

**CENTERVILLE, IA.**—The Centerville Lt. & Trac. Co. will begin work on the erection of a transmission line to Mystic in about 30 days.

**HULL, IA.**—The Town Council has granted a franchise to D. J. Vander-Schaft to construct and operate an electric-light plant in Hull. The town agrees to use 30 or more 60-cp tungsten lamps for lighting the streets of the town at \$25 each per year for a period of five years.

**MARCELINE, IA.**—The City Council is considering a proposition submitted by parties representing the Mississippi River Pwr. Co., which is erecting a large power plant at Keokuk, Ia., to furnish electricity to operate the municipal electric-light plant. The proposed transmission line through Linn County to Chillicothe and Trenton will come within 4 miles of Marceline.

**MARSHALLTOWN, IA.**—Plans are being prepared by the Iowa Ry. & Lt. Co. for increasing the output of its local plant. The proposed work will include the construction of a building to be used exclusively for boiler room. Contract has been awarded for a new 2100-hp Westinghouse turbine. A new cooling tower will be erected, 40 by 70 ft., having a capacity of 100,000 gal. A generator is to be installed to supply service in emergencies and transformers for high-tension service and also material for erection of transmission lines leading east of Marshalltown to Tama, Toledo and eventually to Cedar Rapids.

**ROCKWELL, IA.**—C. C. Carhart, of Sheffield, Ia., has applied to the Village Board for a franchise to operate an electric-light system here. Mr. Carhart proposes to erect a transmission line from his plant in Sheffield to Rockwell to furnish energy to operate the system here.

**SHEFFIELD, IA.**—C. C. Carhart, owner of the local electric-light plant, contemplates extending a transmission line from Sheffield to Rockwell to supply electricity for lamps and motors there. Application will soon be made for a franchise in Rockwell.

**TOLEDO, IA.**—The Iowa Ry. & Pwr. Co. contemplates extensive improvements to its local plant. The present plant will be remodeled and made an emergency station, at a cost of about \$30,000. The street-lighting system will be extended to all parts of the city.

**ARCADIA, KAN.**—At an election held Jan. 15 the proposition to issue \$7,500 in bonds for the installation of an electric-light plant was carried. Bids will be called some time in February. E. T. Archer & Co., New England Building, Kansas City, Mo., consulting engineers, have charge of the work.

**KINGMAN, KAN.**—The entire issue of \$45,000 in bonds recently authorized for the installation of a municipal electric-light plant has been sold. Active work will soon begin on the construction of the plant.

**MILTONVALE, KAN.**—Plans are being prepared for the construction of a municipal electric-light plant, to cost about \$32,000. E. T. Archer & Co., of Kansas City, Mo., have charge of the engineering work.

**TOPEKA, KAN.**—Sealed bids will be received by the State Board of Control, Topeka, Kan., until Feb. 8 for furnishing electric lamps to the state charitable institutions of Kansas for a period of one year. Contract will be awarded upon a basis of 5000 lamps to be delivered as ordered by the chief executive officer of the following institutions: Topeka State Hospital, Topeka; Oswatomie State Hospital, Oswatomie; State Hospital for Epileptics, Parsons; State Home for Feeble-Minded, Winfield; School for Deaf, Olathe; School for Blind, Kansas City, Kan.; State Orphans' Home, Atchison; Boys' Industrial School, Topeka, and Girls' Industrial School, Beloit. Bidders will make one price covering carbon lamps from 2 cp to 24 cp, another price covering 32-cp lamps; also prices covering Gem, Mazda and tungsten lamps, same candle-power as above, and as high as 60 cp; these lamps to be upon Edison base, 110-volt. N. C. Bowman is chairman of board.

**LEXINGTON, KY.**—The Burrell Engineering & Construction Co., of Chicago, Ill., has been engaged by the Blue Grass Commission Co., of Lexington, to prepare plans and erect an electrically operated grain elevator in this city.

**LOUISVILLE, KY.**—A decision has been handed down requiring the Kentucky El. Co., of Louisville, to continue in competition with the Louisville Lig. Co. and other public utilities of similar character in this city until its franchise expires. This decision practically makes impossible the sale of the company's plant.

**LOUISVILLE, KY.**—The Louisville Ltg. Co. has entered into a contract with the Wedgerite Chemical Co., a new concern which will manufacture high explosive, to supply electricity to the Wedgerite powder mills, to be located 2 miles south of Kenwood Hill. The contract will necessitate an extension of the transmission line of the lighting company over Kenwood Hill. Six motors are to be purchased by the powder company for the initial installation.

**DONALDSONVILLE, LA.**—The contract for the construction of the power house for the new municipal electric-light plant has been awarded to R. L. Stewart for \$8,000, subject to the approval of the Louisiana Fire Prevention Bureau.

**CATONSVILLE, MD.**—The Baltimore County Commissioners have awarded the contract for street lighting in Catonsville to the Patapsco El. & Mfg. Co., of Ellicott City. The contract is for a period of two years. Victor G. Bloede, of Baltimore, Md., is president of the company.

**WILLIAMSPORT, MD.**—Ernest R. Gentis, superintendent of the Frederick & Hagerstown Pwr. Co., of Hagerstown, has submitted a proposition to the Burgess and Commissioners of Williamsport offering to furnish electricity for lighting the streets of the town, giving an all-night service, at \$65 per arc lamp per year.

**BOSTON, MASS.**—The stockholders of the New England Pwr. Co. have voted to increase the capital stock of the company from \$1,500,000 to \$2,500,000.



**BROCKTON, MASS.**—Steps have been taken toward the installation of an ornamental street-lighting system in the business district. Arthur H. Andrews, president of the Chamber of Commerce, is leader of the movement.

**FALL RIVER, MASS.**—The Fall River El. Lt. Co. has purchased the property adjoining its substation on Hartwell Street. The purchase of this plot will make it possible to enlarge the substation and storehouse. The company has announced that extensive improvements are to be made at the substation within the next few months.

**WESTFIELD, MASS.**—The Amherst Pwr. Co. has submitted a proposition to the Municipal Light Board offering to furnish electricity to consumers through the municipal electric-light plant. The municipal electric-light plant is furnishing from 800 hp to 900 hp during the day and will call for an appropriation of \$20,000 this spring to enlarge the power plant, increasing the output by 750 hp. This will not be done if the proposition of the Amherst company is accepted.

**ALPENA, MICH.**—The Great Lakes Lime & Stone Co., recently organized with a capital stock of \$1,500,000, will build a lime plant with an output of 200 tons per day; the rock crusher plant will be capable of handling 12,000 tons of rock each day. Much electrical equipment will be required, for which, it is said, bids will soon be received. E. P. Smith is at the head of the project.

**DETROIT, MICH.**—The Detroit General Hospital will install a power plant to furnish electricity for lamps and motors to the various buildings.

**DETROIT, MICH.**—The Public Lighting Commission has asked the Common Council for an appropriation to build underground conduits from the power plant to the new office building.

**DETROIT, MICH.**—A petition has been presented to the Public Lighting Commission asking that the cluster lamps on Michigan Avenue be extended westward to Martin Avenue; also that 12 lamps be erected on both sides of the walk in the subway at Twentieth Street and Michigan Central Railroad.

**GRAND RAPIDS, MICH.**—Plans have been prepared by Wernette & Bradford, engineers, for the construction of a one-story power house for the White Lake Lt. & Pwr. Corp. at Montque, to be built of cement block.

**PONTIAC, MICH.**—The Michigan State Tel. Co. has been notified to place its wires underground on West Pike Street, Williams Street, Mount Clemens Street and Saginaw Street.

**SHEPHERD, MICH.**—The municipal electric-light plant has been closed down and electricity will be furnished by the Consol. Pwr. Co. at 5 cents per kw-hr., with a 24-hour service.

**FULDA, MINN.**—The Fulda Lt. & Pwr. Co. has made arrangements to supply electricity in Kinbrae and Dundee and also to farmers along the line. The company will erect a transmission line from its power plant in Fulda to the villages of Kinbrae and Dundee.

**HIBBING, MINN.**—The Water and Light Commission has decided to engage an electrical engineer to make investigations of the municipal electric-light plant and submit a report of improvements needed to bring the plant up to the highest standard of efficiency and economical operation.

**NORWOOD, MINN.**—The Lethert El. Co., of St. Paul, represented by J. W. Schuller and F. C. Fitzgerald, has applied to the Village Council for a franchise to furnish electricity here. The company expects to erect several plants in this section and proposes to furnish electricity in towns as far west as Montevideo and as far north as Eden Valley, where a plant is already in operation.

**ROYALTON, MINN.**—The Royalton Pwr. & Lt. Co. is now receiving electricity from the plant at Little Falls and is furnishing a 24-hour service. The installation of a new street-lighting system is under consideration.

**WARROAD, MINN.**—The Village Council is considering the question of installing a municipal electric-light plant this spring.

**JACKSON, MISS.**—The Jackson Ry. & Lt. Co. will install a new street-lighting system in Jackson in the near future. The company has not yet decided upon what method it will adopt.

**ESSEX, MO.**—The Dexter El. Lt. Ht. & Pwr. Co., of Dexter, has applied to the City Council for a franchise to install an electric-lighting system in Essex. If granted a franchise, the company will begin work at once on construction of the plant.

**ST. CHARLES, MO.**—The Mississippi River Pwr. Distributing Co., of Keokuk, Ia., has applied to the City Council for a franchise to supply electricity for lamps and motors in St. Charles.

**DAVID CITY, NEB.**—Frank Humpal has submitted a proposition to furnish electricity for lighting the streets of the city and for commercial and residential lighting. Mr. Humpal is operating a small plant and if granted a contract and franchise will enlarge his plant to supply the service. The city has been without street-lighting service for more than a year and a half.

**PLATTSBROUGH, NEB.**—The Nebraska Ltg. Co., of Plattsmouth, has decided to increase the output of its plant with a view of furnishing electricity for lamps and motors in the surrounding towns and to farmers in the east end of the county. Albert Clabaugh is superintendent.

**GOLDFIELD, NEV.**—The Goldfield Oro Co. is planning to install electrically operated compressors and drills.

**FREEHOLD, N. J.**—The Monmouth Lt. Co., which furnishes electricity for lamps and motors in Freehold, Englishtown and Marlboro,

contemplates substantial improvements to its plant and extensions to the service. Captain Peter Vredenburg is president and David H. Smith treasurer of the company.

**GLOUCESTER CITY, N. J.**—The Delaware & Atlantic Tel. & Tel. Co. has applied to the City Council for permission to install an underground system on Bergen Street.

**LAMBERTVILLE, N. J.**—The property of the Lambertville Ht., Lt. & Pwr. Co. has been taken over by F. Stanley North, of Bay Shore, N. Y., and associates. The new owners contemplate extensive improvements to the local plant and extension of service in the near future. For the present plant will be under the management of T. I. Axel.

**MERCERVILLE, N. J.**—The Public Ser. El. Co. will install a new lighting system in Hamilton Township, taking in Hamilton Square and Mercerville.

**PATERSON, N. J.**—The El. Pwr. Co. has applied to the Board of Public Works for a franchise to supply electricity in Paterson. The company proposes to develop 48,000 hp on the Neversink River, near Monticello, and transmit power to Paterson, Passaic and other New Jersey cities. C. A. Caban, of Montreal, Que., Can., is president of the company and Carl C. Giles is manager.

**PERTH AMBOY, N. J.**—For the purpose of encouraging the merchants to erect ornamental lamps the city will agree to bear 25 per cent of the cost of maintaining the lamps where 10 or more lamps are installed.

**PHILLIPSBURG, N. J.**—The Phillipsburg Lt., Ht. & Pwr. Co., has applied to the City Council for a franchise to supply electricity for lamps and motors in Phillipsburg.

**SOUTH RIVER, N. J.**—The Board of Public Works has recommended to the Borough Council extensions and improvements to the municipal electric-light plant, involving an expenditure of about \$25,000, as follows: (1) One 300-hp suction gas producer in addition to the one contracted for, together with complete appurtenances; (2) one 300-hp, four-cylinder gas engine direct-connected; (3) one 200-kva multiphase alternating-current generator, with exciter; (4) switchboard and instruments, including automatic voltage regulator; (5) addition to power house to provide room for new equipment; (6) equipment for 50 additional street lamps, including transformers, regulators and line construction; (7) line extensions, transformers, etc.

**TRENTON, N. J.**—Plans are being considered by the Merchants' Committee and the Board of City Commissioners for the installation of additional ornamental street lamps in the business section and will soon open negotiations with the Pub. Ser. El. Co. for same.

**BELEN, N. M.**—Plans are being prepared for the installation of an electric-light plant in Belen. Local capitalists are interested in the project.

**BUFFALO, N. Y.**—Proposals will be received by the Commissioner of Public Works, Room 5, Municipal Building, Buffalo, until Feb. 21, for construction of a new high school building, to be known as the Hutchinson Central High School and to be located on the corner of South Elmwood Avenue and Clappan Street. A complete statement of the specifications for the following divisions of the work will be submitted: (a) structural iron and steel work, including ornamental iron and brass work; fireproofing; carpentry work; roofing, including skylights, sheet-metal work, etc.; marble and tile work; electric wiring, switchboards, telephone system, lighting fixtures, etc.; elevators, ash-hoists, etc.; heating, ventilating and power-plant equipment, including boilers, pumps, tanks, fans, motors, high-pressure piping, radiation, temperature regulation, air-washers, humidifiers, etc.; (c) plumbing, drainage and gas-fitting, including water heaters, water-purifying and filtration apparatus, etc. Plans and specifications are on file and may be examined at the office of the deputy building commissioner, Room 6, Municipal Building, Buffalo, where blank forms of proposals and other information may be obtained. Francis G. Ward is commissioner of public works.

**DRESDEN, N. Y.**—Negotiations are under way between the city of Dresden and the Taylor Chemical Co., whose plant is located on the outlet of Lake Keuka, about 2 miles from Dresden, for lighting the town by electricity. E. R. Taylor is president of the company.

**GLENEVA, N. Y.**—Bids will be received by the City Council until Feb. 6 for the installation of a new electric-lighting system in the business section of the city. The specifications for the work are as follows: (a) 100-hp suction gas producer; (b) 200-kva multiphase alternating-current generator, with exciter; (c) 200-kva transformer; (d) 100-hp suction gas producer; (e) 200-kva transformer; (f) 100-hp suction gas producer; (g) 200-kva transformer; (h) 100-hp suction gas producer; (i) 200-kva transformer; (j) 100-hp suction gas producer; (k) 200-kva transformer; (l) 100-hp suction gas producer; (m) 200-kva transformer; (n) 100-hp suction gas producer; (o) 200-kva transformer; (p) 100-hp suction gas producer; (q) 200-kva transformer; (r) 100-hp suction gas producer; (s) 200-kva transformer; (t) 100-hp suction gas producer; (u) 200-kva transformer; (v) 100-hp suction gas producer; (w) 200-kva transformer; (x) 100-hp suction gas producer; (y) 200-kva transformer; (z) 100-hp suction gas producer; (aa) 200-kva transformer; (ab) 100-hp suction gas producer; (ac) 200-kva transformer; (ad) 100-hp suction gas producer; (ae) 200-kva transformer; (af) 100-hp suction gas producer; 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(wm) 200-kva transformer; (wn) 100-hp suction gas producer; (wo) 200-kva transformer; (wp) 100-hp suction gas producer; (wq) 200-kva transformer; (wr) 100-hp suction gas producer; (ws) 200-kva transformer; (wt) 100-hp suction gas producer; (wu) 200-kva transformer; (wv) 100-hp suction gas producer; (ww) 200-kva transformer; (wx) 100-hp suction gas producer; (wy) 200-kva transformer; (wz) 100-hp suction gas producer; (xa) 200-kva transformer; (xb) 100-hp suction gas producer; (xc) 200-kva transformer; (xd) 100-hp suction gas producer; (xe) 200-kva transformer; (xf) 100-hp suction gas producer; (xg) 200-kva transformer; (xh) 100-hp suction gas producer; (xi) 200-kva transformer; (xj) 100-hp suction gas producer; (xk) 200-kva transformer; (xl) 100-hp suction gas producer; (xm) 200-kva transformer; (xn) 100-hp suction gas producer; (xo) 200-kva transformer; (xp) 100-hp suction gas producer; (xq) 200-kva transformer; (xr) 100-hp suction gas producer; (xs) 200-kva transformer; (xt) 100-hp suction gas producer; (xu) 200-kva transformer; (xv) 100-hp suction gas producer; (xw) 200-kva transformer; (xx) 100-hp suction gas producer; (xy) 200-kva transformer; (xz) 100-hp suction gas producer; (ya) 200-kva transformer; (yb) 100-hp suction gas producer; (yc) 200-kva transformer; (yd) 100-hp suction gas producer; (ye) 200-kva transformer; (yf) 100-hp suction gas producer; (yg) 200-kva transformer; (yh) 100-hp suction gas producer; (yi) 200-kva transformer; (yj) 100-hp suction gas producer; (yk) 200-kva transformer; (yl) 100-hp suction gas producer; (ym) 200-kva transformer; (yn) 100-hp suction gas producer; (yo) 200-kva transformer; (yp) 100-hp suction gas producer; (yq) 200-kva transformer; (yr) 100-hp suction gas producer; (ys) 200-kva transformer; (yt) 100-hp suction gas producer; (yu) 200-kva transformer; (yv) 100-hp suction gas producer; (yw) 200-kva transformer; (yx) 100-hp suction gas producer; (yy) 200-kva transformer; (yz) 100-hp suction gas producer; (za) 200-kva transformer; (zb) 100-hp suction gas producer; (zc) 200-kva transformer; (zd) 100-hp suction gas producer; (ze) 200-kva transformer; (zf) 100-hp suction gas producer; (zg) 200-kva transformer; (zh) 100-hp suction gas producer; (zi) 200-kva transformer; (zj) 100-hp suction gas producer; (zk) 200-kva transformer; (zl) 100-hp suction gas producer; (zm) 200-kva transformer; (zn) 100-hp suction gas producer; (zo) 200-kva transformer; (zp) 100-hp suction gas producer; (zq) 200-kva transformer; (zr) 100-hp suction gas producer; (zs) 200-kva transformer; (zt) 100-hp suction gas producer; (zu) 200-kva transformer; (zv) 100-hp suction gas producer; (zw) 200-kva transformer; (zx) 100-hp suction gas producer; (zy) 200-kva transformer; (zz) 100-hp suction gas producer.

**HADDLEY, N. Y.**—The Haddley El. Co. has applied to the City Council for a franchise to furnish electricity for lamps and motors in Haddley.

**MICHIGAN FALLS, N. Y.**—The Michigan Falls El. Co. has applied to the City Council for a franchise to furnish electricity for lamps and motors in Michigan Falls.

Feb. 5 (extension of date from Jan. 21), for furnishing all labor and material required for the inspection and maintenance of electrical apparatus as follows: (a) For the boroughs of Manhattan and Bronx; (b) the boroughs of Brooklyn and Queens; (c) the borough of Richmond. Blank forms and further information may be obtained at the office of the chief engineer of the department, foot of East Twenty-sixth Street, New York, where plans and specifications may be seen. Michael J. Drummond is commissioner.

**NIAGARA FALLS, N. Y.**—The City Council is considering a charter amendment bill permitting the city to install a municipal electric-light plant.

**BANNERS ELK, N. C.**—A 75-kw hydroelectric power plant is being installed at Banners Elk. Prof. J. A. Switzer, Knoxville, Tenn., is in charge of the hydraulic work and D. R. Shearer, of Knoxville, Tenn., has charge of designing the electrical plant and installation of same.

**GLEN ALPINE, N. C.**—The North State Pwr. Co., of Morgantown, contemplates the construction of a hydroelectric power plant across the Catawba River opposite Glen Alpine, 4 miles from Morgantown. Electricity generated by the plant will be transmitted to Morgantown, Marion and Lenoir.

**DEVIL'S LAKE, N. D.**—Sealed bids will be received until Feb. 10 for the installation of an ornamental street-lighting system. Plans and other information may be obtained at the office of W. E. Bryant, city auditor. P. J. McClory is Mayor.

**CAMBRIDGE, OHIO.**—The Brooks Syndicate, United Service Co., of Scranton, Pa., has closed a deal whereby it acquires the property of the Midland Pwr. & Traction Co., which operates the local electric-light plant and street-railway system and the Cambridge-Byesville interurban line. The company owns the electric plants in Coshocton, New Philadelphia, Uhrichsville and Dennison and the interurban railway which connects the last three cities named. The new owners contemplate the erection of a transmission line to connect Cambridge, Coshocton and New Philadelphia, to cost approximately \$150,000. L. H. Conklin, of Scranton, Pa., is manager of the United Service Co. P. B. Barnhard, of New Philadelphia, has been chosen vice-president of the new Cambridge company.

**COLUMBUS, OHIO.**—Sealed proposals will be received by the director of public service, City Hall, Columbus, Ohio, until Feb. 4 for furnishing approximately 50,000  $\frac{1}{2}$ -in. by 12-in. cored carbons and approximately 50,000  $\frac{1}{2}$ -in. by 12-in. solid carbons for the municipal electric-light plant. S. A. Kinnear is director of public service.

**COLUMBUS, OHIO.**—Proposals will be received by the director of public service, City Hall, Columbus, until Feb. 4, for furnishing lamps as follows: 200 30-watt gem lamps, 1000 40-watt gem lamps, 300 80-watt gem lamps, 800 16-cp refilled lamps, 200 60-watt gem lamps, 200 25-watt tungsten lamps, 200 40-watt tungsten lamps, 300 60-watt tungsten lamps, 4000 100-watt tungsten lamps, 96 150-watt tungsten lamps, 96 250-watt tungsten lamps, 8 500-watt tungsten lamps and 800 60-cp street series lamps. S. A. Kinnear is director of public works.

**EAST LIVERPOOL, OHIO.**—The City Council has engaged Sidney B. Martin, consulting engineer, Glanshaw Building, Pittsburgh, Pa., to prepare plans for the construction of a municipal electric-light plant for the city. The Council has authorized a \$60,000 bond sale to provide funds for the municipal electric-light plant.

**LORAIN, OHIO.**—The Cleveland, Columbus & Southwestern Ry. Co., of Cleveland, has applied to the City Council for a franchise to furnish electricity for lamps in Lorain.

**STUEBENVILLE, OHIO.**—The City Council and a committee of the Chamber of Commerce have advised the Steubenville & East Liverpool Ry. & Lt. Co. to install additional machinery in its power plant. The city probably will not build a municipal electric-light plant.

**ELK CITY, OKLA.**—The Elk City Lt. & Pwr. Co. and the Elk City Ice & Fuel Co. have been consolidated under the name of the Elk City Ice, Fuel & Lt. Co. with a capital stock of \$60,000. It is understood that E. W. Merrifield, superintendent, has been instructed to secure bids on a new 200-kw generator and engine. W. E. Corn will be general manager of the new company.

**CORVALLIS, ORE.**—The Corvallis & Eastern Ry. Co. is planning to install a new boiler, additional motors, etc., in its power house during the coming year. D. M. McLaughlin will have charge of the work.

**MILTON, ORE.**—Plans are being prepared for the construction of a 2000-hp plant on the Walla Walla River, 7 miles above Milton. A company, to be known as the Walla River Pwr. Co., has been incorporated to build and operate the proposed plant. Local capitalists are interested in the project.

**ERIE, PA.**—The County Commissioners have awarded the contract for lighting the court house and county jail for the ensuing year to the Erie Lig. Co. at 2.9 cents per kw-hr.

**FRANKLIN, PA.**—Steps have been taken toward the installation of ornamental street lamps on Liberty and Thirteenth Streets. The proposed system will be installed by the Franklin El. Co. and the cost of maintenance borne by merchants and property holders on the streets named. B. F. Ott is superintendent of the company.

**GEIGER'S MILLS, PA.**—The Geiger Mill property has been purchased and will be converted into an electric light plant. A company has been organized under the name of the Geigertown El. Lt. & Improvement Co., with a capital stock of \$15,000. The mill property will be taken over

April 1. The officers of the company are: E. M. Zerr, president; J. Wesley Wolf, secretary, and H. G. McGowan, treasurer.

**NEWVILLE, PA.**—The property of the Big Spring El. Co., of Newville, has been taken over and will be operated by the Cumberland Ry. Co., of Carlisle. Extensive improvements are being made to the power house of the railway company along the Conodoguinet Creek, near Newville, to provide for the increasing business on the Newville division. W. H. McCrea, of Newville, is president of the Cumberland Ry. Co. and L. Richards, of Carlisle, general manager.

**PITTSBURGH, PA.**—Governor Tener has approved the merger of 28 electric companies chartered in Allegheny, Washington, Greene and other counties into the West Penn Lig. Co. The company is capitalized at \$547,000 and W. S. Kuhn, of Pittsburgh, is president.

**TITUSVILLE, PA.**—The business men on Spring and Franklin Streets are contemplating the installation of ornamental lamps on those thoroughfares.

**PROVIDENCE, R. I.**—Approximately 4000 new incandescent electric lamps will be installed in various parts of the city at once. The lamps are no. to replace others, but are all new locations. About 800 of these lamps will be on underground connections with ornamental iron posts and globes. Many new arc lamps will also be put into commission near the enter of the city. Work is already under way and is being done under the direction of Electrical Engineer Burnett.

**DRESDEN, TENN.**—The City Council contemplates making application to the State Legislature for authority to issue bonds for the installation of an electric-light system.

**DUCKTOWN, TENN.**—The Burra Mining Co. contemplates increasing the output of its power plant. Additional machinery will be installed, including boilers and electric generators to supply electricity for underground haulage, pumping and lighting mines.

**HALLS, TENN.**—We are advised that the Halls Service & Machinery Co., of Halls, has abandoned its proposed electrical project for the present.

**MEMPHIS, TENN.**—The property owners on Main Street are contemplating the installation of an ornamental street-lighting system, covering a distance of about 2 miles. Plans provide for 275 ornamental lamp standards, each carrying five lamps, similar to those on Madison Avenue. J. S. Dunscombe is interested in the project.

**DALLAS, TEX.**—The proposition to establish a municipal electric-light plant in Dallas will be submitted to the voters in April. The cost of a plant to supply electricity for the business part of the city is estimated at \$373,000.

**ELGIN, TEX.**—The Elgin Lt. & Pwr. Co. expects to purchase within the next two months an engine direct-connected to alternator, electrically operated feed pumps, marble switchboard, transformers and poles and miscellaneous electrical appliances and supplies. Thomas L. Deisch is president.

**MANOR, TEX.**—Work will begin at once on the installation of an electric-lighting system in Manor. W. M. Allison is interested in the project.

**PLANO, TEX.**—The Wilcox Lt. & Pwr. Co., which has purchased the property of the Plano Lt. & Pwr. Co., is contemplating improvements to the plant, work on which will begin in April or May. The work will include the installation of one 75-kva, 19,100-33,000-220-440-volt transformer and the purchase of one carload of white cedar poles, 25 ft. to 40 ft. long. C. W. Potts is manager.

**TENHOMA, TEX.**—At an election held recently the proposition to issue \$25,000 in bonds, the proceeds to be used for the construction of a municipal electric-light plant and water-works system, was carried.

**SALT LAKE CITY, UTAH.**—Application has been filed with the State engineer by Thomas W. Cameron, Theodore K. Winkler, Frank D. Wyant and other St. Louis capitalists for 2370 second-ft. of water daily from the Green River to be used for power purposes. It is proposed to divert the water about 3 miles south of the junction of the Green River and Minnie Creek in Carbon County. The work will consist of a dam, headgates, wasteway and steel pipes. Articles of incorporation will be filed as soon as possible and work will be started in the near future.

**BURLINGTON, VT.**—A bill has been introduced in the State Legislature allowing the city of Burlington to issue \$50,000 in bonds, the proceeds to be used to enlarge the municipal electric-light plant.

**BURLINGTON, WASH.**—The Independent Tel. Co. is planning to make extensive improvements in its service at Burlington.

**CENTRALIA, WASH.**—The Lewis County Commissioners have granted a franchise to the United States government for the construction of a telephone line from Lake Creek to Crandle, a distance of 25 miles. The line will be used by the forestry service.

**CENTRALIA, WASH.**—The Cougar Flats Tel. Co. has been granted a franchise by the Lewis County Commissioners to erect a telephone line. The line will be erected at once, and will connect with rural lines in the eastern part of Lewis County. William Booth is president of the company.

**SEATTLE, WASH.**—The City Council is considering the question of issuing additional bonds to the amount of \$600,000 for extensions to the municipal street railway system.

**SEATTLE, WASH.**—E. M. Mills, representing bondholders and creditors of the Seattle, Renton & Southern Ry. Co., has applied to the



City Council for three franchises for extensions to the present electric system in the Rainier Valley.

**TACOMA, WASH.**—The Chicago, Milwaukee & Puget Sound Ry. Co. is planning to erect a power house on the tide flats, at a cost of about \$5,000.

**GRAFTON, W. VA.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 6, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures, hydraulic mail lift and approaches, of the United States post office in Grafton. Drawings and specifications may be obtained at the above office or from the custodian of site at Grafton. O. Wenderoth is supervising architect.

**KENOVA, W. VA.**—The Ohio Valley El. Co. is planning to erect a new transmission line from Kenova to Ashland and Ironton to provide better service for these cities. Work will begin on the line as soon as possible. The proposed line will require 35 miles of wire and will cost about \$20,000.

**MORGANTOWN, W. VA.**—The Morgantown & Wheeling Rys. Co., recently organized, has taken over the Morgantown & Dunkard Rys. Co., which extends from Morgantown to Cassville. The new company proposes to build a railway from Cassville to Wheeling. Dr. L. S. Brock is president of the Morgan & Wheeling Rys. Co.

**WELLSBURG, W. VA.**—The City Council is considering the proposition to establish a municipal electric-light plant.

**EAU CLAIRE, WIS.**—It is announced that the Chippewa Valley Ry. Lt. & Pwr. Co. will build an electric line between Eau Claire and Altoona, an extension of the street-railway system to the South Side factory district and a loop in the downtown section of the city.

**EAU CLAIRE, WIS.**—The Eau Claire Business Men's Association has appointed a committee to promote the installation of an ornamental street-lighting system on North Barstow Street, South Barstow Street and Grand Avenue, east. J. E. Cass, president of the association, is chairman of the association.

**MEDFORD, WIS.**—Sealed bids will be received by Carl Herman, county clerk, Medford, Wis., until Feb. 15, for construction of court house for Taylor County, in accordance with plans and specifications prepared by Rauber & Mehner, architects, of Manitowish. Separate bids will be received for all general bids, heating and ventilating and electrical work. Plans and specifications are on file at the Builders' Exchange at St. Paul, Minn.; Builders' Exchange, Milwaukee, Wis.; Builders' Exchange, La Crosse, Wis.; Builders' Exchange, Fond du Lac, Wis., and Builders' Exchange, Chicago, Ill. Copies of plans may be secured from the architects upon deposit of \$25 for general work and \$10 for mechanical equipment.

**MILWAUKEE, WIS.**—The East Side Advancement Association will petition the Common Council to erect lamps on East Water Street similar to those on Grand Avenue.

**MILWAUKEE, WIS.**—For the third time the proposition to build a municipal electric-light plant will be submitted to the voters at the election to be held in April.

**NEW WESTMINSTER, B. C., CAN.**—The City Council has entered into an agreement with the British El. Ry. Co. whereby the company will supply the city of New Westminster with electricity for a period of 11 years. The company will erect a new substation at Sapperton, B. C.

**VICTORIA, B. C., CAN.**—The British Columbia Tel. Co. will erect a telephone line from Victoria to Nanaimo, a distance of about 60 miles. The cost is estimated at about \$15,000. C. F. Bollschweiler, of Victoria, is superintendent of construction.

**WINNIPEG, MAN., CAN.**—The Legislature has decided to adopt the resolution introduced by T. C. Norris asking that the Public Utilities Commissioners be authorized to investigate and report as to the feasibility of publicly owned hydroelectric power within the Province, with a view of securing for all sections of the Province, rural as well as urban, the benefits now enjoyed by the citizens of Winnipeg in power distribution.

**GLACE BAY, N. S., CAN.**—Plans are being considered for the installation of another boiler, condenser and turbine engine in the municipal electric-light plant.

**SYDNEY, N. S., CAN.**—The Cape Breton El. Co. has issued \$100,000 in bonds, the proceeds to be used for permanent improvements to its system.

**FLESHERTON, ONT., CAN.**—The Georgian Bay Pwr. Co. has sold its plant at Eugenia Falls to the Ontario Hydro-Electric Power Commission for \$60,000. The commission will build two large dams on the Eugenia River and pipe the water through the mountain near the falls, obtaining a head of nearly 500 ft. Electricity generated at the plant will be distributed in towns near Georgian Bay.

**LONDON, ONT., CAN.**—The Water Commissioners are contemplating utilizing the water-power of the Thames River to generate electricity with which to supply the peak load. It is estimated that 500 hp can be developed there. Work will begin on the installation of the machinery as soon as possible.

**ST. CATHARINES, ONT., CAN.**—Plans are being prepared by the Niagara, St. Catharines & Toronto Ry. Co. for the construction of a new 1000-hp substation in St. Catharines, also one at Niagara-on-the-Lake having an output of 500 hp.

**TORONTO, ONT., CAN.**—Sealed tenders will be received by H. H. Adam Beck, chairman Hydro-Electric Power Commission, 709 Continental Life Building, Toronto, until March 17 for material required in construction of about 100 miles of transmission line for operation of 110,000 volts a. c. full wave. Substances and fixtures, special cross-arms, insulators, cable, aluminum cable, insulators, galvanized malleable-iron clamps, galvanized pressed-steel clamps. Plans, specifications and form of contract can be seen and form of tender obtained at the above office.

**WINDSOR, ONT., CAN.**—Preliminary plans for transmitting electricity from Niagara Falls to Windsor, Ont., and the erection of a distributing plant, also for the laying of conduits, are being inspected by R. T. Jeffrys, hydroelectric engineer of Toronto. Overhead lines will be used between Windsor and London, which will be carried on steel towers. Much of the right-of-way has already been secured.

## New Industrial Companies

**THE ADAMANT BATTERY COMPANY**, of Boston, Mass., has been incorporated with a capital stock of \$200,000 to manufacture storage batteries, etc. The directors are: William L. Walker, 48 Beacon Street, Boston, Mass., president and treasurer; R. S. Barlow and A. G. Grant.

**THE ELECTRIC CALL ALARM COMPANY**, of Oklahoma City, Okla., has been incorporated with a capital stock of \$100,000 to manufacture electric alarms by P. A. Huddleson, D. M. Huddleson and A. L. Davis.

**THE ELECTRIC TRANSPORT COMPANY** has been incorporated under the laws of the State of Arizona with a capital stock of \$5,000,000. The incorporators are: Arthur d'Romra, Cape May Point, N. J.; Robert M. Ewing, of Philadelphia, Pa., and Robert H. Harris, of Wilmington, Del.

**THE INCANDESCENT LIGHT COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$10,000 to manufacture and deal in lighting appliances and to do a general manufacturing business. The incorporators are: Fred E. Davis, Jay F. Lawrence and H. H. Hardinger.

**THE JAMISON RAILROAD & ELECTRICAL SUPPLY COMPANY** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$50,000. The incorporators are: N. P. Coffin, W. J. Maloney, of Wilmington, Del., and C. H. Jarvis, of Jamaica, N. Y.

**THE McARTHUR AUTOMATIC TRAIN CONTROL COMPANY**, of Wilmington, Del., has been incorporated with a capital stock of \$250,000 by R. Boyd Cooling, of Wilmington.

**THE McRAY MANUFACTURING COMPANY**, of Indianapolis, Ind., has been incorporated with a capital stock of \$50,000 by John E. McCray, Harold A. McGray and William W. Spencer. The company proposes to manufacture all kinds of electrical machinery and apparatus.

**THE SECURITY ELECTRIC LAMP COMPANY**, of Chicago, Ill., has been incorporated by Samuel Grossman, Louis Grollman and Morris A. Wernberg. The company is capitalized at \$200,000 and proposes to manufacture and deal in electrical appliances.

**THE TEMPLE ELECTRIC COMPANY**, of Temple, Tex., has been chartered with a capital stock of \$200,000 for the purpose of doing a general contracting business. The incorporators are: James F. Ferguson, C. A. Hughes and J. E. Love.

**THE VICTOR ELECTRIC & STAMPING COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$200,000 to manufacture all kinds of electrical and novelty goods. The incorporators are: Morris Goldreich, Joseph Feniger, M. A. Riegler, B. Feniger and C. A. Cornsweet.

**THE ZENITH LAMP COMPANY**, of Boston, Mass., has been incorporated with a capital stock of \$75,000 by F. H. Radford, of Boston, G. O. Willey, of East Haven, and G. M. Fadden, of Boston. The company proposes to manufacture and deal in electrical appliances.

## New Incorporations

**EAST ST. LOUIS, ILL.**—The East St. Louis Electric & Gas Co. has been incorporated with a capital stock of \$1,000,000 for the purpose of doing a general contracting business. The incorporators are: James F. Ferguson, C. A. Hughes and J. E. Love.

**ALEXANDRIA, IND.**—The Alexandria Electric & Gas Co. has been incorporated with a capital stock of \$100,000 for the purpose of doing a general contracting business. The incorporators are: James F. Ferguson, C. A. Hughes and J. E. Love.

**KNIGHTSOWN, IND.**—The Knightsown Electric & Gas Co. has been incorporated with a capital stock of \$100,000 for the purpose of doing a general contracting business. The incorporators are: James F. Ferguson, C. A. Hughes and J. E. Love.

**HOUSTON, TEXAS**—The Houston Electric & Gas Co. has been incorporated with a capital stock of \$1,000,000 for the purpose of doing a general contracting business. The incorporators are: James F. Ferguson, C. A. Hughes and J. E. Love.



officers are: G. W. Boynton, president, and C. O. Grant, treasurer, both of Houlton, and C. P. Barnes, clerk.

**YARMOUTH, MAINE.**—The Royal River & Mfg. Co. has been incorporated by John Tanner, Philip F. Nestel and Walter B. Allen. The company is to be capitalized at not less than \$150,000 and proposes to generate and distribute electricity for lamps and motors in the towns of Yarmouth and Freeport.

**GRIFFIN CORNERS, N. Y.**—The Fleischmann Tel. Co., has been incorporated with a capital stock of \$25,000 by A. H. Todd, George A. Speenburgh and Sara C. Todd, of Griffin Corners.

**ALLENTOWN, PA.**—A charter has been granted to the Lehigh Lt. & Pwr. Co. with a capital stock of \$200,000. This corporation was formed by the merger of ten companies.

**GREEN LANE, PA.**—A charter has been granted to the Green Lane Lt., Ht. & Pwr. Co. with a capital stock of \$5,000. The company will operate in and around Green Lane.

**HARRISBURG, PA.**—Charters have been granted to the Upper Chichester Township El. Co. and the Lower Chichester Township El. Co., both to operate in Delaware County. Each company is capitalized at \$5,000.

**PITTSBURGH, PA.**—The McKee's Rocks Lt., Ht. & Pwr. Co. has filed articles of incorporation at Dover, Del. The company is capitalized at \$150,000 and will generate electricity for lamps, heat and motors. The incorporators are: S. L. Lambert and G. G. Williams, of Pittsburgh, and Homer Lambert, of McKee's Rocks.

**BISHOP, TEX.**—The Bishop Wtr. & Lt. Co. has been incorporated with a capital stock of \$50,000 by F. Z. Bishop, R. R. Hall and H. T. Ellsworth.

**MILWAUKEE, WIS.**—The Wisconsin Ry., Lt. & Pwr. Co. has been incorporated with a capital stock of \$1,000 by N. F. Adams, J. B. Black and J. G. Hardgrove.

**TORONTO, ONT., CAN.**—The Dominion Trac. & Ltg. Co. has been incorporated with a capital stock of \$12,500,000 for the purpose of generating and distributing electricity for lamps, heaters and motors.

## Trade Publications

**ELECTRIC SIGNS.**—The Greenwood Advertising Company, 500 Charles Street, Knoxville, Tenn., illustrates and briefly describes in a thirty-two-page booklet some recent examples of electric signs designed for advertising purposes.

**INSULATORS.**—The Brookfield Glass Company, 2 Rector Street, New York, has recently sent out a twelve-page catalogue which illustrates forty-two types of its insulators, among which are pin insulators for 40,000 volts and a suspension-type insulator.

**LAMPS.**—The General Electric Company is distributing Bulletin No. 4850C, which deals with the standard line of multiple drawn-wire tungsten lamps for ordinary commercial circuits. It is divided into four parts—construction, classification, uses and application.

**MOTORS.**—Catalog No. 177 of the Sprague Electric Works of General Electric Company, New York, contains brief illustrated descriptions of generators, motors, electric equipments for printing machinery, exhaust-fan outfits, electric hoists and other apparatus.

**VACUUM CLEANERS.**—A folder referring to "Invincible" vacuum cleaners, manufactured by the Electric Renovator Company, Pittsburgh, Pa., illustrates and gives names and prices of nine types of its cleaning apparatus. The publication will interest central-station men.

**WIRE.**—The Bridgeport Brass Company, Bridgeport, Conn., gives a little advertising talk on its "Phono-Electric" wire on a 4-5-in by 5-in card that is being distributed. The suggestion is given to put up a section of its wire on the hardest spot in the line and watch results.

**LIGHTING.**—"How to Figure Illumination" is the title of a twenty-page booklet published by the Sunbeam Incandescent Lamp Works of General Electric Company. The object of this bulletin is to acquaint the general public with the most simple and up-to-date method of designing commercial and industrial illumination installations.

**PHOTOMETERS.**—A four-page folder issued by the Leeds & Northrup Company, Philadelphia, gives two illustrations and a brief description of its double-arm exploring mirrors, which are used for obtaining distribution curves of arc lamps and other large units. Catalog No. 60 refers to the Reichanstat precision photometer and accessories and deals briefly with potentiometers also.

**ELECTRICITY IN BAKERIES.**—Bulletin No. A4073 of the General Electric Company deals with the electric equipment of bakeries and refers to the sanitary advantages derived from such arc equipment and the efficiency, economy of space, convenience, cost and maintenance of apparatus in bakeries equipped with electric motors. It refers also to electric lighting and to electrically heated ovens for bakers' use.

**WOODEN LIGHTING FIXTURES.**—In the 1913 catalog (No. 15) of the W. B. Brown Company, Bluffton, Ind., a number of wooden electric lighting fixtures are illustrated and described. Some of these fixtures, such as those of mahogany exhibited at the recent Peoria electrical show, are really beautiful, and the assortment is one that attracts a good deal of attention wherever it is shown.

**COOKING DEVICES.**—In a twelve-page catalog the Berkeley Electric Cooler Company, Berkeley, Cal., presents an illustrated description of its new electric automatic cooker, for which special advantages are claimed. It differs from the fireless cooker in that heat is supplied regularly to keep the cooking temperature constant. The demand being only 550 watts, the cooker can be connected at any lamp socket.

**OIL ENGINES.**—Diesel oil engines of the stationary type, rated at from 75 hp to 450 hp, form the subject matter of Bulletin No. 106, published by the Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo. A diagram of the main working parts and a curve showing the principle of operation illustrate the reading matter, which also includes the results of tests made with this prime mover in various industries.

**ELECTRICITY IN CONSTRUCTION WORK.**—The General Electric Company has issued a bulletin, No. A4080, devoted to the use of "Electricity in Excavation and Construction Work," which deals with both the generating of the energy and its use through motors. It touches on the advantages of electric service and refers briefly to the use of motors in connection with the Panama Canal, the Catskill Aqueduct, the New York Barge Canal and in general building construction.

**ELECTRIC DRILLS.**—Heavy-duty electric drills for alternating current are illustrated in Bulletin E-22, issued recently by the Chicago Pneumatic Tool Company, Chicago, Ill. Bulletin E-26 refers to Universal electric drills operating on direct or alternating current; heavy-duty electric drills form the subject matter for Bulletin E-27, and Bulletin 34 G is devoted to descriptive and illustrated matter referring to air receivers, after-coolers, air-line drain traps, reheaters and economizers.

**STORAGE BATTERY.**—A revision of a paper read by Mr. Walter E. Holland at the twenty-sixth annual meeting of the Association of Edison Illuminating Companies, entitled "Characteristics of the Edison Storage Battery," has been issued as Bulletin No. 1011 of the Edison Storage Battery Company, Orange, N. J. Descriptive illustrations of the battery are given, and a number of curves showing the results of various tests and also a reference table of electrical data on the individual-cell basis are included.

**BATTERIES.**—The Edison Storage Battery Company, Orange, N. J., has recently issued a number of publications of interest to present and prospective users of batteries. "The Edison Storage Battery for Railway Signals" is the title of a twenty-four-page pamphlet which gives a comprehensive illustrated description of its subject matter. In a brochure of thirty-four pages the subject of "Train-Lighting Batteries" is broadly treated, and much information is given. A four-page oblong folder gives instructions for operating the "B" type Edison storage battery for use in automobile and launch lighting, ignition and with private fire and burglar alarm systems, etc. General information and instructions relating to the Edison storage battery for electric vehicles are contained in an eight-page booklet referring to the "A" types.

## Business Notes

**THE CARL M. GREEN COMPANY** has moved its Detroit office from the Penobscot Building to the Free Press Building.

**THE SIMPLEX ELECTRICAL COMPANY** has changed its name to Simplex Wire & Cable Company. No change of management or interest accompanies this alteration of name.

**THE SHELTON ELECTRICAL COMPANY,** manufacturer of electric vibratory appliances, massage machines and hair dryers, has moved its New York office from 13 West Forty-second Street to 4 East Forty-second Street.

**THOMPSON & MACPHERSON.**—Messrs. Guion Thompson and R. G. MacPherson, formerly of the engineering department of the American Brass Company, have opened a consulting engineering office at 27 West Main Street, Waterbury, Conn. Mr. Thompson is an electrical engineer and Mr. MacPherson a mechanical engineer.

**H. R. WILSON MACHINERY COMPANY.**—Mr. Harold R. Wilson formerly associated with the firm of Arthur S. Partridge, St. Louis, has organized the H. R. Wilson Machinery Company to conduct a general second-hand electric and steam machinery business, with offices in the new Bank of Commerce Building, Broadway and Pine Streets, St. Louis.

**MR. R. R. LIVINGSTON,** 2 Rector Street, New York, consulting and constructing engineer, who designed among other work the hydroelectric stations of the Auglaize Power Company, near Defiance, Ohio, has opened a Chicago office in the People's Gas Building under the style of "Robert R. Livingston, hydraulic engineer." Mr. A. P. Peck is the resident engineer. The detail engineering work will be handled in the New York office, while all new work and construction for the Middle West will be looked after in the Chicago office.

**LACLEDE-CHRISTY CLAY PRODUCTS COMPANY.**—At the annual meeting of the Laclede-Christy Clay Products Company the following officers were elected: President, John L. Green; vice-president, treasurer and general manager, Richard D. Hutton; second vice-president, Montague Lyon; secretary, W. J. Westphalen; assistant secretary and assistant treasurer, William T. Christy. Other appointments made at the meeting were: Gas engineer and manager of the chain-grate stoker department, Roger W. Polk; manager general sales department, Henry K. Lackland, and manager of the glass industry department, John H. McKelevy.

## Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Doncker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Doncker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travill, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL DEVELOPMENT LEAGUE, INC. Secretary, P. S. Dodd, 29 West 39th St., New York.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Annual convention, Buffalo, N. Y., Feb. 11-13.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 43d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Borell, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. F. Chubbuck, Peoria, Ill.

ILLINOIS STATE ELECTRICAL SOCIETY. Secretary, J. C. ... Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th Street, New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. I. Sherrill, 81 New St., New York. Meeting, first Monday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month, at Levee Landing.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. I. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Juffhet (president), F. L. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower, Spanenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Steddie, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 27-29, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Mottishaw, 41 Marlin Building, Union, N. Y.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick A. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, J. C. Mathin, Engineering Societies Building, 29 West 39th St., New York. Annual meeting, Chicago, June, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION CANADIAN SECTION. Secretary, T. S. Young, 226 King St., West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF NEW YORK STATE. Secretary, R. E. Riechel, 300 Madison St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF PENNSYLVANIA. Secretary, M. H. Hazlett, Altoona, Pa.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF WASHINGTON. Secretary, Helmut Silvester, 18 Washington St., Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF VIRGINIA. Secretary, A. H. Jones, McGuire Co., York, Va. Meeting, York, Va., May 21-23.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF WISCONSIN. Secretary, S. J. Bell, David City, Wis.

NATIONAL ELECTRIC LIGHT ASSOCIATION OF NEW ENGLAND. Secretary, J. C. Mathin, 300 Madison St., New York.

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NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. K. Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARMEN'S ASSOCIATION. Secretary, H. H. McKinney, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. 'Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkenney, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

## Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 21, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,050,780. SYSTEM AND APPARATUS FOR RECORDING ELECTRIC SIGNALS; W. W. Alexander and E. T. Keim, Denver, Col. App. filed April 9, 1911. Electromechanical telegraphing receiving instrument.
- 1,050,796. PROCESS FOR SEPARATING VANADIUM FROM URANIUM; W. F. Blecker, Canonsburg, App. filed May 24, 1912. The vanadium is precipitated by electrolytic action.
- 1,050,797. DISINFECTOR; L. Block, New York, N. Y. App. filed March 13, 1912. Telephone mouthpiece guard.
- 1,050,812. INDICATOR FOR AUTOMOBILES; D. Dann, Chicago, Ill. App. filed April 27, 1912. A pointer at the rear to indicate turning.
- 1,050,824. FIRE ALARM; J. E. Goodwin, Cumberland Gap, Tenn. App. filed Feb. 23, 1912. Weight-actuated electrical switch-control mechanisms.
- 1,050,827. TIMER FOR ELECTRIC WELDING MACHINES; J. A. Leiby, Washington, D. C. App. filed May 17, 1912. Automatic electric stopping mechanism.
- 1,050,830. TROLLEY; E. P. Hinchberger, Pittsburgh, Pa. App. filed May 4, 1912. Yielding extended side plates.
- 1,050,885. TERMINAL FOR ELECTRIC WIRES; G. R. Welch, Detroit, Mich. App. filed May 3, 1912. Spring wire jaws.
- 1,050,887. STORAGE BATTERY; J. D. White, Niagara Falls, N. Y. App. filed Dec. 15, 1911. Interlocking flange support for the cover.
- 1,050,893. TERMINAL FOR BATTERY PLATES; T. A. Willard, Cleveland, Ohio. App. filed April 1, 1909. Rubber-covered binding post.
- 1,050,908. TROLLEY MECHANISM; L. R. Barker and E. C. Diterich, Riverton, Kan. App. filed Aug. 19, 1912. Short-pole support for cranes, etc.
- 1,050,912. ELECTRIC RESISTANCE; F. Bolling, Frankfurt-on-the-Main, Germany. App. filed June 20, 1912. Sheet-metal clamps for thin sheets.
- 1,050,939. AUTOMATIC SINGLE-POLE ELECTRIC SWITCH; W. E. Gorton, St. Joseph, Mo. App. filed May 16, 1912. Pneumatically controlled switch for pumping system.
- 1,050,960. ELECTRICAL RECIPROCATING MECHANISM; J. C. Lincoln, Cleveland, Ohio. App. filed Aug. 12, 1904. Sectional lensoid.
- 1,050,978. PROCESS OF MANUFACTURING CYANIDE OF HYDROGEN; I. Mosicki and C. Jablczynski, Freiburg, Switzerland. App. filed July 7, 1910. Electrochemical process. (For machine see patents Nos. 930,213 and 933,094.)
- 1,051,009. TROLLEY HARP; G. W. Rickard and E. C. De Voe, Dayton, Ohio. App. filed March 22, 1912. Cushioned support.
- 1,051,035. METHOD OF MAKING TRANSPARENT QUARTZ GLASS; A. Voelker, Beul, Germany. App. filed Feb. 18, 1911. A tube is formed, remelted and drawn and again melted.
- 1,051,036. ELECTRIC RESISTANCE MELTING FURNACE; A. Voelker, Beul, Germany. App. filed Feb. 18, 1911. Details of quartz furnace.
- 1,051,056. LEVITATING APPARATUS FOR CONVEYING AMMUNITION, ETC.; E. Bachelet, Mount Vernon, N. Y. App. filed Feb. 15, 1912. Electromagnetically suspending and moving projectiles.
- 1,051,060. APPARATUS FOR ELECTROLYZING LIQUIDS; E. Balke, Charlottenburg, Germany. App. filed Sept. 24, 1912. Electrode spacers for making chloride of lime.
- 1,051,065. ELECTRIC SMELTING; G. H. Benjamin, New York, N. Y. App. filed Nov. 6, 1911. A charge containing iron and nitrogen is submitted to electric current and the action of magnesia.
- 1,051,091. ELECTRIC RAILWAY SAFETY DEVICE; E. J. Dunne, Jersey City, N. J. App. filed July 3, 1912. Danger signal is raised when the track is open.
- 1,051,098. ALTERNATING-CURRENT RHEOSTAT FOR POLY-PHASE CIRCUITS; W. H. Gaulke, Milwaukee, Wis. App. filed Jan. 3, 1911. For controlling synchronous induction motor.

- 1,051,109. TELEPHONE SYSTEM; E. R. Hobbs, Buhl, Idaho. App. filed Nov. 28, 1908. Central-station, common-battery, two-wire, multiple-circuit system.
- 1,051,113. TELEPHONE; P. L. Jensen and E. S. Pridham, Napa, Cal. App. filed April 22, 1912. Parts of the conductor are subjected to a magnetic field.
- 1,051,118. TELEGRAPHIC RECORDING INSTRUMENT; E. T. Keim and W. W. Alexander (deceased), Denver, Col. App. filed July 29, 1911. The electrically actuated impression member is movable.
- 1,051,120. PROCESS OF AND FURNACE FOR SECURING PRODUCTS FORMED IN GASES AT HIGH TEMPERATURES; C. F. R. von Koch, Stockholm, Sweden. App. filed Oct. 25, 1911. The products are cooled by expansion.
- 1,051,131. APPARATUS FOR THE ENDOTHERMIC REACTION OF GASES; W. S. Lee, Charlotte, N. C. App. filed March 4, 1911. Fixation of nitrogen between two continuously moving surfaces.
- 1,051,133. FIRE AND BURGLAR ALARM; C. Liaci, New Haven, Conn. App. filed Sept. 11, 1911. Central electric-alarm device mechanically connected to the protected point.
- 1,051,147. STORAGE-BATTERY PLATE; W. M. McDougall, East Orange, N. J. App. filed July 30, 1910. Protecting and reinforcing frame.
- 1,051,148. SELECTIVE SIGNALING SYSTEM; J. McFell, Chicago, Ill. App. filed July 6, 1909. Party-line common-battery telephone.
- 1,051,156. ORGAN TUNER'S KEYBOARD PLAYER; M. J. Olson, Ishpeming, Mich. App. filed Nov. 12, 1910. For operating keys from a distance.
- 1,051,182. FEED-WATER PURIFIER; F. E. Ackerman, Pittsburgh, Pa. App. filed May 18, 1911. Boiler-feed water is electrolyzed.
- 1,051,194. PROCESS OF EFFECTING REDUCTION AND PRODUCING FERRO-SILICON; E. A. Byrnes, Waukegan, D. C. App. filed June 26, 1907. Vitrified molten resistor column.
- 1,051,219. PUSH-BUTTON ELECTRIC SWITCH; H. E. Grabau, New York, N. Y. App. filed Feb. 23, 1911. Single button with rocker.
- 1,051,228. ELAPSED-TIME ELECTRIC SIGNAL; F. C. Hirdler, Oklahoma, Okla. App. filed Oct. 18, 1910. Telephone-call apparatus.
- 1,051,238. ELECTRICAL REGULATING APPARATUS; C. Lamboeuf, Belfort, France. App. filed Jan. 13, 1911. Starting generator of reversible rolling-mill motors.
- 1,051,259. DYNAMO-ELECTRIC MACHINE; W. H. Powell and R. B. Williamson, Milwaukee, Wis. App. filed Nov. 21, 1910. Ventilation of rotors.
- 1,051,261. ELECTRIC STORAGE-BATTERY PLATE; A. Ricks, Gross Lichterfelde Ost, Germany. App. filed April 30, 1912. Lead oxide, lead and aluminous substance and a sulphuric acid and phenol hardening agent.
- 1,051,262. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed Feb. 1, 1910. Requires a trolley wire or rail.
- 1,051,263. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed Feb. 1, 1910. Automatic signal when the trolley pole is dislocated.
- 1,051,264. RAILWAY SIGNALING SYSTEM; A. Rioux, Nashua, N. H. App. filed July 29, 1910. An alarm in the cab in case of a broken rail.
- 1,051,270. SELECTIVE SIGNALING SYSTEM; H. O. Rugb, Sandwich, Ill. App. filed Feb. 15, 1910. Central telephone station calling system.
- 1,051,271. SIGNALING SYSTEM; H. O. Rugb, Sandwich, Ill. App. filed Nov. 25, 1910. Selective telephone signal receiving and sending devices.
- 1,051,303. PROCESS OF PRODUCING NITROGEN COMPOUNDS; C. E. Acker, New York, N. Y. App. filed March 23, 1909. Producing sodium cyanide by reacting with nitrogen and carbon reagents on an alloy of lead sodium and vanium.
- 1,051,349. ELECTROTHERAPEUTICAL APPARATUS; A. W. Neitro, Seattle, Wash. App. filed July 11, 1910. Electric light bath cabinet.
- 1,051,373. INDUCTION GENERATOR FOR IGNITION PURPOSES; J. L. Milton, Chicago, Ill. App. filed June 17, 1907. The inductor may be accommodated to a reversible motor.



# Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER and AMERICAN ELECTRICIAN

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NEW YORK, SATURDAY, FEBRUARY 8, 1913

No. 6

## Patent Legislation

It has been announced in Washington that efforts to secure patent legislation during the present session of Congress will be dropped. The time is too short and the subject too intricate for thorough consideration until next winter. Other matters are engrossing Congress at present, and it is not likely that the extra session will provide suitable occasion to go into the matter properly. What could be done, and what ought to be done now to avoid further delay, is to appoint a competent non-partisan commission to conduct a thorough investigation and report a year hence. This program, which we have long urged, can easily be launched in the time remaining before the close of the session.

## Co-operative Manufacturing

The decision handed down last Monday by the Supreme Court in the United Shoe Machinery case, it should be observed, covers very limited ground and does not bear at all upon the patent situation or the legality of the famous shoe-machinery leases. These leases were made after the consolidation of manufacturers took place in 1899, while the Supreme Court reviewed only the question, which came up to it on a writ of error from the Massachusetts District Court, whether two counts in the indictment charging the 1899 merger as unlawful ought to stand. The lower court threw out these two counts and is now sustained by the final authority, on the general ground that when two or more manufacturers who turn out different component parts of a fabricated product join together as one concern for the purpose mainly of economy there is no illegal restraint of trade involved. The propriety of the subsequent leases and the lawfulness of subsequent acts of the Shoe Machinery company, in the light of the Sherman act and the patent laws, were not under review in the present instance.

## New York State Hydroelectric Scheme

The Conservation Commission of the State of New York is evidently determined to push legislation for a comprehensive scheme of hydroelectric development and high-tension transmission under state ownership and management. Inspiration for such a movement is found in the system of the Hydro-Electric Power Commission of Ontario, the Niagara division of which has been in successful operation for over a year. However, the New York scheme, which was outlined in these pages on Jan. 4, is open to legitimate engineering and commercial attack from all sides. For instance, it is proposed to transmit hydroelectric energy to New York City, and the nearest electrical development from which the energy can be derived is ap-

proximately 170 miles from the city. Even granting that the commission will have enough energy to make an impression on the New York market, no center like New York in the present state of the art can afford to depend exclusively on hydroelectric energy transmitted that distance. To-day the city of Buffalo is served over eight independent lines from Niagara Falls, 25 miles away, and notwithstanding the fact that these lines can be switched together in any way, the transmission company is unable to give absolutely continuous service. Moreover, it will be necessary for any municipality desiring to contract for state hydroelectrical energy to obtain a certificate of convenience and necessity from one of the public service commissions of the State. Where utilities already in existence are rendering efficient and reasonable service it is doubtful if a commission will permit competitive conditions; but should even this obstacle be overcome, the municipality will still be confronted with the problem of disposing of its bonds.

## The Distribution of Producer Gas

An abstract of an important paper read before the British Institution of Civil Engineers recently describing a producer-gas plant unique in the history of the art in that it is designed for a general distribution of gas for power purposes alone is given in the *Digest* in this issue. The gas producer is an old acquaintance. Many plants have been installed for general power purposes or for purposes of electrical supply and fairly satisfactory results have been obtained. The present system bears the same relation to these casual producers that the great electric central station does to the isolated plant. The particular gas concern which is now under consideration is the South Staffordshire Mond Gas Company, utilizing eight 20-ton producers, seven of which are kept in regular use. No arrangement is made for storage, the speed of the blowers on the producers being modified to keep pace with the demand for gas, which passes from the producers through cooling and purifying apparatus and thence to steam-driven gas compressors delivering the gas at high pressure, about 5 lb. per sq. in., to the distributing main. The thermal value of the fuel gas produced is about 1,000 Btu. per cu. ft., and the output at the peak of the load reaches the rate of 1,000,000 cu. ft. per hour. The area covered in the operation of the plant is 123 sq. miles and about 30 miles of mains are in regular use. Most of them are of steel in diameter from 36 in. down. The distribution of gas at high pressure for power and heating purposes is a thing long ago proposed and tried on a small scale, but in view of the present work projects of this kind from now on must be taken as serious enterprises. The South Staffordshire Company is selling gas at an

average price of 3.5 cents per 1000 cu. ft., and is said to be making money at that price. The output is used for production of power in gas engines and for various forms of heating, new uses being continually found for the product. Although as stated no storage is used in the system, yet a storage equipment could easily be added and it might in the long run prove advantageous in steadying the supply. Gas of the kind here distributed is equivalent in cost to the ordinary thermal value of lighting gas sold at about 14 cents per 1000 cu. ft. Reduced to an output basis this amounts to about  $\frac{1}{3}$  cent per hp-hr. when the gas is utilized in large engines running at fairly steady load.

It would be exceedingly interesting for someone to work out the application of such a system in connection with electrical distribution. It is hardly to be supposed that the small gas engine, even with cheap gas, can make much headway against the electric motor with fairly cheap energy supply, the engine losing in convenience more than it gains in economy. However, in cases where a large electrical distribution system is under way it is by no means impossible that fuel gas distributed at high pressure and utilized in large directly driven units for the operation of auxiliary stations might not prove economical and extremely convenient. Gas engines have been frequently suggested and tried as auxiliaries for hydroelectric installations, and where water-power is used to furnish part of the output of a central station, the possibility of locating gas auxiliaries at strategic points and supplying them with fuel from a single gas generating station is one well worth considering. Likewise in railway work where it is desired to use direct current on the motors the possibility of high-pressure gas distribution to feeding stations along the line as a substitute for overhead electrical transmission is certainly worth investigation. All electrical questions aside, so far as generation is concerned, the possibilities of a very cheap fuel gas supply for mere heating are worth serious consideration. Without attempting to forecast the future, since prophecy after the fact is the only safe kind, it does seem that the future city should be freed from the present smoke nuisance. And the distribution of fuel gas on a very large scale is the readiest means to this highly desirable end. Between fuel gas and electric service the city of half a century hence should be completely free from every sign of smoke, as free as some of the cities of the Middle West were during the best days of the natural-gas industry. Let the cheap fuel-gas supply come, for in the long run it will help a good deal more than harm the business of furnishing electrical energy.

### Graphical Representation of Light Distribution

It frequently happens that in the course of evolution of some branch of exact science the later developments are out of sympathy with the earlier developments. This has happened, for example, in a number of branches of mathematics. Thus, the ordinary theory of modern arithmetic includes negative numbers, as well as positive numbers. Yet in the history of arithmetical development, according to Sir Robert Ball, the minus sign is not found until the fifteenth century; so that, although the process of subtrac-

tion was known much earlier than this, the notion of negative numbers came into existence later than this. The old arithmetic was not wrong; it was merely undeveloped. The new arithmetic includes and extends the old, the extensions having taken place dissymmetrically and in unexpected directions.

When the science of illumination entered its quantitative stage of evolution, it started with a point source of light. Photometry began business with candles, which had to be fitted in to the scheme of point sources by a doctrine of equivalents. At a later stage the concept of luminous flux, with its unit the lumen, modified the entire theory. It came to be realized that luminous flux was a more natural and fundamental concept than candle-power, or luminous intensity. In the modern theory candle-power is no longer the primordial concept. It is the ratio of flux to the solid angle through which that flux is emitted. Nevertheless, the art and literature of the subject are so inextricably tied up with candles and candle-power that there is no immediate hope of changing the existing order of photometric things. The fundamental unit should be the lumen, and the intensity of a source should be stated in terms of the lumen, but law, custom and literature stand in the way.

In the article on page 297 Mr. R. F. Pierce attacks the term candle-power and seeks to substitute luminous flux in its place. The same numeric  $4\pi$  intrudes into this proposal as in electromagnetic units. We think, however, that the consensus of qualified opinion will sympathize with him as to the desirability of the scientific order he advocates. On the other hand, it is very doubtful whether such a change is feasible at the present time. The article points out the misconceptions that a zonal-candle-power diagram may produce in untrained minds. Two ingenious polar diagrams are offered, by way of substitution—namely, one a polar diagram so drawn that its area over any angular distance measures the flux emitted by the source within the corresponding spherical angular zone, and the other a polar diagram such that the radius vector at any angle measures the integral of the area, on the first diagram, up to that angle. The first diagram is therefore designed to indicate the flux zonal distribution, as distinguished from the usual candle-power zonal distribution, while the second gives the total flux distribution from zenith to nadir.

The utility of the two new diagrams cannot be denied—but the exclusion of the regular zonal candle-power diagram is undesirable. In many practical cases the candle-power distribution curve is just what the engineer needs. The fact is that three quantities are ordinarily required in the graphical display of the photometric properties of any lamp, namely, (1) the usual zonal candle-power polar curve; (2) the flux distribution, zone by zone, and (3) the total flux between any assigned zonal limits, including the total flux emitted between zenith and nadir. According to the plan of Mr. Pierce one curve would be needed for each of these presentations, or three curves in all, because items (2) and (3) call for separate curves or halves of the sheet. Either the Rousseau diagram or the Kennelly diagram, appended to a polar candle-power diagram, presents items (2) and (3) conjointly; so that with either of those dia-

grams all three items can be given on the same sheet, one-half being assigned to the candle-power distribution curve and the other half to the flux. The chief value of the Pierce method resides in the enforced use of the lumen per unit area for illumination rather than some expression involving the conception of point light source. To the extent that it encourages the substitution of the term lumen per square foot for foot-candle, the method should be welcomed by illuminating engineers.

### A Daring Scandinavian Transmission Project

In this issue are given some details of a bold and interesting project for long-distance international transmission of energy from Trollhättan, Sweden, to Copenhagen. The great Trollhättan plant, described in our columns Jan. 11, 1913, is itself a notable example of enterprise in the development of a great national resource. That some of the energy should be transmitted a distance of 200 miles is in itself nowise remarkable, but that the transmission line should extend far to the southward and under the strait into the ancient capital of Denmark lends something of startling novelty even to a project involving no sensational distance. Still more remarkable, from the standpoint of American conservatism, is the report of the engineers to whom the investigation of the project was intrusted by the Swedish government. After deliberate investigation of all the circumstances and the probable costs of carrying out the generation and transmission of some 20,000 kw to Copenhagen, the engineering commission found in favor of the Thury direct-current system as against the ordinary three-phase system. It is especially worthy of note also that the decision was not only in favor of direct current but also of the transmission thereof with a ground return.

We have had occasion several times to comment on the Thury system and also on that remarkable set of experiments which was tried to determine the efficacy of ground return, looking forward to just such a case as the one that has arisen now. We have consistently taken the attitude that while direct-current transmission has never appealed to American engineers, it is nevertheless neither dead nor sleeping, but very much alive, and the present situation well bears out this judgment. It is perfectly well understood that direct-current high-voltage transmission by constant current is a method of special rather than general applicability, and consequently it is not surprising to find that the conditions in the case here under discussion were somewhat exceptional, in a way that gave a fair chance for the employment of direct current.

The comparison was made on the basis of transmitting about 20,000 kw at fairly steady load into Copenhagen, and the comparison of costs was made between three-phase transmission of the usual sort at 100,000 volts and the Thury system at 90,000 volts. The advantage of the latter lies in the relative simplicity of the insulation problem, a thing which comes into play only at the extremely high voltages necessary for the economical transport of energy over very long distances. A large and steady load is also a favoring condition of no small importance. The matter of insulation, however, proved the determining factor in the

case, and its importance was emphasized by the situation which arises near the receiving end of the line. The Strait of Öresund lies between Helsingborg, the southern terminus of the proposed land line, and the island of Zealand, on which Copenhagen is situated. To cross this strait, nearly  $3\frac{1}{2}$  miles wide, by cables carrying alternating current at 100,000 volts was adjudged an utterly impracticable proposition. It therefore became necessary to plan for a reducing station at Helsingborg, bringing the pressure down to 20,000 volts for transmission under the strait, beyond which it could either continue the relatively short distance to Copenhagen at 20,000 volts, or the electromotive force could be stepped up again if desirable. On the other hand, submarine cable can actually be obtained for 90,000 volts direct current, according to the report of the Swedish engineers, and consequently the energy could be carried through to Copenhagen without any reduction in voltage on account of the submarine work. This matter alone put the alternating-current project at a serious disadvantage, rendered even more formidable by the facility with which a grounded line can be used in operating at constant current. When the project was worked out in its details the alternating-current plan had little to recommend it save its orthodoxy, and orthodoxy does not necessarily help to pay dividends.

The comparison between the various items of expense in the two plans is a very instructive one. In the generating station the three-phase equipment had the advantage in first cost, as might have been expected, to the extent of nearly 30 per cent, owing to the necessity of using more units and more expensive units with the direct-current scheme. Two three-phase units were sufficient for the alternating-current plan, while the Thury system required twenty generators in four groups, each coupled to a 5000-hp turbine. In the line structure the tables are completely turned, the cost of the direct-current line being only about half that of the alternating-current line, not even taking into the account the difference in the cost of the cables and the presence of at least one extra transformer station in the alternating-current project. The cables for the three-phase transmission cost two and one-half times as much as did the direct current. The grand total for the alternating-current project reached \$1,593,000, as against \$1,202,000 for the direct-current project advised. When everything was footed up for the rival projects the estimated annual expense for the direct-current transmission was \$6.75 per kw, as against \$12.43 per kw for the three-phase project, to say nothing of the fact that the multiple transformations necessary with the latter would cause it to operate at a lower efficiency, thus yielding a materially small amount of power for the final distribution. All this is striking evidence of the great usefulness of direct-current transmission under conditions which are favorable to its economical use. No engineer would take the ground that such conditions always exist, even in that region of extremely high voltages in which direct current is known to have marked advantages as regards insulation. Beyond any doubt, however, high-voltage transmission at constant current is very far from being a dead issue, and it is not at all out of competition when high-voltage projects are to be considered.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Transpacific Wireless Stations

The Marconi Wireless Telegraph Company has placed contracts with the J. G. White Engineering Corporation, New York, for the erection of eight wireless telegraph stations, two pairs for Atlantic service and two pairs for Pacific service. Receiving and sending stations 30 miles apart will be constructed at Oahu, in the Sandwich Islands; Tamales Bay and Bolinas, Cal.; near Belmar, N. J., and in eastern Massachusetts at a point not yet definitely selected. These stations will be part of a globe-girdling system which will continue to the East by way of Japan and thence ultimately to India. Twelve towers ranging in height from 400 ft. to 450 ft. will be spread out over a semicircle covering a square mile at each station, and it is estimated that the range of each station will be from 4000 to 6000 miles.

### Convention of Electric Vehicle Association to Be Held in Chicago

It is considered very probable that the next annual convention of the Electric Vehicle Association of America will be held in Chicago some time in October or November. Although definite arrangements have not yet been concluded, the advantages of Chicago as the next convention city have been so well and convincingly presented that the officers of the Electric Vehicle Association of America are strongly inclined to accept the proposition, seeing that the two previous conventions were held in New York and Boston respectively.

### Movement for State Hydroelectric System in New York

Bills were introduced this week in the New York State Legislature authorizing the Conservation Commission to embark on a system of development and distribution of electricity from stored water along the line of the work of the Hydro-Electric Power Commission of Ontario. The bill will create a hydroelectric bureau in the commission, authorized to develop and distribute electrical energy at cost to municipalities. The commission is to have power of condemnation and may build storage dams, power plants and transmission lines. For this purpose the State is divided into development districts, and the bills create the first, or capital, district around Albany, to be served by the power company from the Crescent and Visscher's Ferry dam of the Barge Canal. It is provided that the initial cost, which it is estimated will not be more than \$650,000 on plants to develop 12,000 hp, shall be paid by the State, and the cost of the energy developed to consumers shall be enough to pay the interest on this money and the upkeep of the plants and transmission lines and to wipe out the initial expense in fifty years. A system capable of developing and transmitting 12,000 hp will be first built, and this will later be enlarged to handle 35,000 hp. It is estimated that this development can be undertaken and an auxiliary steam plant installed to keep the output of electricity up to that standard, even in low-water periods, for about \$1,500,000. The municipalities which it is expected will be served from the stations are located at distances ranging

from 6 to 13 miles. These municipalities will have to build their own distribution systems, the State bringing its transmission lines only to the city limits.

### Supreme Court Decision on Co-operative Manufacturing

On Feb. 3 the United States Supreme Court handed down a decision in the United Shoe Machinery case which has an important bearing on the interpretation of the Sherman law. The case came up on a writ of error to determine whether two counts in the indictment as construed by the District Court should stand. The District Court in Massachusetts threw out these two counts, and this action the Supreme Court upheld.

Up to Feb. 7, 1899, three separate concerns made most of the shoe machinery in use, but on that date they combined. These concerns, however, did not make the same kind of machinery, but each one made machines for doing some particular part of the work. Since the date of consolidation they have ceased to sell their machines, but instead lease them under the patent rights and require the lessees to use no other machines but theirs.

The District Court construed the indictment of the merger company—the United Shoe Machinery Company—as confined to the combination of Feb. 7, without regard to the subsequent leases or acts of the company. Thus the question reviewed by the Supreme Court was very limited. The act of combining companies which contributed the separate parts going to make a finished product was held to be entirely proper. In other words, it is not so much the size of the combination as its purpose or intent that constitutes an infringement of the law. The court said, in part:

"The disintegration aimed at by the statute does not extend to reducing all manufacturers to isolated communities of the lowest degree. It is as lawful for one corporation to make every part of a steam engine and put the machine together as it would be for one to make the boilers and another to make the wheels. Until the intent is nearer accomplishment than it is by such juxtaposition alone, no intent could raise the conduct to the dignity of an attempt."

The subsequent leases and the so-called "tying clauses," which are alleged to be legal under the patent laws, were not at issue in the present case. Judgment of the lower court was affirmed.

### Preparations for Chicago N. E. L. A. Convention

As a very large attendance is expected at the annual convention of the National Electric Light Association to be held at the Medinah Temple, Chicago, during the first week in June, the preparations for this event are already well under way. It will not be surprising if the registration at Chicago reaches 7000 or more. A considerable proportion of this number will consist of members and visitors from Chicago and vicinity, and it is not unlikely that an arrangement will be made whereby the registration of the convention attendants representing the Commonwealth Edison Company will be made separately from the registration of the out-of-town delegates. This arrangement, if carried out, will undoubtedly assist in the laborious and high-

pressure work of handling the large throngs that will be in attendance.

While no official announcement has been made as yet of the personnel of local committees, it is learned that Mr. Samuel Insull, president of the Commonwealth Edison Company, Chicago, has accepted President Tait's invitation to be chairman of the entertainment committee for the Chicago convention. One of the first of the local committees to "get busy" will be the hotel committee, and it is understood that Mr. Peter Junkersfeld will act as chairman of this committee, with Mr. E. A. Edkins as secretary. Both of these gentlemen are connected with the Commonwealth Edison Company and can be addressed at 120 West Adams Street, Chicago.

A particular effort will be made to look after the visiting ladies, and it is probable that there will be a large committee of Chicago ladies whose duty it will be to see that all visitors of their own sex are greeted and cared for hospitably, so that the men may be left free to attend to the work of the association.

Arrangements have been completed with Singer, the New York decorator who has had charge of recent N. E. L. A. exhibit effects, to design and execute the decorations for the exhibition hall at Chicago. The manufacturers' displays this year will occupy the great banquet room on the lower floor of the Medinah Temple. By an ingenious use of mirrors and lattice-work surrounding the columns it has been found possible to overcome the effect of the rather low ceiling imposed by the construction of the building, while by employing booth partitions of limited height the vista of the entire room from any given point will not be interfered with.

At a meeting of the transportation committee of the National Electric Light Association held in New York on Jan. 30 preliminary plans for conveying delegates to the Chicago convention next June were discussed. It is the intention of the committee to try to arrange for one or more special trains to the convention from San Francisco and Pacific Coast points, to be known as the Golden Poppy Special No. 2. Mr. E. B. Strong, committeeman from San Francisco, said that the Electrical Development League of San Francisco is creating enthusiasm for such a special tour. Of course, special trains will be run, as heretofore, from New York and also from Southern points. After the convention many of the Pacific Coast delegates contemplate a journey to the Atlantic Coast, stopping at various electrical centers and returning by way of Yellowstone Park.

### Banquet of Patent Law Association

The Patent Law Association held its annual banquet in Washington on Feb. 1, its members and guests listening to addresses by Commissioner of Patents Edward B. Moore, Representatives R. J. Bulkley and Martin A. Morrison, both members of the House patent committee; Mr. C. C. Linthicum, of Chicago; Justice Van Orsdel, of the Court of Appeals of the District of Columbia; Mr. J. E. Laskey, president of the Bar Association of the District of Columbia, and others. The Oldfield patent bill, the prospect of a new building for the Patent Office and other patent matters were discussed by the speakers. Commissioner of Patents Moore made the principal address, and he told his hearers that there was nothing so seriously the matter with the present patent system of the country as to justify its being made completely over, as he said the Oldfield bill would do, if passed. He declared himself for higher fees, for additional officials and for higher salaries.

Representative Bulkley gave as his opinion that the patent laws of the United States are not so much at fault as is the administration thereof. He would have the Patent Office raised to a state of efficiency where no grants would be made not based on real invention, and declared himself

in favor of a new building, increase in personnel and salaries and increase in pension fees for the rehabilitation of the system.

Representative Morrison advocated a patent bureau independent of any department of the government.

### Federal Regulation of Niagara Falls Approved

After wrangling for more than a year the House committee on foreign affairs reached a complete agreement this week on the measure to regulate the use of water for power purposes at Niagara Falls. The measure gives the Secretary of War authority to regulate the diversion of the water at Niagara Falls, but leaves to the New York Public Service Commission the right to control the rates for electricity generated therefrom. No change is made from the present provisions of the Burton act limiting the amount of water to be diverted from the American side of the Niagara River to 15,600 cu. ft. per second.

### Edison Association to Convene at Cooperstown, N. Y.

The Association of Edison Illuminating Companies has completed arrangements to hold its twenty-ninth annual convention at the Hotel Otesaga, Cooperstown, N. Y., during the week beginning Sept. 8. Cooperstown is one of the finest summer resorts in New York State, and may be reached over the lines of the Delaware & Hudson Railroad. The Hotel Otesaga is said to compare favorably with any hotel in the country, and the Country Club at Cooperstown, which possesses an excellent golf course, will also be available for some of the functions. Lake Otesaga, near by, affords facilities for excellent water sports. Work on the various committee reports to be presented at the convention is already under way.

### Electric Vehicles in Fire-Department Service

About 100 members and guests of the Electric Motor Car Club of Boston and the New England Section of the Electric Vehicle Association of America attended a theater party on Jan. 28 at which the use of electrically operated apparatus in fire-department service was featured by cinematograph displays. The hit of the evening was the presentation of a moving-picture play in which a country boy joins a city fire department and has various adventures. These photographs were taken recently at Springfield, Mass., which is probably the largest user of electrically driven fire apparatus in the United States. Views of the parade of electric vehicles in Boston last Memorial Day, when over 225 machines were in line, were also shown.

Prior to the entertainment, which took place at Keith's Bijou Dream Theater, a dinner was held at the Hotel Georgian. In the course of a brief business meeting plans were outlined to combat proposed legislation limiting to 500 lb. the weight per inch of width of tires of motor vehicles running on highways. Both electric and gasoline truck interests planned to hold a meeting at the American House, Boston, Feb. 1, to prepare a formal protest against this bill.

### Convention of the Electrical Contractors' Association of New Jersey

The annual convention of the Electrical Contractors' Association of New Jersey was held in Newark on Feb. 1. Twenty-two new firms were admitted to membership and the officers elected were as follows: President, Mr. Elmer P. Strang, Camden; vice-president, Mr. J. P. Toman, Trenton; secretary, Mr. Jewell Van Dyke, Asbury Park; treasurer, Mr. Paul H. Jaehnig, Newark; state directors, Messrs.



Carl F. Adam, Trenton; Samuel H. Smith, Trenton; John H. Blaskill, Merchantsville; R. P. Ward, Dover; F. R. Evenden, Newark, and the national director, Mr. Paul H. Jaehnig, Newark. Representatives of central-station companies, jobbers and manufacturers were present at the banquet given in the evening, and the speakers and their topics were as follows: Mr. Frank D. Pembleton, contract agent of the Public Service Electric Company, "How New Business Is Obtained by the Company and How Contractors Can Obtain New Business"; Mr. E. P. Strang, "The State Association"; Mr. P. M. Thorpe, formerly state director to the national association, "Co-operative Electrical Development Society"; Mr. Carl F. Adam, "Status of the Electrical Contractor as a Business Man"; Mr. F. W. Fullerton, "The Relation of the Electrical Jobber to the Contractor"; Mr. M. B. Gleason, "Underwriters' Rules and Their Application to Electrical Trades"; Mr. E. L. Bradbury, "Illumination with Holophane Glass as Used in the Electrical Business"; Mr. P. D. Davis, "Insurance Protection." The next meeting of the association will be held at Asbury Park in July.

### Electrical Equipment for Navy Department

Details of the plans of the Navy Department for the coming fiscal year in regard to the purchase of electrical equipment and material have been brought out at various hearings held before the House committee on naval affairs, which is now framing the naval appropriation bill and which will report it to the House about Feb. 10. Rear Admiral H. I. Cone, chief of the Bureau of Steam Engineering, which has charge of electrical equipment installation in the navy, told the committee that it will be necessary during the coming year to replace the batteries in at least eight of the submarine torpedo boats of the navy, and he also went into various matters in connection with coast signal radio stations, radio installations on board ship, gyro compasses, search-lanterns, etc. The sum of \$666,500 is asked for the purchase of radio-telegraphic apparatus for land and sea use. Special appropriation under the Bureau of Navigation has been made for purchase of gyro compasses for the battleship fleet, and it is estimated that there will be twenty of these installations. The latest practice on torpedo destroyers provides for larger search-lanterns than those at present on board of twenty-six of the older destroyers. This will necessitate the purchase of two larger search-lanterns for each destroyer, and also two larger generating sets, making fifty-two search-lanterns and fifty-two generating sets. The estimate for the above is \$364,200. It will also be necessary to replace the batteries in at least eight submarine boats, which will entail an expenditure of \$320,000. Admiral Cone is asking for the coming year the sum of \$2,927,000 for electrical machinery and equipment for the navy.

### Photography by Invisible Light

Photography by means of ultra-violet and infra-red light was the subject of a lecture by Dr. R. W. Wood, professor of experimental physics in Johns Hopkins University, Baltimore, Md., before the New York Electrical Society Jan. 30. The address, which was recently delivered before the Royal Institution of Great Britain, was illustrated by lantern slides showing landscapes, objects, etc., photographed by ultra-violet and by infra-red rays, together with views of the moon and the Orion nebula taken with ultra-violet light.

Dr. Wood remarked that the longest infra-red rays thus far measured (those of the quartz-tube lamp) have a wavelength of 0.3 mm, while the shortest electrical waves observed are 2 mm in length, indicating a very brief undiscovered gap between the two sets of phenomena. The

lecturer also described his "resonance" mercury-vapor lamp, and showed ultra-violet photographs of the invisible electronic discharge which proceeds from the ordinary electric arc, although not detectable by the eye. A current of air diminishes the intensity of this discharge within its own range but does not affect the streamers beyond.

The ultra-violet photographs exhibited were most interesting in showing the diffusion of the ultra-violet in sunlight by the sky and the consequent absence of ultra-violet shadows even in full sunshine. Ordinary glass is practically opaque to light of this short wave-length, while the pigment, "Chinese white," appears black under its illumination. Dr. Wood's lunar photographs also show hitherto invisible patches of heterogeneous material near one of the moon's craters, indicating strongly the possibility of these being sulphur deposits and so contributing to the evidence of their volcanic origin. The infra-red landscape views were remarkable for their black skies and strong shadows and for the snowy whiteness with which the green foliage appears, owing to the deep-red component of its chlorophyll coloring matter.

Drs. Emil Heuel and Edward C. Titus presided and discussed the subject, and they were followed by Prof. Charles Baskerville and Mr. W. J. Hammer, who spoke briefly.

At the Feb. 20 meeting of the society Mr. E. E. Sperry will lecture on the application of the gyroscope to the flying machine, and Lieut. T. G. Ellyson, U. S. N., will describe "The Flying Boat."

### Electrical Display at New Orleans Mardi Gras

Celebrating the return of King Momus, jovial sovereign of New Orleans' annual Mardi Gras celebration, more than 25,000 vari-colored incandescent lamps made brilliant the streets of the Louisiana city during carnival week, Jan.



FIG. 1—MARDI GRAS ILLUMINATION OF BOSTON CLUB

30 to Feb. 4, while at least 25,000 other units were used in the numerous and elaborate displays on the fronts of local buildings. Canal Street, as usual, was the center of festivity and light. Both transverse and longitudinal streamers of lamps marked this superb, broad thorough-



fare. Festooned across the pavements and reaching to the middle "neutral ground" were hundreds of strings of purple, green and yellow lamps, the carnival colors.

The four clubs which foster the city's Mardi Gras spirit and celebrations had their own buildings handsomely decorated with electrical designs. The Louisiana Club was

The New Orleans Railway & Light Company also signalized the celebration by installing a mammoth roof sign on its new office building, which attracted much complimentary comment from the carnival crowds.

A feature of the Mardi Gras celebration on Saturday evening, Feb. 1, was a parade and pageant arranged by

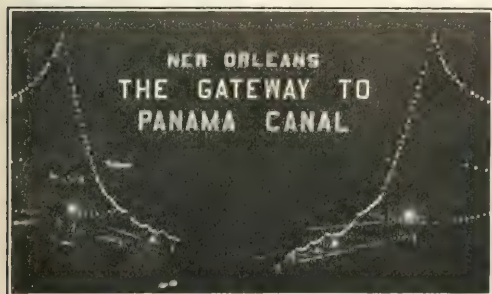


FIG. 2—WELCOME SIGN ON CANAL STREET, NEW ORLEANS

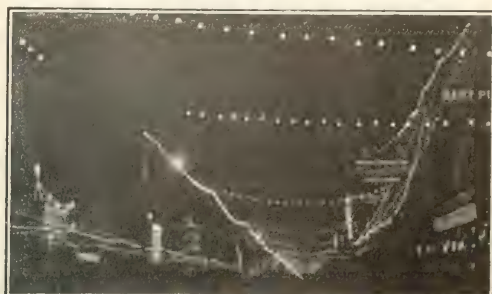


FIG. 4—ELECTRIC STREAMER DECORATIONS, NEW ORLEANS

artistically outlined in lamps to simulate a Japanese temple, topped with a Japanese emblem. Banks of clear-globe tungsten lamps studded the façade of the Boston Club, setting off the galleries of fashionably attired people who watched the parade from this vantage point. Hundreds of lamps were used in decorating the Chess, Checkers and Whist Club, and the Pickwick Club's display included a great illuminated throne dedicated to the king of the carnival. Hotels and business houses also vied with one another

members of the Jovian Order from New Orleans and nearby Southern cities. A number of decorated floats and automobiles made up the procession, which followed the course taken by other night parades, ending at the Hotel Grunewald, where an initiation and banquet were held under the direction of Mr. Fred B. Stern, Louisiana statesman.

### Special Illumination for Inauguration

Washington is planning a most elaborate illumination of the city streets and public buildings in honor of the inauguration of Wilson and Marshall on March 4. The dome of the Capitol is to be brilliantly illuminated from large search-lanterns placed on the west roof of the building and on the roofs of the House and Senate office buildings. There will be an added attraction in the "Court of Honor" to be constructed before the White House. This will be a reproduction of the classic part of the Jefferson mansion at Monticello, and on either side of it will be a stand designed for the seating of distinguished guests. The porch in which the President is to sit will have "spot" lamps directed against it so as to bring it out in bold relief. No lights are to be on the stand, but there is to be a hedge of cedar trees on either side of it, which are to be brilliantly illuminated with color boxes which will throw on this hedge of cedars a dense blue and gold light in sharp contrast with the green foliage. At the ends of the "Court of Honor" there will be a classic group of statuary placed in a recess formed by the trees extending to the curb line, and the back of this group will be illuminated from incandescent lamps concealed in the foliage, while the front will be brought out sharply by means of "spot" lamps. From 1200 to 1500 varicolored miniature lamps operated on flasher circuits will be irregularly placed in the hedge so as to obtain an effect similar to that given by fireflies.

Pennsylvania Avenue will be decorated from the Treasury to the Peace Monument with looped festoons supported at three points on steel messenger wires. From the center of the span there will be dropped a brilliantly illuminated pendant of light in varicolored lamps. These festoons will be placed at intervals of 100 ft. The fountain will be in operation at the Peace Monument, at the base of the Capitol, and this work of art will be brightly lighted from three "spot" lamps placed near the base. These lamps will be provided with color screens, so that combinations of color can be effectively used on the flowing water.

The Washington Monument will be illuminated by search-lanterns and "spot" lamps, the latter to be placed in the

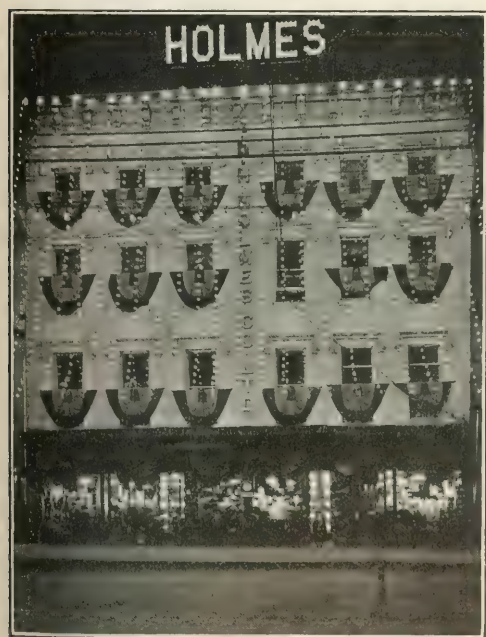


FIG. 3—MARDI GRAS DECORATIONS ON DEPARTMENT STORE

other in paying brilliant tribute to Momus. Among the most striking of the private electrical displays was that of the Holmes department store, illustrated herewith, where strings of lamps were festooned across the white front. The Elks' Club exhibited another handsome installation.

monument lot with their rays directed toward the lower portion of the monument, while projectors from the Raleigh Hotel, from the State, War and Navy Building and from the Potomac Electric Power Company's building will be directed to the north and east sides of the shaft. Flagpoles located back of the Columbus Memorial at Union Station will be brilliantly spiraled with electric lamps, and "spot" lamps will be used to bring out the beauty of the memorial. Cedar trees, effectively decorated in the manner of a Christmas tree or with festoons of lamps suspended immediately over them from poles, will be used to outline the plaza at Union Station. In all of the festoon work for the inauguration decorative twin-conductor cables will be used and the lamps employed will be mainly of 4-cp rating with clear globes.

### Contract Between Great Falls Power Company and Puget Sound Railway

In connection with the plans for the electrification of the Chicago, Milwaukee & Puget Sound Railway from Harlowton, Mont., to Avery, Idaho, the details of the contract between the railway company and the Great Falls Power Company, mentioned briefly in our issue of Jan. 11, are of some interest. This contract is made part of the articles of agreement between the power company and the federal government, by which a fifty-year grant of right-of-way for transmission lines across public lands was secured.

The railway company agrees to electrify its line between Harlowton and Deer Lodge, Mont., before Jan. 1, 1918, and also agrees to buy from the power company electric energy at the rate of 10,000 kw for the full period of the ninety-nine-year agreement, but two years' notice will be given the power company that delivery must commence. The railway company has several options for more power, up to a total rate of 25,000 kw, as follows: Not less than 4000 kw, nor more than 8000 kw, if called for prior to Jan. 1, 1923; not less than 3500 kw, nor more than 7000 kw, if called for between the last date and Jan. 1, 1928; or, failing to exercise the foregoing options, the full 25,000 kw may be called for at any time between Jan. 1, 1918, and Jan. 1, 1928, if at least 6300 kw additional has been called for prior to Jan. 1, 1923. Additional energy, when once called for, as above, will be supplied for the entire remaining term of the contract. The power company is not liable for interruptions to supply, nor the railway company for interruptions to its consumption, owing to causes beyond their control, such as strikes, fires or floods. The contract will be broken automatically in the event that the federal government permanently enjoins at any time from the enjoyment of its privileges. The railway company is made a preferential customer entitled to first service.

Delivery of energy will be made to not more than five stations between Deer Lodge and Harlowton, at 50,000 volts or 100,000 volts, three-phase, 60 cycles, alternating current. The voltage shall not be changed except by mutual agreement. The railway company will receive the energy at the terminals of air-break, high-tension line switches to be provided by the power company and will transform and distribute such energy to its line of railway in such manner as it sees fit. Watt-hour meters and curve-drawing wattmeters will be employed to measure the energy delivered. The railway substations are to contain sufficient synchronous machinery to secure a power-factor, leading or lagging, of at least 80 per cent. Twelve months' notice will be given the power company of the location of the delivery points. The power company will also have the right to install Tirrill regulators in the substations for the operation of synchronous machinery in such manner as to receive any power-factor between 80 per cent leading and 80 per cent lagging.

The rate for energy will be \$0.00536 per kw-hr., subject

to a minimum bill after the first year of service equivalent to 60 per cent of all the energy contracted for. The power company is also required to pay the federal government a tax of 5 mills per 1000 kw-hr. for all energy delivered over transmission lines crossing the public domain. Other details between the power company and the government were published in our issue of Jan. 11.

The power company also has the conditional right to occupy the railroad right-of-way with its transmission lines, subject to sixty days' notice of removal, and such transmission lines shall not interfere with the operation of the railway or its telephone or telegraph lines. The railway company is forbidden to resell any of the energy purchased of the power company. Disputes of any nature between the two companies will be referred to and settled by a board of three arbitrators, chosen one by each company and the third by these two.

### Conference on Meters in Ohio

At a conference of meter men from the electric lighting companies of Northwestern Ohio, held at Lima, Ohio, on Jan. 17, the following subjects were presented for consideration and general discussion: (1) Advance in metering conditions to be brought about by co-operation of the various meter departments, by Messrs. A. H. Bryant, of Cleveland, and R. S. Graves, of Cincinnati. (2) Importance of maintaining meters within commercial accuracy, by Mr. F. C. Jennot, of Marysville. (3) Essentials in meter testing, by Mr. C. B. Stelle, of Springfield. (4) The office and record side of meter testing, by Mr. John Himes, of Dayton. The meeting, one of the first of its kind ever held in Ohio, was a source of encouragement to the meter committee of the Ohio Electric Light Association, which is trying to bring about a co-operation among the electric-lighting companies of Ohio so as to obtain a more efficient metering system.

### Opposition of Wood Preservers to Duty on Creosote

At the ninth annual meeting of the American Wood Preservers' Association, held in Chicago on Jan. 21, 22 and 23, there was an attendance of about 200, including many representatives of railroad and commercial wood-treating plants. In his address President E. A. Sterling, of Philadelphia, remarked that the membership of the association had increased from 104 to 157 during the last year and that it was doing a constantly increasing amount of useful work. The association aims to standardize wood-treating processes. Mr. Sterling referred to the decided advance in the price of creosote during the year and to the additional menace pending because of the proposed 10 per cent duty on imports of creosote. He recommended various subjects of investigation by committees and urged that the association give greater publicity to its work.

The secretary-treasurer's report, submitted by Mr. F. J. Angier, of Baltimore, showed the finances of the association to be in a satisfactory condition. Twenty-nine railroad companies are represented in the association and a considerably larger number of commercial wood-treating plants. The wood-preserving industry is perhaps on a better basis than ever before. The secretary also read a letter recently written by President Sterling to Mr. O. W. Underwood, chairman of the ways and means committee of the House of Representatives, in which, speaking for the American Wood Preservers' Association, the writer asked that coal-tar creosote be retained on the free list of the tariff. Mr. Sterling explained that only about 30 per cent of the creosote used in this country is produced in the United States. There is an actual shortage in the European market and prices have increased sharply in the last few years, promising to go still higher. Mr. Sterling



pointed out the importance of the subject of wood preservation in relation to the conservation of the timber resources of the country.

Mr. B. A. Johnson, publisher of the *Lumber World Review*, of Chicago, made an address of welcome, in which he embodied a plea that greater and more intelligent publicity be given to the practical working of wood preservers. Mr. J. H. Waterman, of Galesburg, Ill., responded for the association.

A number of papers were presented relating in general to either the technical side of the art of wood preservation or the practical applications in plants for treating railroad ties or wood paving block. There was little or no reference to the treatment of poles or cross-arms. One point brought out by a visitor was that in applying preservative to wood the factor of heat is nearly as important as that of pressure.

Following the recommendation of President Sterling, the association adopted a strong set of resolutions in opposition to the proposed levying of an import duty on dead oil of coal tar, or creosote. These resolutions point out that it is necessary to import large quantities of creosote, the domestic supply being entirely insufficient to meet the demand. In 1912 about 60,000,000 gal. was imported. Practically all of this amount was used in the preservation of timber, serving to increase from three to five times the life of wood used in the industries. Thus the use of creosote is of the greatest importance in the preservation of the timber resources of the country. The proposed duty of 10 per cent would interfere very seriously with the art of wood preservation, and the association urges that Congress retain creosote on the free list, as at present.

Entire unanimity was exhibited in discussion of this subject, which the association considers of vital importance. It was voted to send copies of the resolution to all members of the Senate and House of Representatives, and the association also urged upon all members to use their personal influence with members of Congress to prevent imposition of the proposed duty. A committee was appointed to wait on the ways and means committee of the House of Representatives and present the arguments of the association. This committee consists of Mr. E. A. Sterling, of Philadelphia; Dr. Herman von Schrenk, of St. Louis; Mr. William A. Fisher, of Gainesville, Fla.; Mr. George A. Lembecke, of New York, and Mr. Earl Stimson, of Baltimore.

A resolution was also adopted approving the existing plan of maintaining national forest reserves by the federal government and opposing the movement to turn these forest reserves over to the several states.

Another resolution expressed the sense of the association that unsound timber should not be treated and that treating plants should not allow customers to persuade them to attempt wood preservation when the conditions are such that the proposed preservation is of no real benefit.

The thanks of the association were expressed to Messrs. H. F. Weiss, F. M. Bond and C. P. Winslow, of the Forest Products Laboratory of the government Forest Service at Madison, Wis., for presenting papers before the association.

In relation to standard specifications for the testing of creosote a committee, of which Mr. H. M. Newton, of Minneapolis, was chairman, made a progress report. It was recited that further work should be done before standard specifications could be recommended, and it was noted that 80 per cent of the members who had replied to an inquiry favored the retort method of testing. The standards of the National Electric Light Association and of the Forest Service were mentioned by the committee. Mr. Weiss said that he could not approve of the retort method of testing creosote oil.

Mr. H. F. Weiss, director of the Forest Products Laboratory at Madison, Wis., and Mr. C. W. Berry, of Laramie, Wyo., were elected honorary members of the association.

Officers for the ensuing year were elected as follows:

President, Mr. A. E. Larkin, Minneapolis; first vice-president, Mr. J. H. Waterman, Galesburg, Ill.; second vice-president, Mr. E. B. Fuls, Chicago; third vice-president, Mr. George E. Rex, Topeka, Kan.; secretary-treasurer, Mr. F. J. Angier, Baltimore. After a spirited contest New Orleans was selected as the place of the 1914 meeting.

## Tariff Hearings

Extended testimony of much interest was given before the ways and means committee of the House of Representatives on the subject of incandescent lamps, following the brief submitted on rods and wire, of which we presented an abstract last week.

### INCANDESCENT LAMPS

Mr. B. A. Levett addressed the committee on behalf of the Lamont-Corliss Company in reference to incandescent lamps. His company is an importer of such lamps from Europe. He asked for a reduction in the present duty of 45 per cent under the basket clause to 10 per cent ad valorem. The witness then quoted the following from the government's bill of complaint in a suit against the General Electric Company:

"Approximately 80,000,000 incandescent electric lamps are manufactured, sold and used annually in the United States, of an aggregate value of about \$18,000,000. Of these, the defendants, in virtue of their combination and conspiracy hereinafter described, control the manufacture and sale of more than 97 per cent."

He next asserted that the General Electric Company controls 97 per cent of the incandescent lamp business in this country. The Lamont Corliss Company started to import foreign lamps in 1909, when tungsten filaments were being produced by the squirting process, instead of being wire-drawn, as at present. The prices of tungsten lamps at that time were as shown in the accompanying table. When

TUNGSTEN LAMPS—PRICES, COST AND PROFITS

Size of Lamp	PROGRESSIVE REDUCTION—IN PERCENTS					Cost of Material Manufacturing	Net Price	Per- centage Profit
	1	2	3	4	5			
25-watt	\$0.85	\$0.70	\$0.64	\$0.50	\$0.40	\$0.107	\$0.280	161.
40-watt	1.00	0.80	0.70	0.55	0.45	0.110	0.35	186.
60-watt	1.40	1.10	1.00	0.75	0.60	0.167	1.20	200.
100 watt	1.75	1.45	1.35	1.10	0.90	0.217	0.630	191.

the prices were those shown in the first column the importers were obtaining the so-called Kuzel lamp, and the General Electric Company, he said, secured control of it. Then the importers secured a brand of lamp made in Holland and thereupon the General Electric Company cut its prices to those shown in the second column. The importers followed suit, said Mr. Levett, and the former company made another cut to the prices given in the third column.

Then, in the effort to produce a less fragile lamp, the wire-drawn filament was introduced and the foreign manufacturers soon duplicated the performance. This produced another price cut to the figures in the fourth column. On Oct. 1, 1912, the prices were cut still more, as given in the fifth column. The sixth column shows the actual business declared, was the actual cost of production to the General Electric Company. The seventh column shows the net price after discounts ranging from 17 to 37 per cent on the average, and the eighth column the per cent of profit. Mr. Levett said his figures came from a confidential but reliable source, and that the cost may be even less than that given. Foreign-made lamps sell at about 10 cents each on the other side. He also declared that the General



Electric Company, because of the high tariff, is driving the importers out of business.

An extended brief was also filed by the Laco Phillips Company, of New York, importer. The lamp business is now and has been for twenty years past controlled by the General Electric Company, said the statement. The prices given in the table were confirmed as of the following dates: Column 1, 1909; column 2, Feb. 1, 1910; column 3, April 1, 1911; column 4, March 1, 1912; column 5, Oct. 1, 1912. The cost of production for various sizes of lamps was stated, agreeing with column 6 in the table, while 150-watt lamps are said to cost about \$0.341 each and 250-watt lamps about \$0.50. The General Electric Company was declared to be quoting its sub-factories to-day at discounts of 50 per cent, 10 per cent, 10 per cent and 5 per cent from the list, bringing the net figures to the following: 25-watt, 15-39 cents; 40-watt, 17-31 cents; 60-watt, 23-08 cents; 100-watt, 34-63 cents.

The output of the largest manufacturer abroad who ships to this country does not exceed, said the brief, 1,250,000 lamps a year. But 20 per cent of the cost of manufacture is labor. The figures in columns 6, 7 and 8 of the table were confirmed also. A reduction of the duty to 10 per cent was asked for in order to permit competition from foreign lamps and save the situation for the importers.

### Western Association of Electrical Inspectors at St. Louis

The eighth annual convention of the Western Association of Electrical Inspectors was held at the Planters' Hotel, St. Louis, Mo., Jan. 28, 29 and 30, the opening session, as reported by telegraph in these columns last week, being attended by more than seventy delegates.

Following the address of welcome by Mayor F. H. Kreisman of St. Louis and the response by Mr. B. W. Clark, of Detroit, Mich., Mr. W. J. Canada, engineer for the Rocky Mountain Fire Underwriters' Association, Denver, Col., president of the inspectors' association, delivered his annual address. In this he emphasized recent rapid advances to the present uniformity of electrical inspection methods, a uniformity which, he declared, is unusual in the application of any other construction standard. For eight years the work of the Western association has been directed toward securing this desirable uniformity. Increasing demands on the inspectors have made them necessarily greater factors in their communities. President Canada urged further restrictions in the use of flexible cord and the connection of electrical appliances to final circuits as being among the more pressing inspection problems demanding early consideration from the association.

The report of Secretary-treasurer W. S. Boyd, Chicago, showed the association's present membership to number 172, with a geographical range from Seattle to Montreal and from Winnipeg to Texas.

#### ELECTRICAL PORCELAIN

In his paper on the subject of electrical porcelain Mr. F. A. Driscoll, of Pass & Seymour, Chicago, traced the history of white-clay working in China and at Dresden, Germany, and the use of white kaolin, feldspar and quartz mixtures. After describing the processes of grinding, mixing, glazing with non-metallic flux, firing, sizing, etc., the speaker referred to the cost of the dies necessary for forming such complicated pieces as transformer cut-outs, which sometimes run into thousands of dollars. An interval of about one week is ordinarily required to convert the raw material into the finished porcelain product. Messrs. H. H. Bloomer, Milwaukee; B. H. Glover, Chicago, and W. J. Canada, Denver, took part in the discussion, in which the desirable quality of toughness in electrical porcelain was especially emphasized.

#### HIGH-VOLTAGE LINE REQUIREMENTS

Mr. H. B. Gear, Commonwealth Edison Company, Chicago, followed with a paper on "High-Voltage Transmission-Line Requirements." For moderately high voltages the speaker indorsed underground construction on account of its assurance of service continuity. Intersecting railroads and telegraph and telephone lines impose many and varying restrictions on overhead construction. Cradle crossings have in many cases caused more troubles than they were expected to save. Attempts are now being made to draft uniform crossing specifications, including such vital requirements as short spans, 30-ft. minimum clearance above tracks, minimum wire size No. 4 copper or No. 1 aluminum, high safety factor with allowance for simultaneous sleet and wind, ground-stripped cross-arms, and straight-line construction near crossings. Instances of the antagonism existing between telephone and transmission interests were cited; this often results in enjoining power circuits from paralleling established signaling lines.

In answer to a question by Mr. G. W. See, Minneapolis, Minn., Mr. Gear said that 13,000-volt cable would be preferable to open-wire construction where continuity could be assured, although if many cables were to be installed underground construction might prove equally cheap and to be preferable. Mr. Gear insisted that weatherproof braids protect linemen up to 2300-volt pressures if joints are well taped, although beyond this voltage the protection is chiefly psychological. In the discussion the point was developed that mechanical wire-break devices, like the Dostal drop-out, have in many localities established an unassailable reputation for reliability.

#### LABORATORY TEST PROBLEMS

"Electrical Laboratory Test Problems" was the title of a paper by Mr. B. H. Glover, associate electrical engineer of the Underwriters' Laboratories, Chicago, in which the author described the relation between field inspectors and laboratory workers in the protection of life and property. Mr. Glover also emphasized the need of tabulated experience taken from the field, citing such examples as defective contacts in ground clamps, design of cut-out and automatic-switch cabinets, etc. The discussion which followed brought out several minor inconsistencies in code requirements.

#### THE 660-WATT BRANCH CIRCUIT

The letter on the subject of the 660-watt branch-circuit limitation received from Mr. W. H. Blood, Jr., Boston, Mass., insurance expert for the N. E. L. A., as mentioned last week, occasioned lively discussion. Mr. Blood's views are given fully on another page of this issue. The author's suggestion that No. 12 be used for final circuits instead of No. 14 was objected to on account of its greater cost. Some approval was accorded to the proposal to abolish the 10-amp fuse, but on condition that No. 18 wire be prohibited for either flexible cord or fixture wire. The present requirements of 660-watt final circuits and the twelve-socket limit were strongly defended. Mr. Canada pointed out that any relaxation of the present rules might tend to still greater increases of future limitations. Mr. Glover reported that a 250-volt, 660-watt socket is now being marketed. The sense of the meeting apparently favored restricting sockets to such capacities if the 6-amp limit is to be raised.

#### STATUS OF GROUNDED SECONDARIES

An extended paper, "The Present Status of Grounded Secondaries," was next presented by President Canada, electrical engineer Rocky Mountain Fire Underwriters' Association, Denver, Col. This valuable treatise included a collection of data on injuries and accidents resulting from contacts with transformer secondaries and a compilation of grounding-practice data obtained from 100 representative operating companies in the United States and Canada. The latter information is given in detail on another page of this issue. Besides tracing the history of grounding, the author

entered into a discussion of its chief theoretical considerations. Then followed a careful exposition of the practical advantages and disadvantages of grounding, use of interconnected secondaries, use of and opposition to water-main grounds, cost of grounding, effect on meters and transformers, electrolysis of service connections, relation of conduit grounding, etc.

In conclusion Mr. Canada declared unshaken the evidence that: (1) Properly grounded secondaries are a thorough safeguard against entrance of high voltages from every source on building wiring. (2) Prevention of high voltage in building wiring prevents personal injury, fire, meter troubles, lamp burnouts, and usually transformer breakdowns. (3) Grounding is effective in proportion to its thoroughness. (4) Grounding introduces no known troubles not already existing either in life hazard, fire hazard, prejudice to building piping systems or operating difficulties, and increases none. (5) Thorough grounding entails numerous grounds, good grounds, easily inspected grounds, and grounds close to buildings to be protected. (6) Grounding emphasizes the value of solid neutrals in interior conduit wiring. (7) Grounding should not be prohibited by code rule because of very slight current flow through ground connections. (8) Grounding is equally desirable as protection against undesigned voltages on secondaries of all voltages.

After some discussion Mr. Canada's paper was referred to the code committee, and a vote of thanks extended to the author for his work.

#### REPORTS ON STAGE AND DISPLAY LIGHTING

An interesting portion of the convention program was the reading of committee reports, which occupied a full day.

A rule advocated by the committee on theater wiring, prohibiting link fuses on stage switchboards, was supported in discussion by Messrs. Waldenfels, F. Daniels, R. Daniels and J. Hall, the last-named directing attention to the panic possibilities of open fuses. Requirement of insulators in each "border-light" support cable was also indorsed, and the adoption of uniformly interchangeable plugs and pockets for stage work was urged.

The committee report on show-window and display lighting, presented by Mr. F. P. McGough, Omaha, Neb., chairman, secured the convention's indorsement of flush-type waterproof receptacles as the only acceptable fitting for show-window floors and of the prohibition of key sockets.

The convention also indorsed the recommendation of Mr. F. J. Burch, Chicago, chairman of the committee on induction motors, that a table of sizes for motor leads and branch and running fuses be specified for the National Electrical Code. Inspectors do not find the code's provisions to prevent over-fusing generally complied with, it was shown. Several manufacturers present offered their co-operation and help in formulating such a table.

#### ORDINANCES AND PUBLIC SAFETY

Through its chairman, Mr. W. S. Boyd, Chicago, the committee on laws and ordinances recommended requirements for porcelain sockets near grounded surfaces. Discussion showed that much dissatisfaction has resulted with the life of reinforced portable cord in garage service, although the impracticability ascribed by garage men to the vapor-proof lamp is largely an indication of their general disregard for restrictions of any nature, an attitude accounting for much of the high fire hazard in such buildings. The discussion turned upon comparative values of galvanized and enameled conduit under action of acid and concrete. Among those who took part were Messrs. Waldenfels, McDowell, Fred Adams and other manufacturers' representatives, opinion apparently favoring galvanized fittings, if available.

The report of the committee on public safety was divided

by the chairman, Mr. W. J. Canada, Denver, into two parts, the first offering general recommendations and the second suggesting definite changes in present code rules governing grounding of secondaries. The following general changes from present practices received the association's indorsement and were by it referred to its code committee with instructions to recommend them to the electrical committee of the National Fire Protection Association: (1) Elimination of flexible cord where practicable, and particularly in certain hazardous plans, such as warehouses, flour mills, kitchens, bakeries, meat shops, stables, etc. (2) Prohibition of brass-shell sockets and fixtures in kitchens, bakeries, meat shops, stables, etc. (3) Prohibition of open contacts in wiring installations, particularly by use of cabinets, knife-switch inclosures, etc. (4) Requirement of conduit in all places where by any possibility open wiring can become mechanically disturbed or its insulation injured so that personal contact or fire may result. (5) Protection, by effective grounding, of all circuits in buildings, or where subject to handling by the public or by employees in industrial establishments, from abnormal voltages of all sources. (6) Grounding of casings of all motors, generators, oil switches, cabinets, etc., where surrounding grounded surfaces exist.

The following changes in the present code rules on the grounding of secondaries were also indorsed and after full discussion were recommended for transmission to the electrical committee of the National Fire Protection Association: (1) Station ground connection to all available water-pipe systems and to any available permanently moist earth. (2) Similar ground-connection requirements for transformer banks. (3) Overhead-line neutral or grounded sides must be grounded every 500 ft. as above, or, if underground, grounded at every subway box. (4) Individual services should be grounded to water pipes, outside meters, fittings, etc. (5) Station ground-wire should be as large as the largest wire of the system and be carried in a straight line to the ground. (6) Ground wire at transformer bank should be as large as the wire grounded; never less than No. 6. (7) Individual service ground connection to be not smaller than No. 6 and at least half of the size of the largest secondary wire. (8) Ground wire should be run outside the building and protected within 7 ft. of the ground by conduit. Conduit may be used if necessary to run the ground wire inside of the building. Well-bonded conduits are permissible as part of the ground connection.

#### DISCUSSION OF CODE REVISIONS

As the Western Association's convention closely preceded the biennial issue of the National Electrical Code, a special study had been arranged of various code sections at the suggestion of President Canada, assignments being given to committees. Discussion of general inspection problems and experience with present code requirements occupied one session. Motor drive for motion-picture machines was welcomed if approved arrangements are provided. Much trouble with porcelain-tube services has been experienced, and conduit services were favored. It seemed to be the general practice to require no additional heat protection where oil-immersed auto-transformer starters are installed on frame partitions. Re-inspections were believed generally to be insufficient and poorly handled, largely from lack of funds, although some portions of Quebec and Ohio constitute happy exceptions to this statement and Chicago and Detroit report fair results.

Several manufacturers spoke briefly concerning their wish for co-operation with inspection departments and commended the highly desirable uniformity to which the Western Association of Electrical Inspectors is largely contributing. The protection afforded by thorough inspection against the use of inferior products was declared to have figured largely in the rapid advance of safety in electrical materials.



At the request of Mr. Atwood, of the National Metal Molding Company, the position of the association was expressed by vote as indorsing single braid for rubber-covered wire in metal molding. The convention indorsed the use of such molding run without additional protection through partitions but discouraged the use of more than 660 watts per two-wire or three-wire circuit in any metal molding. The association further resolved to support the prohibition of wood molding in all locations.

#### ELECTION OF OFFICERS

The nominating committee, through Chairman Waldemar Michaelsen, Omaha, Neb., recommended the following officers, who were formally elected to serve the association for the ensuing year. President, Mr. James Bennett, assistant manager Canadian Fire Underwriters' Association, Montreal, Canada; first vice-president, Mr. B. W. Clark, city electrician, Detroit, Mich.; second vice-president, Mr. A. W. Davis, city electrician, Spokane, Wash.; executive committee, Messrs. H. M. Maxwell (chairman), G. W. Lee, W. J. Canada, S. J. Conrad, H. M. Davis and W. B. Hubbell.

#### ENTERTAINMENT

The entertainment features of the program were arranged by Mr. J. H. Fenton, chief electrical inspector of the Missouri Inspection Bureau. On Tuesday evening, Jan. 28, the inspectors were the guests of the St. Louis League of Electrical Interests, Jovian Chapter, at its annual banquet at the Mercantile Club. Secretary W. S. Boyd, Chicago, replied to the welcome of President A. C. Einstein, general manager of the Union Electric Light & Power Company, and the evening concluded with a number of entertainment features of unusual interest. On Wednesday evening the Jovian Order held a rejuvenation at the Elks' Club, when more than 200 attended and a class of eighty-two was initiated. The degree team comprised Messrs. L. S. Hunt, W. E. Rapp, J. P. Casey, W. N. Matthews, Charles A. Dostal, J. H. Fenton, F. D. Phillips, R. H. Robinson, P. V. Brokaw, S. N. Clarkson, R. W. Stockwell, W. F. Barklage and D. Houck. Mr. S. A. Hobson, Western manager of the *Electrical World*, spoke of the high personnel of the night's initiates and gave a résumé of the order's history. Talks on Jovianism and co-operation were also given by Mr. W. N. Matthews, St. Louis, and others.

### Mr. McHenry on Railroad Electrification

In response to a recent request of the Boston banking house of Thompson, Towle & Company for a statement regarding electrification plans on the New York, New Haven & Hartford Railroad, Vice-president E. H. McHenry has issued a statement pointing out that the New Haven company is now committed to an expenditure of \$20,000,000, covering work along this line completed, in progress or authorized. In addition to the work between Woodlawn and Stamford, completed several years ago, the company has substantially finished the work on the Harlem River and Westchester lines. Construction is actively in progress between Glenbrook and New Haven, and the electrification of the main line between Boston and Providence will begin in the spring. The latter is the first step toward the ultimate electrification of all the steam railroad lines within the suburban radius of Boston. Mr. McHenry states that in his opinion electricity will be installed upon a large scale within the next decade, particularly at the great railroad centers. He believes that the initial electrification of congested traffic centers will be followed by an ever-extending zone of electrical operation until such centers are finally interconnected by electrically operated lines. In the larger cities the obligations to electrify will be forced upon the companies regardless of economy and considerations of uniformity, and disabilities attending a break in the kind

of operation will make it economical and desirable to extend the electrification to parts of the railroad system which would not be justified if independently considered. Mr. McHenry says that as yet little direct economy has resulted from the electrification already completed but that "the indirect advantages are large, and with an extension of electric operation to include passenger, freight and switching service, it is probable that a direct and sufficient return upon the necessary investment will be secured under favorable conditions. . . . In general it may be stated that the principal and almost the entire economy to be effected by electric operation is comprised in the two items of fuel and engine repairs, which will be approximately reduced by 50 per cent."

### Governor Dunne Favors Municipal Ownership

Mr. Edward F. Dunne, who was inaugurated Governor of Illinois on Feb. 3, has apparently lost none of the zeal for municipal ownership which was such a prominent characteristic of his administration as Mayor of Chicago several years ago. In his inaugural address as Governor he declared that the day of competition in the supply of gas, electric service, street-railway service and some other public utilities has passed. Only one utility of each description should be allowed the privilege of doing business in each city. "The sole aim of all private corporations unregulated by law," said the Governor, "is to make money for their stockholders, and the most money can be made by poor service at a high rate to the consumer." After this rather startling statement Governor Dunne stated his position in the following paragraph:

"While most cities of Illinois may not be ready as yet to undertake municipal operation of other than waterworks, legislation should be enacted immediately giving all cities the right to build or buy and to operate their utilities. For this purpose cities should be empowered to issue bonds, subject to a referendum and such other reasonable safeguards as may be necessary. If such rights are given, it will force private corporations now furnishing these utilities to give decent service at decent rates or face the alternative of public ownership."

The Governor favors municipal control of purely local utilities, but says that what might be called "interurban utilities," including electric railways, natural-gas supply, electric transmission and telephone service, can be regulated only by the State. For that purpose he recommends the creation of a state public utility commission with large powers. This commission should control the issue of securities, the character of service, the rates to be charged, etc. The control of city utilities might be given to the commission on the request of the municipality concerned. However, it should be empowered to secure uniformity of accounting and full publicity with respect to both municipal and "interurban" utilities.

In relation to the issuing of securities by public utilities, the state commission should have full control. On this point the Governor says:

"It should be distinctly provided that future issues of securities, when approved by the commission, should be clearly separated by serial numbers, or otherwise, from existing securities, to the end that purchasers might always know whether they were buying new securities approved by the State, and issued for an increase of physical investment, or whether they were buying securities issued prior to the enactment of the law and that had not in any way passed under the scrutiny of the State."

Another of the Governor's recommendations is that Chicago shall receive the right, "enjoyed" (as he says) by the city of St. Louis, of creating a public utility commission which shall report directly to the City Council and possess such powers and resources as may be conferred upon it by the city itself.



## Public Service Commission News

## MASSACHUSETTS COMMISSION

Following the recent order of the Gas and Electric Light Commission reducing the price of gas from 85 to 80 cents per 1000 cu. ft. in the city of Haverhill, the Haverhill Gas Light Company, one of the Stone & Webster properties, has brought suit in equity in the United States District Court against the board and Attorney-General Swift, raising the constitutional question as to the right of the defendants to compel the plaintiff company to reduce the price as ordered. The company contends that the manufacturing conditions under which it operates should cause the price to be not less than 95 cents. An injunction is sought against the enforcement of the order.

## WISCONSIN COMMISSION

The Wisconsin Railroad Commission has taken testimony on the application of the city of Milwaukee for an order reducing the rates of the Milwaukee Gas Light Company. The present value of the property, according to the appraisal of the commission, is \$8,770,000. The value of the physical property was accepted by both parties and the testimony confined to the question of overhead expenses and going value. The company, through its experts, endeavored to show that the commission's allowance of 15 per cent for overhead expenses was too low. The various experts testified that in their experience an allowance of at least 30 per cent was a conservative estimate, and one considered that 36.5 per cent was none too high for the property in question. He apportioned the items as follows: Contractors' services and expenses, 10 per cent; cost and maintenance of works office, 3 per cent; insurance and damages, 1 per cent; taxes, 2 per cent; organization and legal expenses, 5 per cent; interest during construction, 7.5 per cent; expenses of placing securities, etc., 5 per cent. Considerable testimony was offered to substantiate the company's claim of approximately \$2,500,000 of going value. Evidence offered by the defendant shows that while the population of Milwaukee has increased but 93 per cent since 1890, the number of consumers has increased 640 per cent, the sale of gas 645 per cent and the sales per capita 284 per cent. It was shown that while the average consumption of gas in the cities of the country was 5190 cu. ft. per capita, the consumption in Milwaukee is 7360 cu. ft. per capita. Inasmuch as this showing was made possible by the excellent service rendered and a continued effort to secure new business, it was contended that the profit on all gas sold in excess of the average should be capitalized at 8 per cent and be included in the total valuation as going value. The present rates of the Milwaukee Gas Light Company range from a rate of 75 cents for the first 1000 cu. ft. per month to a rate of 50 cents for all gas used in excess of 1000 cu. ft. per month. The commission has recently issued three pamphlets containing the rate schedules of every electric light, gas and heating company in the State which makes a report to the commission.

## OHIO COMMISSION

Some headway has been made with a bill in the Legislature which will require the commission to make a valuation of every public-service company in the State, in order to determine whether the rates charged for service are fair or not. The bill provides that the work shall be done by instructors connected with the engineering department of the Ohio State University and students of the department. The fees for the work are to be paid from the funds of the commission and of the university.

The complaints of citizens of Cincinnati against the meter charge made by the Cincinnati Gas & Electric Company will be heard in the council chamber in Cincinnati on Feb. 27 and 28. The company filed an answer denying any unjust discrimination or excessive or unreasonable charges.

## Current News and Notes

**BROOKLYN EDISON COMPANY TO ENTERTAIN CONTRACTORS.**—The Edison Electric Illuminating Company of Brooklyn will give its annual dinner to the electrical contractors of that borough at the Union League Club on Feb. 15.

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**TITANIC FUND FOR CORNELL UNIVERSITY.**—A fellowship in mechanical and electrical engineering has been founded at Cornell University by Mr. and Mrs. Eugene Meyer, of New York City, who have given \$10,000 in memory of their son, Edgar J. Meyer, who was graduated from Sibley College in 1905 and perished in the wreck of the *Titanic*.

\* \* \*

**ELECTRIC SHOW IN A TENT FOR CHARITY.**—For the benefit of the public playgrounds of New Orleans an "electric marvel show" was held in a circus tent at Elk Place, New Orleans, during Mardi Gras week, Jan. 27. Besides many electrical novelties, exhibitions of wireless telegraphy, the X-ray, etc., a number of manufacturers displayed their products, and the New Orleans Railway & Light Company, through its president, Mr. Hugh McClosky, and its contract agent, Mr. W. E. Clement, substantially aided the interests of the show and fund. Mr. E. H. McFall, a well-known electrical supply dealer, acted as manager for the show.

\* \* \*

**INTERSTATE COMMERCE COMMISSION PROMULGATING UNIFORM ACCOUNTS FOR TELEPHONE COMPANIES.**—A uniform system of accounts for telephone companies having annual operating revenues in excess of \$50,000 has been promulgated by the Interstate Commerce Commission, taking effect the first of this year. Such companies are divided into two classes, the dividing line being at annual operating revenues of \$250,000. The accounting system is issued under the authority contained in Section 20 of the act to regulate commerce. The commission has under consideration the promulgation of a system of accounts for smaller companies to be issued at a later date.

\* \* \*

**TELEGRAPHING 40,000 WORDS AN HOUR.**—The first American demonstration of the Pollak-Virag system of rapid telegraphy, with which, it is declared, 40,000 words can be dispatched per hour, was given by Antoine Pollak, the inventor, at New York, Jan. 31. By means of a beam of light controlled by motions at right angles, the receiving machine produces written characters on sensitized paper. Owing to the rapid succession of impulses involved, the system is limited in its use over very long inductive iron-wire lines, although entirely feasible within present telephonic ranges using copper circuits. It is reported that during a recent demonstration in France messages were sent 900 miles with this system.

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**SOCIETY FOR ELECTRICAL DEVELOPMENT.**—The Society for Electrical Development, Inc., will shortly issue a broadcast invitation to the electrical industry to attend a conference for the purpose of discussing concrete methods for action on the publicity campaign through which it is endeavoring to effect the co-operative movement for benefiting the entire electrical industry. This conference will be held in New York on March 1 and 2. It is an important and comprehensive project, and the participation of many of the leaders in all branches of the central-station and electrical manufacturing industries have already accepted invitations to address the meeting on pertinent subjects and acceptances are being awaited by the committee from a number of other men whose views on the purposes of the society and methods of effecting these will be of great interest to those present.

**TOUR OF JUPITER F. E. WATTS.**—Local organizations of the Jovian Order on the Pacific Coast from Spokane to Los Angeles have this week received a visit from Mr. F. E. Watts, head of the order, who is making a tour of visitation which, when completed, will include twenty-five cities of the middle and far West. In many of his speeches to his brother Jovians Mr. Watts has dwelt upon the need for co-operation by the order in bringing about patent reform and in other activities for the good of the electrical industry. State and local officials have very generally joined with the electrical men in the gatherings where the Jupiter has been entertained. His itinerary next week includes Salt Lake City, Denver and Omaha.

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**PULMOTOR SHOWN AT JOVIAN LUNCHEON.**—At the New York Jovian luncheon in New York this week a practical demonstration of the pulmotor was given by Mr. E. W. Gorry, chief operator of the United Electric Light & Power Company. The "patient" whose resuscitation was successfully accomplished was Mr. J. F. Lufkin, of the same company. The instrument used was one of the forty-five pulmotors with which the New York electric and gas companies are now equipped. Besides showing the pulmotor in operation, Mr. Gorry thoroughly explained the necessary manipulation of the patient, the positions in which he is placed and the means necessary to keep the throat unobstructed and to prevent the pulmotor acting as a stomach pump in addition to inflating and deflating the lungs. Statesman Becker, who presided at the luncheon, announced that the next rejuvenation in New York would be held on March 10, at which time it is expected that 125 candidates will be admitted.

\* \* \*

#### SOCIETY MEETINGS.

**COLUMBIA ELECTRICAL ENGINEERING SOCIETY.**—At a meeting of the Electrical Engineering Society of Columbia University to be held on Feb. 13 at 8:15 p. m. in the Engineering Building, 117th Street and Broadway, Mr. Frederick B. Corey, of the Union Switch & Signal Company, will give an illustrated talk on "Railway Switch Practice."

\* \* \*

**BOSTON ENGINEERS' CLUB.**—Among the speakers at the opening of the Engineers' Club of Boston, Mass., on Jan. 25 were Mr. George Westinghouse, Colonel George W. Goethals and President A. Lawrence Lowell of Harvard University. The officers of the club are: President, Mr. Ira N. Hollis; vice-presidents, Messrs. Charles L. Edgar and Charles T. Main; treasurer, Mr. Eliot Wadsworth, and secretary, Mr. Luzerne S. Cowles.

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**JOVIAN REJUVENATION AT BALTIMORE.**—A rejuvenation and banquet of the Baltimore Jovians on Feb. 1 at the Hotel Emerson was addressed by Prof. Charles F. Scott, past-president of the A. I. E. E. Statesman Melvin H. Jones presided at the banquet, and in the course of his remarks said that Jovian progress in Baltimore in the past year was "only the yawn of a giant just waking up. When we really get thoroughly awake we will show Baltimore a real electrical shock."

\* \* \*

**ANNUAL BANQUET OF LYNN SECTION OF A. I. E. E.**—The second annual banquet of the Lynn Section of the American Institute of Electrical Engineers was held at the Boston City Club, Boston, Mass., on Jan. 25. Prof. Elihu Thomson acted as toastmaster, and Mr. Frederick P. Fish, the well-known attorney, spoke on "The Recall of Judges and the Referendum, or the Judicial Decision of the People." The Lynn Section has now a membership of 510, making it the banner local section of the A. I. E. E.

**INSTITUTE OF OPERATING ENGINEERS' LECTURE.**—The Institute of Operating Engineers has secured Dr. Frederic Bannerth, consulting chemist, to give three talks on Feb. 15, March 15 and April 19 on the following subjects: "Fuel, Combustion and Fire-Room Principles," "Water for Boiler Purposes" and "Lubricants and Their Value." The lectures will be given in the order named to members and non-members in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, on the dates mentioned at 8:15 p. m.

\* \* \*

**MINNESOTA CONTRACTORS.**—A meeting of the Minnesota Electrical Contractors' Association was held in the Builders' Exchange, St. Paul, on Feb. 1. In a general discussion it was agreed that the growth of the association in numbers and influence would be a decided benefit in raising the standard of the electrical construction business in the State. The St. Paul members gave a banquet to the visitors. The next meeting will be held in Minneapolis on June 20. Mr. G. M. Jones, of Minneapolis, is secretary of the association.

\* \* \*

**ORGANIZATION OF CHICAGO JOVIAN LUNCH CLUB.**—At a meeting held on Feb. 3, attended by sixty-five members of the Jovian Order living in Chicago, a Chicago Jovian Lunch Club was formed. For the present the new club will meet at luncheon at the Grand Pacific Hotel every Monday at 12:15 p. m. Mr. George C. Richards, statesman for Northern Illinois, is chairman, and Mr. M. S. Hart is secretary. The club will begin an active campaign for new members, and it is probable that several rejuvenations will be held before the great rejuvenation to take place during the N. E. L. A. convention in Chicago on June 2-6.

\* \* \*

**JOVIAN CHAPTER, ST. LOUIS ELECTRICAL LEAGUE.**—At its annual meeting and dinner, held at the Mercantile Club, St. Louis, Jan. 28, the Jovian Chapter of the St. Louis League of Electrical Interests entertained as its guests the visiting delegates of the Western Association of Electrical Inspectors. Mr. Sam A. Hobson, the retiring president, presented Secretary Eli C. Bennett with a handsome leather case in token of the league's appreciation of his services. Mr. Bennett's report showed a treasury balance of \$800. Upon motion of Mr. W. O. Layman a resolution was passed urging the selection of St. Louis as the place of next year's Jovian convention and the election of Mr. W. N. Matthews, of that city, as national Jupiter. St. Louis chapter officers for the year were unanimously elected as follows: President, A. C. Einstein; vice-president, W. N. Matthews, and secretary-treasurer, E. C. Bennett. An attendance of 400 marked the meeting and banquet.

\* \* \*

**MEETING OF HAMILTON SECTION, N. E. L. A.**—Over 100 members attended the meeting of the Hamilton (Ont.) Section of the National Electric Light Association on Jan. 22 to wish President Thomas F. Kelly success in his new undertaking. As has been already announced in these columns, Mr. Kelly has severed his connection with the Hamilton Electric Light & Power Company and accepted the post of sales agent of the Dayton (Ohio) Power & Light Company. The meeting was therefore very largely a farewell reception to Mr. Kelly, who was presented with a cabinet of silver by the employees of the Hamilton Electric Light & Power Company, and who in turn presented a life-size photograph of himself to the section. Previous to the presentation there was an illustrated lecture on the Panama Canal by Mr. George W. Magalhaes. Addresses were also made by President-elect L. W. Pratt of the Hamilton Section; Mr. George W. Ames, past-president of the Buffalo Section, and Messrs. George D. Fearman, W. G. Angus and Charles G. Choate.

## Gas-Engine-Driven Central Station

**High Load-Factor Obtained by the Titusville Light & Power Company in the Natural Gas and Oil Regions in the Northwestern Part of Pennsylvania**

**T**ITUSVILLE, Pa., is said to be one of the wealthiest cities per capita in the United States. It has a population of approximately 9000 and is situated on Oil Creek, in Crawford County, about midway between Buffalo and Pittsburgh, on the Chautauqua division of the Pennsylvania Railroad and at the terminus of the Dunkirk, Allegheny Valley & Pittsburgh branch of the New York Central & Hudson River Railroad Company. Surrounded by an agricultural and farming community, Titusville presents many features as a manufacturing town. Primarily, it is the home of several of the most influential oil men in the country and contains the principal offices of the Tidewater Oil Company, Pure Oil Company, South Penn Oil Company, Carter Oil Company, United States Pipe Line Company, National Oil Company, Derrick Oil Company, and possibly twenty other smaller companies. Both the Tidewater Oil Company and the United States Pipe Line Company have important pumping stations there, and in fact all the oil from the Illinois field for the East is brought in pipe lines through Titusville.

In addition to the large refineries of the Pennsylvania Paraffine Works, the American Oil Works and the Titusville Oil Works there are several important manufacturing concerns located there. Among these are the American Radiator Company, the largest manufacturer of steam and hot-water radiators; the Cyclops Steel Works, which make a specialty of high-grade tool steel; the Titusville Forge Company, which manufactures iron forgings for all kinds of work; the Titusville Iron Company, which manufactures gas and steam engines, boilers, tanks, pumping rigs and specialties for the oil industry; the acid works of the Gras-

sell Chemical Company; extract works; the Queen City Tannery, owned by the United States Leather Company; a silk mill, cutlery works, a chair factory, several wood-working concerns and smaller machine shops.

The Titusville Light & Power Company is incorporated under the laws of Pennsylvania and at present owns the only franchise for supplying electricity in Titusville. For this privilege it pays the city by lighting its city hall, hose houses and jail, so long as no competing franchise is granted. The company's power house is located on a rectangular piece of ground, 70 ft. by 170 ft., abutting on Franklin Street, a principal business street within 200 ft. of the business center. The Pennsylvania Railroad Company has a switch on one side and the New York Central Railroad Company a switch on the other side of the property. An ample supply of water is secured from a 65-ft. drilled well capable of supplying at least 10,000 gal. of water an hour continuously.

The station building itself was erected during the summer of 1908 and is 62 ft. by 42 ft., all in one room with a heavy concrete floor, brick walls and steel roof. A steel runway carries a 10,000-lb. crane the entire length of the building, 20 ft. above the floor. The generating equipment comprises two 180-hp, three-cylinder, 14-in. by 18-in. vertical-type gas engines each directly connected to a 125-kw, 2300-volt, three-phase, 60-cycle alternator with directly connected 6-kw exciter, and one four-cylinder, 250-hp vertical-type gas-engine unit with the same cylinder dimensions. This unit drives a 200-kw generator. At present a fourth unit, similar to the third, is being installed. The gas engines were built by the Titusville Iron Company, the works

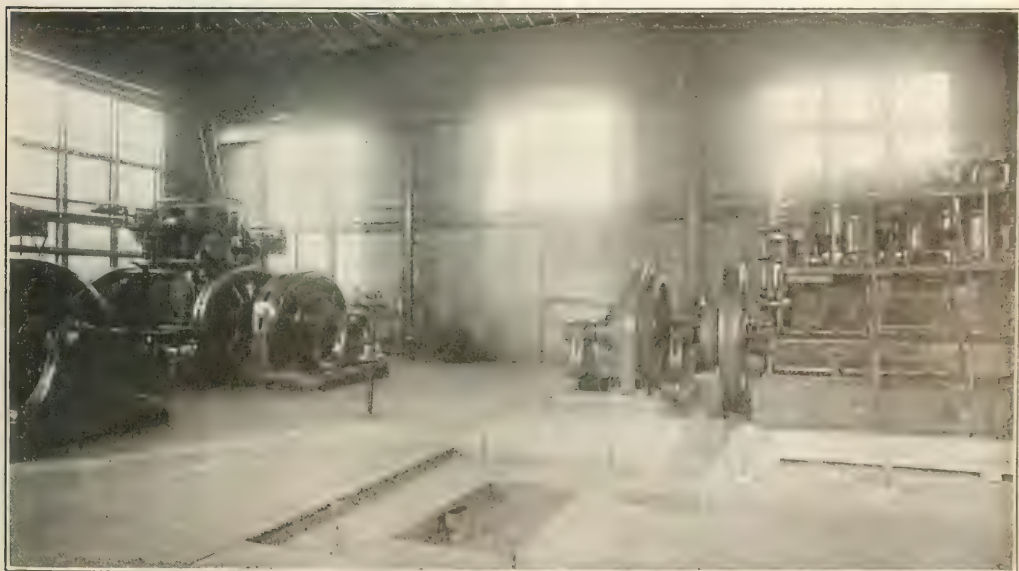


FIG. 1.—INTERIOR VIEW OF THE TITUSVILLE STATION



of which are located on the property adjoining the electric-light plant. The latter has the constant attention of the iron company's engineers, who use the plant as a showroom for prospective gas-engine purchasers. A Deming triplex pump geared to a 5-hp, three-phase, 220-volt motor supplies all the necessary water for plant purposes, and a Bury double-acting air compressor belted to a 5-hp, three-

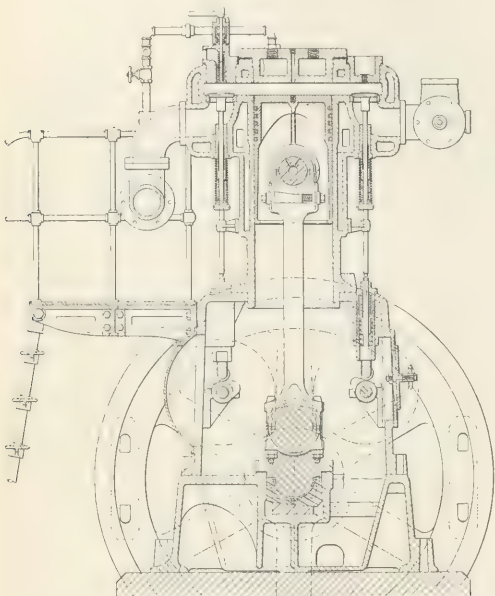


FIG. 2—SECTIONAL VIEW OF ONE OF THE GAS ENGINES

phase, 220-volt motor supplies air for starting the engine, driving a pneumatic tool and drawing oil and gasoline from the storage tank. A steel tank holding 110 cu. ft. is used to store air under a pressure of 160 lb., and two tanks each of 119-gal. capacity store the necessary oil and gasoline. The latter tanks are buried outside the building and are equipped with the necessary piping, air connections, etc., to bring the oil and gasoline into the plant. A 1-kw motor-generator set supplies 110-volt direct current for telegraph purposes and also for engine-ignition purposes.

The engines are of the vertical, single-acting, four-stroke cycle type governed by automatically controlling a gas and air mixture of practically constant quality. The cylinders are bolted to the top of an inclosed crank case which serves the added purpose of providing means for accomplishing copious oil-bath lubrication of all working parts. Natural gas containing approximately 1000 effective heat units per cubic foot is supplied to the engines at a pressure not exceeding  $\frac{1}{2}$  lb. per square inch by pressure gage and not less than 4 in. pressure by water column. The cylinder and the cylinder heads are water-jacketed, but there is no water connection between the heads and the cylinders. Both have ample independent supply to permit the engines to be operated at full load continuously without overheating. The inlet and exhaust valves are of the poppet type and are operated by cam and spring valve gear. Each exhaust valve is provided with a cam to enable the operator to relieve the compression at will for starting purposes.

Separate air and gas valves are contained in the mixing valve. The air and gas valves are of the cylindrical type operated vertically by the governor and have suitable ports arranged so that they can be rotated by hand independently of each other so as to vary the size of the port opening for

air and gas to get the best mixture. A governor of the fly-ball type is geared directly to the cam shaft and operates the mixing valve by means of a shaft and levers. A dual system of ignition is employed; one, a jump spark with magneto, and the other of positive make-and-break type, both being driven from the cam shaft. Provision is made for starting the engine automatically by means of a starting valve which is operated by a cam on the cam shaft and admits compressed air to one of the cylinders. Between 25 per cent of full load and full load the speed of the engine does not vary more than 2 per cent either way from the mean speed for all reasonable usual changes of load during normal operation. In case of unusual and sudden large changes of load the speed momentarily exceeds these limits. Standard switchboard equipment is employed, and in addition to the lightning protection in the station graded shunt and non-arcing lightning arresters are used on the line to protect the large transformers and the motor installations.

There is nothing unusual about the station except perhaps the simplicity of the layout and the fact that until recently no reserve apparatus was installed. Located as the company is in the heart of a natural gas and oil region, competition from both of these forms of fuel is of course to be expected. The city of Titusville, moreover, owns and operates its own street-lighting plant. The generating equipment for the latter, which has been in operation since 1889, is located in the water works and furnishes energy for 152 Brush open-arc lamps rated at 9.6 amp. The plant is rather antiquated and is unable to furnish additional lighting service for the city. Inasmuch as there are no funds available for improving the municipal lighting installation, the Titusville Light & Power Company will in all probability be called upon in the near future to do some of the street lighting of the city.

The company purchases natural gas at a net rate of \$.028 per 1000 cu. ft., and this rate is given to every other consumer of natural gas in Titusville. It is significant, therefore, that in the face of these competitive conditions the company has increased its output three and one-half times in the last two years and acquired quite a motor load. The

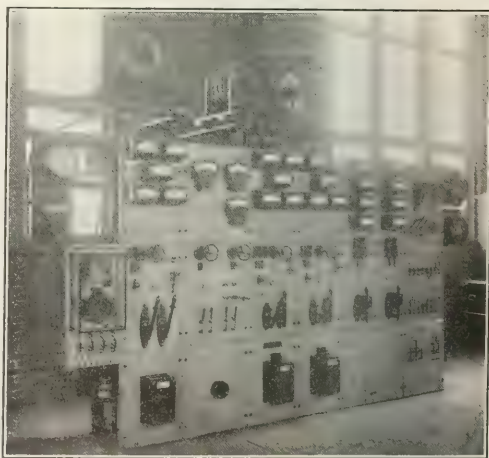


FIG. 3—SWITCHBOARD IN TITUSVILLE STATION

latter load is about four times the size of the lighting load, although the revenue derived from each is about the same. By a judicious use of synchronous apparatus on certain of the motor circuits the average power-factor of the system is maintained at 90 and over. The company has been fortunate in the acquisition of certain installations possessing excellent diversity factors. There is, therefore, no evening

peak such as is found in systems where the motor load and the lighting load overlap. The maximum load is encountered shortly after 9 o'clock in the morning and again in the early afternoon, and the load curve is lowest between midnight and about seven in the morning. Under these conditions a fairly good load-factor is to be expected, and the Titusville Light & Power Company's system possesses a load-factor ranging between 70 and 80 per cent. The station is operated at minimum labor expense, there being two twelve-hour shifts with a single engineer in charge. The day operator receives \$80 a month and the night operator \$65 a month; so that the total labor cost for operating the station is \$145 a month.

It was felt at the time this load was taken over that there would be a very marked increase in the station demand, and some anxiety was manifested by the forge works as to its effect on the company's system. However, much to the surprise of all concerned, the diversity factor of the installation was such that the demand on the station was increased only slightly. The Titusville Iron Works, which operate a gas-engine-driven isolated plant, contracts with the central station for service extending from about 10 p. m. to 4 a. m., during which time its engines are shut down. Having a direct-current equipment, the iron works have installed a motor-generator set to carry the night load, seeing that the central station supplies only alternating current.

The set is rated at 60 kw and the load comes on at a time when the system is delivering minimum output. Since the iron works are enabled to operate at night without keeping their own plant in operation, with its necessary attendants, considerable saving is effected by employing central-station service.

The number of residences supplied with electricity is more than 200, about 100 of these being equipped with "Excess" indicators. For the latter service a charge of 1 cent a watt a month, with a minimum bill of \$1.25 a month, is in force. The base meter rate for residence service is 12 cents per kw-hr. There is a very little competition encountered with natural gas, despite its cheapness for store lighting, and where 50 kw-hr. is consumed monthly the rate is 9 cents per kw-hr. less a discount of 5 per cent. for prompt payment.

The company carries a full line of electrical supplies in its office in the Post Office building, on Central Avenue, and engages in contracting work also. Incandescent lamps are sold at list prices and all goods are sold at a profit. Such wiring work as the company does is also done at a profit. In a great many of the residences the meters are placed on the back porches, a custom which obtains in many Pennsylvania towns and by reason of which meters are read expeditiously and with minimum expense.

Every precaution is taken to keep down the operating

pense without sacrifice of reliability. Of all the apparatus the gas engines are probably most prone to cause unexpected trouble, but, inasmuch as these are manufactured next door, the station is amply guarded in this respect. Thus far, however, the engines have given remarkable service. A representative copy of the station log, reproduced herewith, shows a fuel consumption of 14.8 cu. ft. of gas per kw-hr. The cost of electrical energy delivered at the switchboard, including fuel, engineers' wages, supplies, repairs to building, machinery and equipment, is less than 8 mills per kw-hr., which is remarkably low for so small a station. Mr. E. F. McCabe is the general manager of the Titusville Light & Power Company.

## Titusville Light and Power Company

DAILY STATION REPORT.

12 M. November 6

1912

UNIT No. 1			UNIT No. 2			UNIT No. 3		
STARTED	STOPPED	HOURS RUN	STARTED	STOPPED	HOURS RUN	STARTED	STOPPED	HOURS RUN
On	10:40	10 1/2	On	On	24	On	11:30	11 1/2
11:30	On	13				8:30	On	5 1/2
TOTAL HOURS RUN 23 1/2			TOTAL HOURS RUN 24			TOTAL HOURS RUN 17		
AVERAGE LOAD K W			AVERAGE LOAD K W			AVERAGE LOAD K W		
GAS METER NO. 1 READS 6,246,560			GAS METER NO. 2 READS 5,755,150			GAS METER NO. 3 READS 7,831,370		
YESTERDAY'S READING 6,218,310			YESTERDAY'S READING 5,724,660			YESTERDAY'S READING 7,797,800		
CUBIC FEET GAS USED 28,250			CUBIC FEET GAS USED 30,490			CUBIC FEET GAS USED 33,570		
ELECTRIC METER NO. 1 READS 3,826			ELECTRIC METER NO. 2 READS 4,034			ELECTRIC METER NO. 3 READS 99,250		
YESTERDAY'S READING 1,903			YESTERDAY'S READING 1,919			YESTERDAY'S READING 97,070		
K W HOURS GENERATED 1,923			K W HOURS GENERATED 2,116			K W HOURS GENERATED 2,180		
Cu Ft of Gas K W Hrs 14.1			Cu Ft of Gas K W Hrs 14.4			Cu Ft of Gas K W Hrs 15.3		
TOTAL HOURS RUN			AVERAGE LOAD K W HOURS ON USED			UNITS		
TOTAL GAS USED 92,310			CUBIC FEET divided by Total Output 6,219 K W HOURS			14.8 CUBIC FEET PER K W HRS		
REMARKS: Maximum Kw. 349			Average Load 24 hrs. 259.12 kw					
Time 1 p.m. to 2 p.m.			Load Factor 74.2 per cent					
A B C			Power Factor 90 per cent					
Amp. 300 100 100 100								
Signed			Alan G. Dame			ENGINEER		

FIG. 4—STATION LOG OF THE TITUSVILLE LIGHT &amp; POWER COMPANY

There are over 102 motors connected to the company's system with an aggregate rating of approximately 1000 hp. Most of the large installations are driven directly by 2300-volt motors, thus eliminating transformer losses. The largest load fed from the system is that of the Titusville Forge Works, which aggregates 600 hp. A part of the equipment comprises a 200-kw synchronous converter which is over-excited so as to improve the power-factor of the system. The works were formerly operated from a gas-engine installation, but after a thorough investigation, which took cognizance of the troubles caused by gas-engine mishaps, it was decided to employ central-station service. The rate is 1.75 cents per kw-hr. for a twenty-four-hour load.

# International Scandinavian Transmission System

**Comparative costs of generating equipment and proposed 200-mile line from Trollhättan to Copenhagen  
—90,000-volt direct-current system recommended**

**N**EGOTIATIONS have been under way for some time between the Swedish and Danish governments for the sale and transmission of electrical energy from Trollhättan, Sweden, to Copenhagen. The commercial feasibility of the project has been investigated by the Swedish government, which engaged Mr. Carl A. Rossander, of the Elektriska Pröfningsanstalten, Stockholm, to report on the matter. Mr. Rossander was assisted in his investigations by Messrs. Torsten Holmgren, of Trollhättan, and Mr. Georg Centerwall, of Stockholm, and the following information is contained in their report to the Swedish government.

The present generating stations in Copenhagen being too small to meet the increasing demand for electrical energy in the city and its suburbs, it was proposed either to build a new modern steam station or to purchase energy from the large hydroelectric system recently erected by the Swedish government at Trollhättan and transmit it at high tension to Copenhagen. In order to obtain exact knowledge of the relative merits of the prevailing transmission schemes for the project in hand, a thorough study was made of the existing conditions, the probable ultimate demand, production costs in a modern steam generating station at Copenhagen, and the cost of transmitting energy from Trollhättan across the strait to Denmark and thence on to Copenhagen.

The city and suburbs of Copenhagen have a population of 581,000 and are at present served by three central steam stations and a number of isolated plants. Extensions or improvements of these stations were not considered for the purpose of furnishing the whole supply, but in case energy should be purchased from Trollhättan it is proposed to retain these stations with their storage-battery equipments in case of interruptions on the high-voltage system and also for carrying the peak load. The Trollhättan plant, which was described in the *Electrical World* Jan. 11, 1913, is designed for 100,000 hp generated by ten 10,000-hp turbo-generators, of which eight are now installed. The remaining two units could be used for the generation of energy for sale to Copenhagen. During 1911, when the investiga-

annual expense per kilowatt. In this connection it should be mentioned that the estimates do not include cost of administration, taxes, insurance, etc., and that the rating of the proposed plant corresponds to the present demand. The variable annual expenses for the proposed plant, including cost of fuel, oil, coal transportation and storage, would

TABLE II—FIXED ANNUAL EXPENSES PER KILOWATT FOR STEAM TURBO-GENERATOR STATION AT COPENHAGEN

Interest, 5 per cent on \$34.60 .....	\$1.73
Depreciation:	
Turbo-generators, condensers and auxiliaries, 3 per cent.....	\$0.38
Boilers, cranes, switchboard, miscellaneous, 4.6 per cent.....	0.73
Buildings, 0.5 per cent.....	0.02
Maintenance:	\$1.13
Turbo-generators, condensers and auxiliaries, 1.5 per cent.....	\$0.19
Boilers, 4 per cent.....	0.49
Building, 1 per cent.....	0.03
Switchboard, cranes, miscellaneous, 2.5 per cent....	0.09
Wages.....	0.80
	1.34
Total.....	\$5.00

amount to 0.4 cent per kw-hr., based upon the manufacturer's guarantee of steam consumption and the market price of fuel at Copenhagen. The cost of generating electrical energy at Copenhagen would, therefore, be a fixed charge of \$5 per kw per annum plus 0.4 cent per kw-hr.

The operating expenses of the present plants are of interest. Table III shows the variable annual expense per kilowatt-hour during 1910. Assuming that the plants would be used as reserve and for carrying the peak loads, the figures would be somewhat reduced. The cost of maintenance and supplies would be decreased by about 75 per cent and the total variable annual expense per kw-hr. would then be as follows: Copenhagen, 0.76 cent; Fredriksberg, 1.07 cents; Skovshoved, 1.05 cents. The fixed charges, including in-

TABLE I—COST PER KILOWATT FOR STEAM TURBO-GENERATOR STATION AT COPENHAGEN

7000-kw turbo-generators with condensers and auxiliaries.....	\$12.62
Boilers with economizers, pumps and piping.....	12.12
Cranes, etc.....	2.08
Switchboard.....	1.35
Building.....	3.40
Real estate.....	2.70
Miscellaneous and incidentals.....	0.33
Total.....	\$34.60

tion was made, the demand in Copenhagen was about 24,000 kw and the yearly energy consumption 65,000,000 kw-hr. The load-factor was about 31 per cent. The demand for 1913 is estimated to be about 35,000 kw and the yearly energy consumption about 95,000,000 kw-hr.

## COST OF MODERN STEAM PLANT AT COPENHAGEN

The value of electrical energy at Copenhagen can, of course, best be determined from the cost of generation in that city. For this purpose quotations were obtained for a complete steam turbo-generator plant, the cost of which per kilowatt is given in Table I. Table II gives the fixed

TABLE III—VARIABLE ANNUAL EXPENSES PER KILOWATT-HOUR FOR PRESENT STEAM GENERATING STATIONS

Station	Cost of Fuel, Cents	Cost of Oil, Cents	Maintenance and Supplies, Cents	Total Cost, Cents
Copenhagen.....	0.65	0.02	0.37	1.04
Fredriksberg.....	0.96	0.05	0.24	1.25
Skovshoved.....	0.97	0.03	0.19	1.19

terest, depreciation, wages, etc., are not considered, as they would remain practically the same as under present conditions.

## TRANSMISSION FROM TROLLHÄTTAN

In planning a transmission system from Trollhättan to Copenhagen, a distance of 204 miles, a matter of primary importance was the amount of energy which could be transmitted with greatest advantage. As stated above, it was estimated that during 1913 the demand would be 35,000 kw during 2700 hours. On account of the length of the transmission line and the consequent large expen-



diture involved a comparatively large load-factor would be essential in order to make the project commercially successful. To supply the whole demand at a load-factor of, say, 30 per cent would not be feasible, as the price in that case would be considerably higher than that of energy

TABLE IV—FIXED ANNUAL EXPENSES FOR ALTERNATING-CURRENT SYSTEM

	Interest, per Cent	Deprecia- tion, per Cent	Mainten- ance, per Cent	Total, per Cent
Hydraulic works . . . . .	4	3.4	0.7	8.1
Buildings . . . . .	4	3.4	1.0	8.4
Turbines . . . . .	4	3.4	2.0	9.4
Generators . . . . .	4	3.4	2.0	9.4
Transformers . . . . .	4	3.4	2.0	9.4
Switch gear . . . . .	4	3.4	2.5	9.9
Converters and frequency changers . . . . .	4	3.4	2.0	9.4
Auxiliaries (cranes, pumps, etc.) . . . . .	4	3.4	3.0	10.4
Transmission poles of iron . . . . .	4	3.4	2.5	9.9
Iron cable . . . . .	4	8.3	1.5	13.8
Insulators . . . . .	4	3.4	2.5	9.9
Copper conductors . . . . .	4	2.6	0.2	6.8
Submarine cables . . . . .	4	3.4	5.0	12.4

generated at a steam plant in Copenhagen. Further investigations proved that one-third of the maximum demand, or about 11,600 kw, would be required during 5200 hours. As this corresponds to 20,000 hp at Trollhättan, which is equal to the output of the two available generating units the following calculations have been made on that basis. The energy consumption would, however, probably be considerably higher than the figures indicate, as it is proposed to sell the energy at a fixed price per kilowatt plus a very low charge per kilowatt-hour, in which case it would be to the purchaser's interest to distribute energy at a low rate, for instance, during the night, and to utilize the present storage-battery system to the largest possible extent.

The route of the proposed transmission line is along the west coast of Sweden from Gothenburg to Helsingborg, where it crosses the Strait of Öresund to Helsingör, and thence along the coast of Denmark to Copenhagen. Both alternating-current and direct-current systems have been considered for generation and transmission. At present 25-cycle alternating current is generated at Trollhättan and 50-cycle alternating current at Copenhagen.

#### COST OF THREE-PHASE GENERATING EQUIPMENT AND TRANSMISSION LINES

This system involves the installation of turbines, three-phase generators, transformers, transmission line, submarine cables, transformer stations in Helsingborg, Helsingör and Copenhagen and frequency changers in Copenhagen for the generation and transmission of 20,000 hp measured at the turbines at Trollhättan.

Assuming a 100,000-volt line, calculations as to the most economical size of copper conductor show that a cross-section between 100,000 circ. mils and 200,000 circ. mils could be used with equal advantage, and the following estimates were based on 150,000-circ. mil conductors. The total length of the proposed line is 204 miles with a single three-wire circuit on iron poles with suspension insulators. At Helsingborg it is proposed to step down the tension to 20,000 volts and to carry the energy by four three-phase submarine cables, each 3 by 187,435 circ. mils, across the Strait of Öresund to Helsingör, a distance of 3.4 miles. From Helsingör to Copenhagen either 20,000 volts or 100,000 volts can be used, the latter being the more economical.

If the generators have an efficiency of 96 per cent, all the transformers 98.5 per cent, and the frequency changers at Copenhagen 90 per cent, there would be available for distribution at 10,000 volts 11,600 kw at 25 cycles or 10,440 kw at a frequency of 50 cycles.

In estimating the fixed annual expenses (Table IV) 4 per cent interest has been allowed on the investment. The life of the material is considered to be about twenty years except the steel cable, the life of which is limited to ten years. No value has been set on any material after the time of depreciation except for the copper conductors, which are supposed to sell at 25 per cent of first cost. The wages of linemen have been estimated at \$11 per mile a year, and the sum allotted for wages and lubricating material at the generator station at Trollhättan and at the converter station at Copenhagen is \$3,200, and at each of the transformer stations at Helsingborg, Helsingör and Copenhagen about \$1,300.

In the total expense (Table V) is included the whole project from the turbines at Trollhättan to and including the transformer station at Copenhagen. The total cost, including the frequency converter station at Copenhagen, is given separately. Twenty per cent has been added to the actual cost to cover incidentals and administration.

#### COST OF DIRECT-CURRENT GENERATION AND TRANSMISSION

For direct-current transmission the Thury constant-current system at 90,000 volts was considered. Submarine cable can be obtained for that voltage and consequently no transformer stations would be required at Helsingborg and Helsingör. The Trollhättan plant is at present arranged for two future 10,000-hp turbines, but a direct-current system would require instead four 5000-hp machines each driving five direct-current series-connected generators. The Thury system would also involve a converter station at Copenhagen for changing from direct current to 50-cycle alternating current.

TABLE V—COST OF GENERATING AND TRANSMITTING ALTERNATING CURRENT AND EVENTUALLY CONVERTING IT INTO 50-CYCLE ALTERNATING CURRENT AT COPENHAGEN

	Cost of Installation	Annual Expenses
<b>Generating station:</b>		
Two 10,000 hp turbines and auxiliaries . . . . .	\$81,000	\$7,000
Three-phase generators . . . . .	70,000	6,600
Transformers at Trollhättan . . . . .	31,500	2,950
Switch gear . . . . .	27,000	2,650
Wages, oil and supplies . . . . .		3,200
	\$210,000	\$22,800
<b>Transmission line:</b>		
Iron poles, including erection, at \$1,350 per mile . . . . .	\$275,000	\$27,200
Insulators, at \$390 per mile . . . . .	80,000	7,900
Iron cable, at \$87 per mile . . . . .	17,900	2,500
Copper conductors, at \$1,525 per mile . . . . .	310,100	21,000
Wages for linemen . . . . .		2,200
	\$683,000	\$61,800
<b>Three-phase converter station:</b>		
Buildings . . . . .	\$40,500	\$3,400
Transformers . . . . .	81,000	7,000
Insulators . . . . .	30,500	3,000
Auxiliaries . . . . .	40,500	4,000
Wages and supplies . . . . .		
	\$192,500	\$17,400
<b>Submarine cables:</b>		
Four cables, each 3 cables, at \$1,800 per mile . . . . .	\$216,000	
Each cable, 1 cable, laying and erecting . . . . .	20,000	\$14,200
Freight and marine insurance . . . . .	5,400	
Anchorages at cables . . . . .	9,500	
	\$113,500	\$14,200
<b>Incidental:</b>		
Total . . . . .	\$1,102,500	\$142,000
<b>Frequency-converter station:</b>		
Three frequency converters . . . . .	\$1,000,000	
Switch gear . . . . .	100,000	
Wages, oil and supplies . . . . .		
Incidentals . . . . .		
		\$10,000
<b>Grand total . . . . .</b>	<b>\$1,202,500</b>	<b>\$152,000</b>

A plan for the generation of 25-cycle alternating current at Trollhättan and its conversion to direct current for transmission was studied. Either impregnated wooden poles or iron poles might be employed and a ground return. Estimates were made for this as well as for ordinary metallic-return systems. For the direct-current generators and mo-

TABLE VI—COST OF GENERATING AND TRANSMITTING DIRECT CURRENT AND EVENTUALLY CONVERTING IT INTO 50-CYCLE ALTERNATING CURRENT AT COPENHAGEN

	WOODEN-POLE TRANSMISSION LINE				IRON-POLE TRANSMISSION LINE			
	GROUND RETURN		METALLIC RETURN		GROUND RETURN		METALLIC RETURN	
	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses
Changes for turbines.....	\$40,500	\$3,400	\$40,500	\$3,400	\$40,500	\$3,400	\$40,500	\$3,400
Isolating machinery.....	2,700	200	2,700	200	2,700	200	2,700	200
	\$43,200	\$3,600	\$43,200	\$3,600	\$43,200	\$3,600	\$43,200	\$3,600
<i>Generating equipment:</i>								
Four 5000-hp turbines.....	\$81,000	\$7,600	\$81,000	\$7,600	\$81,000	\$7,600	\$81,000	\$7,600
Direct-current generators and auxiliaries.....	216,000	21,400	216,000	21,400	216,000	21,400	216,000	21,400
Wages, oil and supplies.....		3,200		3,200		3,200		3,200
	\$297,000	\$32,200	\$297,000	\$32,200	\$297,000	\$32,200	\$297,000	\$32,200
<i>Submarine cables:</i>								
Two cables, each 3.4 miles, 150,000 circ. mils.	\$24,600	\$5,400	\$24,600	\$5,400	\$24,600	\$5,400	\$24,600	\$5,400
Laying of cables, etc.....	18,900		18,900		18,900		18,900	
	\$43,500	\$5,400	\$43,500	\$5,400	\$43,500	\$5,400	\$43,500	\$5,400
<i>Transmission line:</i>								
Poles, including erection.....	\$125,100	\$13,000	\$204,000	\$21,100	\$178,000	\$17,700	\$264,000	\$26,100
Insulators.....	31,900	3,200	28,400	2,800	32,900	3,200	28,400	2,800
Iron cable.....	17,800	2,500	17,800	2,500	17,800	2,500	17,800	2,500
Copper conductors.....	166,200	11,300	470,000	32,000	166,000	11,300	470,000	32,000
Wages for linemen.....		2,200		2,200		2,200		2,200
	\$341,000	\$32,200	\$720,200	\$80,600	\$394,000	\$36,900	\$780,200	\$85,600
Incidentals.....	\$140,000	\$14,000	\$220,000	\$19,700	\$153,000	\$15,100	\$227,000	\$20,700
Total.....	\$864,700	\$87,800	\$1,320,900	\$121,500	\$931,400	\$93,200	\$1,390,900	\$127,400
<i>Frequency-converter station:</i>								
Direct-current motors and auxiliaries.....	\$221,000	\$22,000	\$212,000	\$21,000	\$221,500	\$22,000	\$213,500	\$21,000
Three-phase generators.....	51,500	4,800	48,500	4,600	51,500	4,800	48,600	4,600
Switchboard and switch gear.....	10,800	1,100	10,800	1,100	10,800	1,100	10,800	1,100
Wages and supplies.....		3,200		3,200		3,200		3,200
Incidentals.....	54,000	6,200	51,500	5,900	54,000	6,200	51,500	5,900
	\$337,300	\$37,300	\$322,800	\$35,800	\$337,800	\$37,300	\$324,400	\$35,800
Grand total.....	\$1,202,000	\$125,100	\$1,643,700	\$157,300	\$1,269,200	\$130,500	\$1,715,300	\$163,300

TABLE VII—COST OF GENERATING ALTERNATING CURRENT AND CONVERTING IT INTO DIRECT CURRENT AT TROLLHÄTTAN, TRANSMITTING DIRECT CURRENT AND EVENTUALLY CONVERTING IT INTO 50-CYCLE ALTERNATING CURRENT AT COPENHAGEN

	WOODEN-POLE TRANSMISSION LINE				IRON-POLE TRANSMISSION LINE			
	GROUND RETURN		METALLIC RETURN		GROUND RETURN		METALLIC RETURN	
	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses	Cost of Installation	Annual Expenses
Building for converter station.....	\$54,000	\$4,500	\$54,000	\$4,500	\$54,000	\$4,500	\$54,000	\$4,500
<i>Generating equipment:</i>								
Two 10,000-hp turbines.....	\$81,000	\$7,600	\$81,000	\$7,600	\$81,000	\$7,600	\$81,000	\$7,600
Two three-phase generators.....	70,300	6,600	70,300	6,600	70,300	6,600	70,300	6,600
Switchboard and switch gear.....	10,800	1,100	10,800	1,100	10,800	1,100	10,800	1,100
Three-phase motors.....	62,200	5,900	62,200	5,900	62,200	5,900	62,200	5,900
Direct-current generators and auxiliaries.....	194,300	19,300	194,300	19,300	194,300	19,300	194,300	19,300
Switchboard and switch gear.....	8,100	800	8,100	800	8,100	800	8,100	800
Wages and supplies in power station.....		3,200		3,200		3,200		3,200
Wages and supplies in converter station.....		3,200		3,200		3,200		3,200
	\$426,900	\$47,700	\$426,900	\$47,700	\$426,900	\$47,700	\$426,900	\$47,700
<i>Submarine cables:</i>								
Two cables, each 3.4 miles, 150,000 circ. mils.	\$24,600	\$5,400	\$24,600	\$5,400	\$24,600	\$5,400	\$24,600	\$5,400
Laying of cables.....	18,900		18,900		18,900		18,900	
	\$43,500	\$5,400	\$43,500	\$5,400	\$43,500	\$5,400	\$43,500	\$5,400
<i>Transmission line:</i>								
Poles, including erection.....	\$125,000	\$13,000	\$204,000	\$21,100	\$178,300	\$17,700	\$261,000	\$26,100
Insulators.....	31,900	3,200	28,400	2,800	32,600	3,200	28,400	2,800
Iron cable.....	17,800	2,500	17,800	2,500	17,800	2,500	17,800	2,500
Copper conductors.....	166,000	11,300	470,000	32,000	166,000	11,300	470,000	32,000
Linemen.....		2,200		2,200		2,200		2,200
	\$340,700	\$32,200	\$720,200	\$80,600	\$394,700	\$36,900	\$777,200	\$85,600
Incidentals.....	\$174,500	\$18,300	\$240,500	\$23,000	\$188,500	\$19,000	\$263,000	\$24,700
Total.....	\$1,039,600	\$108,100	\$1,485,300	\$141,800	\$1,107,600	\$113,500	\$1,564,600	\$148,100
<i>Frequency-converter station:</i>								
Direct-current motors and auxiliaries.....	\$200,000	\$19,800	\$192,000	\$19,000	\$200,000	\$19,800	\$192,000	\$19,000
Three-phase generators.....	46,000	4,300	43,200	4,100	46,000	4,300	43,200	4,100
Switchboard and switch gear.....	9,500	900	9,500	900	9,500	900	9,500	900
Wages and supplies.....		3,200		3,200		3,200		3,200
Incidentals.....	55,500	5,500	52,700	5,500	55,500	5,500	52,700	5,500
	\$311,000	\$33,900	\$297,400	\$32,700	\$311,000	\$33,700	\$297,400	\$32,700
Grand total.....	\$1,350,600	\$141,800	\$1,782,700	\$174,500	\$1,418,600	\$147,200	\$1,862,000	\$180,800

tors a constant current of 150 amp was proposed, which, with a total of 14,720 kw at the turbines and a maximum emf of 91,250 volts, could be obtained on twenty 4560-volt generators. The generators would be arranged in four groups, each having five generators in series, and each group would be connected to a 5000-hp turbine.

The efficiency of the direct-current generators and motors was assumed to be 93 per cent, that of alternating-current generators 96 per cent, and that of alternating-current motors 94 per cent. For transmission with ground return a 238,000-circ. mil conductor could be used, which, however, should preferably be divided up into two conductors each of 119,000-circ. mil cross-section. For the metallic-return

apparent disadvantage of the direct-current system, it was pointed out, is that relatively little is known about the operation of the system.

#### CONCLUSION

The relative merits of a modern steam-power plant as compared with the proposed purchase of energy from Trollhättan and transmission to Copenhagen were not considered in the report. The figures showing the cost of production at such a plant were used in this connection primarily to show the value of energy at Copenhagen.

The summary of the total annual cost per kilowatt of the various methods proposed (Table VIII) shows that direct-

TABLE VIII—SUMMARY OF COST ESTIMATES FOR VARIOUS SYSTEMS OF TRANSMISSION FROM TROLLHÄTTAN TO COPENHAGEN

System of Generation and Transmission	WITHOUT FREQUENCY CONVERTER STATION AT COPENHAGEN				WITH CONVERTER STATION AT COPENHAGEN FOR CHANGING TO 50 CYCLES			
	Kilowatts Available at Copenhagen	Total Cost of Installation	ANNUAL EXPENSES		Kilowatts Available at Copenhagen	Total Cost of Installation	ANNUAL EXPENSES	
			Total	Per Kw			Total	Per Kw
Generating and transmitting alternating current ...	11,600	\$1,431,500	\$144,500	\$12.43	10,440	\$1,593,000	\$163,500	\$15.66
Generating and transmitting direct current:								
Wooden-pole transmission line:								
Ground return.....	12,615	864,700	87,800	6.95	11,225	1,202,000	125,400	11.16
Metallic return.....	12,170	1,320,900	121,500	10.00	10,830	1,643,700	157,300	14.52
Iron-pole transmission line:								
Ground return.....	12,615	931,400	93,200	7.38	11,225	1,209,200	130,500	11.61
Metallic return.....	12,170	1,390,900	127,400	10.48	10,830	1,715,300	163,300	15.06
Generating alternating current and transmitting direct current:								
Wooden-pole transmission line:								
Ground return.....	11,280	1,039,600	108,100	9.61	10,040	1,350,600	141,800	14.12
Metallic return.....	10,830	1,485,300	141,800	13.07	9,640	1,782,700	174,500	18.10
Iron-pole transmission line:								
Ground return.....	11,280	1,107,600	113,500	10.09	10,040	1,418,600	147,200	14.68
Metallic return.....	10,830	1,564,600	148,100	13.68	9,640	1,862,000	180,800	18.75

system two 335,000-circ. mil conductors would be required. In case of emergency operation could be maintained on one wire with ground return, and on this account allowance was made for the same insulation of machinery in both the ground-return and the metallic-return systems.

The price of copper was figured at 21 cents a pound and insulators at \$8 each, including cost of installation. The line losses in the ground-return system were estimated at 1075 kw and for a metallic-return system at 1520 kw. The use of iron poles of lattice-work construction was contemplated. The estimates of annual expenses for this system were based on the same rate of depreciation as given for the alternating-current system in Table IV, except that for the direct-current generating equipment and auxiliaries 2.5 per cent was allowed for maintenance, making the fixed annual expense 9.9 per cent. The maintenance of wooden poles was figured at 3 per cent with the total annual expense at 10.4 per cent.

In regard to the technical merits of the various proposed systems the engineers point out that high-tension alternating-current systems are now commonly used and the method of operation is well known. Three-phase alternating current is now generated and distributed at Trollhättan. By using this system the generating equipment would be more uniform and the employees would be familiar with the operation of the system. The advantages claimed for the direct-current system are: simplicity in operation of generating equipment and building of transmission lines, the tension of the latter corresponding to only 64,000 volts alternating current; elimination of trouble from voltage variations due to varying load (the current is automatically kept constant at the power stations); high-tension underground and submarine cables can be used wherever necessary; simple protection against lightning and other disturbances; a certain amount of reserve in the ground-return system by using two wires, of which one will be able to carry the load temporarily in case of emergency. The only

current generation and transmission using wooden-pole line construction and ground return is the most economical and also possesses favorable operating features, so that that system was recommended for the proposed line. The total annual expenses for this system are estimated to be \$6.75 per kw for direct-current or \$11.16 per kw for 50-cycle alternating current, in the former case 12,615 kw being available for distribution and in the latter case 11,225 kw.

#### A Rational Method of Showing Light Distribution

BY ROBERT FRENCH PIERCE

Engineering in all its branches is presumed to be an art singularly free from the trammels of tradition. In practically every branch "efficiency"—in the broad application of the word—is the consideration of first importance. With an assiduity commendable in a better cause, in illuminating engineering we have split hairs enthusiastically regarding the efficiencies of light sources and lighting systems, yet have remained helplessly in the shackles of an antiquated and cumbersome system of units which mean nothing and cannot be made to mean anything except by transformation into an alternative and more logical system, and we have persisted in a method of graphical representation of light-distribution characteristics which interposes almost every conceivable difficulty in the way of calculation and is so utterly misleading as to defeat its own object.

It is difficult to explain our adherence to the term "candle-power" upon any other ground than a reverence for a tradition more or less entrenched by common usage. As ordinarily interpreted and applied, the candle-power—if it is a unit of anything—is a unit of quantity. Its most frequent use is in connection with the photometric or distribution curve, and here it represents nothing more or less than the results of certain measurements involving the comparison of equal quantities of light with reference to the relative



magnitude of the respective solid angles containing these equal quantities. Thus, in making a photometric measurement we gather upon opposite sides of the photometric disk equal quantities of light, and by calculating from the relative distances of the light sources from the disk the relative magnitudes of the solid angles containing these equal fluxes establish a proportionality between the respective quantities

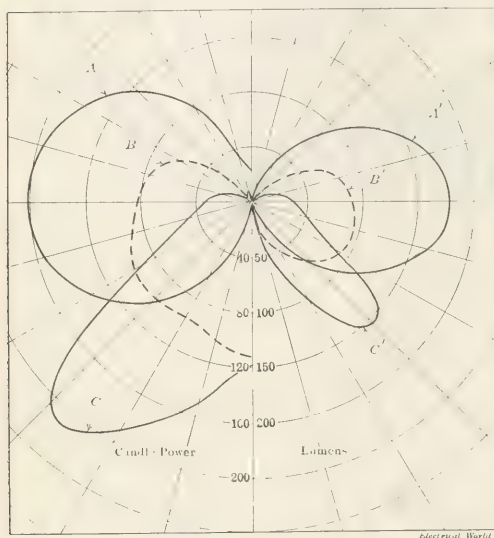


FIG. 1—PLANE AND SPACE DISTRIBUTION CURVES FROM UPRIGHT AND INVERTED GAS LAMP

of light emitted in equal solid angles by the light sources under comparison.

As used in this connection therefore—and this is by all odds the widest use of the term—the candle-power is a unit of quantity, yet it does not contain within itself any specification of quantity, nor can it be transformed in such a manner as to permit of quantitative calculations without resorting to a second unit (the lumen) which would have served every purpose of the candle-power in the first place. Why not, therefore, abandon the candle-power and substitute in its stead the lumen?

It may be argued that the lumen as at present defined is not easily reproducible for purposes of measurement or comparison. This is easily arranged by defining the lumen as ten times the quantity of light emitted in a solid angle of  $1/100$  steradians in a specified direction from a standard specified lamp consuming a specified quantity of pentane per hour under certain standard atmospheric conditions of humidity,  $\text{CO}_2$  content, barometric pressure and temperature. This is a reproducible standard available for actual measurements. In plotting the results of such measurements in any form we shall have expressed the actual quantities measured—precisely what we should express.

It may be held by those who delight in analogies that the candle-power and the lumen are analogous to the unit magnetic pole and unit magnetic field. This fact does not justify the use of the term candle-power in distribution curves, however, for results of magnetic-field explorations are not stated in terms of unit magnetic poles but in terms of unit magnetic field. There is moreover this further discrepancy—that no source of artificial light distributes light equally in all directions. Therefore, if the analogy is to be preserved, the "candle" or "candle-power" must be defined as a theoretical non-reproducible unit having such distribution characteristics and its specification derived from the definition of the lumen given above, or similarly.

It has been advanced in defense of the retention of the candle-power as the practical primary unit that primary units should be expressive of the quality or attribute through which the senses perceive the existence of the phenomenon involved, and that candle-power represents the luminous intensity by which the source is perceived. From this standpoint there is really still less excuse for retaining the candle-power as a working unit, for just as the strength of a magnet pole is perceived by the force it exerts through the magnetic field set up, so a light source is perceived through the flux of light received by the eye. Just as pole strength is non-existent at the point where magnetic force is perceived, so candle-power—using the term to designate light-producing power—is non-existent at the eye.

It is argued that luminosity—as perceived by the eye—is inherent in the light source, and that the relation between luminosity and light is not a causal one in a sense permitting their separation. This opinion is due to a loose and variable use of the term light. Light as a form of radiation is quite different from light as a physiological phenomenon. The latter conception is a subjective concomitant of the former. As far as our sense perceptions are concerned a light source may exist where there is no light, in evidence of which witness the image of a light source in a mirror. Thus light as a sense perception is an entirely different thing from light as radiation from a designated source, and it is utterly impossible to conceive, much less use, any unit referring to the source itself which shall be immanently connected with sense perception.

Thus the term candle-power—except as a pure abstraction—has no excuse for existence, scientific or practical, save that it is in common use. As for this consideration, it may safely be stated that as used at present it is chiefly valuable for conveying misinformation, or rather preventing and hampering the conveying of information. Any salesman of lighting appliances will testify to the innumerable occasions upon which he has been asked to state the

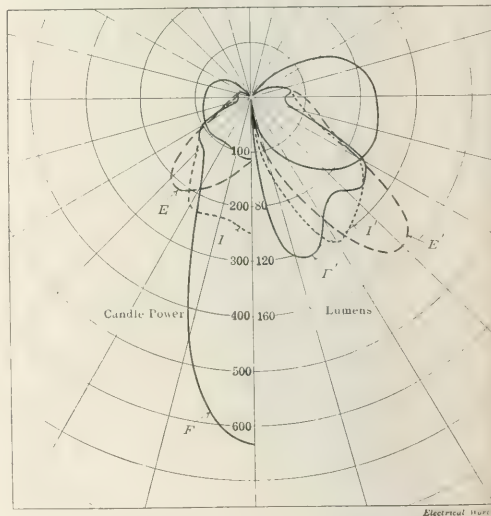


FIG. 2—DISTRIBUTION CURVES FROM INCANDESCENT GAS LAMP USING DIFFERENT TYPES OF REFLECTORS

candle-power of a lamp at 2 ft., at 10 ft., etc., and the almost invariable lack of success which attended his efforts to clear up the matter in the customer's mind.

Practically all the troubles encountered in conveying to the layman an idea of the characteristics of light sources are traceable to the illogical nature of the unit used. Where a unit is designated as being of 100 cp and an attempt is

made to explain how it may be caused to produce 5000 cp—in certain directions—by the use of reflectors it is small wonder that the layman is completely befuddled.

The "power" of the unit can refer only to its capability of transforming one form of energy into another and can take no account of distribution in space. As referring to the power of producing light localized at a given point in space, the candle-power is quite admissible and might be defined as the energy-transforming power of a point light source producing 12.57 lumens of light. The moment, however, that spatial relations or concepts are introduced it is absolutely necessary to use quantitative units. By the very nature of things, if the candle-power be not a unit of quantity it must express the radiating power of a point source, and a point source that does not radiate equally in all directions cannot be conceived. Therefore, the candle-power, which is based upon the performance of a point source, cannot possibly be made the unit for use in connection with a distribution curve except in the form of an "equivalent" or other awkward and useless expedient. To say that in one particular direction a 100-cp light source with reflector produces the same illumination as would be produced by a 5000-cp source—without a reflector—in the same position is a method so round-about and cumbersome as to be self-condemnatory, and the fact that the layman fails to "see" it is evidence of his logical mind.

In short, candle-power is an attribute of a light source having no relation to the distribution of light in space. To mean anything at all and to have practical value a unit by which light sources are to be measured must contain by definition the conception of quality and be capable of expressing flux density by the simple addition of the words "per square foot" or other unit area. The lumen fulfils this requirement admirably and perfectly, and there is no reason why it should not be used in every connection in which the candle-power is used at present.

In devising methods of using the lumen as the unit for the construction of distribution curves, the writer wished at the same time to eliminate the disadvantages of the present form of curves which make them perplexing and misleading not only to the layman but to the engineer as well. The chief purpose of any sort of curve—aside from those used as mechanical calculating devices—is the presentation of data in a graphical form, by which the eye may grasp at a glance the relation between two variables.

The ordinary distribution curve is not a complete statement of the distribution of light in space but simply a record of "samples"—so to speak—taken in a certain vertical plane and the quantity of light represented by each "sample" varies according to the angle at which it is taken.

Thus, before any adequate idea of the distribution of light in space may be obtained from this curve, it must be entirely transformed mentally, which robs it of all its graphical significance. On the right-hand side in Figs. 1 and 2 are shown curves designed to represent the distribution of light in space, in which the radial ordinates express the flux of light in a zone 10 deg. wide extending 5 deg. on either side of the designated angle. The width of this zone could of course be 1 deg., 2 deg. or any desired width. In Fig. 1 curves *A*, *B* and *C* are ordinary (or plane) distribution curves from respectively an upright incandescent gas lamp, an inverted incandescent gas lamp, and the latter with extensive prismatic reflector. Curves *A'*, *B'* and *C'* are space distribution curves of the same units in the same order. In Fig. 2 curves *E*, *I* and *F* are plane distribution curves of inverted incandescent gas lamps with "extensive," "intensive" and "focusing" prismatic reflectors respectively, while curves *E'*, *I'* and *F'* show space distribution of the same units. Comparing *E* with *E'*, it will be seen that while the former suggests that most of the light is within 45 deg. from the vertical the latter shows that at last one-half the light from this unit is above 45 deg. Curve *I* conveys the impression that the light from this unit is fairly well con-

centrated within 30 deg. from the vertical, but curve *I'* shows that only about one-third the light is actually emitted in this zone.

According to curve *F* this unit delivers most of its light within 20 deg. from the vertical, while *F'* shows that about three-fourths the light is outside this zone.

These approximations are necessarily rough, for it is difficult to estimate the degree to which different individuals would mentally take into account the greater fluxes represented by a certain candle-power as the angle approaches 90 deg. in the plane-distribution curves. Furthermore, the fluxes in different zones in the space distribution curves are not proportional to the areas cut off by the angles representing these zones. To correct this latter discrepancy the method of construction shown in Fig. 3 was devised. Here the lengths of the radial ordinates are proportional to the square roots of the quantities represented and the areas cut off by angles bounding certain zones are proportional to the fluxes in these zones.

Curves constructed in this manner may be used for point-by-point calculations with the same facility as the plane distribution curve plotted to candle-power simply by using

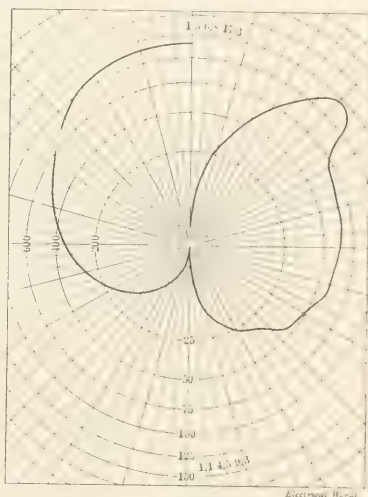


FIG. 3—NEW TYPE OF DISTRIBUTION CURVE

another set of constants. In the space distribution curve the ordinates at and near 0 deg. and 180 deg. are too small to read from the curve and the numerical values at 0 deg., 5 deg., 10 deg., 170 deg., 175 deg. and 180 deg. are given on the angles designated as shown in Fig. 3.

It may be objected that this form of curve is extremely misleading in that practically no light flux is indicated directly below the lamp even with a focusing reflector. This feature, however, being a characteristic of all curves plotted in this form, the low values at the angles mentioned will be expected by the engineer and convey no misapprehension. At the left hand in Fig. 3 is shown a summation curve giving the values on the right-hand side. At any angle this curve gives the total flux up to the angle designated. Zonular fluxes in any zone, from 0 deg. upward, lower hemispherical and spherical fluxes may thus be read directly from the curve and upper hemispherical flux, and flux in the zone between any two angles may be obtained by one subtraction or obtained from the right-hand curve by planimeter.

The curves in Fig. 3 appear to the writer to convey all the data required by the engineer in a graphical and usable form to a far greater extent than any other form yet devised, and he has accordingly decided to adopt them as the basis of engineering calculations and photometric records.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Central-Station "Safety First" Watch-Fobs

As a reminder of the company's paramount instruction to its employees, "Safety First!" the West Penn Electric Company, of Connellsville, Pa., has presented each of its employees with a watch-fob bearing this legend. The fobs are being worn with evident pride by the men of the company, who take especial care to see that the safety precept is in a conspicuous position. Besides being handsome and serviceable as ornaments, the new fobs serve to identify employees of the organization and so strengthen the *esprit de corps*.

## System Factors of Southern California Company

During 1912 the Southern California Edison Company, which operates in Los Angeles and vicinity, constructed fourteen substations, built 80 miles of transmission lines and installed a 15,000-kw turbine unit at Long Beach, where it has a third machine under way. The system load-factor for the year was 60.5 per cent, against 52.4 per cent for 1911. Industrial motor service contracts were signed amounting to 26,923 hp, compared with 16,876 hp for the year before, and the appliance sales numbered 23,148. Forty-seven new automobiles were added to the company's equipment, making a total of seventy-eight. In addition to the 80 miles of transmission lines above mentioned, several hundred miles of low-tension distributing circuits were constructed during the year recently closed.

## Appliance Sales at Oklahoma City

During the last eight months of 1912 1328 electric appliances were sold in Oklahoma City, according to the estimate of Mr. R. C. Leonard, contract agent for the Oklahoma Gas & Electric Company. No records were kept prior to May, but the report as submitted includes 675 flatirons, 190 fans, 150 toasters, 94 grills and 45 percolators. The 1328 appliances represent a total load of 529 kw, which at accepted figures means an annual revenue to the company of nearly \$7,500. Mr. Leonard estimates that this result was secured with an expense of only \$663, for newspaper advertising in excess of regular space.

## Central-Station Service in Flood Times

The crest of the Ohio River flood of this season reached an elevation of nearly 40 ft. at Louisville, Ky., the highest rise on record there since the memorable flood of 1884. An incident of the recent rise was the shutting down of a number of isolated power plants in the manufacturing district of the Kentucky city's river front. The water went over the cut-off protecting the lower section of the town and filled many private boiler rooms and engine rooms to a depth of from 8 ft. to 10 ft.

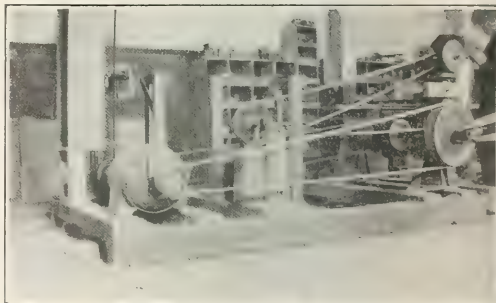
Among the factories in the flooded district was that of the Louisville Veneer Mills, which had been recently equipped with central-station service from the lines of the Louisville Lighting Company. Despite the flood, which paralyzed manufacturing everywhere about, the veneer

works were shut down barely twenty-four hours, being able to resume regular operation though islanded by the overflow, according to Mr. A. T. Macdonald, sales manager for the Louisville company.

The Louisville Veneer Mills now has a connected load of 400 hp and heats all its glue (of which it consumes about \$600 worth each month) by electricity. "We have been especially delighted with electric service," said Mr. Harry E. Kline, of the company, "and in flood times it is the greatest ever!"

## A Portable Motor-Driven Shop

The convenience of electricity in construction work is well illustrated in the accompanying illustration of a temporary machine shop assembled by a contracting firm in an electric-railway substation at Brookline, Mass. The shop was set up in the basement of the uncompleted building, a 5-hp motor and some pulleys being mounted on a timber frame and connected to drive a grinder, a hack-saw and other small tools. These proved most useful in expediting



PORTABLE MOTOR-DRIVEN SHOP

the work of installing switchboard angle-irons, bus structures and wiring. Energy was supplied from a 550-volt feeder circuit in the vicinity, and the installation proved to be a positive factor in saving time during the erection of the substation and the adjustment of its equipment. The building was located in a high-class residential district, and the absence of noise and dirt was much appreciated.

## Co-operation in Minneapolis

The Minneapolis General Electric Company gave a dinner on Jan. 16 to the electrical contractors and supply men of that city at which 115 guests were present. The object of the meeting was to create a better understanding between the electric-service company and the other electrical interests of the city. The city wiring inspector and the city underground inspector were both present and gave short talks. During the evening a committee was selected by vote of those present to act with the electric-service company in various ways for better co-operation between the electrical interests of the city.



## Power for Adzing and Boring Railroad Ties

In a paper on "Adzing and Boring Ties," read by Mr. James A. Lounsbury, of Chicago, before the recent convention of the American Wood Preservers' Association, the author contended that it is folly to pay 20 to 35 cents a tie for wood preservation and then to mutilate the ties by hand-adzing and spike-driving, reducing greatly the beneficial effects of treatment. Naturally, the adzing and boring should be done before the treatment is applied. Adzing and boring machines are of two types—permanent and portable. Referring to the latter, Mr. Lounsbury said: "The kind of power to be used in these movable plants is often a somewhat troublesome problem. Electric drive is by far the most reliable and satisfactory if it is available. In yards using electric switching locomotives and strung with trolley wires the application of electric power is easy, but where this is not to be had resort must be made to some other source of power, usually a self-contained gasoline engine of about 60 hp installed in the car with the machine. This gives satisfactory results but requires more careful management than would be necessary with an electric motor."

## Ton-Mile Electric Delivery Costs

The following data bearing on the comparative cost of ton-mile haulage by horses and electric vehicles were obtained by a prominent electric-truck manufacturer from installations in New York City. The 1500-lb. delivery service cited was that of a large department store; the 2-ton service included general-merchandise delivery, usually in units of medium size, and the third class, 5 tons, covered the delivery of large cases of similar material over a wide area. The figures given in the table include the stabling of the horses required to haul a truck of the stated size.

CLASSIFICATION OF SERVICES

	1500-LB.		TWO TONS		FIVE TONS	
	Horses	Electric	Horses	Electric	Horses	Electric
Miles per day....	17	30	16	30	12	24
Ton-miles per day..	12.75	22.50	32	60	60	120
Cost per day.....	\$6.00	\$6.00	\$6.37	\$8.50	\$9.10	\$11.00
Cost per mile.....	0.35	0.20	0.52	0.28	0.76	0.45
Ton-mile cost.....	0.466	0.207	0.26	0.14	0.15	0.09

These figures bear out the contention that the electric truck gives a greater service and at a lower cost than is possible with horse-drawn equipment. The figures represent practically the limit of the horse, but they do not indicate the maximum possibilities of the electric truck, the mileage of which often runs considerably higher than in the figures presented. The data above given include all expenses and charges, with energy at 4 cents per kw-hr.; chauffeur's wages at \$15 per week; writing off the investment in eight years; payment of 6 per cent interest meanwhile, with insurance and taxes, and one renewal of battery plates and tires yearly.

## The Electric Truck as a Source of Income to the Central Station

The figures recently brought out by Mr. H. W. Hillman in a paper before the Electric Vehicle Association of America on the relative importance of the electric truck and other classes of central-station business (reported on page 179 of the *Electrical World* of Jan. 25) contain much food for thought for the central-station manager. Many

plants, even in the smaller cities, have sales organizations whose sole duty it is to popularize and sell heating and cooking appliances. Others have departments devoted to building up industrial-motor day load, while still others are inaugurating and carrying out extensive house-wiring campaigns.

Strong and convincing argument for an electric-vehicle



FIG. 1 GRAPHIC COMPARISON OF LOAD-FACTORS

department, as well, in every progressive central station is presented by the fact that it requires eighty-six flatirons to produce an annual income equal to that from one 2-ton truck. The load-factor of the commercial electric vehicle is 35 per cent and that of the industrial motor is 10 per cent. Twenty-seven houses wired and added to the central-station lines would be required to produce an annual income equal to that from one truck of average size.

Of the twelve classes of service furnished by the central station only two return a higher income than is derived from one 2-ton truck. Figures compiled from thirty cities whose population varies from less than 25,000 to more than 1,000,000 show the saloon to be at the head of the list, with an average annual return of \$191.51. Next is the drug store, with \$118.40. Then comes the 2-ton truck, with a revenue of \$86.00. Then follow, in order, large residences, with \$63.04; industrial plants, with twenty motors, \$35.11; eight-motor installations, \$50.96; small factories with three motors, \$19.61; plants with two motors, \$41.18; single-



FIG. 2 RELATIVE ANNUAL INCOME FROM THE SEVERAL CLASSES OF COMMERCIAL LOAD

motor installations, \$15.10; residences, \$12.75; small stores, \$31.75, and the small residence is last, with \$10.00.

The "off-peak" character of the load furnished by the truck, combined with the fact that the electric-truck owner is a long-hour consumer who will help fill up the costly depressions and deep hollows in the load curve, should stimulate an aggressive sales policy in this direction on the part of central-station commercial managers.

## How Weather Conditions Affect Electric-Light Bills

Customers of electric-service companies often fail to understand the vital and immediate effect of meteorological conditions on their monthly bills for lighting. To explain this graphically several companies have issued charts showing the artificial-lighting periods during the various months of the year. One chart of this description, used by the lighting department of the Kokomo, Marion & Western Traction Company, was illustrated in the *Electrical World* of Sept. 7, page 512.

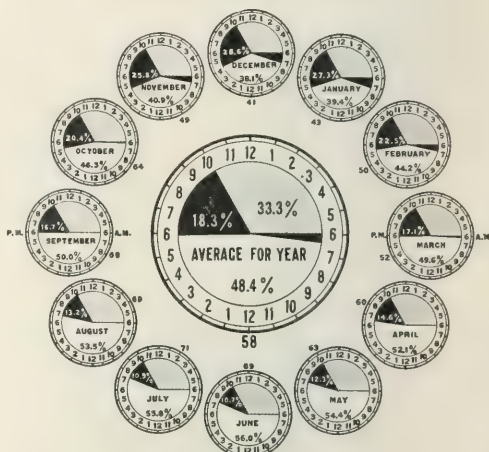
Considerable study has been given to this subject recently by various departments of the Commonwealth Edison Company of Chicago. One plan adopted to make the conditions clear to the public is shown in the chart in the newspaper advertisement reproduced in fac-simile herewith (Fig. 1). In this case the horizontal-line method is used, these lines (one for each month) being divided into unequal portions showing the daylight period, from noon until dusk; the artificial lighting period, from dusk until 10 p. m.; the sleeping period, reckoned from 10 p. m. to 6 a. m., and the period from sunrise to noon, principally daylight but also containing an artificial lighting period in the winter months, as shown in the chart. This form shows that in Chicago the average use of electric light in residences in June is 2.55 hours a day, whereas in December the corresponding figure is 6.85 hours a day. The average use of electric light in the home is therefore nearly three times as great in December as in June.

At the request of the claim department, which wished an explanatory diagram to serve as a wall chart for the benefit of customers, the statistical department of the Commonwealth Edison Company has arranged another graphical

count but also the effect of cloudiness. The percentage of normal sunshine for each month is shown by the figure just outside of each of the clock-dial diagrams.

It will be observed that the artificial lighting period in the latitude of Chicago is of shortest duration in the month of June, being but 10.7 per cent of the twenty-four hours. It is longest in December, being 28.6 per cent. For the

### WHY YOUR ELECTRIC LIGHT BILLS VARY.



WHITE PORTION REPRESENTS DAYLIGHT AFTER 6 A. M.

SHADED PORTION REPRESENTS SLEEPING PERIOD - EIGHT HOURS.

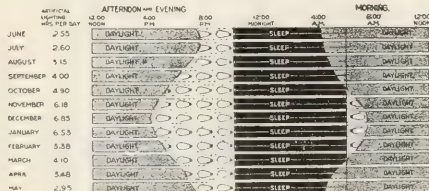
BLACK PORTION REPRESENTS ARTIFICIAL LIGHT PERIOD.

NORMAL PER CENT SUNSHINE—FIGURE OUTSIDE OF CLOCK.

FIG. 2—CLOCK-DIAL CHART OF ARTIFICIAL-LIGHTING PERIOD

## Why Your Electric Light Bills Vary

The Reason Why Residential Lighting Bills are Higher in December than in June



### People Use Electric Light Nearly Three Times as Long in December as They Do in June

This chart divides the 24 hours of a day into three periods—the period of *sleep*, the period of using *Electric Light* and the period of *daylight*.

In June, the average use of Electric Light in Residences is 2.55 hours per day.

In December, the average use of Electric Light in Residences is 6.85 hours per day.

Therefore, the average use of Electric Light in the home is *nearly three times as great* in December as in June.

Commonwealth Edison Company

120 West Adams Street

FIG. 1—REPRODUCTION OF AN "AD" FROM A CHICAGO NEWSPAPER

representation, as shown in Fig. 2. In this case clock-dial diagrams are used, the smaller ones for individual months and the larger one showing the average for the whole year. These diagrams are the result of considerable work and are thought to set forth the situation with a close approximation to accuracy. It is to be remembered that not only are the actual daylight and darkness periods to be taken into ac-

whole year the average of the artificial-lighting period is 18.3 per cent. The sleeping period for all months is constant at eight hours, or 33.3 per cent. It is considered to be from 10 p. m. to 6 a. m., and the daylight period is computed after 6 a. m., ending at sunset. The average daylight period for the whole year is a little less than twelve hours.

Similar charts have been prepared by the Louisville Lighting Company. The chart for each month comprises a circle on which segments show the periods designated as "night," "sunshine," "cloudiness" and "very dark." The October, 1912, chart shows the night segment to be 53.3 per cent; "very dark," 4.6 per cent; cloudy, 12.9 per cent; sunshine, 29.2 per cent. In that month there were in Louisville fourteen clear days, eleven partly cloudy days, six cloudy days and two days with dense fog. The average sunshine per day for that month in Louisville is given as seven hours. The Louisville charts are records made up from United States Weather Bureau's reports, while the Chicago chart is made from a long series of observations.

## Electricity in a Pillow Factory

The Louisville Pillow Company, of Louisville, Ky., manufacturer of bedding materials, has found central-station electric service to be eminently satisfactory in the operation of the varied equipment which it uses and which must be run at different speeds and under different conditions. It has just purchased four 35-hp alternating-current three-phase motors from the General Electric Company for the operation of ragpickers used in its shoddy factory. The Louisville Lighting Company is furnishing the service.



# Illumination and Wiring

## Symbolic Lighting Fixtures in Chicago Telephone Building

In the handsome new Bell Telephone Building at 212-226 West Washington Street, Chicago, there are some interesting symbolic lighting fixtures and allegorical designs. This building is twenty stories high and is said to be the largest telephone building in the world. It is occupied by the main offices of the Chicago Telephone Company and also contains the executive offices of the Wisconsin, Central Union, Cleveland and Michigan State telephone companies. These companies constitute the "Sunny group" of Bell telephone companies, Mr. B. E. Sunny being president of all of them. The building has a frontage of 141 ft. on Washington Street and extends back 181 ft. to an alley. It contains 4,600,000 cu. ft. of space.

Fig. 1 shows the large overhead lighting fixture in the main entrance lobby. It is in the shape of the familiar blue bell of the Bell telephone companies. At present this lighting fixture is equipped with twenty-four 25-watt tungsten lamps. Later these may be replaced by twenty-four 100-watt lamps. A single frosted lamp is used to represent the clapper of the bell. Fig. 2 depicts one of the allegorical designs in relief over the main entrance. It will be noted that the same motif is carried out throughout the fixture ornamentation.

Electricity for the lighting and motor requirements of the building is purchased from the Commonwealth Edison Company. Each distributing panel from the third to the



FIG. 1—BELL LIGHTING  
FIXTURE

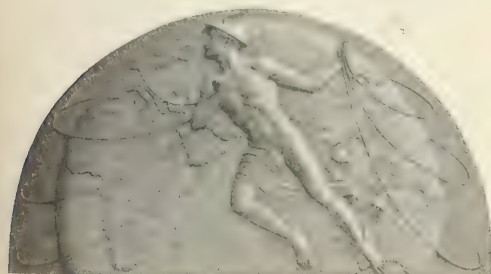


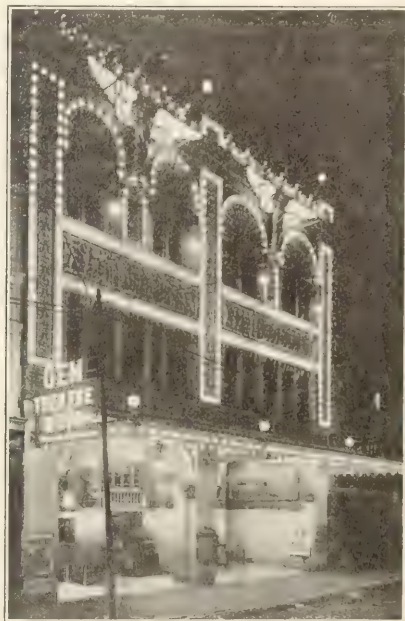
FIG. 2—ALLEGORICAL DESIGN AT ENTRANCE OF CHICAGO  
TELEPHONE BUILDING

twentieth story inclusive is equipped for the installation of sixteen meters. General illumination is obtained from single-unit tungsten lamps. These are placed on centers of approximately 10 ft. and are designed so that the expenditure of power for lighting will be about 1 watt per square foot of floor space. Nine electric elevators are provided in the building.

## Theater-Front Illumination with Tungsten Lamps

The elaborate and attractive lighting of the Gem vaudeville theater, St. Louis, is shown in the accompanying illustration. This theater front is studded with nearly 2000

tungsten lamps, which outline the windows, panels and classic frieze designs. By an arrangement of flashers the winged figures at the top of the display appear to be in flight, lending an attractive touch of motion to the otherwise uninterrupted operation of the main decorative units. The Gem Theater is directly across the street from and under the same management as the Hippodrome, concerning



ILLUMINATION OF THEATER FRONT

which an illustrated account was given in the *Electrical World* of Dec. 7, 1912, page 1214. This article described the 380-contact flasher mechanism which controls the 9000 lamps studding the Hippodrome façade.

## Present Status of Grounded Secondaries

As a matter of safety, theory apparently indicates the necessity of thorough grounding, said Mr. W. J. Canada, engineer for the Rocky Mountain Fire Underwriters' Association, Denver, Col., in his address on present practices in grounding secondaries, delivered before the Western Association of Electrical Inspectors at St. Louis Jan. 29.

One naturally turns to practice, however, to support theory or to locate its flaws, for the engineering judgment of observing operators must have considerable weight in any investigation. To obtain such consensus of practice, 140 service companies, representing every state and the Dominion of Canada, were written to, and 111 replies were being inclosed, and one hundred or more replies were received. The accompanying recapitulation shows the satisfaction in all sections following adoption of grounding. Of the forty-five companies grounding in the Rocky Mountain field, only eleven are not grounding a full 100%.

That many companies recognize the ungrounded secondary as a fire and life hazard is proved by their own statements of experience with injuries and fires from high voltage on their secondaries, said Mr. Canada, who went on to state that of forty-nine cities from which deaths were reported forty-one are now partly or entirely grounded. That



some companies not grounding see no necessity for change seems to show an unprogressive policy and appears too much like "waiting for the horse to be stolen." But as one service company manager writes: "It depends on your own

#### RECAPITULATION OF DATA ON GROUNDING

1. Companies using grounding.....	86, or 87 per cent
Companies not grounding.....	13, or 13 per cent
2. Expressing belief in grounding.....	92, or 96 per cent
Expressing disbelief in grounding.....	4, or 4 per cent
3. Experience with grounding, one to twenty-five years, average, five years	
4. Companies reporting advantages in grounding.....	69, or 85 per cent
Companies reporting disadvantages in grounding.....	12, or 15 per cent
5. Total number advantages mentioned.....	171, or 89 per cent
Total number disadvantages mentioned.....	21, or 11 per cent
6. Companies uncertain whether advantageous or not.....	8, or 9 per cent
7. Expense of one ground, \$0.50 to \$15, average.....	\$3.50
8. Companies grounding above 110 volts.....	6
9. Companies' experience with grounding "good".....	86, or 99 per cent
Companies' experience with grounding not "good".....	1, or 1 per cent
10. Companies' experience shows life hazard reduced.....	84, or 98 per cent
Companies' experience shows life hazard not reduced.....	2, or 2 per cent
11. Companies' experience shows fire hazard reduced.....	64, or 84 per cent
Companies' experience shows fire hazard not reduced.....	2, or 3 per cent
Companies' experience shows no preference.....	11, or 13 per cent
12. Companies' experience shows operating conditions bettered.....	63, or 76 per cent
Companies' experience shows operating conditions worse.....	9, or 11 per cent
Companies' experience shows operating conditions same.....	11, or 13 per cent
13. Companies utilizing mains.....	34, or 31 per cent
Companies utilizing driven pipes.....	52, or 48 per cent
Companies utilizing cones.....	6, or 6 per cent
Companies utilizing plates.....	13, or 12 per cent
Companies utilizing tracks.....	3, or 3 per cent
14. Companies which prefer water mains.....	71, or 92 per cent
Companies which prefer other methods.....	6, or 8 per cent
15. Companies interconnecting secondaries.....	33, or 49 per cent
Companies not interconnecting secondaries.....	34, or 51 per cent
16. Companies grounding within buildings.....	17, or 28 per cent
Companies not grounding within buildings.....	43, or 72 per cent
17. Companies finding current shunted into buildings over ground connection.....	4, or 6 per cent
Companies not finding current shunted into buildings over ground connection.....	62, or 94 per cent

experience with injuries and fires from high voltage how strongly you feel on the subject. If you have been lucky enough to escape, you are not inclined to see the advantages of grounding so clearly."

### Re-equipment of a Pittsburgh Department Store

The large fourteen-story department store of McCreery & Company, Pittsburgh, Pa., was recently re-equipped with a new and modern lighting installation, the result being a marked improvement in the quality of illumination secured, in addition to a saving of over 50 per cent effected at the same time in the cost of operation. In a paper read before the Pittsburgh Section of the Illuminating Engineering Society on Jan. 24 Mr. H. W. Shalling described the changes made in the McCreery equipment and presented data of tests made under the new lighting.

In general the work consisted of substituting tungsten lamps for the existing arc lamps and carbon-incandescent units, with practically no changes in the wiring. The task of substitution was completed floor by floor, in a single night, so that when the sales force arrived next morning a complete new lighting installation was found in service, without the dirt and annoyance usual with such changes.

Direct illumination was decided upon for general use, glass being avoided by inclosing the bowl-frosted lamps, where necessary, in opal or diffusing glassware. The quality of tungsten illumination was considered desirable both on account of its close approximation to daylight and the

fact that many of the fabrics sold in the store are used chiefly under equivalent artificial lighting in the home, at the theater, etc.

The McCreery building is fourteen stories high, including the basement and the attic. The ground floor covers a space 100 ft. by 216 ft. and each of the remaining floors 90 ft. by 216 ft. The inside area of the first floor is ap-

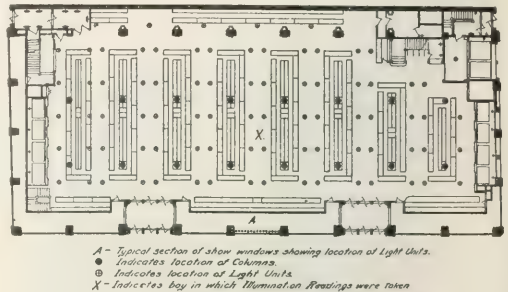


FIG. 1—LIGHTING ARRANGEMENT OF FIRST FLOOR

proximately 20,370 sq. ft., and that of the remaining floors 17,850 sq. ft. The outside of the building is finished in white terra-cotta; the interior, including the fixtures, is in mahogany.

#### LIGHTING BY FLOORS

In the basement delivery room carbon clusters were replaced by eighteen 60-watt clear tungsten lamps in enameled steel reflectors.

On the main floor (men's furnishings, jewelry, stationery, trimmings, etc.) the ornamental arc and incandescent fixtures were adapted to reflector-ball units of special design, with upper prismatic reflectors resting on stalactite-shaped blown globes, the whole satin-finished. By varying the lamp position, extensive, intensive and focusing distributions could be obtained, the intensive being adopted. Each of the sixteen 5-amp arc lamps was replaced by a 250-watt clear tungsten unit. The five four-lamp pillar brackets and the thirty-four two-lamp fixtures were replaced by 25-watt tungsten lamps in decorative shades.

For the second floor, where bedding and yard goods are sold, the equipment formerly consisted of fifty-three 5-amp inclosed-arc lamps, with opal outer globes. Fairly high illumination is required here for matching dress goods. Each arc lamp was replaced by a 400-watt clear tungsten lamp placed inside a 14-in. two-piece diffusing glass bowl.

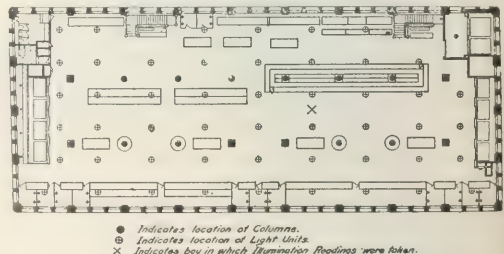


FIG. 2—TYPICAL ARRANGEMENT ON UPPER FLOORS

The unit consists of a clear stiletto-prism reflector mounted over a satin bowl, in a verde-antique fixture.

On the third floor, where ladies' suits, waists and furs are sold, fifty-one arc lamps were replaced by 250-watt tungsten lamps, and in the side brackets 25-watt tungsten lamps were substituted for 16-cp carbon lamps.

In the millinery department on the fourth floor, twelve arc lamps were replaced by 150-watt clear tungsten lamps in

semi-indirect fixtures of Louis XIV. ornamental design to conform with the room. The rest of the floor is lighted by thirty-three 250-watt units like those on the third story.

Of the fifty arc lamps on the fifth floor, where china, bric-à-brac and rugs are sold, twenty-five were replaced by 150-watt units and twenty-five by 250-watt clear tungsten lamps.

#### SPECIAL RUG-RACK ILLUMINATION

A special form of lighting was installed for the rug rack. Twenty-five outlets were provided on the circumference of a semicircle, the radius of which was approximately 2 ft. greater than the maximum swing of the rack arms. Outlets were located at centers 2 ft. 6 in. apart. Wiring was run in metal molding and small porcelain receptacles having a metallic head for use with shade holder were used. Each outlet was equipped with one 40-watt clear tungsten lamp and a 30-deg. angle-steel reflector having an aluminized interior surface mounted on the ceiling in a pendent position.

Mission furniture, wall paper, draperies, art goods and the ladies' parlor occupy the sixth floor. For the general illumination thirty arc lamps were replaced by tungsten units as on the third.

Forty-five arc lamps formerly lighted the men's clothing department on the seventh floor, where also are located the general offices. Of these thirty-six were replaced by 400-watt and nine by 250-watt clear tungsten units. A high intensity is needed here, as on the second floor, on account of the dark colors of the goods displayed.

The installations already cited exemplify the general practice followed on the remaining floors, except in the dining-room, where 30-watt carbon lamps in seventy-one six-lamp clusters were replaced by 15-watt tungsten units.

#### SHOW-WINDOW EQUIPMENT

In average size the show windows measure 23 ft. 6 in. long, 8 ft. deep and 19 ft. high, the plate glass extending to a height of 12 ft. and prism glass being used at the top.

The former equipment consisted of 326 60-watt clear carbon lamps mounted in a mirrored trough back of the transom bar. The present equipment consists of 195 60-watt clear tungsten lamps. Fifteen are used in each section, the outlets being located back of the transom bar on centers approximately 14 in. apart. Each lamp is equipped with a 100-watt-size concentrating-type prismatic reflector, the units being mounted at an angle so that the tip of the lamp is pointing at a line on the floor two-thirds of the distance from the plate glass to the opposite wall. This angle is found best for the average window dress, but provision is also made for varying the angle. The wattage allowance for the windows is but 4.7 per square foot.

Comparative tests made in similar positions on similar floors using the former arc and incandescent lighting and the new tungsten installation showed 50 to 100 per cent better illumination with the new improved lighting.

#### INSPECTION AND CLEANING

A careful system for regular inspection and cleaning has been initiated whereby all units in the McCreery building are brushed off with a stiff brush and cloth once every two weeks, and each unit is taken down and washed thoroughly once each month. The cost of cleaning, including labor and materials, is approximately \$350 per year for approximately 1000 units installed. Since the units are thoroughly cleaned once a month, the cost of cleaning per unit will be approximately 3 cents, which includes one dusting and one washing. A fair division of this cost would be 0.05 cent per unit for dusting and 2.5 cents for thorough cleaning. Under such a system the illuminating efficiency is kept at a practical maximum. It is probable, however, that in other places where dirt and dust conditions are not as severe the cleaning could be done at less frequent intervals. The above-given figures represent a very

small part of the operating expense and are considerably less than the cost of trimming and other maintenance charges incident to the operation of the old system.

## Recent Telephone Patents

### COMPOSITE SYSTEM

A composite system forms the subject of a patent granted to Mr. O. T. Lademan, of Milwaukee. In this system the telegraph keys, telegraph relays and telephone instruments are all in series relation to the line. The telegraph relays are shunted by high-capacity condensers and the telegraph keys by low-capacity condensers. The telephone instruments are of special make and are provided with an adjustable repeating coil for controlling the inductive relation between the receiver circuit and the line, with a view to reducing a Morse disturbance. High-frequency vibrators and buzzers are provided for telephone signaling. The transmitter circuit must be manually switched from receiving to transmitting position. This patent is assigned to the Railroad Telephone & Electric Company.

### MISCELLANEOUS APPLIANCES

A patent granted to Mr. I. D. Fellows, of Syracuse, N. Y., relates to an emergency signaling system. According to this arrangement, an emergency signal may be sent to the Central Office without access to the telephone instrument. To this end push buttons are arranged at suitable places which release a sender akin to a messenger call box. The signals are continuously repeated, however, until answered so that the central-office operator may discover their nature and send the proper assistance. Such an arrangement is suggested where, in the case of emergency, the telephone may have been purposely disabled or access to it is impracticable.

## Letters to the Editors

### Central-Station Consolidation

*To the Editors of the Electrical World:*

SIRS:—In connection with recent discussions in your journal regarding central-station consolidation, you may be interested in some views which are perhaps more representative of the banker's standpoint than anything you have so far published on the subject. From this standpoint—that of the banking house buying mortgage bonds—the holding company has material disadvantages. It has been the experience of such bankers that in very few instances have utilities under holding-company control made proper provision for the complete present and future maintenance of their physical properties. I can recall the case of one holding company which was reported to be showing 10 per cent on its common stock. This stock happened to be very nearly equal in amount to the combined annual gross earnings of its subsidiary companies. The stock sold at a price in excess of par and a dividend of 6 per cent was being paid on it. If 10 per cent of the gross earnings were deducted for depreciation, there would have been nothing available for dividends on the common stock, and the market value would no doubt have been less than par. These and other facts afford ground for some concern as to where "high finance" is going to lead in the public-utility business. It may, unfortunately, lead to drastic legislation which will fall alike on the just and the unjust. Such doubts as these are worth more consideration than the views of those who are devoting most of their energies to making money while the sun shines but who do not make the ultimate good of the industry a prime consideration in their operations.

Philadelphia, Pa.

A. E. ROSENBERGER.

## Commercial Training for Engineers

To the Editors of the *Electrical World*:

SIRS:—Economic engineering, sometimes called commercial engineering, is a combination of good business management and technical knowledge correctly applied. Large corporations as well as smaller business interests have come to realize the necessity of such a combination, and for that reason a few of the technical schools of the country are giving it the attention it should receive. The chief fault to be found in the engineering instruction given by most of our technical schools has been the laying of too much stress on theory and abstract matters, with too little attention to the practical and concrete phases of the profession. The great manufacturing and producing interests must have high-grade engineers, men who are capable of harnessing and utilizing the forces and materials of nature, but their crying need to-day is for the man who can do more than this. They demand men who can dispose of their product after it has been made marketable by the inventive genius of the creative engineer.

In the complex commercial world of the present there exists a great amount of competition. No matter how good a product may be or how useful and efficient it is, if it cannot be marketed it might just as well have never been produced. Hundreds of devices which were the result of hard and long years of labor on the part of the struggling inventor are still of no use to the world simply because the inventor or owner is without the sales ability or business knowledge to market them. Yet the engineering schools of the country persist in ignoring this state of affairs and continue to grind out mechanical, civil, electrical and chemical engineers by the thousand, and then wonder why many graduates are not more successful.

There is a reason for this condition, and it is not the lack of ambition or ability in the individual in most cases. It is simply due to the fact that these men failed to receive the proper training. They were loaded down with formulas, laws, methods of computation, etc., yet they did not learn the first principle of salesmanship, a single fundamental method of business, or an elementary knowledge of advertising. These things are of vast and growing importance, particularly in the commercial electrical field, but they have been completely and persistently ignored. While there are undoubtedly many positions which require the talent of the pure engineer, these are in the small minority, and the very fact that they are so few renders the competition extremely keen because of the rapidly increasing number of candidates, all graduates of technical schools. The condition which has just been described is certainly abnormal and should be remedied without delay.

The solution is simple. An engineer should be equipped with a business training; he should learn selling and advertising principles; he should be a close student of economics and politics, for it is the laws of the former that govern supply and demand, and he should certainly receive in some degree what is commonly known as a liberal education. While such a course would take a trifle longer to complete, the man who finished it would be much farther advanced than the pure engineer. It could be made optional, but there is no question that it would soon become the only course, because it is the sensible method.

In the majority of technical schools or state universities such a course is possible if a man will use his "horse sense" in addition to the curriculum as prescribed in the courses. Although there has been some progress in the schools, a great deal more is necessary. The general manager of one of the largest central stations in the Middle West recently observed on this subject: "What we need are not only trained technical men, but men who are more than technical. We need men with business and sales ability, men with initiative and knowledge of human nature, a knowledge which is not gained in the technical courses to-day. We can buy engineering knowledge at any time and

at almost any price and anywhere, but we are forced to scour the country for a man who has combined in his make-up the technician and the salesman. It requires the former knowledge to enable a man to know what he is selling and the latter to enable him to dispose of it. Our rates and service may be the most reasonable and satisfactory in the country, but if we cannot market our product, we might as well close down our generators and quit business."

The foregoing is true not only in the electrical field but in other industries as well. Let us have, therefore, more economic engineers.

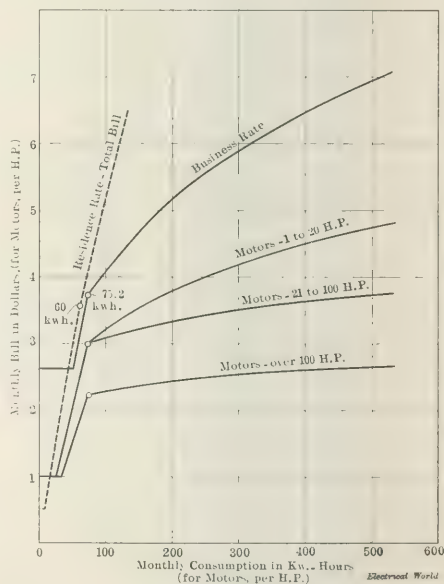
Lawrence, Kan.

F. H. M. RILEY.

## Rate Schedules from the Customer's Standpoint

To the Editors of the *Electrical World*:

SIRS:—The article on "Rate Schedules from the Customer's Standpoint," on page 49 of the issue of Jan. 4, and your editorial comment the following week on "Lucid Rate Schedules," call attention to a detail of central-station management wherein improvement has been remarkably



CURVE ILLUSTRATING FUNDAMENTAL RATE CHARACTERISTICS

slow. The writer has long been of the opinion that a simple curve plotted between dollars as one co-ordinate and kilowatt-hours as the other is the most feasible way of introducing the customer to the otherwise complex subject of rates.

Such a curve avoids the annoying difficulties of "minimums" and "base rates." And, especially in lighting bills, it shows the customer at a glance how to translate the kilowatt-hour reading of his meter into the familiar terms of dollars and cents.

For example, the accompanying curve illustrates the fundamental characteristics of the rates charged by the Seattle lighting plant for all classes of service. Of course when approaching a customer with respect to some particular subject, such as residence lighting, only one of these curves, plotted separately and to the most advantageous scale, need be presented.

Seattle, Wash.

GEORGE HOLMES MOORE.



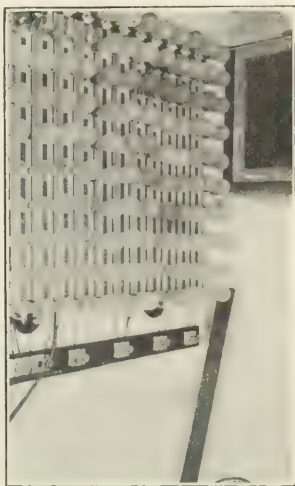
# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Lamp Bank for Meter Testing

The accompanying photograph shows a convenient form of lamp resistance in use in the meter laboratory of the United Electric Light Company of Springfield, Mass. The lamps are arranged

in banks mounted on a grille of iron straps, 0.125 in. to 0.25 in. in thickness and 1 in. wide. This grille is supported on 2300-volt porcelain insulators bolted into the wall. Clearance of about 8 in. is thus provided between lamps and wall. Carbon-filament units of 2 cp to 50 cp are used. Each circuit is separately fused on a panel, shown in the picture, and connections are carried to switches on the test board in an adjoining room. In the same room is a water rheostat, which is provided with a permanent water-supply connection and a spigot discharge into a trap leading to the sewer, so that the barrel may be conveniently emptied and filled anew as its contents become fouled by electrolytic action.



LAMP BANK FOR TESTING METERS

## The 660-Watt Branch-Circuit Rule

Considerable ambiguity still exists in the interpretation of the 660-watt rule, said Mr. W. H. Blood, Jr., Boston, Mass., insurance expert for the National Electric Light Association, in a letter dealing with this rule's bearing on tungsten-lamp circuits, read before the Western Association of Electrical Inspectors' convention at St. Louis, Jan. 28. The rule itself, he pointed out, is further complicated by the requirement that 125-volt branch circuits shall be fused with 6-amp fuses.

In view of the fact that so many heating appliances of about this rating are being sold for use on branch circuits, Mr. Blood asserted that this 660-watt rule is at present a mistake. It is an unnecessary hardship, he declared, to require the running of a separate circuit for a percolator, teakettle or small flatiron. He also insisted that a mistake is made in limiting branch circuits to ten or twelve outlets, for there is no more danger with twenty outlets than with ten. Records would not be likely to show any special menace due to increase in the number of outlets. On the other hand, said Mr. Blood, there ought to be some way of limiting the circuits from the customer's standpoint. It might be a mistake to put twenty lamps on a circuit, for this would mean, in many small installations, that if a fuse blew every lamp in the house would be extinguished.

Investigation will show that there are comparatively few 6-amp fuses used. One manufacturer, for example, last year put out no 6-amp fuses, although he did distribute 5000 10-amp fuses. Another company put out only 1200 6-amp fuses and 32,000 10-amp fuses. Mr. Blood suggested, however, the wisdom of limiting branch circuits to carrying 1000 watts, and providing that these circuits be protected by 10-amp fuses. He also proposed the substitution, as far as possible, of No. 12 wire for No. 14, for with No. 14 the question of drop enters materially.

In this connection the writer recommended the suggestion already made that two types of plugs be used, one a "household plug" to be furnished with all portable heaters taking less than 1000 watts, and all other heaters taking over 1000 watts to be furnished with a larger plug. The latter heaters should be distinctly marked "not suitable for use on lighting circuits," but would be installed on separate circuits with their own switches and pilot lamps.

## Plant Changes at Reading, Pa.

Some of the reconstruction work recently carried out at the plant of the Metropolitan Electric Company, Reading, Pa., was particularly interesting in that new floors had to be installed before the old steam-driven apparatus could be abandoned. Special steel columns were designed with splices, so that they could be brought up to position, piece by piece, and later the old wooden floor was used as form-work for the new concrete floor.

The main generating station at Reading gets its cooling water from the river, but this source is not suitable for boiler-feed. On a small creek a mile from the station a good pond was available, but measurement showed only a 13-ft. head between the pond surface and the boiler-feed pumps. Calculations further revealed the fact that a 2-in. or 24-in. pipe line would be needed to keep the friction loss within the exceedingly narrow margin which remained after allowance was made for placing the heater above the feed pumps.

A large number of old boiler shells, however, happened to be available, and these were placed in a trench through the meadow, the joints being sealed up with cement. Although far from standard pipe-line design, this improvised tube delivers the water with ample pressure.

Meanwhile the system was being converted from 11,000 volts to 22,000 volts, necessitating the change of line insulators, etc. Two gangs, each comprising three linemen and one groundman, were employed on the work. Working at maximum efficiency it took about two weeks to change a pole, and an average day's work would be about ten or eleven poles. The men were working on nine poles. Some days only the far side of a corner pole or double-arm poles were changed. Work on the corners was very hazy and dangerous, and was accomplished while the line was live. Consequently it had to be done on Sundays, when interruptions were not so important. No serious accidents occurred during the work. Tying in was always done on a dead line, the dead line being first grounded or short circuited. No one was allowed to touch the line until he was sure it was "dead." The cost of the work amounted to \$475 per mile, including labor, cross-arms, insulators, etc.. The cost of labor per

single-arm pole was about \$1.50. Although the cross-arms were found suffering from dry rot, the poles, which were of chestnut, had been in service ten or twelve years, and no sign of rot or decay, even in the gains, was found.

### Low-Freezing Mixtures for Oil Switches

By F. W. HARRIS

It is very common for oil switches to be so located that they are exposed to the action of extreme cold, especially in the northern part of this country and Canada. The effect of such cold on the ordinary transformer or switch oil is first to render it very thick and at very low temperatures actually to solidify it. Even if it is reduced to the consistency of a thick jelly it is likely to interfere seriously with switch operation, and it is desirable in switches so exposed to provide a liquid that is not open to this objection. There are now on the market several oils that have very low freezing points, and the manufacturers of oil switches are ready to furnish such oil at a rather high price, which, however, represents a fair increase over the cost.

In this connection it is desirable to point out that were it not for two features tetrachloride of carbon would be far superior to any oil for use in such switches. It is not inflammable and does not produce inflammable vapors and it has a very low freezing point. It is, however, rather expensive, about seven times as expensive as a good oil, and it is volatile, producing disagreeable vapors at a relatively low temperature. It is probable that if the matter of price could be corrected it would come into very general use for this purpose, special switches being arranged for it. It is valuable for reducing the freezing point of oil, and a half-and-half mixture will not stiffen up appreciably at 20 deg. below zero C. It must however be watched as it evaporates and its use is not to be commended at this time.

There is another substitute, however, that may be used with good effect, and that is turpentine. A half-and-half mixture of good turpentine and ordinary transformer oil will freeze at about minus 30 deg. C. It does not materially lower the breakdown voltage and is not harmful owing to carbonization in breaking the circuit. It is inflammable and evaporates, but the standard low-freezing mixtures and oils all do that so far as the writer is aware. It used to be the practice on the outdoor switches used on the line of the New York, New Haven & Hartford Railroad to use a low freezing oil in the winter and to take it out in the spring and use standard oil in the summer. When operators have trouble with switches freezing this turpentine mixture is a good one to know about, and if a little care is used no harmful results need be feared. It is probably too volatile for summer use, however, and should be removed in the spring before the warm days come.

### Facts About the Modern Dry Cell

What are the components of the modern dry cell and what functions do they serve? How are the various parts arranged? Are there any statistics available on the size of the industry? N. U. L.

The manufacture of the common dry cell engages the attention of forty or more separate companies and the magnitude of the industry is little appreciated by those not familiar with it. A year's production of dry cells in this country approximates over \$10,000,000 in value. At the present time it is probable that over 50,000,000 standard 2.5-in. by 6-in. batteries are manufactured yearly, 5,000,000 flash-lamp batteries consisting of approximately 15,000,000 single cells 13/16 in. by 2 5/16 in., and about 2,000,000 other cells of special sizes. The present type of dry cell consists of (1) a zinc container, or negative pole, (2) a paper, or porous partition, between the positive and negative poles, and (3) a positive pole comprising a rod of carbon sur-

rounded by a mixture of manganese dioxide, ground carbon and electrolyte. The zinc container is rolled from zinc 0.020 in. thick; the paper partition may consist of three layers of thin blotting paper or a single layer of heavy pulp-board; the positive pole mixture consists of pyrolusite (85 per cent manganese dioxide), 100 parts by weight; ground coke, 80 parts; artificial graphite, 20 parts; sal ammoniac, 20 parts, and zinc chloride, 7 parts. The manganese dioxide acts as the depolarizer; the ground carbon which is next to the paper separator collects the current at the periphery of the mixture and conducts it by means of the other carbon particles to the center carbon plug; the graphite is employed to reduce the internal resistance; the sal ammoniac is the electrolyte, while the zinc chloride is used only to improve the life of the cell by reducing local action. The zinc container is the most expensive part of the cell, and the total manufacturing cost has been given by one authority as approximately 8 cents per cell.

### Effects from Railway-Current Electrolysis in Pipe-Grounding Secondary

Some of the building-construction journals have presented articles by engineers in that field pointing out possible dangers from leakage railway-return currents in buildings where ground connections are made to water pipes and other underground piping systems. From a theoretical standpoint it seems possible that stray direct current might cause injury in this way, but no reports are apparently available concerning the occurrence of such damage or investigations made to determine its extent.

K. L. S.

The path of the current in producing the possible action described would be from the interior piping system through the grounded secondary connection on the water service, thence over secondary to some other ground, either railway-track, water-main or driven-pipe ground, the amount of current and severity of anticipated trouble being in the order named. Although very little is known of the limitations of such possible current, a few figures recently obtained in Denver by Mr. W. J. Canada, electrical engineer for the Rocky Mountain Fire Underwriters' Association, show that with water-main grounds used exclusively and with areas where sandy soil makes possible the very high voltage drop of 10 to 20 volts between neighboring track and water main, a paralleling No. 4 secondary, grounded by No. 4 to hydrants, showed a maximum current flow of less than 1 amp in the largest reading obtained. This would be very considerably less in the ordinary case since the larger number of good grounds the less would be the current. From the readings taken by this observer he concludes that direct current on secondaries can never, when secondary connections to water mains are intact, reach an amount at which perceptible electrolytic action begins, even with salt solutions, to say nothing of the ordinary soil conditions. With secondary grounded to driven pipes, there seems, indeed, somewhat greater possibility that the delivery of current from house-service pipes to neighboring pipe grounds placed (as sometimes occurs) near roof drains, and therefore possibly near buried water services, might reach such a voltage as to cause injury to the service pipe, but such action has never been observed. In case the current was reversed, an increase of resistance from the driven pipe to ground might be expected to result from oxidation or from drying out the earth, and has been found to result when current exceeded a small minimum, thus injuring the effectiveness of such driven-pipe ground. While there always exists the possibility that some direct current may be shunted over paths including secondary grounds, it is apparent from theoretical consideration and from experience that such shunting will rarely cause any injury to such grounds either from heating or from electrolysis. Undoubtedly greater current flows are to be expected from varying voltages between incoming gas, water and drain pipes, because of their differing conductivity.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Testing of Direct-Current Traction Motors.**—WALTER E. FRENCH.—An illustrated description of a slightly modified "Hopkinson or return-current test" to meet the special requirements of traction motor testing. Two similar traction motors  $M$  and  $G$  (Fig. 1) are suspended by their axle bearings on a common shaft  $S$ . They are mechanically coupled through their spur gearings  $p_1, p_2$ ; hence the speed

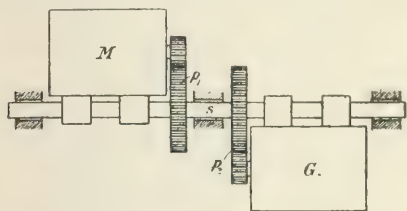


FIG. 1. DIAGRAM OF COUPLING.

of both machines is the same. They are electrically connected according to Fig. 2, one machine being run as a motor, the other as a generator. The motor armature  $M$ , the motor field  $F_m$ , and the generator field  $F_g$  are all in series. Both machines have the same speed and excitation, and as identical flux conditions prevail in both, the iron losses in motor and generator are equal. A booster  $B_1$  (Fig. 2) is placed in series with the generator armature in order to make up the deficiency of the voltage  $V_g$  and to raise the pressure in the generator circuit to  $V_1$ , the potential difference existing in the motor circuit. This is necessary to effect the "pumping back" of the energy to the motor. The pressure  $V_m$  across the motor terminals must be kept constant for all loads, at the voltage for which it is designed, and therefore a second booster  $B_2$  will be required, should the pressure of the mains be too small to allow this adjustment to be done by rheostatic control.

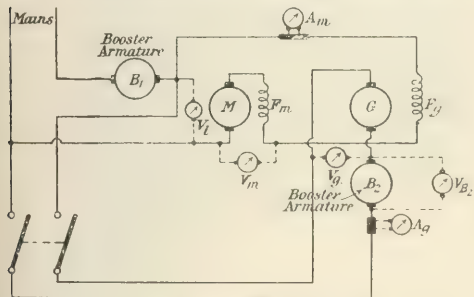


FIG. 2. CIRCUIT DIAGRAM.

The product of the current flowing in the generator circuit and the booster voltage in the generator circuit gives the total loss of the set, comprising the iron losses, gear friction and windage losses of the two machines. The resistance of the armatures being known, their Joulean heat losses can be computed. Subtracting these from the total loss, we obtain as a residue the gear friction and windage

losses, as well as the field  $IR$  and iron losses of both machines. One-half of this difference is the eavage lost in the motor alone by friction, windage, hysteresis, eddy currents and field  $IR$ . The friction includes the losses in the axle bearings, and the efficiencies taken in this way represent the actual working efficiency of the motor on the car. Adding to this the heat loss in the motor armature, the total motor loss is obtained. —*London Electrician*, Jan. 17, 1913.

**Pressure Regulation of Direct-Current Dynamos.** A note on a recent (British) patent (No. 28,486, Jan. 9, 1913) of Brown, Boveri & Company. The excitation is pulsatingly varied. The oscillating system to effect this consists of a single electromagnet, excited according to the pressure of the machine, together with an oscillating armature, whose period oscillation is less than that necessary for the regulation, and a retracting spring. The damping is supplied by a short-circuited winding on the field-magnet poles. The resistance to be short-circuited by the oscillating system is in the dynamo shunt-field circuit. —*London Elec. Eng'ng*, Jan. 16, 1913.

**Ventilation Arrangement for Large Generators.**—KARL WELTZEL.—The author points out several disadvantages in the usual ventilation arrangement in which the cooling air is sucked in from both sides or from the two axle ends of the rotor. The Ganz Electric Company follows a different practice, which is illustrated in Fig. 3. The cooling air is sucked in only from one side of the magnet wheel while the other is completely closed by an iron sheet. Centrifugal force developed in the magnet wheel moves the air in the usual way in radial directions through the stator. The air passes out through a series of holes on one side of the rim into the space between the magnet wheel and the iron

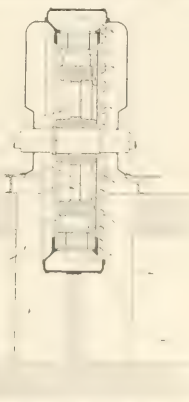


FIG. 3. DIAGRAMMATIC VIEW OF AIR PASSAGE.

sheet. The cooling air is sucked in on one side and flows out on the other through channels in the iron sheet. —*Elek. und Masch. (Vienna)*, Jan. 2, 1913.

**Physical Theory of Commutation.**—W. WOLFF.—The author endeavors to give a physical theory of commutation and discusses especially the self-induction of the short-circuited coil and the magnetic condition of the com-



mutating zone. As to the discrepancy between Arnold's commutating-field theory and Menges' neutral-field theory he thinks that the differences of theory are not real and that if the basis of the arguments be examined in the light of known physical principles the various theories will be found to be merely different ways of stating the same thing. The author's own views are not given as a compromise, but as a basis for a theory which both sides can adopt.—*London Electrician*, Jan. 17, 1913.

### Lamps and Lighting

*Metallic-Filament Lamps*.—A. LEDERER.—A paper read before the Association of Austrian and Hungarian Central Stations on the development of the incandescent lamp with special reference to metallic-filament lamps and the work done by Auer von Welsbach. Some microphotographs are given to show the differences between tungsten filaments made by different processes.—*Elek. und Masch.* (Vienna). Dec. 12, 1912.

### Generation, Transmission and Distribution

*Swiss Water-Power Station*.—A note stating that a hydroelectric power station is now being equipped at Laufenburg on the Rhine which will, when completed in 1914, be the largest plant of its kind in Switzerland. The installation will comprise ten turbines, each coupled to a 5200-kw, three-phase alternator, generating at a voltage of 6000 to 6600, which will be raised to 47,000 volts for transmission.—*London Electrician*, Jan. 17, 1913.

*Producer Gas*.—H. A. HUMPHREY.—A paper read before the (British) Institution of Civil Engineers on the generation and distribution of producer gas in South Staffordshire. It is a pioneer undertaking, since it is the first example of a company giving, under Parliamentary powers, a supply of producer gas for public purposes. There are eight Mond gas producers, one of which is a spare. Each producer is rated at 20 tons of coal per twenty-four hours, but in the course of operation the plant, which was designed for gasifying 140 tons per day, has reached the rate of 200 tons per day. The Mond producer gas distributed averages over 150 heat units per cubic foot, and the regularity of the calorific value is remarkable. There are at present over 150 gas engines connected with the company's mains, and practically every suction producer situated near the mains has been shut down, the owner finding it more advantageous to take a supply from the Mond gas mains. The average price received from consumers was in June, 1912, about 3.5 cents per 1000 cu. ft., and this is equivalent, having regard to its calorific value, to lighting gas at 14 cents per 1000 cu. ft. A considerable amount of the gas is also used for heating operations.—*London Electrician*, Jan. 17, 1913.

*Hydroelectric Power in Switzerland*.—In 1911 there were 783 electric power plants in operation in Switzerland, and, as marked evidence of the rapid growth in this branch of industry in that country, there was an increase of 108 electric power plants in one year. Some of the most important sources of water-power are rivers supplied by glacial waters, but, as at certain seasons of the year these are very low, many of the hydroelectric works are obliged to have auxiliary steam or gas engines. The Rhine, for instance, at the point where the important Laufenburg plant is being constructed, discharges 132,000 gal. to 176,000 gal. of water per second, but this amount is reduced to about 60,000 gal. during nearly two months each year. It is estimated that Swiss waters are capable of furnishing energy to the extent of 2,000,000 hp, and of this amount 500,000 hp to 700,000 hp is now harnessed and in actual use.—*London Electrician*, Jan. 17, 1913.

### Installations, Systems and Appliances

*The Arc on Opening a Switch*.—WILHELM HOEPP.—A long paper, illustrated by numerous diagrams, read before

the Electrical Society of Berlin. The author first describes a series of extended researches on the arc produced on opening a direct-current circuit. Experiments with horn lightning arresters are described, which show that in all cases in which the arc travels to the ends of the two horns the initial direction of the arc is the direct continuation of the horns. The form of the ends of the horn is, therefore, very important, and it makes a great difference whether the ends are slightly bent to one side or not. The direct-current arc is always non-symmetrical and the "stream" from the negative pole seems to be stronger than that from the positive pole. This is especially evident with an arc between two carborundum rods. With a horn lightning arrester the arc rises upward always in a non-symmetrical form. Another interesting point is that if a switch is placed in a metallic casing which is connected with the positive or the negative pole (as is the case with railways and in three-wire systems) it is found that the arc jumps much more willingly (that is, with a lower current strength) toward the casing when it is connected with the positive pole than when connected with the negative pole. The voltage of the arc is the sum of the minimum voltage required to form the arc, the ohmic drop and another voltage proportional to the length of the arc. The minimum voltage required to form an arc between copper electrodes is 20 to 30 volts. If at 600 volts twenty or thirty copper contacts are connected in series and they are all broken at the same time, there will be no arcs. On the other hand, with a single arc gap and higher voltages, above 500 volts, the minimum voltage becomes practically insignificant and the required maximum arc length of the arc itself is approximately 1 mm (0.04 inch) per volt; that is, 500 mm for 500 volts and 1 m for 1000 volts. The distance of the electrodes from each other depends entirely on the form of the contacts. Contacts at which arcs occur in operation should be lubricated only slightly, but often. The author then describes some experiments with maximum-current circuit-breakers and discusses the arc caused by opening an alternating-current circuit. Although if carbon electrodes are used an arc may be easily formed with alternating current if the current and voltage are not too low, the conditions are very different with metallic electrodes. With metallic electrodes the arc is usually extinguished within a half period of the alternating current. There is a certain minimum current which depends on the voltage, the kind of connections and the power-factor, and below this minimum current the arc cannot exist longer than half a period. Below this minimum current the contact may be broken slowly, since the arc is extinguished automatically. Rules are given on the best speed of breaking, etc. In order to utilize the advantages of slowly breaking the contact it is best to use for the electrodes a metallic material of high heat conductivity like copper. In an appendix it is shown that in a non-inductive alternating-current circuit the formation of the arc starts only at very high currents with some metals, and that with inductive loads the formation of arcs can be avoided to a certain degree by a small additional artificial load.—*Elek. Zeit.*, Jan. 9 and 16, 1913.

### Wires, Wiring and Conduits

*30,000-Volt Polyphase Cable*.—W. FRANKKUCH.—A translation of his German paper recently abstracted in the *Digest* on the 30,000-volt cable system of the Oberspreewitz central station at Berlin.—*London Electrician*, Jan. 17, 1913.

### Electrophysics and Magnetism

*Speaking Incandescent Lamp*.—KARL ORT AND JOSEF RIEGER.—A description of an experiment in which a high-candle-power metallic-filament lamp was made to reproduce speech when telephone currents were passed through the filament. The connections are shown in Fig. 4. The primary circuit of the microphone transformer MT contains a powerful microphone M and the five-cell storage

battery *B*, the current supplied to the microphone being about 400 milli-amp. The secondary winding of this transformer (the ratio of transformation being from 300 to 5300) was connected through the condenser (2 mfd capacity) to the poles of a 100-cp osram lamp *G* fed from the 120-volt direct-current supply, the induction coil *D* being inserted in the circuit. Words spoken into the mi-

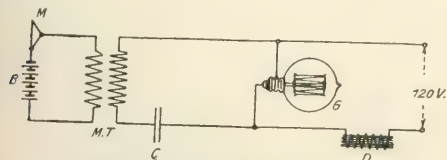


FIG. 4—DIAGRAM OF CONNECTIONS

crophone were reproduced by the incandescent lamp. The filament is subjected to temperature variations due to the speaking currents, and these temperature variations are supplied to the glass globe of the lamp, which produces vibrations of the air. The phenomenon is especially noticeable with high-candle-power lamps the globes of which are made of thin glass.—*Phys. Zeit.*, June 15, 1912.

**Changes of Energy.**—P. SCHIEMANN.—An article on the changes of energy which take place when an electromagnet or a permanent magnet attracts the armature.—*Elek. und Masch.* (Vienna), Jan. 5, 1913.

**Theory of Dielectrics.**—TCHESLAS BIALOBYESKI.—A theoretical and mathematical article on the theory of dielectrics based on the ionic theory. The dielectric is assumed to have a lamellar or granular structure, in its interior there being spaces without any conductivity whatever.—*Le Radium*, Vol. IX, 1912, page 250; abstracted in *Elek. Zeit.*, Jan. 9, 1913.

**Secondary Rays.**—O. W. RICHARDSON.—A mathematical paper on the theory of the non-symmetric emission of secondary rays.—*Phil. Mag.*, January, 1913.

**Positive Ions.**—G. W. TODD.—An account of experiments on the mobility of the positive ion at low pressure.—*Phil. Mag.*, January, 1913.

**Ionization Produced by Beta and Gamma Rays.**—D. C. H. FLORANCE.—An account of an experimental investigation of the ionization produced by beta and gamma rays of high pressures. The apparent coefficient of absorption of the beta rays from uranium X was found to be  $0.04 \text{ cm}^{-1}$  in air. By a special arrangement this value could be reduced to 0.007 approximately. The "emergent" beta rays produced by gamma rays from  $\text{RaC}$  have an absorption coefficient of  $0.046 \text{ cm}^{-1}$  air, and the incident beta rays  $0.056 \text{ cm}^{-1}$  air. The emergent beta rays are similar in penetrating power to the beta rays of  $\text{UrX}$ . The absorption coefficient of the beta rays of  $\text{UrX}$  and of the emergent beta rays, when the plates are 2 cm apart, is  $0.025 \text{ cm}^{-1}$  approximately. The beta rays appear to be independent of the material of the plates, as other investigators have also shown. When the plates are 1 cm apart the ionization due to gamma rays in the gas is negligible at atmospheric pressure and is approximately 25 per cent of the total ionization at 80 atmospheres.—*Phil. Mag.*, January, 1913.

#### Electrochemistry and Batteries

**Induction Furnace.**—J. HARDEN.—An illustrated article on the present status of the induction furnace. The author describes the design of a two-phase induction furnace on the lines of the Roehling-Rodenhauser furnace, which is intended to combine the good points of both the three-phase and single-phase types. Some details are given of the construction of the lining, especially the lining developed by the Poldihütte. *Met. and Chem. Eng'g*, February, 1913.

**Electric Resistance Furnace.** R. H. McMILLEN.—An

illustrated description of the application of the electric resistance furnace to the determination of oxygen in iron and steel by the utilization of the Ledebur method modified to meet the special requirements.—*Met. and Chem. Eng'g*, February, 1913.

**Spray Process for the Production of Metallic Coatings.**—M. U. SCHOOP.—An illustrated article on recent advances in the author's spray process for the production of metallic coatings. In the latest apparatus for this purpose just as much metal is melted from a ribbon as is required to be sprayed in that moment on the surface to be coated. The process is applicable to the production of metallic coatings of any kind (brass, copper, nickel, iron, gold and even platinum) on any surfaces whatsoever, even on inflammable substances like celluloid, laces, etc.—*Met. and Chem. Eng'g*, February, 1913.

#### Units, Measurements and Instruments

**Measuring of Power in Three-Phase Systems.**—KARI SCHMIDEL.—Alternating-current motors with only one measuring system are used with different forms of connections for measuring the power in three-phase systems. But their indications are correct only if all three phases are equally loaded. If the loads are unequal the readings of the meter may be quite wrong. The author calculates exactly the error of the meter reading for the case where one phase of the system is disconnected. This is done for the three principal forms of connections used in practice with induction meters. In the case which occurs most often in practice and in which such meters are used for measuring the power of induction motors, the errors may become so great that either the central station or the consumer will be under serious disadvantages.—*Elek. Zeit.*, Jan. 16, 1913.

**Measuring Very High Resistances.**—TOURNIER.—An illustrated description of a method for measuring very high resistances, including those of electrolytic resistors, by means of a quadrant electrometer. The connections are shown in Fig. 5, where  $V_0 - V_1$  is the potential difference between the needle and one of the quadrants;  $V_2 - V_0$  that between the two quadrants. There will be no deflection of the needle if  $(r_1 - r_2)x = R(r_1 + r_2) + r_1r_2$ , so that from  $R, r_1, r_2$  it is possible to determine  $x$ . In a test of the method the resistances  $r_1, r_2$  were constituted of a potentiometer with a total resistance of 110 to 111 ohms. The fixed resistance  $r$  was a metallic resistor of 1 megohm. The resistance  $x$  to be determined was that of an electrolyte. The source of current  $S$  was an alternating-current

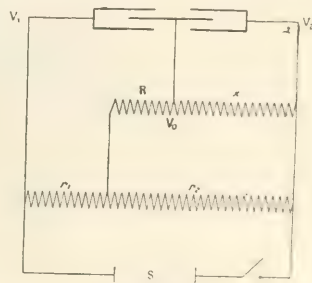


FIG. 5—METHOD FOR MEASURING VERY HIGH RESISTANCES

supply at 110 volts. When  $r_1$  is of the order of magnitude of 10 megohms, the error of the measurement is less than 0.1 per cent, if  $r_2$  is of the order of 100 megohms, it is still less than 1 per cent. The method is particularly applicable to the determination of the resistivity of exceedingly dilute solutions. *Comptes Rendus*, Dec. 9, 1912; *Ind. Eng'g. Chem.*, Jan. 17, 1913.

### Telegraphy, Telephony and Signals

**Loading Telephone Lines with Induction Coils.**—F. LUSCHEN.—A mathematical paper illustrated by diagrams on the calculation of two-conductor and four-conductor lines with Pupin coils in such a way that phantom circuits may be formed.—*Elek. Zeit.*, Jan. 9, 1913.

**Telephone Exchange.**—An article illustrated by diagrams on the telephone exchange in Rotterdam using the central battery system.—*Elek. und Masch.* (Vienna), Dec. 12, 1912.

**Organization of Telephone Exchanges.**—MAX FREIMARK.—An article giving a review of the principal features of the organization of American telephone exchanges.—*Elek. Zeit.*, Jan. 16, 1913.

**Cable Ship Practice.**—E. RAYMOND-BAKER.—An article giving notes for junior assistants on the use of graphs in the cable-ship drum rooms.—*London Elec. Review*, Jan. 17, 1913.

**Wireless Telegraphy.**—An illustrated description of a new wireless telegraph system is due to J. G. Balsille. The transmitting system (Fig. 7) consists of the usual turned alternator circuit supplying a transformer  $EC$ , the secondary of which supplies an oscillating circuit. This is across a variable capacity  $H$  in the antenna, there being no variable coupling. The oscillating circuit contains two capacities,  $F$  and  $G$ , which are arranged symmetrically in each connection to the antenna. There is also a reactance  $K$ , and in shunt to the secondary of the transformer is the spark-gap  $LM$ , consisting of a plate and nozzle, unidirectional impulses being obtained by an air blast through the latter at 100 lb. to 105 lb. per square inch. In operation the constants of the exciting circuit are so adjusted that it has no distinctive frequency of its own, in order that the radiator may freely oscillate in its own period. The receiving antenna is of the looped type, the extremities of which are connected to earth. One or both legs include a variable condenser around which is shunted a closed oscillating circuit, tuned to the oscillating frequency of the received waves and provided with a variable inductance forming the primary of a transformer. The secondary of this transformer is included in a detector circuit, adapted to be tuned to the group frequency of the received waves.

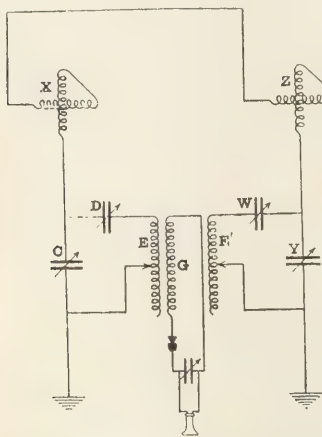


FIG. 6—DIAGRAM OF RECEIVING CIRCUIT

The receiver may thus be tuned to receive from any particular transmitter, working on the two-tone principle and emitting two distinct wave trains of different frequencies, but having a certain predetermined group frequency. The circuit is formed with a variable reactance  $XZ$  in each leg (Fig. 6). Adjustable condensers  $C$  and  $Y$  are adapted to be varied equally with condensers  $D$  and  $H'$  respectively,

the latter being included in closed oscillation circuits, each of which forms a shunt to condensers  $C$  and  $Y$  respectively. These circuits are adapted to be tuned in resonance with the absorbing loop and therefore oscillate in the oscillation frequency of the received waves. The variable inductances  $E$ ,  $E'$ , respectively, included in each shunt circuit, form the primaries of a transformer, the secondary  $G$  of which

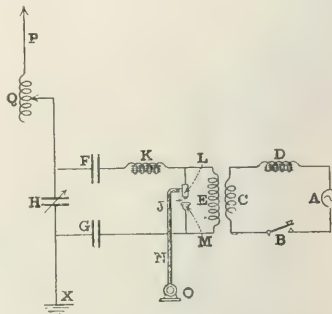


FIG. 7—DIAGRAM OF TRANSMITTING CIRCUIT

forms part of a detector circuit. This is consequently responsive to any oscillation frequency in either shunt circuit through the inductive coupling.—*London Electrician*, Jan. 10, 1913.

### Miscellaneous

**Thirtieth Anniversary of Society and Journal.**—New Year's Day, 1913, was the thirtieth anniversary of the foundation of the Electrical Society of Vienna and also of the foundation of its organ, which first appeared under the title *Zeitschrift für Elektrotechnik* as a semi-monthly. In 1898 it was changed into a weekly and in 1906 the title was changed and the journal became known as *Elektrotechnik und Maschinenbau*, the name under which it has since continued to be published.—*Elek. und Masch.* (Vienna), Jan. 5, 1913.

**United States and Europe.**—F. NIETHAMMER.—A paper read before the Electrical Society in Vienna on heavy electrical engineering practice in the United States in comparison with European practice. In general the author thinks that the industrial conditions in the United States and in Europe are no longer so different as they were before. The author discusses some special points in the design of direct-current machines, synchronous machines, induction machines and converters. The article is to be continued.—*Elek. und Masch.* (Vienna), Jan. 5, 1913.

## Book Review

HANDBUCH DER ELEKTRIZITÄT UND DES MAGNETISMUS. By Prof. Dr. L. Graetz. Leipzig: J. A. Barth. 156 pages, 122 illus. Price, 6 marks.

The first of a series of five collaborated volumes relating to the principles of electricity and magnetism from the standpoint of the laboratory worker. This volume deals with the field of electrostatics. The first section takes up the history and elementary principles of electrostatics. The second section deals with electrostatic generators, by friction and inductive influence. Condensers are included. The third section discusses the measuring apparatus of electrostatics. The three sections have been written by different authors. The book is clearly written and well illustrated. The third section is particularly well treated. The student of high-tension electricity will find much interest in the volume, especially on the side of German laboratory apparatus.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Porcelain Pothead

A two-wire, all-porcelain pothead, especially designed for use on arc-lamp circuits, has been placed on the market by the Colonial Sign & Insulator Company, of Akron, Ohio. Though so small as to be inconspicuous when mounted on a pole, it is designed with long arcing distances between

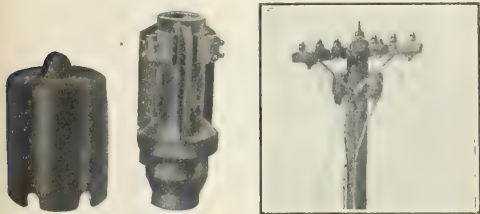


FIG. 1—DETAILS OF POTHEAD FIG. 2—POTHEAD INSTALLED

live parts, long creeping surfaces and double barriers between terminals of opposite polarity. It is said it will withstand a pressure of 30,000 volts and can safely be used on any arc-lamp circuit for a maximum of 100 lamps. It is designed for duplex cables having a maximum outside diameter of  $1\frac{1}{2}$  in. with terminals for any size wire up to No. 6 B. & S. gage.

### Electric Shovels for City Excavations

Since the smoke abatement law became effective in Boston engineers and contractors have co-operated very successfully to eliminate the smoke nuisance accompanying



ELECTRIC SHOVEL IN OPERATION ON EXCAVATION FOR NEW CITY HALL, BOSTON

the use of steam shovels and other steam-operated devices in construction work.

For the new city hall an area of 225 ft. by 60 ft. had to be excavated to a depth of 20 ft. The lot is surrounded by

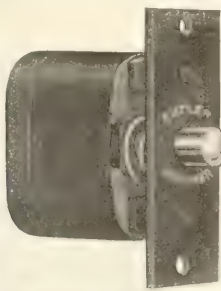
high-class buildings, making noise or smoke objectionable. On this account the contractors, the Wells Brothers Company, New York, decided to use an electric shovel for this work.

The labor cost of operating a Type No. 1 Thew electric shovel with a dipper of 1 cu. yd. capacity on railroad work in Canada varied between 2.9 cents and 3.7 cents per cu. yd. While the conditions were different, it may be interesting to compare this cost with the per diem figures furnished by the Central Construction Company of Boston for operating a Thew Type No. 0 steam shovel. They are as follows: Engineer, \$6; fireman, \$3; two trackmen at \$2.25, \$4.50; coal, at \$4.50 per ton, \$1.25; total, \$14.75. The average output for an eight-hour day was about 350 cu. yd., making the cost per cu. yd. 4.2 cents.

The use of an electric shovel also saves a great deal in team time. The crews ordinarily employed in hand shoveling will load a 2-yd. wagon in from six to ten minutes. It is believed that an average saving in team time of three minutes per yard loaded is conservative. This represents a saving of about \$9 or \$10 daily, an amount almost equal to the entire cost of operating a shovel with a rated output of 35 cu. yd. to 40 cu. yd. per hour.

### Automatic Door Switch for Automobile Lighting

A device for the automatic operation of a lamp arranged to light the running board of an automobile when opening the door is shown full size in the accompanying illustration.



AUTOMATIC DOOR SWITCH

It automatically closes the circuit and lights the foot lamp when the door of the vehicle is opened, while closing the door causes the lamp to be automatically cut out of circuit. It is of the quick make-and-break type and is rated at 10 amp and 80 volts. The insulating material used in the body is said to be fire proof and waterproof and not to char or warp out of shape. The switch body and push-bar are of rugged construction.

This automatic door-switching device has been placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee, W.

### Use of Copper-Clad-Steel Tie-Wires

In the construction of 20 miles of 13,000-volt transmission line which the Beacon Light Company, of Chester, Pa., recently completed from Chester to Media, and thence to Philadelphia, No. 4 annealed copper-clad wire was used for tying in the No. 2/o solid-copper conductors. For work of this character No. 2 copper ties had heretofore been employed, but according to Mr. A. R. Granger, manager of the Beacon Light Company, the use of these will now be discontinued, since he finds the annealed copper-clad wire more economical as well as easier to install.

From figures furnished by Mr. Granger in a letter to the Duplex Metals Company, Chester, Pa., manufacturer of the copper-clad wire, the following comparison of costs is given between No. 2 solid-copper wire and No. 4 copper-clad wire for tying purposes:

7270 ft. No. 2 copper, 1461 lb., at 18¾ cents.....	\$273.94
7270 ft. No. 4 copper-clad, 840 lb., at 14¾ cents.....	123.98

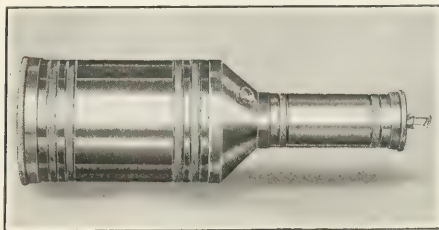
Saving in initial cost .....	\$149.96
Saving in interest charges (fifteen years at 6 per cent simple interest) .....	134.96

Total saving in fifteen years.....	\$284.92
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In addition to this gain in economy secured by substituting No. 4 copper-clad for solid-copper ties of the larger cross-section, the tie-wires are lighter and stronger.

### Linemen's Searchlamp

The usefulness of a searchlamp in locating break-downs and other trouble along a transmission line has on several occasions been pointed out in these columns. A new type of lamp for this purpose has recently been placed on the

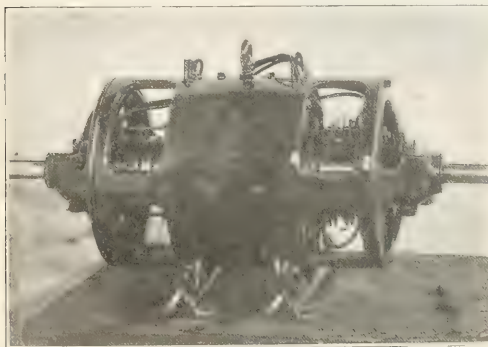


LINEMEN'S SEARCHLAMP

market by the Niagara Searchlight Company, Niagara Falls, N. Y. The lamp illustrated herewith is made entirely of aluminum and weighs only 31 oz. It is said to give sufficient light for illuminating the top of the tallest pole or tower.

### Machine for Laboratory Use

The Diehl Manufacturing Company, Elizabethport, N. J., has developed an interpole inverted rotary converter with



LABORATORY MACHINE

special characteristics which make it adaptable for use in laboratories. The machine will generate single-phase or three-phase current at 60 cycles, or it may be operated as a shunt-wound or compound-wound direct-current motor of the commutating-pole type.

In order to make it flexible for testing purposes the machine is equipped with a compound winding on the field spools so that it may be operated as a compound-wound, direct-current generator. When operating as a direct-current generator at a speed of approximately 2200 r.p.m. the machine is flat-compounded from no load to 50 per cent overload. It is equipped with commutating poles and has shaft extensions on both ends in order that arrangements may be made for its operation either as a direct-current motor or a belt-driven generator. When the machine is brought up to speed from the direct-current end it can be synchronized with a three-phase line to operate as an alternating-current motor or as a rotary converter.

### Metal Conduits

Several new conduit systems and fittings have recently been brought out by the General Electric Company, Ltd., 67 Queen Victoria Street, London, E. C. In the so-called "Duplex" pin-contact system (Fig. 1) use is made of a double pin or staple which is driven between the wall of the fitting outlet and the tube, thus making electrical contact between successive parts of the conduit through the intervening fittings. The "Magnet" grip (Fig. 2) is a

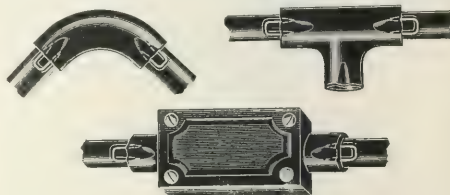


FIG. 1—PIN-CONTACT SYSTEM FOR METAL CONDUITS

steel strap, with two sets of serrated teeth on the inside edges, for making an efficient contact between plain conduit and fittings. It has the advantage of being self-contained, no special fitting being necessary. It is also possible to fit this grip to existing surface installations without dismantling. It is automatic in its action, no scraping or filing of the tube being required.

The "Griptite" fittings are said to possess all the advan-



FIG. 2—GRIP WITH SERRATED TEETH FOR MAKING CONTACT

tages of screwed split fittings, but are simpler and do not require screwed tubes. This system employs non-losable screws which are held in the "lid" half of the fitting so that when the fittings are taken apart the screws cannot



FIG. 3—SPLIT FITTINGS WITH NON-LOSABLE SCREWS

drop out and get lost. When the wires are in place the top halves of the fittings are placed and the screws tightened so as to fasten the fittings securely around the tube. To obtain a proper mechanical and electrical contact the enamel is removed from the end of the tube.



## Electrical Equipment for the Melbourne (Australia) Suburban Railways

Probably the most notable railway electrification project at the present time is that about to be undertaken in connection with the suburban steam railways of Melbourne, Australia. The advisability of the step has been under consideration for a number of years, and in 1908 Mr. Charles H. Merz, of the firm of Merz & McLellan, Victoria Street, Westminster, London, presented a comprehensive report on the subject to the Victorian Railway Commission.

Since that time a number of important railways have been electrified in all parts of the world, and experience has demonstrated the great advantages and economies which result from electric operation. In this particular case the rapid growth of the suburban traffic of Melbourne was also a decisive factor that emphasized forcibly the need for electrification. Recent practice especially has shown that the adoption of the high-voltage direct-current system by a number of roads has resulted in successful and economical operation both for suburban and through service.

In a later report, embodying a comparative analysis of the merits of both the single-phase alternating-current and high-voltage direct-current systems, based on the tenders submitted, Mr. Merz claims that the adoption of the high-tension direct-current system for this installation would mean a saving of about \$3,500,000, or nearly 30 per cent, in first cost over that of the single-phase system. Furthermore, a saving of about \$350,000 per annum, or nearly 28 per cent, in the cost of operation would be accomplished, and consequently the adoption of the high-tension direct-current system was recommended for the Melbourne railways, which recommendation was accepted by the Victorian government.

Melbourne, the capital of the State of Victoria, is situated in the southern part of eastern Australia, on the Yarra River, 8 miles from its mouth at the head of Port Philip. The river is accessible for vessels requiring not over 22 ft. of water, and all larger vessels are accommodated at Port Melbourne in Hobson Bay. Along the river are large docks, shipyards, foundries and manufacturing plants representing a number of industries. The city has a population including its suburbs of over 500,000 and is the most important municipality and the greatest trade emporium in Australia.

The electrification of the Melbourne Suburban Railways is of exceptional interest because it will be one of the largest projects of its kind in the world, involving heavy rolling-stock equipment with overhead collectors. The magnitude of the undertaking from the standpoint of equipment and service may be compared with that of the third-rail electrified section of the New York Central Railroad out of New York City, and it ranks with the Oakland, Alameda & Berkeley electrification of the Southern Pacific Railroad at San Francisco.

After an exhaustive study and consideration of the relative merits of various propositions, Mr. Merz approved in his report the recommendations of the General Electric Company, New York, as to choice of system and economical features of operation, and the Victorian government awarded to this company the contract for the rolling-stock apparatus equipment, comprising 400 motor-car equipments, consisting of four motors each; 800 control equipments, 400 of which are for trailer cars, and 400 air-compressor equipments. This is said to be the largest single order ever placed for electric railway apparatus.

The mileage of the suburban lines included in the scheme is made up of 150 route-miles, or 289 track-miles of running roads, and 34 miles of sidings. The potential selected for this direct-current system is 1500 volts. Energy will be supplied from a central station at Yarraville, a suburb of Melbourne, in the form of three-phase alternating current at a frequency of 25 cycles per second, which will be transmitted at 20,000 volts to twelve substations at various points

on the system, where it will be converted into direct current of 1500 volts. The high-tension transmission is by underground cables from the power house to the substations in the central area, and by overhead wires erected on the structures carrying the railway track conductors to the outlying substations. Overhead railway feeders will be used throughout the system and the cars will be equipped with roller pantograph collectors. The complete equipment involves the expenditure of approximately \$12,000,000, and Mr. Merz figures that the saving of electric operation over the steam-operated lines will amount to about \$600,000 in 1915.

Normally trains, weighing about 180 tons, will consist of two motor cars and two trailer cars. The track gage is 5 ft. 3 in. In 1908 the suburban traffic amounted to 70,000,000 passengers and last year the figure exceeded 90,000,000. In 1917, when it is expected that the conversion to electric operation will be entirely completed, it is estimated that the suburban lines will carry 150,000,000 passengers per annum. In the present plans provision is made for this probable increase in traffic, but all parts of the electrification scheme will allow extension from time to time as the traffic subsequently grows. The handling of heavy traffic during the rush hours of morning and evening will be provided for by increasing the length of trains, although for the initial service it is the intention to have the maximum train consist of six cars.

The motors, numbering 1600 in all, which will be installed in the 400 motor cars will be of a new design which is said to embody the most modern developments in railway motor construction. They will have inherent ventilation and be provided with commutating poles. The rating will be 140 hp at 725 volts, two motors being operated in series on a 1500-volt circuit.

It is stated that the method of self-ventilation which will be incorporated in the design of these motors will assure exceptionally effective and uniform cooling by means of a broad-bladed centrifugal fan cast integral with the pinion end armature core head. Fresh air is drawn into the interior through a screened opening on the upper side of the motor frame at the pinion head. This is circulated over the armature and field coils, under and through the commutator, through longitudinal holes in the armature core, and thence exhausted to the exterior through openings in the pinion and bearing head.

The service on the lines calls for both local and express schedules. The motors will therefore be arranged for tap-field control, which will allow a free running speed of 52 miles per hour over level track for the suburban cars on express runs. This method of auxiliary control was introduced by the General Electric Company a number of years ago, but owing to the commutating limitations of the earlier motors it was eventually abandoned. Its successful application to commutating-pole motors is therefore modern.

The principal advantages to be derived from tap-field control are increased operating efficiency, continuous saving of power, economy effected through decrease in the weight of the equipment and an increase in the service capacity. The practical effect of tapping the field is to eliminate one resistance step and to secure the desired accelerating effort throughout, from start to full speed, with a lower current input.

The 800 control equipments for both motor and trailer cars will be of the Sprague-General Electric Type M relay-automatic control, which provides for multiple-unit operation and control of the train from the platform of any motor or trailer car. This type of control has been in operation for many years, notably on the subway and elevated lines in New York and other large cities.

It is interesting to note that two of the principal factors that apparently influenced Mr. Merz and the commissioners to decide in favor of the high-tension direct-current system, rather than the single-phase alternating-current system,



were the lower maintenance of the rolling-stock equipment and the saving in energy consumption. They found that the greater number and complexity of the electrical parts carried on the coaches in the case of the single-phase equipments not only cause these equipments to be initially more expensive but also render them more costly to maintain; and when routine inspection is taken into account, and also the fact that repairs are necessarily subject to the exigencies of traffic requirements, the maintenance of single-phase equipments would exceed that of direct-current equipments in a slightly higher proportion than that governing their respective first costs.

The direct-current motor, known as Type GE-237, selected for these equipments is designed especially to obtain low energy consumption. This comparison of energy consumption is included in Mr. Merz's report in the number of kilowatt-hours required by a four-coach train making a round trip between Sandringham and Broadmeadows. Based on several manufacturers' guarantees, Mr. Merz arrives at an economy of 23 per cent in energy consumption in favor of the high-tension direct-current equipment.

Other points that were brought out as being adverse to the single-phase system for this application might be mentioned, as follows: Slightly reduced seating capacity of the trains on account of the extra amount of room required by the single-phase equipments; the extra wear on the track rails due to the extra dead weight of the single-phase motors, and the extra amount of reserve plant equipment required in connection with the single-phase scheme on account of the greater complexity of the equipments. As mentioned before, Mr. Merz estimated that the annual operating cost of the single-phase system would be about \$350,000, or nearly 28 per cent, more than for the direct-current system, and he also came to the conclusion that the latter system would show an increasing advantage over the single-phase system as the traffic becomes yearly greater.

Electrification of steam roads both here and abroad has emphasized the fact that the conversion to electrical operation is always accompanied by a faster and more frequent train service and, because of greater convenience, comfort and cleanliness, a general improvement in suburban traveling conditions, while the reduction in working cost and the increased earnings of the line combine to increase profits.

### Boiler Efficiency Meters

A simple device for indicating the relation between furnace and boiler has been brought out by W. A. Blonck & Company, Fisher Building, Chicago. It consists of two

most efficient operating condition of each particular boiler. The instrument is mounted on the boiler front, so that firemen can see at a glance the working conditions of each unit.

The sliding scales are provided with indications showing normal operation (arrow), excess amount of air (+ air) and insufficient supply of air (— air).

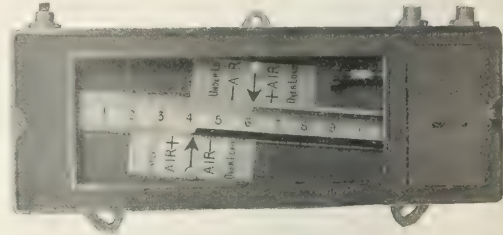


FIG. 2—BOILER EFFICIENCY METER

The connections between the instrument and the furnace and boiler side of the damper, shown in Fig. 1, are standard 1/8-in. steel pipes. This illustration also shows certain positions of the instrument and the deductions to be read from each one. In practical operation the instrument indicates when to put on fresh coal, cover up holes or clean the fire.

Fig. 3 shows the operation of a 300-hp hand-fired Heine boiler as recorded by one of these meters. With a fresh fire the meter would stand at 0.35 and 0.70, indicating normal furnace draft and the friction loss between fire and damper respectively. The firing periods in this case lasted about three minutes. Gradually the scales moved to 0.22 and 0.80, respectively indicating excess of air and the want of fresh fuel. As the fire gets "dirtier" and the cleaning time approaches the meter will gradually move to 0.42 and 0.58, calling the fireman's attention to the lack of air in the furnace. The CO<sub>2</sub> curve plotted on the same sheet shows the greatest efficiency of the furnace at normal positions of the meter.

### Electric Passenger Automobiles at Chicago Show

Among the electric passenger vehicles shown at the National Automobile Show held at Chicago, Feb. 1 to 8, were exhibits of the Argo, Baker, Borland, Broc, Buffalo, Century, Chicago, Detroit, Ohio, Hupp-Yeats, Rauch & Lang, Standard, Waverley and Woods cars.

The Woods Motor Vehicle Company made a special fea-

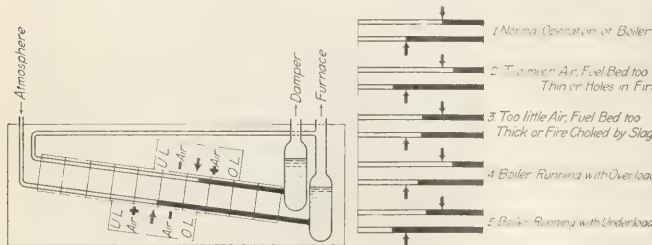


FIG. 1—DIAGRAM OF METER AND EXAMPLES OF METER READINGS

sensitive draft gages, the lower one filled with red oil, indicating the pressure of the air entering into the furnace or the resistance of the fuel bed, while the upper gage, filled with blue oil, measures the amount of gases passing the boiler proper.

In addition to the two gages the meter is provided with two sliding scales, which are adjusted to the best and

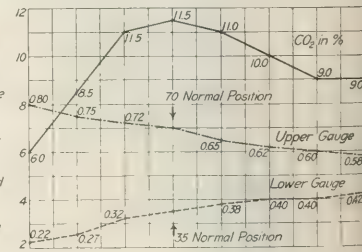


FIG. 3—OPERATING CHARACTERISTICS AS READ FROM METER

ture of its controlling device. Horizontal control is used with five speeds forward and five backward.

The Borland-Grannis Company has a mechanical-electrical controller giving five speeds forward.

Most of the vehicles on exhibition were equipped with dome lamps which illuminate the running board when the corresponding door is opened, but a Waverley car shown

had a special lamp located on a level with the running board.

In the Broc car the batteries are so placed that when the front or rear hood is raised nothing prevents the complete inspection of each cell. This is of great advantage when testing the electrolyte with a hydrometer.

The Ohio Electric Company is one of the concerns building cars which may be operated from either front or rear seat, interlocks rendering it impossible to manipulate both controllers at the same time.

The Ohio car exhibited was supplied with an electric foot warmer. The resistor of the foot warmer makes use of the energy otherwise wasted in the resistance on starting. Another feature on this car is the electric braking, which is accompanied by pressing a button located on the control handle.

To prevent the burning out of brake-bands the Rauch & Lang Company has a new "wrinkle" by which a bell is rung in case the controller is turned on while the brake is set. When the control lever is in the neutral position an electric brake is shunted across the batteries; pulling the handle back farther puts a service brake on the motor.

Only a few of the gasoline cars at the exhibit were not equipped with self-starters of some kind. Practically all of the cars were electrically lighted, the tendency seeming to be toward the 6-volt system. Exceptions were the three-wire, 6-12-volt system and an 8-volt system. In the design of electric starting mechanisms the tendency seems to be toward double-unit sets to obviate gearing complications, one unit being used for starting and another for generating.

### Surface Condenser for Brooklyn Edison Company

In the Bay Ridge station of the Brooklyn Edison Company a surface condenser has recently been installed as an auxiliary to the 6000-kw Curtis turbine which is in operation at that plant. The cooling surface available is 20,000 sq. ft., and it is stated that the condenser will produce a 28.8-in. vacuum when the cooling water is injected at a temperature of 70 deg. Fahr. On account of the large amount of foreign substance in the feed water the tubes of the condenser were made approximately twice as large as is the usual practice, the interior measurement being 1.5 in. Under contract conditions it is said that a transfer of about 300 heat units per square foot of surface

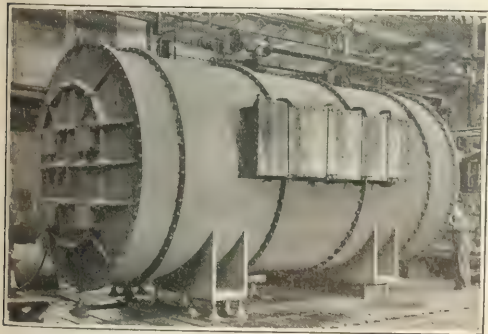


FIG. 1—LARGE SURFACE CONDENSER

has been realized, which is quite a remarkable figure in view of the large size of the tubes. The difference between the temperature of the exhaust steam and that of the hotwell is said to be at all times less than 1 deg. Fahr.

In connection with the condenser a Le Blanc air pump and a turbine-driven circulating pump have been installed. The circulating pump is driven from the turbine through

a reduction gear. The efficiency of this pump is given as 76 per cent, and the steam consumption of the turbine with all losses included is said to be 53 lb. per water hp-hour. This pump with the reduction gear and turbine are shown in Fig. 2.

As an interesting fact in this connection it may be mentioned that this is the second installation of this type in



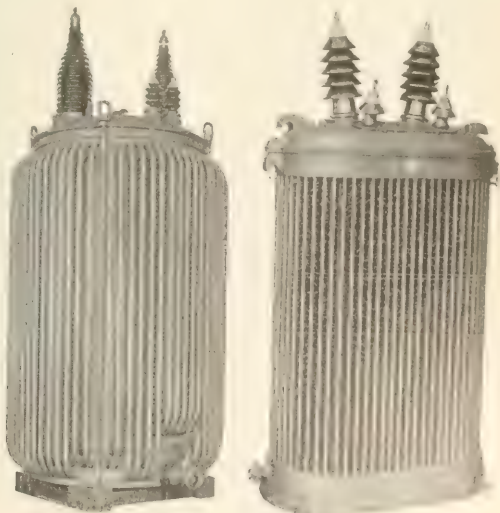
FIG. 2—MOTOR-DRIVEN CIRCULATING PUMP

the United States. The first was made at Terre Haute, Ind., for the Indianapolis & Eastern Traction Company, by the Wheeler Condenser & Engineering Company. In the Brooklyn plant the entire equipment was furnished by the Westinghouse Machine Company, of East Pittsburgh, Pa.

### Outdoor Transformers

It is often desirable to tap a high-tension line where the load is not sufficiently great to justify building a substation, and for this purpose transformers of all ratings and all commercial voltages have been designed for outdoor service.

The familiar pole-type transformers, having a poten-



TWO TYPES OF OUTDOOR TRANSFORMERS

tial of from 2300 volts to 4000 volts, are of simple construction owing to the low voltage. Of the transformers made by the General Electric Company, those with a rating below 25 kva are placed in smooth cast-iron tanks. Units above this rating are provided with corrugated shells in order to obtain sufficient surface for radiation of heat.

Transformers rated at 100 kva or above are either self-



cooled or water-cooled. In the former case the shells are made of corrugated sheet steel and in the latter case a plain steel-plate tank is provided. The large radiating surface necessary for self-cooled transformers above 750-kva rating is obtained by compounding the corrugation; that is, two plain corrugated sheets are welded together to form one large corrugation. This tank is said to have about 65

tinge to a light yellow and on this account is sometimes classified as red and yellow fir. The red fir, as a rule, has a coarser grain and contains a considerable amount of the dark-colored summer wood. It is usually obtained from second-growth timber or from the heart of older trees. Yellow fir is the soft, fine-grained wood obtained from the outer portion of mature trees. It yields a large propor-



FIG. 1—CROSS-ARMS UNDER TEST



FIG. 2—A VIEW OF THE TESTING APPARATUS

per cent more radiating surface than the plain corrugated tank. Another type of tank for self-cooled transformers is known as the "tubular" or "pipe" tank. This consists of a boiler-plate tank having a double row of vertical steel tubes from top to bottom, thus providing circulation for the hot oil in the tank through these external pipes where the heat is dissipated.

The tanks for water-cooled transformers are made of heavy plain boiler plate, being round for single-phase and elliptical for three-phase units. The General Electric Company has recently delivered three 2750-kva transformers of this type for outdoor operation on 110,000-volt circuits and also several 1000-kva self-cooled transformers in tubular tanks for the same voltage.

### Comparative Tests on Fir Cross-Arms

In Bulletin No. 88 of the United States Forest Service were published the results of a number of tests on the

TABLE I—RESULTS OF TESTS ON YELLOW AND RED FIR

Test	Fir	Rings per Inch	Section in Inches	Length in Inches	Result
1	Yellow Red	15 to 20 10 to 12	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
2	Yellow Red	12 to 15 7 to 10	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
3	Yellow Red	14 to 20 8 to 12	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
4	Yellow Red	13 to 18 9 to 12	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
5	Yellow Red	15 to 21 7 to 9	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
6	Yellow Red	16 to 20 6	2 1/8 x 3 1/2 2 1/8 x 3 1/2	62 62	Broke
7	Yellow Red	14 to 20 12 to 15	3 x 4 1/2 2 1/8 x 3 1/2	62 62	Broke

comparative strength of the so-called yellow-fir and red-fir cross-arms. Quoting from this bulletin, the distinction between the two species is as follows:

"Douglas fir varies in color from a decided reddish

tinge to a light yellow and on this account is supposed to be due mainly to the difference in the rate of growth."

According to these tests, performed on high-grade wood, such as is used in cross-arms, the modulus of rupture of the yellow fir is 6773 lb. as against 7440 lb. for red fir, while the moduli of elasticity are 1,871,000 lb. and 2,106,000 lb. respectively. Again quoting this bulletin: "On the basis of all grades, the difference in favor of the red fir varies from 2 to 4 per cent."

The Barnes-Lindsley Manufacturing Company, Spokane, Wash., recently made some tests on a home-made testing machine at its plant on the Columbia River, which are said to have shown that the red fir averaging from ten to fourteen rings per inch is much stronger than the yellow fir with the closer grain.

The tests were made as shown in the illustrations, a yellow-fir and a red-fir arm being crossed and the strain applied by means of a windlass. There was no way of telling the amount of strain needed to break the arms, as a dynamometer could not be secured. These tests resulted as shown in Table I.

Some time ago a number of cross-arms were obtained from a Western Union Telegraph Company's line at Winnemucca, Nev., after forty-three years of service. Table II

TABLE II—CONDITION OF CROSS-ARMS

Number	Rings to Inch	Condition	Remarks
1	6 to 7	Good	Three knots in center, 1-in., 1 1/2-in., 2 1/2-in.
2	9 to 12	Very good	
3	10 to 15	Very good	
4	15 to 18	Good	
5	21 and closer	Very poor	
6	19	Very good	
7	9	Very good	
8	14	Very poor	
9	15	Very poor	One 1-in. knot
10	17	Good	One 1-in. knot
11	16	Poor	
12	20	Very good	

shows the condition of some of these cross-arms, those with a coarser grain, or red fir, evidently being in as good condition, if not better, as the close-grained or yellow-fir cross-arms.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Crude-Oil Engine Manufacture.**—Since the expiration of the fundamental patents on the Diesel engine numerous manufacturers in this country, attracted by the possibilities of this field, have begun building crude-oil engines operating on the Diesel principle. Several of these manufacturers have obtained licenses from the foreign concerns that were the pioneers in the field, and have thus received the benefit of the shop experience, designs, patterns, etc., of these foreign builders. Among the well-known American manufacturers making crude-oil engines are the Busch-Sulzer Brothers-Diesel Engine Company, St. Louis; Snow Steam Pump Works, Buffalo, N. Y.; Lyons Atlas Company, Indianapolis; Fulton Iron Works, St. Louis; Otto Gas Engine Works, Philadelphia, and the New London Ship & Engine Company, Groton, Conn. One of the largest electrical manufacturers is also about to enter the field. The Fulton Iron Works have the American rights to the complete line of engines built by Franco Tosi, of Legano, Italy, but are still in the preparatory stage. The Otto company has built only one size thus far, a 50-hp engine of the horizontal type. One of these engines has been used for driving part of the company's works for some time. On tests made when operating on one of the heaviest grades of Mexican crude oil, a fuel consumption of one-sixteenth of a gallon per brake hp-hour was shown by the engine on a ten-hour run. The Snow company is building crude-oil engines in both single-cylinder and twin-cylinder types, in sizes from 50 hp to 600 hp. These engines have been operated satisfactorily on the heaviest grades of Mexican crude oil, running as high as 54 per cent in asphalt, and also on California crude oils averaging in the neighborhood of 35 per cent asphalt. In the past four or five weeks the company has been operating its engine on coke-oven tar from the Joliet works of the Illinois Steel Company and from the Buffalo plant of the Lackawanna Steel Company, in addition to running it on carbureted water-gas tar from several illuminating gas plants in various parts of the country. The company has several 450-hp engines on order for driving alternators. These units will be installed in Mexican lighting plants, where they will be operated on Mexican crude oil. Many small units, the smallest being of 50-hp rating, are also being completed in the Snow shops. The New London Ship & Engine Company, which has been building a marine-type Diesel engine for some time, is also building the stationary type. The company has obtained the exclusive American rights to all types of heavy oil engines developed by the Maschinenfabrik Augsburg-Nürnberg A. G., of Germany. The stationary type will be built in single-cylinder designs of 100 hp and 150 hp, in two-cylinder designs of 200 hp and 300 hp, and in four-cylinder designs of 400 hp and 600 hp. Any size, or type, between the foregoing and the horizontal, four-cycle, tandem-compound, double-acting engine up to 2000 hp will also be built on order. The new London company has been operating a 200-hp engine, belted to a generator, at its works for several months. In November, with an average load of 78 kw, carried for 33.5 hours, the cost per kilowatt-hour delivered at the switchboard was \$0.0119. The total cost covered 274.5 gal. of fuel oil at \$0.056 per gal., 10.5 gal. of lubricating oil at \$0.28 per gal., and \$10 for attendance. In December the unit was run for 110.6 hours with an average load of 61.5 kw, at a cost of \$0.0124 per kw-hr. The cost in this case included 705.78 gal. of fuel oil, 43 gal. of lubricating oil and \$32 for attendance.

**Foreign Capitalists End Their Tour of United States.**—The party of English and American bankers and public-utility officials mentioned in the *Electrical World* of Jan. 25, page 213, as being on a tour of this country, were in Chicago on Jan. 27. The visitors spent one day in Chicago and were escorted to points of interest and entertained by a dele-

gation of local electrical men. The party were taken in automobiles to the Fisk and Quarry Street generating stations in the forenoon, took lunch at the South Shore Country Club, inspected the Northwest generating station in the afternoon and had dinner at the Blackstone Hotel. After a theater party in the evening the travelers took the train for Keokuk, Ia., where the hydroelectric development of the Mississippi River Power Company was the next item on the itinerary. Owing to a number of business matters requiring their attention before sailing for London, the visitors were obliged to curtail their tour to some extent, and the original itinerary referred to on Jan. 25 was not therefore followed in its entirety. The party returned to New York this week. The visitors will sail for London on Feb. 11.

**Western Electric's 1912 Business.**—While final figures showing the results of the year 1912 will not be completed prior to April 1, the sales of the Western Electric Company last year amounted to over \$71,000,000, as was noted in these columns Jan. 18. This figure is slightly in excess of the total in 1906, which heretofore was the biggest year in the history of the company. The increase has been in American sales outside of the Bell system, which have increased about 100 per cent over 1906, and in European sales, which were the largest in the company's history. The results have been accomplished by an aggressive selling campaign in the face of increased and increasing competition. The company is now selling to upward of 30,000 customers in the United States alone. It is expected that the profits will be satisfactory, considering the wider distribution and increased competition. The board of directors has established two additional vice-presidents in the company's organization and has appointed to these newly created positions Gerard Swope, general sales manager, and A. L. Salt, general purchasing agent.

**To Develop Water-Power Sites Near Hot Springs, Ark.**—Following investigation by Ford, Bacon & Davis, 115 Broadway, N. Y., of the water-power resources of the Ouachita River, Arkansas, plans are being completed for the erection of a hydroelectric station on that river about 6 miles from Hot Springs. Part of the energy generated at this station will be supplied to the Little Rock (Ark.) Railway & Electric Company, which is a subsidiary of the American Cities Company, New Orleans, of which George H. Davis, of Ford, Bacon & Davis, is president. Details of the plan are not known at this time.

**Salmon River Power Company (N. Y.) to Sell Bonds.**—The Public Service Commission for the Second New York District has authorized the Salmon River Power Company, which has a 15,000-hp hydroelectric station under construction about 40 miles north of Syracuse, N. Y., to issue \$882,000 forty-year 5 per cent gold bonds to be sold at not less than 85. A reference to the station of this company and the transfer of its common stock to the Niagara, Lockport & Ontario Power Company appeared in the *Electrical World*, Oct. 12, 1912.

**American Power & Light Declares Initial Dividend.**—An initial dividend of 1 per cent on its common stock, payable March 1 to stock of record Feb. 20, has been declared by the American Power & Light Company. The latter is controlled by the Electric Bond & Share Company and is a holding corporation for the Kansas Gas & Electric, Pacific Power & Light, Portland Gas & Coke and Texas Power & Light companies.

**Lambertville (N. J.) Company Sold.**—At the annual meeting of the Lambertville (N. J.) Heat, Light & Power Company recently, control of the company passed to F. S. North, of Bay Shore, L. I., and associates. It is stated that the new owners are planning improvements to the station and extension of the company's lines.

**Public Utility Earnings Show Improvement.**—Noticeable increases in earnings are shown in the annual reports of public utility companies for 1912. The income account of the Detroit Edison Company for the year ended Dec. 31, 1912, including the earnings of the Eastern Michigan Edison Company, shows gross revenue of \$4,385,615 as compared with \$3,598,094 in 1911, an increase of \$787,521; net earnings of \$1,858,434, as compared with \$1,536,904, an increase of \$321,530, and surplus earnings of \$1,145,509, as compared with \$853,174, a gain of \$292,334. The report of the Southern California Edison Company for the year ended Dec. 31, 1912, shows net earnings of \$2,001,414, an increase of \$109,134. The balance available for dividends on the common stock was equal to 13.21 per cent on the outstanding issue, as compared with 9.7 per cent in 1911. The gross income of the Pennsylvania Water & Power Company for the year ended Dec. 31, 1912, was \$721,883, as against \$516,285 in 1911, a gain of \$205,598. Net earnings were \$619,908, as compared with \$447,325, an increase of \$172,583, and the surplus for the year was \$235,769, as compared with \$66,200, a gain of \$169,569. The gross earnings of the Columbus (Ohio) Railway & Light Company were \$2,944,052 last year, as compared with \$2,824,489 in 1911, an increase of \$119,563; net earnings were \$1,347,837, as compared with \$1,321,432, a gain of \$26,405, and the surplus for the year was \$75,014 as compared with \$88,420, a decrease of \$13,406. Plans for reorganization of the Columbus company are now under the consideration of a committee composed of ten men from the boards of the operating and subsidiary corporations.

**Planning Transatlantic Wireless Service.**—H. Bredow, managing director of the German Telefunken Wireless Telegraph Company, has arrived here from Berlin in order to take up the question of establishing a transatlantic wireless service between the United States and Europe. Since 1906 the German Telefunken company has had an experimental station at Nauen, near Berlin, where improvements and new inventions in the field of wireless telegraphy are tested. The station has been continually enlarged and improved in the intervening years, and now works with 500 hp to 600 hp as compared to the 35 hp originally installed in 1906. The result has been an increase in range from about 1000 miles to as much as 4000 miles. It is now intended to open this station for regular public service. The company planned last year to test the practicability of transmitting radiograms to the United States, but the tower at Nauen, which was over 600 ft. in height, was thrown over by a heavy storm before the tests were begun. A new tower, approximately 900 ft. in height, is now under construction. The company, hoping to transmit across the ocean before the completion of this tower, began tests on Jan. 11 with a provisional antenna 400 ft. high. On the first trial the signals sent out from Nauen were distinctly received by the station at Sayville, L. I., belonging to the Atlantic Communication Company, New York, and messages transmitted from Sayville were received at Nauen so as to be distinctly legible, even though the station at Sayville operated at only 45 hp.

**Rate Reductions Lowered Union Electric Light & Power's Income in 1912.**—A. C. Einstein, vice-president and general manager of the Union Electric Light & Power Company, St. Louis, attributes the decrease in that company's income in 1912 to the rate reductions that were placed in effect last year. On this point the annual report of the company states: "While the increase in energy sold to commercial and residence consumers amounted to 11.4 per cent over 1911, the increase in gross earnings from this source was only seven-tenths of 1 per cent because of the material reductions in rates inaugurated during the year, this decrease being approximately 9½ per cent in the average net rate received. Because of the reduction in the residence rate of 22½ per cent there has been a decrease in revenue from residence customers of 4 per cent. The number of residence customers has increased 18 per cent. The financial operations of the year 1912 are shown in the following figures: Gross earnings, \$3,663,621.67; operating expenses, \$1,943,646.43; gross income, \$1,720,175.24; interest charges, \$842,927.70; net income, \$877,247.54. During the year more than 371,000 tons of coal were used and for labor and salaries approximately \$800,000, or over \$2,200 a

day, was expended. The taxes paid to the city and State aggregated approximately \$294,000, an increase of \$29,000 over 1911."

**January Incorporations Show Increase.**—Papers filed in the Eastern States in January for companies with an authorized capital of \$1,000,000 and over represented a total of \$324,450,000, says the *Journal of Commerce*, New York. This is an increase of \$132,350,000 over the December total and of \$121,930,000 as compared with that in January, 1912. Charters taken out by other companies with an individual capital of \$100,000 or more, but under \$1,000,000, last month represented a total capitalization of \$64,527,500, which brings the total for the month up to \$417,477,500. This compares with \$252,300,000 in December and with \$330,870,000 in January, 1912.

**Let's Contracts for Worldwide Marconi System.**—Contracts have been let to the J. G. White Engineering Corporation by the Marconi Wireless Telegraph Company for the erection of eight wireless telegraph stations, two pairs for transatlantic service and two pairs for transpacific service. Receiving and sending stations 30 miles apart will be erected at Oahu, in the Sandwich Islands; Tomales Bay and Bolinas, Cal.; near Belmar, N. J., and also at a site in eastern Massachusetts, not yet selected. These stations will be part of a globe-encircling system which will continue to the East by way of Japan.

**Atlantic Gas & Electric to Issue Securities for Acquiring Pennsylvania Properties.**—As was noted in these columns Jan. 25, the Atlantic Gas & Electric Company, recently incorporated under Connecticut laws with an authorized capitalization of \$37,500,000, has made a proposition to the stockholders of the Eastern Pennsylvania Power Company to exchange their holdings for its securities. In accordance with this plan the Atlantic Gas & Electric Company will issue \$2,000,000 first-mortgage 5 per cent bonds, \$1,750,000 convertible 6 per cent preferred, and \$3,500,000 common stock.

**Complete Toledo Railways & Light Reorganization.**—With incorporation of the Toledo Traction, Light & Power Company under Maine laws, with \$8,000,000 6 per cent preferred and \$9,200,000 common stock, the reorganization of the Toledo Railways & Light Company has been completed. The stock and 4 per cent collateral trust bonds of the latter will be taken over by the new company.

**United Public Service Company Organized.**—The United Public Service Company has been incorporated in Delaware with a capital of \$10,000,000. It will take over the electric-service properties at Paris and Danville, Ky., the gas plants at Paris, Ky., and Oberlin, Ohio, and the electric-service properties at Ravenna, Ohio. The main offices of the company will be at St. Louis.

**Westinghouse Machine's Refinancing Plan.**—Holders of all but \$125,000 of the \$605,000 outstanding extension notes of the Westinghouse Machine Company have announced their intention to exchange these notes for bonds of the company in accordance with the proposition made recently by the company. An outline of this proposition appeared in these columns Oct. 12, 1912.

**Allis-Chalmers Reorganization.**—In accordance with the plan for reorganization of the Allis-Chalmers Company the latter's Wisconsin properties were sold in Milwaukee Feb. 3 for \$2,500,000 to J. H. McClement, of New York, chairman of the reorganization committee. The company's Illinois and Pennsylvania properties are to be sold during this month.

**Annapolis (Md.) Gas & Electric Company Sold.**—The Washington, Baltimore & Annapolis Electric Railway Company has taken over the Annapolis Gas & Electric Company, which was recently acquired by the Annapolis Utility Company. The latter is controlled by the Washington, Baltimore & Annapolis company.

**Mississippi River Power Company to Raise Additional Capital.**—It is stated that the Mississippi River Power Company is planning a bond issue of \$6,500,000 to carry out plans for the completion of the station at Keokuk, Ia.

**Robbins & Myers Company Increases Capital.**—Notice of an increase in its capital from \$50,000 to \$1,000,000 has been filed at Columbus, Ohio, by the Robbins & Myers Company, of Springfield, manufacturer of motors and fans



## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Jan 29	Feb. 5
Allis-Chalmers, t.r., 3d pd.	\$15,501,800			44*	4
Allis-Chal., pf., t.r., 3d pd.	13,475,200			93*	93
Amalgamated Copper	153,887,900			72½	71
American Tel. & Tel.	334,852,900	1½	Q	113½	113½
Electric Storage Battery, c.	16,074,425	1	Q	53½	53½
General Electric	101,203,000	2	Q	142½	142
MacKay Cos., c.	41,380,400	1½	Q	84½	84
MacKay Cos., pf.	50,000,000	1	Q	67½	67
Western Union Tel.	99,745,400	1	Q	72½	72½
Westinghouse, E. & M., c.	33,737,350	1	Q	74½	73
Westinghouse, E. & M., pf.	3,998,700	1½	Q	119½	119½*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Copper:	Jan. 28		Feb. 4	
	Bid.	Asked.	Bid.	Asked.
Standard spot	15.50		15.00	
London, standard, spot	68 12 6		67 17 6	
Prime Lake	16.37½		16.12½	
Electrolytic	16.25 to 16.35		16.00	
Casting	16.05 to 16.15		15.87½	
Copper wire, base	18.00 to 18.25		17.50 to 18.00	
Lead	4.35		4.35	
Nickel	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f.o.b. smelter	9.00		8.75	
Spelter, spot	7.00		6.75	
Tin, spot	50.75		49.15	
Aluminum:				
Prompt delivery	26.00 to 26.50		26.00 to 26.50	
Future	26.00 to 26.50		26.00 to 26.50	

## OLD METALS

Heavy copper and wire	14.25	14.25
Brass, heavy	8.75	8.75
Brass, light	7.75	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	6.12½	5.75

## COPPER EXPORTS IN FEBRUARY

Total tons to Feb. 5	6,822
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## Personal

Mr. John H. Roemer has been reappointed a member of the Railroad Commission of Wisconsin by Governor McGovern.

Mr. W. F. White, superintendent of construction and distribution for the Freeport (Ill.) Railway & Light Company, has resigned.

Mr. Sydney B. Martin, Pittsburgh, Pa., has been appointed consulting engineer for the proposed municipal electric-light plant at Sharon, Pa.

Mr. Louis W. Pratt has been appointed contract agent of the Hamilton (Ont.) Electric Light & Power Company, succeeding Mr. Thomas F. Kelly, resigned.

Mr. W. C. Perry has been appointed local manager of the electric light plant at Mount Sterling, Ill., which is controlled by the Central Illinois Public Service Company.

Mr. E. A. Graham, formerly assistant to Mr. C. R. Ross, resigned, has been appointed to the position of electrical engineer for the Winnipeg Electric Railway Company.

Mr. D. McFarlan Moore, inventor of the Moore light, addressed the Colloquium of the Research Laboratory of the General Electric Company at Schenectady, N. Y., on Feb. 1.

Mr. Richard R. Rice, of the General Electric Company, Lynn, Mass., addressed the members of the Detroit Engineering Society on Feb. 7. His topic was "Steam Turbine Systems."

Mr. Thomas Coleman, until recently with Messrs. Chapman & Walker, Toronto, Ont., has been appointed superintendent of the Charlottetown Light & Power Company of Prince Edward Island.

Mr. S. C. Livergood has resigned as chief engineer for the Central Illinois Public Service Company with headquarters at Taylorville, Ill., and will engage in the electrical contracting business.

Prof. Karl Guthe, of the department of physics of the University of Michigan, spoke on "Electrons" before the Detroit-Ann Arbor section of the American Institute of Electrical Engineers on Feb. 1.

Mr. Chester La Croix, superintendent of the Holden, (Mass.) electric-light plant, since its inception, has resigned his position and entered the employ of the Morgan Construction Company, Worcester, Mass.

Mr. James F. Meister has resigned his position of industrial engineer with the Kansas City Electric Light Company and has opened an office as consulting engineer at 706 Victor Building, Kansas City, Mo.

Mr. R. H. Long, formerly assistant superintendent of the Winnipeg Electric Railway Company's hydroelectric plant at Lac du Bonnet, has been appointed to the position of electrical superintendent of the company.

Mr. D. P. Hodson, a former city judge of Buffalo, has been nominated by Governor Sulzer of New York to succeed Mr. John B. Olmsted as a member of the Public Service Commission of the Second District.

Mr. Dean Treat, formerly district superintendent of the Sterling, Dixon & Eastern Railroad, Dixon, Ill., has resigned to accept the post of general manager of the Wisconsin Public Utilities Company at Green Bay, Wis.

Mr. A. W. Conruyer, of the Milwaukee Northern Railroad Company, has been made district superintendent of the Sterling, Dixon & Eastern Electric Railroad with headquarters at Dixon, Ill., succeeding Mr. Dean Treat.

Mr. Lauren A. Pettebone has severed his connection with the United States Light & Heating Company, Niagara Falls, N. Y., and has accepted a position as purchasing agent for the Ontario Power Company, Niagara Falls, Ont.

Mr. Richard F. Buck, the well-known bridge engineer, has retired from the consulting engineering and contracting firm of Messrs. Sanderson & Porter, New York, and has become chief engineer of the Dominion Bridge Company of Canada.

Mr. Robert Bell, of Montreal, Que., has been appointed general manager of the Maritime Coal, Railway & Power Company which supplies the towns of Amherst, Joggins, Maccan and River Herbert, Nova Scotia, from a power plant at Chignecto.

Mr. Edward E. McCall, a judge of the Supreme Court of the State of New York, has been appointed chairman of the Public Service Commission of the First District, New York, as successor to Mr. W. R. Willcox, whose term expired on Feb. 1.

Mr. C. R. Ross has resigned his position as electrical superintendent and engineer for the Winnipeg Electric Railway Company. Mr. Ross has been with the company in that capacity for the past six years and now leaves to engage in private business.

Mr. George G. Anderson, consulting engineer, Denver, Col., addressed the Colorado Electric Club at Denver, Jan. 30, on the subject of "Future Extension of Irrigation by Pumping," touching on the use of electrical energy to enlarge present irrigated areas.

Mr. W. J. Morrison has been elected president of the Carolina Public Service Company, Atlanta, Ga. The company, which is a newly organized corporation, has taken over electric-lighting plants in Charleston, Columbia, Greenville, Spartanburg and other South Carolina towns.

Mr. John S. Kennedy has resigned as secretary of the Public Service Commission, Second District, New York, effective March 1, to go into private business. Mr. Kennedy has been secretary of the commission since its organization and previous to that time was secretary of the State Railroad Commission, its predecessor.

Mr. Paul M. Lincoln, general engineer for the Westinghouse Electric & Manufacturing Company, Boston, Mass., addressed the Boston Edison Company Section of the N. E. L. A. at its January meeting, discussing a paper prepared by Mr. B. G. Lamore on "Sixty Cycle Synchronous Converters at Constant and Variable Values."

Mr. Seton Porter has been admitted into the engineering and contracting firm of Messrs. Sanderson & Porter, of New York and San Francisco. Mr. Porter is a graduate of



Yale. He has been connected with the company for eight years, during part of which time he was in charge of the Stanislaus power development in California.

**Mr. W. I. Middleton**, electrical engineer of the Simplex Wire & Cable Company, delivered at the Franklin Institute, on Jan. 29, an illustrated lecture on the manufacture of insulated wires and cables from the first installations of a bare conductor in a trough of resinous material to the complicated designs developed to meet present-day requirements.

**Mr. Thomas M. Roberts**, who recently resigned his position as professor of electrical engineering at Delaware College, has been appointed chief electrical engineer of the Edison Storage Battery Company, Orange, N. J. Prior to his connection with college work the past year, Mr. Roberts was for ten years engineer with the General Electric Company at the Boston district office.

**Mr. Jefferson Alexander**, for several years superintendent of the Houghton (Mich.) division of the Houghton County Electric Light Company, has been appointed general superintendent of the entire lighting system, with headquarters at Calumet, Mich. Mr. Alexander takes the place of Mr. P. A. Staples, of Calumet, who resigned to take a position in the sales department of the Mississippi Power Company, Keokuk, Ia.

**Mr. Thomas Wickham**, vice-president of the Macon (Ga.) Railway & Light Company, the Central Georgia Power Company, the Macon Gas Company and the Central Georgia Transmission Company, has severed his connections with those corporations to become affiliated with the management of the gas and electric companies at Cincinnati, Ohio, controlled by Messrs. A. B. Leach & Company, bankers, of New York.

**Mr. Thomas H. Hogg**, for some months editor of the *Canadian Engineer*, has been appointed assistant hydraulic engineer of the Hydro-Electric Power Commission of Ontario, effective Feb. 1. Mr. Hogg spent some time on similar work with the Ontario Power Company at Niagara Falls, where he was engaged on stream measurements and investigations on the flow of natural watercourses and feeding of water turbines.

**Mr. Walter E. Holland** has resigned his position of chief electrical engineer of the Edison Storage Battery Company to take a position as research engineer with the Anderson Electric Car Company, Detroit, Mich. Mr. Holland has been affiliated with the various Edison interests for upward of ten years, and was closely associated with Mr. Thomas A. Edison in the pioneer development work on the alkaline storage battery.

**Mr. O. H. Norton**, president of the Central Electric Company, of Peoria, Ill., has retired from active business affairs, being succeeded in the practical management of the company by Mr. L. B. Van Nuys. Mr. Norton has been a resident of Peoria for more than fifty years. He was the first city electrician of the city and he established the Central Electric Company of Peoria more than twenty years ago. For some years Mr. Norton has been totally blind and Mr. Van Nuys has been the active outside man of the concern.

**Mr. Thomas Chandler**, superintendent of the Edison Sault Electric Company, Sault Ste. Marie, Mich., has had granted to him by the board of directors a three months' leave of absence. Mr. Chandler has had some years of very strenuous and exacting work, and the board thought a vacation was needed. Mr. Chandler will spend the time in recreation and travel, chiefly on the Pacific Coast, and he may possibly visit Honolulu. Mr. C. M. Wardwell, for many years with the Eastern Michigan Edison Company, is acting superintendent during Mr. Chandler's absence.

**Mr. C. M. Tait** has been appointed to succeed Mr. James Bennett as chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal, Quebec. He has been for two years chief assistant to Mr. Bennett, who retires at the end of March, and has had a long experience in electrical work, having been connected with the Westinghouse and General Electric companies and the block signaling department of the Canadian Pacific Railway Company. Prior to joining the Fire Underwriters' staff, Mr. Tait did a large amount of inspection work under the late Mr. F. H. Badger

and Mr. W. J. Plews, during the period when inspection was not on such a well-organized basis as it now is.

**Mr. F. A. Gaby** has been appointed chief engineer of the Hydro-Electric Power Commission of Ontario as successor to Mr. P. W. Sothman. Mr. Gaby graduated with honors in the faculty of applied science of the University of Toronto in 1903 and spent a number of years with the General Electric Company of Canada as erecting and supervising engineer, and later with the city of Winnipeg, Man., where he acted as assistant engineer in the preparation of the designs and specifications of the municipal plant. He has been with the Hydro-Electric Power Commission since 1907, and in 1908 was appointed chief assistant engineer to Mr. P. W. Sothman, which position he held until Mr. Sothman's resignation in July, 1912. As chief assistant Mr. Gaby was closely in touch with all the engineering features of the hydroelectric scheme, and he is thus well fitted to take up the work of directing the commission's extensions. Mr. Gaby was born in Richmond Hill, Ont. He is an associate of both the I. E. E. and A. I. E. E. and is at present chairman of the Toronto Section of the latter.

**Mr. Thurston Owens** has been appointed general manager of the La Crosse (Wis.) Gas & Electric Company. Mr. Owens entered the lighting business in 1901 in the distribution department of the Central Union Gas Company, Bronx Borough, New York City. Later he was connected with the lighting department of the city of New York and more recently he has been devoting his time to consulting work and as an associate editor of the *American Gas Light Journal*. Mr. Owens has been a frequent contributor to the technical press and the proceedings of gas and electric societies. He is a member of the Board of Educational Control of the National Commercial Gas Association and a corresponding member of the British Illuminating Engineering Society, chairman of the papers committee of the New Jersey State Gas Association, secretary of the publicity committee of the Pennsylvania Gas Association and secretary of the Gas Meeters. The La Crosse company supplies gas, electricity and hot water in the city of La Crosse and was recently acquired by the American Public Utilities Company of Grand Rapids, Mich.



THURSTON OWENS

## Obituary

**John Patterson**, who was instrumental in the formation of the Hamilton (Ont.) Cataract Power Company, and who probably did more for the making and developing of Hamilton than any of its other citizens, died in that city Jan. 26.

**Arthur Schoellkopf**, president of the Niagara Falls Hydraulic Power & Manufacturing Company, died at his winter home in Miami, Fla., Feb. 4. The Niagara Falls Hydraulic Power & Manufacturing Company is the oldest power company at Niagara Falls, N. Y., having been organized in 1877 when Mr. Jacob F. Schoellkopf, father of Mr. Arthur Schoellkopf, purchased the canal property and all its belongings and rights. Mr. Arthur Schoellkopf succeeded his father as president of the company in 1899. The deceased was born in Buffalo, June 13, 1856, and educated in the schools of that city and at St. Joseph's College, Buffalo. He then went to Germany, where he studied in the Kirchheim gymnasium. His first occupation was that of manager of a flour mill at Niagara Falls belonging to his father. Mr. Arthur Schoellkopf was interested in a great many enterprises at Niagara Falls and was at one time Mayor of the city. Two years ago he relinquished active management of the Hydraulic Power company to his son, Mr. Paul A. Schoellkopf, because of undermined health. He is survived by his widow, his son and a daughter.

## Construction

**KETCHIKAN, ALASKA.**—The Citizens' Lt., Pwr. & Wtr. Co. contemplates the installation of a 1000-hp generating unit. The company has sufficient water and piping to provide for the additional unit. J. C. Barber, president and manager of the company, it is said, is now in Seattle making arrangements for equipment for same.

**BISHOP, CAL.**—The Southern Sierras Pwr. Co. has started a reclamation project comprising approximately 1000 sq. miles lying between Bishop and the summit of the San Bernardino Mountains. Electricity generated by the Bishop Creek power plant will be utilized to drive the pumps, which will furnish water for the development of about 600,000 acres. According to the present plans, the main transmission line will connect near Bishop with the hydroelectric development.

**FWLER, CAL.**—The Town Trustees have awarded the contract for street-lighting to the San Joaquin Lt. & Pwr. Co., of Fresno, for a period of two years. The installation of the new system will necessitate an expenditure of about \$5,000 on the part of the power company. The contract for street lamps calls for 42 lamps of high candle-power.

**HAYWARDS, CAL.**—An election will be held on Feb. 27 to vote on the proposition to issue \$14,000 in bonds, the proceeds to be used for construction of fire house and fire-alarm system. Of the proceeds \$4,000 will be used for the fire system.

**LOS ANGELES, CAL.**—The Southern California Edison Co. has received authority from the State Railroad Commission to issue \$2,500,000 in bonds, the proceeds of \$1,000,000 to be used for completing a unit for the Long Beach steam plant, the balance for additions and improvements to existing stations, hydroelectric plants, new transmission and distributing lines and construction of a \$100,000 addition to the general office buildings in Los Angeles.

**SAN FRANCISCO, CAL.**—Plans and specifications have been prepared by Frederick H. Meyer, Investment Building, San Francisco, for a one-story reinforced concrete substation, to be erected by the Pacific Gas & El. Co. on Townsend Street between First and Second Streets.

**FORT COLLINS, COL.**—The City Council has decided to call an election on March 25 to vote on the proposition to install a municipal electric-light and power plant.

**WATERBURY, CONN.**—The contract for the construction of power house and coal bin, to be erected on West Main Street for the American Brass Co., has been awarded to Charfield & Chatfield. James R. Coe is engineer.

**WASHINGTON, D. C.**—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 18, for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 5152—72,000 ft. portable, ship-lighting cable, miscellaneous lead-covered, single-conductor cable, 72,000 ft. incandescent lamp cord, miscellaneous single and duplex, lighting and power wire, 12,000 ft. twisted telephone wire, miscellaneous weather-proof wire; Schedule 5153—miscellaneous interior communication cable, 60,000 ft. copper-clad steel-wire cable, 3000 ft. silicon bronze conductor, 9000 ft. triple silk conductor, 60,000 ft. flexible silk conductor, 45,000 ft. telephone cord, 300,000 ft. bell wire, miscellaneous plain single-conductor wire, miscellaneous plain twin-conductor wire. Philadelphia, Pa., Schedule 5152—miscellaneous varnished-cloth-insulated double-braided cable. Eastern, Schedule 5153—miscellaneous magnet wire. Boston, Mass., Schedule 5148—two storage-battery trucks. Schedules can be obtained upon application to the navy pay office nearest to each navy yard. T. J. Cowie is paymaster general, U. S. N.

**BOISE, IDAHO.**—The Local Light Improvement District No. 1 has completed plans for the installation of an ornamental street-lighting system. The plans provide for the installation of 200 ornamental lamp standards carrying a magnetite-arc lamp of 700 cp, maintained by underground wires. The cost of the system is estimated at about \$34,019. Contract for installing the system will be awarded early in February. The Idaho-Oregon Lt. & Pwr. Co. submitted the lowest bid.

**CCEUR D'ALENE, IDAHO.**—The Home Builder Mining & Devel. Co. has bonded its properties for \$500,000, and will erect a cyanide plant having a capacity of 5000 tons daily. The company will develop additional water-power.

**GRACE, IDAHO.**—The Last Chance Canal Co. is contemplating the installation of a hydroelectric-plant here.

**POCATELLO, IDAHO.**—The Idaho Consol. Pwr. Co. has been awarded the contract for furnishing street cluster lamps and incandescent lamps for subway and viaduct in Pocatello.

**POCATELLO, IDAHO.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 28 for the construction, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States post office and court house at Pocatello. Drawings and specifications may be obtained at the above office or from the custodian of site at Pocatello.

**POCATELLO, IDAHO.** The City Council has granted L. R. Martineau, of Salt Lake City, Utah, and J. D. Browning, of Pocatello, a franchise to operate an electric street railway in Pocatello and a franchise to install and operate an electric-light plant here. Electricity to operate the system is to be secured from a hydroelectric power plant to be erected on the Port Neuf River at Lava Hot Springs. About 4000 hp will be developed and transmitted to Downey, Bancroft and Pocatello.

**DIXON, ILL.**—Plans have been completed for the erection of a new power station (to cost \$1,000,000) in Dixon, for the Illinois Northern Utility Co. The building will be 100 ft. by 200 ft., one story high. Bids are now being received by Sargent & Lundy, 80 East Jackson Boulevard, Chicago, Ill., for construction of same.

**EAST ST. LOUIS, ILL.**—L. C. Haynes, vice-president and general manager of the East St. Louis & Suburban Ry. Co. and president of the East St. Louis Lt., Ht. & Pwr. Co., a subsidiary company, has announced that a contract had been signed with the Mississippi River Pwr. Co., which will distribute electricity generated at the Keokuk dam, Keokuk, Ia., for power in East St. Louis.

**OGDEN, ILL.**—Arrangements are being made to organize a company to supply electrical service in Ogden. It is proposed to secure electricity from the transmission lines of the Illinois Trac. System, of Peoria. H. V. Cardiff and Mr. Scott, both of Ogden, are interested in the project.

**ANGOLA, IND.**—The Indiana Utilities Co., of Angola Ind., will furnish electricity for lamps and motors in this village, giving a 24-hour service. Tungsten lamps will be used. L. H. Gilbert, of Toledo, Ohio, is installing the wiring system.

**FAIRMONT, IND.**—Arrangements are being made by the Marion Lt. & Htg. Co. for the installation of a rural service to supply electricity to the farmers between Fairmont and Summitville.

**FARMLAND, IND.**—The Indianapolis & Cincinnati Trac. Co. has closed a contract to furnish electricity for lamps and motors in Farmland.

**KOKOMO, IND.**—The Indiana Rys. & Lt. Co. is making extensions to its plant, including new equipment, as follows: Two 500-hp boilers are being installed and it will add one 500-hp, all Stirling; it is installing two 500-hp stokers, Laclede Christy chain-grate, and will install 500-hp stoker; one 3750-kva turbo-generator will be installed soon with switchboard for same; transformers for 500-kw rotary converter; superheater for five 500-hp boilers; new steam piping system for superheat; the erection of several miles of wires for lighting distribution system and 1000 service meters. Most of the material for the above additions has been purchased. P. H. Palmer, assistant general manager and engineer, has charge of the work.

**LAWRENCEBURG, IND.**—Bids will be received by the Common Council until Feb. 17 for furnishing power-plant equipment for the municipal electric-light plant, in accordance with plans and specifications on file in the office of Frank Goble, city clerk. The equipment will include an engine, a single-phase generator, switchboard and boiler. Paul H. White, Union Trust Building, Indianapolis, is consulting engineer.

**PETERSBURG, IND.**—The Pike County Tel. Co. has increased its capital stock from \$50,000 to \$100,000.

**SOUTH BEND, IND.**—The Indiana & Michigan El. Co., of South Bend, has entered into a contract to furnish electricity for lamps and motors in Walkerton and North Liberty.

**ALTON, IA.**—Plans have been prepared by the Mason & Mason El. Lt. & Pwr. Co. for improvements and extensions to its power plant in the spring. The proposed work includes the erection of a new building and the installation of a new 60-hp engine and generator.

**BLAIRSTOWN, IA.**—At an election held recently the proposition to grant the Iowa Ry. & Lt. Co. a franchise in Blairstown was carried.

**CONRAD, IA.**—The Iowa River Lt. & Pwr. Co., of Eldora, has applied for a franchise to supply electricity in Conrad. A special election will be held Feb. 15 to submit the proposition to a vote.

**DYSART, IA.**—At an election held recently the proposition to issue \$10,000 in bonds for the installation of an electric-light plant was carried.

**GREENFIELD, IA.**—The City Council has engaged J. B. Hill, consulting engineer, of Iowa City, to prepare plans for changing the municipal electric-light plant from direct-current to alternating-current system.

**LEON, IA.**—The Leon El. Co. is now placing the cement base for the new engine which it will soon install. The company supplies electrical service in Decorah as well as Leon and will soon enter into contracts in Garden Grove. Ia. will also extend its transmission lines to Humeston as soon as possible to supply electricity for lamps and motors there, and will probably extend its circuits to Weldon in the near future. J. F. Smith is president and treasurer and G. A. Havens, vice-president and secretary.

**ROLFE, IA.**—The Rolfe Lt. & Power Co. will purchase electricity to operate its system from the Northern Iowa Pwr. Co., of Humboldt. The Rolfe company will own the generating plant and the transmission line. Ward Ferguson is secretary and treasurer.

**BLUE MOUNTAIN, KAN.**—The Blue Mountain Electric Co. is now placing the cement base for the new engine which it will soon install. The company supplies electrical service in Garden Grove. Ia. will also extend its transmission lines to Humeston as soon as possible to supply electricity for lamps and motors there, and will probably extend its circuits to Weldon in the near future. J. F. Smith is president and treasurer and G. A. Havens, vice-president and secretary.

**FORT SCOTT, KAN.**—Estimates are being prepared by F. D. Martin, of Fort Scott, for the construction of a new municipal electric-light plant. The Council recently adopted a resolution advocating the installation of a municipal plant. G. N. Sanford is city clerk.

**GOLD, KAN.**—The Gold Electric Co. is now placing the cement base for the new engine which it will soon install. The company supplies electrical service in Garden Grove. Ia. will also extend its transmission lines to Humeston as soon as possible to supply electricity for lamps and motors there, and will probably extend its circuits to Weldon in the near future. J. F. Smith is president and treasurer and G. A. Havens, vice-president and secretary.



**NESHO FALLS, KAN.**—Petitions are being circulated asking that an election be held to vote on the proposition to issue bonds for the installation of an electric-light plant.

**WHITE CLOUD, KAN.**—The contract for construction of a municipal electric-light plant in White Cloud has been awarded to the Alamo Engine & Sup. Co., of Omaha, Neb., at \$6,306. E. L. Marker is city clerk.

**CORYDON, KY.**—Bonds have been sold by the city of Corydon to provide funds for the construction of an electric light and power plant. Work will begin on the proposed plant as soon as the weather permits.

**DANVILLE, KY.**—The Dix River Pwr. Co. contemplates the construction of a large power plant on the Dix River, 8 miles from Danville. The proposed plant will cost about \$1,400,000 and will supply electricity in Lexington, Nicholasville, Danville, Lancaster, Richmond and Harrodsburg, with a possibility of a network of interurban lines south of the Kentucky River.

**EARLINGTON, KY.**—A turbo-generator set will be installed to furnish electricity for lamps and motors for the St. Bernard Mining Co. Frank D. Rash, of Earlington, is interested in the company.

**FERGUSON, KY.**—The Kentucky Utilities Co. has purchased the franchise sold by the town to supply electricity here. The service will be supplied by the United Wtr., Lt. & Trac. Co., of Somerset, a subsidiary of the Kentucky company, from the plant in Somerset.

**FULTON, KY.**—The Fulton El. Lt. & Pwr. Co. has made application for a new franchise in Fulton. The company was recently taken over by St. Louis (Mo.) capitalists.

**LOUISVILLE, KY.**—Bids will be opened about March 1 by Webster Gazlay, of Louisville, engineer in charge of the new power plant to be installed by the Seelbach Realty Company, which owns the Seelbach Hotel, for the erection and equipment of power station, to cost approximately \$75,000. The building will be 95 ft. by 100 ft. and four stories high.

**PADUCAH, KY.**—The Kentucky Southwestern Ry., Lt. & Pwr. Co. contemplates an issue of \$1,500,000 in bonds, the proceeds to be used for the construction of its first division from Paducah southwest to Murray, a distance of about 40 miles, work to begin in the spring. The present plans include a system of electric railways, with electric light and power systems in southwestern Kentucky, aggregating about 210 miles. H. C. Rhodes is president and F. M. Smith general manager, both of Paducah.

**MARKSVILLE, LA.**—Plans are being considered for enlarging the municipal electric-light plant and installing a water-works system. It is proposed to issue \$30,000 in bonds to pay for same.

**FORT KENT, MAINE.**—The Fort Kent El. Co. has applied to the State Legislature asking for an amendment to its charter giving it the privilege to generate and distribute gas and electricity in Fort Kent and the neighboring plantations of Allagash, St. Francis, St. John, Wallagrass and Eagle Lake.

**MOUNT VERNON, MAINE.**—A bill has been presented to the State Legislature providing for the incorporation of the Mount Vernon Wtr. & El. Co. The charter of the company gives it the privilege of taking water from any source in the towns of Mount Vernon and Vienna and of erecting pole and pipe lines in these towns. The capital stock is placed at \$5,000 and may not be increased to more than \$20,000. The incorporators are: J. W. Allen, Horace E. Carson, B. Frank Allen, Harry S. Russ, Thomas W. McQuade and others.

**WOODLAND, MAINE.**—The St. Croix Paper Co., of Woodland, is building a large dam at Grand Falls on the St. Croix River, about 4 miles from its mills in Woodland. The dam will have a spillway of 900 ft. and is for the purpose of water storage and to generate electricity for its plant. The cost of the dam, including flowage damages, will be about \$1,000,000.

**HAGERSTOWN, MD.**—Application has been made to the Maryland Public Service Commission for the incorporation of the Hagerstown & Frederick Ry. Co. The company is to be capitalized at \$3,000,000 and proposes to take over the properties of the Hagerstown El. Ry. Co., the Frederick El. Ry. Co., the Frederick Gas & El. Co. and the Frederick & Hagerstown Pwr. Co.

**CAMBRIDGE, MASS.**—Steps have been taken by the North Cambridge Business Men's Association for the installation of an ornamental street-lighting system on the North Cambridge section of Massachusetts Avenue. A sub-committee, consisting of C. F. C. Henderson, J. Guiney and C. Burnside Seagrave, has been appointed to secure estimates of costs of installing the system.

**FALL RIVER, MASS.**—Extensive improvements are under way involving an expenditure of about \$300,000 by the Fall River El. Lt. Co. Of this amount \$225,000 will be expended to enlarge the main generating station. The building is to be enlarged, a 4000-kw turbo-generator installed and four new boilers added; a new switchboard is to be installed and other improvements are to be made to the Hartwell Street substation, at a cost of \$25,000. About \$50,000 will be expended in new overhead and underground work and installing new meters. Philip Cabot, of Boston, is vice-president.

**ANN ARBOR, MICH.**—The Eastern Michigan Edison Co. has applied to the State Railroad Commission for permission to issue \$60,000 in bonds, the proceeds to be used for improvements.

**BAY CITY, MICH.**—Burns & McDonnell, of Kansas City, Mo., consulting engineers, who have been negotiating with the city for the

reconstruction of the municipal electric-light plant, have submitted their bid. The cost of the work is estimated at \$36,750 and includes the installation of one 750-kw, 2200-volt, three-phase, 60-cycle generator, complete with condenser, pumps, etc., foundations, air ducts, etc., condenser connections, switchboard, two 400-hp boilers, removing old boiler and resetting one, steam piping, heater, moving and resetting feed pipe, re-winding Warren machine, chimney and connections, engineering work and supervision.

**DETROIT, MICH.**—At the last session of the Common Council an appropriation was asked for placing underground all wires owned by the city on Jefferson Avenue from Gladwin Park to the city limits.

**FRANKFORT, MICH.**—Bids will be received by the Benzie County Pwr. Co., of Frankfort, about Feb. 15 for the construction of a 1000-hp hydroelectric power plant. S. B. Wiggins, Engineering Building, Ann Arbor, is engineer in charge.

**MANISTEE, MICH.**—The Manistee Pwr. Co. has applied to the State Railroad Commission for authority to purchase the electric plant of the Manistee Lt. & Trac. Co. in Manistee.

**SAGINAW, MICH.**—The Saginaw Wood Products Co. is erecting a power plant. The building is of fireproof construction, 100 ft. by 50 ft., one story high.

**THREE RIVERS, MICH.**—The Middle West Utilities Co., of Chicago, Ill., has acquired the property of the Constantine Hydraulic Co., of Three Rivers, and that of the Milling & Pwr. Co., of Cassopolis, owned by the Constantine Hydraulic Co. A large steam auxiliary steam-power plant will be erected along the lines the Utilities company has acquired in Michigan, probably at Three Rivers. H. C. Sterling is manager of the Three Rivers plant.

**ARGYLE, MINN.**—The installation of an ornamental street-lighting system in Argyle is under consideration. Local business men are interested.

**MANKATO, MINN.**—The Mississippi Valley El. Co., of Iowa City, Ia., is reported to have purchased the street-railway system of the Mankato El. Trac. Co.

**NEW ULM, MINN.**—Plans and estimates are being prepared by the Oscar Clausen Engineering Co., of St. Paul, for the installation of additional units in the municipal electric-light plant.

**VESTA, MINN.**—The Vesta Hardware Co. has applied for a franchise to supply electricity here.

**KANSAS CITY, MO.**—The Kansas City Terminal Co. has appropriated \$617,000 for the construction of a heating and lighting plant to be erected at Southwest Boulevard and the belt line tracks. The plant will furnish light and heat for the new union station. Bids for the work have already been asked and work will probably begin within 60 days.

**RICH HILL, MO.**—The contract for construction of the proposed municipal electric-light plant has been awarded to E. J. Merkle, of Kansas City, at \$13,600. The contract provides for a Skinner engine, Fort Wayne electric equipment and Wesco (St. Louis) pole-line equipment.

**SPRINGFIELD, MO.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 13 for extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of United States post office and court house at Springfield, Mo. Drawings and specifications may be obtained at the above office or from the custodian of building, Springfield, Mo. Oscar Wenderoth is supervising architect.

**ST. LOUIS, MO.**—Arrangements are being made by Mayor Jos for utilizing electricity generated at the electric plant at the city hospital for maintaining street lamps for a considerable district around Hospital Hill on Gilham Road and over the McGee Street viaduct. At present the plant can supply current for 60 arc lamps. The plant may be enlarged later.

**ST. LOUIS, MO.**—The United States Public Service Co., recently incorporated under the laws of the State of Delaware, with a capital stock of \$10,000,000, will establish headquarters in St. Louis. The company, it is announced, will take over the electric-light plants in Paris and Danville, Ky.; the gas plant in Paris; the gas plant in Oberlin, Ohio; electric plant in Monmouth, Ill.; the electric plant at Mitchell, S. D.; the electric plant at Fort Scott, Kan., and the electric-light plant in Ravenna, Ohio.

**JUDITH GAP, MONT.**—It is expected that this city will have electric service by spring. Energy will be secured from the Great Falls Pwr. Co. and will be taken from the Great Falls-Lewistown transmission line at Moccasin and extend down through Hobson, Buffalo and Judith Gap, thence south to Harlowtown.

**KALISPELL, MONT.**—The government has contracted with the Great Falls Pwr. Co. of Great Falls, for 2500 hp to be used in connection with the Sun River irrigation project.

**BEAVER CITY, NEB.**—A special election will be held Feb. 11 to submit to the voters the proposition to issue bonds for the installation of a municipal electric-light plant.

**NORTH PLATTE, NEB.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 27 for the installation of an electric passenger elevator in the United States post office and court house at North Platte, in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.



**OMAHA, NEB.**—Improvements and extensions are contemplated by the Omaha El. Lt. & Pwr. Co. during 1913, which will involve an expenditure of approximately \$375,000. The present plans provide for the installation of an 8300-hp turbine engine and generator, a new condenser and two boilers of 500 hp each, extensions of overhead and underground wires, meters and a new intake from the river to furnish water for the power plant. F. A. Nash is president of the company.

**FREEHOLD, N. J.**—The Monmouth Lig. Co. will erect about 10 miles of transmission lines. William J. Lansley, Telephone Building, Perth Amboy, is engineer in charge of the work. Peter Vreuenburgh is president of the company.

**COHOES, N. Y.**—The Cohoes Co. has received from the State Land Board the deed for about an acre of land in the Mohawk River, about 600 ft. from the foot of Cohoes Falls. It is stated that the company is preparing plans for the construction of a large plant capable of generating 25,000 hp, to cost about \$1,500,000. W. P. Parsons is superintendent of the company.

**EDWARDS, N. Y.**—The Watertown Lt. & Pwr. Co., of Watertown, has closed negotiations with Woodcock Brothers, of Edwards, whereby it will take over the Cotton Rapids water-power at South Edwards and those adjacent to it, known as the Ball Starch factory and the South Edwards sawmill powers, on the Oswegatchie River. They will furnish a combined head of 100 ft. capable of developing 4000 hp. The company expects to begin the development of its water-power in the spring. C. C. Burns, of Watertown, is president of the Watertown Lt. & Pwr. Co.

**HEMPSTEAD, N. Y.**—A petition has been presented to the Hempstead Town Board by the taxpayers of the villages of Seaford, Wantagh, Bellmore, Smithville, South and North Merrick, asking the board to establish a lighting district in that section.

**MALONE, N. Y.**—The Malone Paper Co. has purchased the property of the Malone Lt. & Pwr. Co., including dam, plant and franchise, for \$200,000.

**MECHANICSVILLE, N. Y.**—The Village Trustees have awarded the contract for street-lighting and operation of fire-alarm system to the Halfmoon Lt., Ht. & Pwr. Co. for a period of five years. The company has agreed to install a standard Gamewell air compressor fire-alarm system immediately at its own expense.

**NEW YORK, N. Y.**—Bids will be received by Joseph Johnson, fire commissioner, until Feb. 10 for furnishing material and installing an incandescent electric-lighting system in the quarters of engine company No. 31, corner of Lafayette Street and White Street. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Fire Department, 157 and 159 East Sixty-seventh Street, borough of Manhattan.

**ORWELL, N. Y.**—The Salmon River Pwr. Co., a subsidiary of the Niagara, Lockport & Ontario Pwr. Co., has received authority from the Public Service Commission, Second District, to issue \$882,000 in bonds, to be sold at not less than 85, the proceeds to be used for the construction of three dikes, hydraulic and electrical equipment, transmission line, raising dam and other work in connection with its property.

**SCHODACK, N. Y.**—The Public Service Commission, Second District, has authorized the Schodack Lt. & Pwr. Corp., to commence construction and exercise a franchise in the town of Schodack.

**WHITE PLAINS, N. Y.**—The Board of Village Trustees has voted to authorize the employment of an electrical engineer to make a survey of the village and report on the feasibility of installing a municipal electric-light plant, to supply electricity for street lighting and for commercial purposes.

**BURLINGTON, N. C.**—A proposition has been submitted to the Board of Aldermen offering to purchase the municipal electric-light plant. The corporation proposes to take over the plant and pay the city the amount it cost to build it, the city in return to give the company a franchise to operate an electric light and power plant here and also a contract to light the streets of the city. The corporation proposes to take over electric plants in Burlington, Graham and Elon College and extend the service to Haw River, Swepsonville and possibly Mebane. It is proposed to supply the service from one central power plant.

**GREENSBORO, N. C.**—A petition has been presented to the City Commissioners for the installation of ornamental street lamps on Elm Street, from Lee Street to Church Street. It is proposed to use ornamental standards carrying five-lamp clusters.

**NEWBERN, N. C.**—The contract for the construction of a new power station for the city water and light plant has been awarded to H. S. Hancock, of Newbern.

**ROCKY MOUNT, N. C.**—The question of calling an election to submit the proposition to issue \$12,000 in bonds to provide funds for the installation of an additional engine in the municipal electric-light plant is under consideration.

**SALISBURY, N. C.**—The North Carolina Pub. Ser. Co., of Salisbury, has submitted a proposition to the City Council for the installation of a new street-lighting system. Under the present contract, which has yet three years to run, the city pays \$75 per arc lamp per year; the company offers to cancel the present contract and furnish 112 lamps at \$65 each per year under a new contract. Bird S. Coler, 43 Cedar Street, of New York, N. Y., is president.

**SILER CITY, N. C.**—The Siler City Lt. & Tel. Co. has been granted a franchise to install and operate an electric-light plant in Siler City.

The company would like to communicate with manufacturers and dealers in electrical equipment and will be in the market for one 50-kw, three-phase, 60-cycle, 2300-volt generator, with switchboard, transformers, meters, etc.; also 10 miles No. 6 copper-covered wire, 6 miles No. 9 copper-covered wire, 8 miles of No. 6 bare copper wire and pole-line equipment. The plant will be located 4 miles from town. Both water and steam power will be used. The company is capitalized at \$17,500 and the stockholders are: J. Wade Siler, C. N. Bray, W. D. Siler and J. F. Milliken, all of Siler City.

**MILNOR, N. D.**—The installation of an electric-lighting system in Milnor is under consideration. Ole Hansen is at the head of the project.

**CIRCLEVILLE, OHIO.**—The Circleville Lt. & Pwr. Co. has received permission from the Public Service Commission to issue \$70,000 in bonds. The proceeds of the new issue are to be used to retire \$20,000 in bonds and \$10,000 in preferred stock outstanding, to reimburse the stockholders for \$29,000 for expenditures made out of the income of the plant, and for improvements to property.

**CLEVELAND, OHIO.**—Sealed proposals will be received at the office of W. H. Kirby, secretary to the director of public service, 104 City Hall, Cleveland, until Feb. 11, for furnishing and installing ten stokers complete for the municipal electric-light plant. Plans and specifications may be obtained at the office of the engineer of construction, room 319, City Hall. W. J. Springborn is director of public service.

**COSHOTO, OHIO.**—The Coshocton Lt. & Htg. Co. contemplates the construction of an addition to its plant, to cost about \$60,000.

**HINTON, OKLA.**—The city has sold the bonds recently authorized for the installation of an electric-light plant. Nothing as yet has been done toward letting contracts. W. L. Benham, of Oklahoma City, Okla., is engineer in charge of the work. C. W. Morrison is city clerk.

**PURCELL, OKLA.**—The Purcell Bank & Trust Co. is reported to have purchased the local electric-light plant, water-works system and ice factory for the city, for \$40,000. It is understood that improvements will be made to the plants and new equipment installed.

**STONEWALL, OKLA.**—The contract for the installation of the proposed municipal electric-light plant has been awarded to Don A. Tolbert. The work includes the erection of a power house and installation of a 50-hp turbine connected to generator, switchboard, etc.; also the erection of 2 miles of transmission line to the city, with distributing system in city, street lamps, etc., to cost about \$12,000. Plans were prepared by J. T. George.

**WANETTE, OKLA.**—The question of calling an election to vote on the proposition to issue bonds for the construction of a municipal electric-light plant here is under consideration.

**BAKER, ORE.**—The proposition to issue \$160,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

**CONDON, ORE.**—George Jacobs, of Condon, contemplates the construction of an electric plant on John Day River. Electricity generated at the plant will be transmitted to numerous towns in this section.

**CORVALLIS, ORE.**—The Corvallis Commercial Club recommends that the city use its right to purchase the electric-light plant and distributing system of the Oregon Pwr. Co. here, to be owned and operated by the municipality.

**EUGENE, ORE.**—The F. P. Minney Co., of Oakland, Cal., holder of an electric railway franchise in Eugene, which proposes to construct interurban railways through the Rogue River Valley, has closed a deal for the purchase of the F. V. Waite tract, about 1½ miles from Ashland, for \$400,000.

**HOOD RIVER, ORE.**—The citizens of Hood River will build an electric street car line from the lower section of the city to the dam. \$10,000 worth of stock will be subscribed for.

**HOOD RIVER, ORE.**—Injunction proceedings instigated by the Pacific Pwr. & Lt. Co. have been withdrawn and the contract for the city with the Hydro-Electric Co. will now be entered into.

**PORTLAND, ORE.**—The Portland, Eugene & Eastern El. Ry. Co. has placed orders for 127-lb. girder rails. Transformer stations will be erected at Springfield and Corvallis. New shops will be built in East Portland.

**PORTLAND, ORE.**—Three propositions have been received by the city that will eventually connect Portland with the Lewis and Clark River and Sound will be built by the Washington El. Ry. Co. this year, at a cost of about \$2,000,000. A Washington proposition for a line from the city to Tacoma, Wash., includes a 12,000-hp hydraulic development on Kahama River. The city has received a proposition from the Tacoma, Wash., proposition for a line from the city to Tacoma, Wash., includes a 12,000-hp hydraulic development on Kahama River.

**ST. JOHN'S, ORE.**—Bids will be received by F. A. Rice, city recorder, until Feb. 25 for lighting the streets of the city for a period of five years. Plans and specifications are on file at the office of the city recorder.

**THE DALLES, ORE.**—The Hydro-Electric Co., of Hood River, has received authority from the County Commissioners to erect transmission lines over Oregon River from the Washington Co. line to the city. The city has also granted the company a franchise over certain streets in the city. Work on the proposed extension will begin about March 1.

**WESTON, ORE.**—The Weston Mountain Tel. Co. will erect a telephone line from Weston up the mountain.

**PANAMA.**—The opening of bids called for by the Isthmian Canal Commission circular (No. 752), dated Dec. 19, to be opened Jan. 30, for furnishing material and equipment for the Cristobal-Balboa transmission line, including steel track-span bridges, copper wire, insulators, ground plates and equipment for substations, has been postponed to Feb. 15, 1913. Major F. C. Boggs is general purchasing officer.

**ALTOONA, PA.**—The Penn Central Lt. & Pwr. Co., it is announced, will make important improvements and extensions to its system.

**COLUMBIA, PA.**—The Janson Iron & Steel Co. is planning to install an electric plant in the near future for the purpose of furnishing electricity for lighting its mill and yard.

**JOHNSTOWN, PA.**—Preparations are being made by the Citizens' Lt., Ht. & Pwr. Co. of Johnstown, to take over the electric companies operating in the eleven surrounding boroughs and townships, and direct their operation from the Johnstown office. The companies to be taken over are the Brownstown El. Co., the Conemaugh Township Lt., Ht. & Pwr. Co., the Daisytown El. Co., the Johnstown Wtr. & Gas Co., the Lower Yoder Township Lt., Ht. & Pwr. Co., the Upper Yoder Township Lt., Ht. & Pwr. Co., the Middle Taylor Township Lt., Ht. & Pwr. Co., the Stonycreek Township Lt., Ht. & Pwr. Co., the Richland Lt., Ht. & Pwr. Co., the Rosedale El. Co., and the West Taylor Lt., Ht. & Pwr. Co. F. H. Morrissey, general manager of the Citizens' company, is president of each of the above companies. H. D. Walbridge is president of the Citizens' company.

**MEYERSDALE, PA.**—E. H. Wise, of Charleston, W. Va., representing a syndicate operating light and power plants in Ohio, West Virginia and Pennsylvania, is negotiating for the property of the Meyersdale El. Lt., Ht. & Pwr. Co., as well as other properties in Somerset County. If the deal goes through, it will also include the Pennsylvania & Maryland St. Ry. Co., at present operating an electric railway between Garrett and Salisbury, a distance of about 13 miles.

**NEW KENSINGTON, PA.**—The Allegheny Valley Lt. Co. has submitted a proposition to the Town Council offering to install 160 tungsten street lamps, 30 lamps of 200 cp and 130 of 80 cp, in place of the 76 lamps now in use at no increase in cost of maintenance by the city, provided the contract of the company is extended.

**PHILADELPHIA, PA.**—The directors of the Philadelphia El. Co. have authorized the installation of a 30,000-kw generator at its main generating plant at Christian Street wharf and of a 7500-kw generator at its Tacony plant, involving a total expenditure of about \$1,000,000.

**READING, PA.**—The City Council has adopted a resolution to appoint a committee of three councilmen to make investigations into the cost of installing and maintaining a municipal electric-light plant.

**SHARON, PA.**—We are advised that Sydney B. Martin, 616 Penn Building, Pittsburgh, Pa., has been engaged as consulting engineer for the proposed electric-light plant in Sharon.

**NEWPORT, R. I.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 21 (extension of date from Feb. 8) for furnishing and installing a direct-current switchboard and station wiring at the naval torpedo station, Newport, R. I., to cost approximately \$11,500. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station, Narragansett Bay, Newport, R. I. H. R. Stanford is chief of bureau.

**FORK SHOALS, S. C.**—The Katrina Mfg. Co. writes that its power development referred to in the issue of Jan. 4 has been under construction since May, 1912, and will be completed within the next few months. Contracts have been placed for all machinery and most of it has been installed.

**GAFFNEY, S. C.**—The Piedmont Tel. & Teleg. Co. has petitioned for an amendment to its franchise permitting it to install a common-battery system and make other changes to its plant, involving an expenditure of about \$10,000.

**DRESDEN, TENN.**—A bill has been introduced to the State Legislature to enable the town of Dresden to issue \$12,000 in bonds, to provide funds for the installation of a municipal electric-light plant.

**ELIZABETHTON, TENN.**—Bonds to the amount of \$400,000 have been sold by the Watauga Pwr. Co., owners of the new hydroelectric power plant on the Watauga River, near Elizabethton, of which \$300,000 represents the cost of the plant. The remainder will be held in reserve for construction of an auxiliary plant and other contemplated improvements. The company now supplies Bristol and Elizabethton with energy and has leased additional power from the Tennessee Eastern El. Co., of Johnson City, which will be transmitted to Johnson City, Jonesboro and Greeneville, Tenn., over transmission lines now being erected.

**KNOXVILLE, TENN.**—Arrangements are being made for the installation of an ornamental street-lighting system in the business district. The standards are to be erected by the Merchants' Pwr. Co., which will also supply electricity to maintain same under a contract with the city.

**DALLAS, TEX.**—The city commission has authorized Commissioner Austin to advertise for bids for cable necessary for the new lighting system to be erected on Broadway between Fourteenth and Twenty-ninth Streets. The cost of the cable is estimated at \$4,000. It is proposed to erect ornamental lamp standards carrying five-lamp clusters, maintained by underground wires. W. D. Masterton is superintendent of electricity.

**DALLAS, TEX.**—Mayor Holland has authorized the contract and bond signed between the city and the Dallas El. Lt. & Pwr. Co. for the instal-

lation and maintenance of the special illumination system for Main and Commerce Streets, from Houston to Central, for a period of five years. The contract is approximately \$50,000 for the installation and maintenance for one year. The plans provide for the erection of 321 iron poles about 18 ft. in height. After the first year the city is to take over the system and will pay \$45 per lamp per year. The contract for poles has been awarded to the Mosher Mfg. Co.

**EASTLAND, TEX.**—The Eastland Lt. & Pwr. Co. will rebuild its plant recently destroyed by fire. The equipment will include one 60-kw, 60-cycle alternating-current Warren generator, either oil or gas engine to be installed; five transformers, three 50-lamp and two 100-lamp. The distributing system consists of about 5 miles of service wire, 75 meters and 800 incandescent lamps. A. A. Abney is manager.

**FORT WORTH, TEX.**—The Northern Texas Trac. Co. is planning to double-track its line between Fort Worth and Handley, at a cost of about \$200,000. The company also expects to extend the double-track from Boundary, Oak Cliff, to Westmoreland, a distance of 2 miles. Work will begin within 30 days.

**GALVESTON, TEX.**—Proposals will be received by John D. Kelley, city secretary, until Feb. 20 for furnishing, f.o.b. Galveston, 13,000 ft. of steel-armored lead cable, guaranteed for 10,000-volt service. Bids on both varnished-cambic insulation and rubber insulation will be received. Detail information may be obtained from W. D. Masterton, city superintendent of electricity.

**GALVESTON, TEX.**—Plans are on foot in which the city and county will co-operate for the installation of an ornamental lighting system. It is proposed to erect ornamental lamps along the boulevard which skirts the sea wall for about 4 miles. The present plans provide for the erection of ornamental standards, maintained by underground cables, like those in use on the north side of the boulevard. The cost of the proposed system is estimated at about \$20,000. The proposition as it now stands is for the county to install the lighting system and the city to maintain it. Details are being worked out by County Commissioner Fred C. Pabst, chairman of the finance and boulevard committee; City Commissioner V. E. Austin, commissioner of streets and public properties; Judge G. E. Mann, Mayor Lewis Fisher and W. D. Masterton, city superintendent of electricity.

**VICTORIA, TEX.**—The Victoria Mfg. Co. is planning to enlarge its electric plant. A new boiler room and compartment to provide space for new machinery will be erected.

**HONEYVILLE (R. F. D. BRIGHAM CITY), UTAH.**—The installation of a municipal electric-light plant in Honeyville has been postponed indefinitely. A. E. Hyde, Jr., of Salt Lake City, is engineer in charge. John G. Wheally is town clerk.

**RUTLAND, VT.**—The Rutland Ry., Lt. & Pwr. Co. is erecting an electric transmission line from Granville to West Pawlet, where it expects to furnish electrical service about April 1. The company will also erect a line between Granville and Wells; later this line will be extended to furnish electrical service to the cottages on the shores of Lake St. Catherine.

**CHRISTIANSBURG, VA.**—The Appalachian Pwr. Co., of Bluefield, W. Va., has purchased the property of the Christiansburg Pwr. Co., for \$30,000. The new owners have also entered into a contract with the town for furnishing power to the town and for street lighting.

**MONTEREY, VA.**—The Highland Garage & Lt. Co. will erect a new power plant, plans for which have been prepared by Paul Slavin. The equipment will include a boiler, an engine and a generator. John Lowmann is engineer.

**BREMERTON, WASH.**—The Puget Sound Bridge & Dredging Co., Central Bridge, Seattle, has been awarded the contract for laying cable across Hoods Canal to supply electricity for lamps and motors in Bremerton from the plant of the Elwha Pwr. Co. The cost of the work is estimated at \$5,000.

**CENTRALIA, WASH.**—H. C. Coffman, representing the Washington-Oregon Corp., of Vancouver, has petitioned the County Commissioners for permission to construct a power line to Dryad and Doty. The company has a line in operation as far as Meskill.

**CHEWELAH, WASH.**—The Stevens County Lt. & Pwr. Co., of Meyers Falls, has secured the contract to furnish electricity to the United Copper & Aurora Mining Co., of Chewelah for a period of ten years. The contract provides for a maximum of 1000 hp daily at \$40 per hp per year.

**ELLENSBURG, WASH.**—Improvements are to be made to the municipal electric-light plant, including the installation of a 200-kw generator and switchboard.

**KELSO, WASH.**—The Washington-Oregon Corp. will soon begin work on improvements to its local system, involving an expenditure of about \$10,000. The new work, it is stated, has no connection with the construction of the Kelso-Castle Rock transmission line heretofore announced.

**MOUNT VERNON, WASH.**—The Home Wtr. & Pwr. Co. contemplates the installation of a new electrically driven pump to replace the old steam pumping plant here. A new power house is being erected.

**NEPPEL, WASH.**—The Grant Realty Co., of Neppe, has just completed the installation of a gasoline engine-driven direct-current generating unit. Storage batteries carry the day and part of the night load, and 28 tungsten street lamps have been installed.



**NORTH YAKIMA, WASH.**—Sealed proposals will be received by the United States Reclamation Service, Department of the Interior, North Yakima, Wash., until Feb. 21, for furnishing electrical apparatus for power plant for storage unit, Yakima project. Bids will also be received by the United States Reclamation Service, North Yakima, until Feb. 15, for furnishing hydraulic apparatus for power plant for storage unit, Yakima project. For further particulars address the United States Reclamation Service, North Yakima. Charles H. Swigart is supervising engineer. Bids will also be received by the United States Reclamation Service, North Yakima, until Feb. 15, for furnishing hydraulic apparatus for power plant for storage unit, Yakima project.

**PORT TOWNSEND, WASH.**—The Olympic Pwr. Co. has completed the erection of its high-tension line to Fort Flagler. The Olympic company also has a contract to furnish Fort Worden with electricity. The transmission line from the Elvha plant has been erected to the edge of the government reserve. Fort Casey is having a new power plant built.

**SEATTLE, WASH.**—The proposition to issue \$2,000,000 in bonds for the installation of a municipal telephone system will be submitted to the voters on March 4. The cost of installing the system is estimated at \$2,500,000.

**SEATTLE, WASH.**—Contracts for equipment for the municipal railway have been awarded as follows: Control and trolley equipment to the Westinghouse El. & Mfg. Co. at \$21,702, and switchboard and apparatus at \$4,000. All bids for two 400-kw transformers have been rejected and are not to be readvertised.

**SPOKANE, WASH.**—Extensions and improvements contemplated and already under way by the Spokane Gas Co. for 1913 call for an expenditure of \$120,000. The company has awarded a contract for equipping the steam-driven machinery at the gas plant for electrical operation, to cost \$20,000. The contract for energy to operate the machinery has been awarded to the Washington Wtr. Pwr. Co. A. N. Cantrill is manager of the gas company.

**ANTIGO, WIS.**—Improvements will be made to the plant of the Antigo Tel. Co. involving an expenditure of about \$16,000.

**BRODHEAD, WIS.**—The town of Brodhead is considering the purchase of the property of the Brodhead El. Co., owned by George M. Pierce. The State Railroad Commission has been requested to give a valuation of the property.

**CHIPPEWA FALLS, WIS.**—Automatic telephone systems are to be installed in Chippewa Falls and Eau Claire by the Chippewa County Tel. Co., at a cost of about \$150,000.

**DE PERE, WIS.**—The De Pere El. Lt. & Pwr. Co. is considering changing its system from direct alternating current.

**NEW RICHMOND, WIS.**—The New Richmond Pwr. Co. is contemplating the construction of a second hydroelectric power plant.

**TWO RIVERS, WIS.**—The Board of Water and Light Commission has recommended to the City Council an expenditure of \$3,500 for the reconstruction of electric transmission lines and the erection of additional lines to supply electricity for motors. Joseph L. Klein is secretary of board.

**EDMONTON, ALTA., CAN.**—The City Council has adopted the commissioners' report recommending the installation of an ornamental street-lighting system, to cost approximately \$186,050; included in the same report was the estimate for lighting the high-level bridge and the Jasper Avenue subway, amounting to \$16,750 additional.

**DUNCANS, B. C., CAN.**—Bids will soon be asked for by Ducane, Dutcher & Co., consulting engineers, Rogers Building, Vancouver, B. C., for the construction of a hydroelectric power plant at Skutz Falls for the city of Duncans, to cost approximately \$45,000. The first installation will provide for 250 hp. Provision will be made for an ultimate installation of 1000 hp.

**DAUPHIN, MAN., CAN.**—We are informed that the town of Dauphin does not contemplate the construction of a power plant at present. The town has been discussing the question of developing the water power at Meadow Portage, but nothing definite has been decided upon. J. W. Johnson is secretary and treasurer of the town.

**DAIHOUSSIE, N. B., CAN.**—Tenders will be received by Alexander J. LeBlanc, town clerk, until March 5 for the following work: Contract B—power house; contract G—booster pump; (1) steam pump; (2) turbine pump; contract H—two boilers; contract J—engine; (1) high-speed steam engine; (2) gas engine and gas producers; (3) Diesel oil engine; (4) crude-oil engine; contract K—electrical equipment and distribution system.

**PARRY SOUND, ONT., CAN.**—Preparations are being made to separate the street-lighting circuits from the remainder of the plant. The equipment required will include either a single or three-panel switch board, with necessary oil switches, fuses, lightning arresters and ammeters, three constant-current transformers or three constant-potential transformers with regulators designed for 60-cycle, 2200-volt, three-phase system at 6.6 amp with rating of 16 kw; also cable suspension clutches for three or four tungenst lamps, single gooseneck pole fixtures, 80-watt and 60-watt tungsten lamps, 6.6 amp series. Tenders for the above will be asked by Feb. 15. G. Groves, superintendent of the municipal plant, has charge of the above work.

**ST. CATHARINES, ONT., CAN.**—P. B. Yates, of Toronto, representing the Ontario Hydro-Electric Power Commission, has quoted the

St. Catharines' City Council a rate of \$14 per hp per year for 2000 hp delivered at 13,000 volts. In addition to this it would be necessary for the city to erect a transformer station, the cost of which is estimated at \$15,000. The Council has taken the latter matter under consideration.

**MONTREAL, QUE., CAN.**—The Board of Control has voted to appropriate \$30,000 to take all matters, which are made for the streets of the city.

**MONTREAL, QUE., CAN.**—The City Council has voted to appropriate \$25,000 for the continuance of the work on the plans for laying all cables underground. The plans for St. Catherine Street are practically complete, and tenders for the laying of conduits will be asked in February.

**WILKIE, SASK., CAN.**—Work will begin in April on improvements and extensions to the municipal electric-light plant and street-lighting system.

**TEPIC, MEX.**—The project of installing a large hydroelectric power plant on the Santiago River in the State of Jalisco, and the erection of a system of transmission lines to Tepic and a number of cities, towns and mining camps within a radius of 150 miles of the plant, has been revived by Rafael Pardo and associates. Application has been made to the government by Mr. Pardo and associates asking for the right to use 8000 gal. of water per second of the Santiago River, to be used for generating electricity.

## New Industrial Companies

**THE BACHLET MAGNETIC WAVE COMPANY**, of New York, N. Y., has been incorporated with a capital stock of \$25,000 by Walter L. Vaughn, Gertrude A. Dickson and Charles Dampf, of Brooklyn. The company proposes to deal in electrical goods.

**THE CONWAT ELECTRIC COMPANY**, of Pittsburgh, Pa., has been incorporated with a capital stock of \$5,000 for the purpose of conducting a general electrical supply business.

**THE DETROIT COIL COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$10,000 to manufacture spark and ignition coils. The incorporators are: Carl C. Cloverdale, Joseph R. Cloverdale and John F. Stoble.

**THE EDWARDS ENGINEERING & MANUFACTURING COMPANY**, of Newark, N. J., has been incorporated with a capital stock of \$220,000 by Douglas F. Johnson, Durwald E. Burchald and Mansfield Ferry.

**THE UNDER-CUT DRILL COMPANY**, of Boston, Mass., has been incorporated by W. G. Giddings, and A. R. MacKusick, of Boston, Mass. The company is capitalized at \$50,000 and proposes to do a general mechanical and electrical engineering business.

## New Incorporations

**MODESTO, CAL.**—The Farmers' Tel. Exchange Co. has been incorporated with a capital stock of \$10,000 by W. H. Hemminger, S. N. McBride, F. L. South, M. Vincent and L. D. Scott.

**REEDLEY, CAL.**—The Reedley Tel. Co. has been incorporated with a capital stock of \$25,000 by E. W. Crosby, D. C. Krehbiel, of Reedley; Dr. G. A. Therker, of Livermore; F. A. Baikin, of Dinuba, and Ira Dick, of San Francisco.

**WAPELLO, IA.**—The Wapello El. Co. has been incorporated with a capital stock of \$25,000 by C. H. Walsh, G. H. Higbee, L. R. Sherrill and Ora Vaught.

**BIDDEFORD, MAINE.**—The York County Pwr. Co. has been incorporated with a capital stock of \$3,000,000 by George F. West, Maynard S. Bird, of Portland, and J. G. Shaw, of Biddeford. The charter of the company gives it the privilege of generating and distributing electricity and gas in York, Oxford and Cumberland Counties.

## Trade Publications

**PLANTMETERS**. The Industrial Engineers' Association of America, at its Bulletin No. 77, has issued a new publication, which includes a two-page sheet of data on plantmeters.

**SWITCHES**. The I. W. N. Co., of New York, has issued a new publication, which includes a two-page sheet of data on switches. At this time, the company is showing

**BALL BEARINGS**. The I. W. N. Co., of New York, has issued a new publication, which includes a two-page sheet of data on ball bearings. At this time, the company is showing

**GAS PRODUCERS**. The I. W. N. Co., of New York, has issued a new publication, which includes a two-page sheet of data on gas producers. At this time, the company is showing



**WIRING SPECIALTIES.**—Bulletin 765, issued by Pass & Seymour, Inc., Solvay, N. Y., gives information to the trade respecting the change from one schedule to another of various devices. Bulletin No. 766 shows in a graphic manner how it is possible to make twenty-four combinations of P & S sockets from fifteen different parts.

**SKYLIGHTS.**—The G. Drouve Company, Bridgeport, Conn., in a recently issued eighty-page catalog effectively illustrates and describes its "Anti-pluvius" puttless skylights. These skylights, which are used in many electric light and street railway companies and in a number of electrical manufacturing plants, give, it is stated, ample daylighting. The brochure contains an interesting illustrated chapter on the relation of daylight and ventilation to industrial efficiency and shows the constructive features of these skylights.

**HOUSE LIGHTING.**—Simplex Conduit, Ltd., of 116 Charing Cross Road, London, is issuing an interesting handbook entitled "Advice on Country-House Lighting," which has been prepared in answer to several requests for a publication dealing in simple language with the various uses to which electricity may be put in the average country house in which a private generating plant is installed. The plan adopted in the arrangement of this handbook has been to consider the rooms in the house one by one, dealing in each case with the various electrical appliances and means of lighting which apply to that particular apartment. With the aid of the book the householder can compile for himself a list of his requirements according to the outlay he intends to make. A section dealing with the types of private plants usually installed is included.

**ALUMINUM VERSUS COPPER.**—The British Aluminium Company, Ltd., 109 Queen Victoria Street, London, has recently issued an interesting pamphlet on the relative merits of aluminum and copper as conductors. Much of the material contained in the publication, particularly the principal characteristics of the metals, is of an engineering handbook nature, the data being comprehensive, clearly presented and illustrated by diagrams. Methods for calculating overhead transmission are described at length with references to a number of curves, charts and tables. Cost data for high-voltage overhead lines for equivalent sizes of copper and aluminum conductors and for various span lengths are also given, these, of course, applying to British conditions. The pamphlet is further illustrated with a number of views of typical installations of aluminum conductors.

## Business Notes

**LARGE ORDER FOR LAUNDRY MOTORS.**—One of the largest orders ever placed for small motors has been given to the Westinghouse Electric & Manufacturing Company by the Hurley Machine Company, of Chicago, manufacturer of the Thor electric home laundry machines.

**CENTRAL ELECTRIC COMPANY.**—Mr. Charles D. Brainard and Mr. L. B. Van Nuys have succeeded to the ownership and management of the Central Electric Company, of Peoria, Ill., Mr. O. H. Norton, president and principal proprietor of the company for more than twenty years, having retired.

**PROJECTOR SALES.**—The Carlisle & Finch Company, 229 East Clifton Avenue, Cincinnati, Ohio, manufacturer of projectors, includes the following in one week's orders: One 14-in. searchlight to New Orleans, two 24-in. to Chicago, one 9-in. to Seattle, one 19-in. to Kansas City, one 19-in. to Pittsburgh, one 14-in. to Montreal, one 19-in. to New York City, one 19-in. to Louisville, one 14-in. to England, and two 19-in. to Detroit.

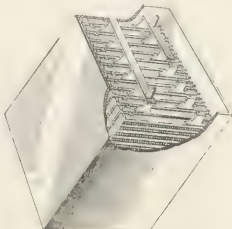
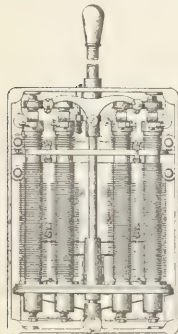
**THE ELECTRIC TACHOMETER COMPANY** has acquired all the rights, interests, good-will and title of the Electric Speedometer Company, of Washington, D. C., and has moved the latter company's plant to its own works at the southeast corner of Broad and Spring Garden Streets, Philadelphia, Pa. In this plant the company will manufacture electrical tachometers of various types, electrical speedometers, odometers and other speed indicating and recording devices. Mr. G. H. Taylor is president of the Electrical Tachometer Company.

**THE MATTHEWS FUSE SWITCH** is mentioned in an article by Mr. R. H. Pearson, superintendent of the inspection department of the Globe Indemnity Company, New York, in the January issue of the *Weekly Underwriter* as one of the best accident-prevention devices of recent design. Practically all of the large liability and accident-insurance companies, the manufacturers state, have placed their seal of approval on this fuse switch. Mr. Byron Cummings, the chief inspector of the Ocean Accident & Guarantee Corporation of London and New York, has authorized its use of his company's name as approving and recommending the Matthews fuse switch to its central-station policy holders. Mr. Pearson, the author of the article above mentioned, has also granted similar permission and requested a sample to be placed in his exhibition of accident-preventing devices. W. N. Matthews & Brother report sales of this fuse switch aggregating over 2000 in 1912.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 28, 1913.

- [Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]  
 1,051,480. **CURRENT CONTROLLER;** L. Bradley, Muskegon, Mich. App. filed March 18, 1909. Variable-pressure resistance device.  
 1,051,481. **ELECTRIC-CURRENT CONTROLLER;** L. Bradley, Milwaukee, Wis. App. filed Nov. 20, 1909. A plurality of compressible variable-resistance elements.  
 1,051,486. **WINDOW GUARD;** G. H. Camp, Leolyn, Pa. App. filed June 30, 1909. Normally open-circuit alarm system.  
 1,051,505. **ELECTRIC FIXTURE;** J. Le Moine, New York, N. Y. App. filed Sept. 27, 1911. Pull socket-switch mechanism.  
 1,051,542. **VOLTMETER SWITCH;** C. H. Bisell, Syracuse, N. Y. App. filed Feb. 28, 1908. Hand-operated rotary type.



1,051,481.—Electric-Current Contol-  
ler. 1,051,816.—Electric Secondary Bat-  
tery.

- 1,051,553. **ELECTRIC-CLOCK MECHANISM;** Le Grand C. Bush, Elkhart, Ind. App. filed Aug. 27, 1909. Operated by electromagnet and gravity.  
 1,051,556. **PRODUCTION OF METALLIC BODIES BY MEANS OF ELECTRODEPOSITION;** S. Consigliere, Genoa, Italy. App. filed Sept. 2, 1910. The metal while being deposited is subjected to hammer blows by small bodies.

- 1,051,557. **CONTROL OF RAILWAY APPARATUS;** F. B. Corey, Schenectady, N. Y. App. filed July 16, 1908. Return indication of electric motor-driven track switches.  
 1,051,580. **PROCESS OF TREATING WOOD FOR USE IN ELECTRIC STORAGE BATTERIES;** B. Heap, Clifton Junction, Manchester, Eng. App. filed Oct. 27, 1908. Deleterious substances are extracted by alcohol.  
 1,051,588. **ELECTRICALLY CONTROLLED LOCK;** W. H. Hollar and H. F. Balou, Philadelphia, Pa. App. filed June 3, 1909. Electric circuit and combination lock distinct from the time mark.  
 1,051,599. **TELEGRAPH CONVERTER;** I. Kiseev, Philadelphia, Pa. App. filed Dec. 4, 1908. Long-distance duplex system.  
 1,051,637. **BATTERY SEPARATOR;** H. Rodman, Pittsburgh, Pa. App. filed March 24, 1908. Fine sand and powdered glass fritted together.  
 1,051,638. **SECONDARY BATTERY SEPARATOR;** H. Rodman, Pittsburgh, Pa. App. filed March 24, 1908. Integral mass of porous glass.  
 1,051,645. **SECONDARY OR STORAGE BATTERY;** E. G. Steinmetz and E. W. Smith, Philadelphia, Pa. App. filed July 12, 1909. The grid is made up of rods.  
 1,051,675. **METHOD AND MECHANISM FOR PRODUCING MUSICAL SOUNDS;** G. Breed, Philadelphia, Pa. App. filed Sept. 23, 1909. Electromagnetically vibrated sonorous members.  
 1,051,743. **ELECTRICALLY HEATED REACTION CHAMBER;** J. MacKaye, Cambridge, Mass. App. filed March 20, 1906. For producing carbon chloride, etc.  
 1,051,749. **ELECTRIC-LAMP SWITCH;** N. C. Nispel, York, Pa. App. filed July 16, 1912. Incandescent lamp socket with adjustable resistance.  
 1,051,758. **MAGNETIC SEPARATOR;** J. C. Preslar, San Antonio, Tex. App. filed June 22, 1912. For extracting foreign matter from grain.  
 1,051,782. **FLYWHEEL COMPENSATING SYSTEM;** L. Thallmayer, Zurich, Switzerland. App. filed May 13, 1912. Motor-generator sets for hauling plants, etc.  
 1,051,810. **APPARATUS FOR THE ELECTRICAL TREATMENT OF GASES OR VAPORS;** W. T. Hooftaghe, Glen Ridge, N. J. App. filed March 12, 1912. Intermittent action for vacuum treatment.  
 1,051,812. **ELECTRIC-RAILWAY SWITCH;** D. W. Johnson, Saginaw West Side, Mich. App. filed July 15, 1911. Concealed motor with switch controlled by the train.  
 1,051,814. **PROCESS OF MANUFACTURING POROUS-METAL BLOCKS;** V. Löwendahl, Stockholm, Sweden. App. filed Nov. 11, 1909. A block of metallic powder and ammonium nitrate is heated.  
 1,051,816. **ELECTRIC SECONDARY BATTERY;** W. Morrison, Chicago, Ill. App. filed Dec. 27, 1904. Porous retainers and anchoring teeth.  
 1,051,821. **DYNAMO-ELECTRIC MACHINE;** W. H. Powell, Norwood, Ohio. App. filed April 1, 1907. Commutating poles magnetically independent of the main-field yoke.

# Electrical World

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## The Retail Dealer and Appliance Sales

Interesting although not unexpected results have been obtained from the canvass conducted by the *Electrical World*

to secure the views of retail electrical-supply dealers concerning present trade conditions in the sale of electric-heating devices. This inquiry, a detailed account of which is given on another page, follows the similar canvass recently carried out among the central stations of the country and reported on page 1183 of our issue of Dec. 7, 1912. Among the dealers, as elsewhere, the flatiron is unmistakably recognized as the most popular and satisfactory device marketed, in the second class, several laps behind, being included toasters, percolators, stoves, radiators, etc. Many retail dealers complain bitterly about the cut-price competition in apparatus sales due to central stations selling at or below cost to further the use of their service. The justice of the dealer's plea cannot be denied, and the central station should also consider whether it may not injure its own case by reckless pursuance of so unsubstantial a policy. Although dealers have undoubtedly profited from the general advertising done by manufacturers, central stations and themselves as well, the answers to the questions show that this benefit has been confined chiefly to creating interest in and demand for the general class of device advertised without respect to individual brands. His interest aroused, the prospective customer comes to the store and asks for simply "an electric iron" in 75 per cent of the cases noted, allowing the dealer to recommend and select the device finally purchased. In this connection it is of interest that about one-third of the dealers reporting carry only a single line, while nearly all the rest handle several makes. After considering the results of the present inquiry, one cannot fail to accord the retail dealer his deserved important place in the distribution of electric-heating appliances. Enjoying as he does the full confidence of the consumer, the dealer has every reason, if he will but "go after the business," to make himself the real factor in electric-appliance distribution and so lift the burden from shoulders less adapted to carry it, but which have done so thus far and capably.

## The Control of Navigable Streams

Two bills dealing with the control of navigable waters now pending in Congress are far-reaching in their effect, especially as regards the relative rights of the states and the federal government to the waters of navigable streams. In the Connecticut River bill in particular, the national government assumes the right to impose a charge for the use of surplus water not needed for purposes of navigation, even where the improvement in navigation has been effected without governmental expenditure. The bill is peculiar in that a private agency is utilized to construct a

dam in aid of navigation, and in consideration therefor receives the use of the incidental water-power thereby created, but is required also to pay the federal government a yearly rental depending on the profits. The bill drafted to take the place of the Burton act regulating the diversion of water in the Niagara River is more limiting in its provisions than the act it is intended to supersede. Both bills have been attacked by adherents of the doctrine of state rights, the former on the ground that it confiscates a natural resource of the State of Connecticut, and the latter on the ground that, having agreed by treaty that 20,000 cu. ft. of water per second may be diverted from the American side of the Niagara River without interfering with navigation or with the flow of the stream, the national government has exercised the only prerogative it possesses in the matter and cannot regulate the distribution of the water without invading the property rights of the riparian owners. It is contended in the first instance that the State of Connecticut owns the water and the bed of the Connecticut River at Windsor Locks and that the federal government, having no proprietary interest in the water-power of the river, has no moral or legal ground to demand compensation in any form for the use of the water-power in the river. The national government for some years has taken complete charge of streams and it is claimed that in doing so it has disregarded the rights of the states. The Senate now has a committee considering the legitimacy of such practice on the part of the federal government, but until the Supreme Court passes on a concrete case the attempt at dual control will always tend to produce chaos.

## Getting Rental Property Wired

Among all the difficulties of getting old houses wired for electricity, the central-station commercial man's problem really becomes acute when he tackles the rented dwelling. The tenant, of course, in most cases welcomes electric light; but the landlord usually remains obdurate when asked to invest from \$25 to \$75 additional in property from which he expects no increase of return. It was an astute contract agent who hit upon the scheme of getting the tenant's agreement to pay from 50 cents to \$1 more per month, provided the landlord would wire the premises. With offer, cheerfully acquiesced in, the central station could approach the owner, showing him that the \$6 to \$12 yearly increase in rental allowed liberal interest on the small investment involved in the wiring, besides leaving a surplus to retire the principal in the course of a few years. The property was thus left with a permanent improvement, worth as a real-estate increment several times the actual outlay, although acquired at no expense whatever to the owner.

## Matter and Electricity

Advocates of the electronic theory, which has already afforded so many interesting explanations in widely divergent departments of science, will welcome as its crowning proof the news of the experiments by Sir William Ramsay and Professors Collie and Patterson, outlined on a following page, in which the investigators believe that they have produced atoms of the relatively complex and heavy elements helium and neon, either from hydrogen atoms or from the ultimate elemental electrical charges themselves. For several years now the identity of electricity and matter has been strongly indicated by experimental and theoretical observations. In the electronic state, for example, the flying corpuscles combine the attributes of matter, mass, inertia, etc., with marked electromagnetic and electrostatic properties.

Analytically it has already been numerically shown that the electronic charges which, from other evidence, may be believed to make up ponderable matter would exert self-inductive effects on the ether to account exactly for the inertia displayed by familiar masses, so that as far as ordinary molar effects are concerned, we need only consider the electric charges, omitting altogether matter in the ordinary sense. When, for example, the emergency brakes are applied on a railroad train the passengers are tossed against the seats ahead not because of the corporeal weights they possess, but really on account of the self-induction of their constituent atomic charges on the ether! Then there is the interesting electrical explanation of gravitation, first presented in these columns, which, referring gravitational effects to familiar electrical facts, affords a pleasing solution for the laws of the inverse squares, products of the masses and extreme feebleness of this all-pervading force. Cathode discharges and even the familiar table of electrochemical equivalents contribute striking evidence to the electronists' claims. Magnetic effects on the bands of the spectrum again indicate the close connection between electrical forces and the constitution of matter. And in radio-activity we see frequent instances of matter "breaking down" and throwing off sets of rays which, when cornered, turn out to be nothing else than negative and, possibly, positive electricity.

Now the British scientists seem to believe they have gone a step beyond this down-hill process, actually succeeding in building up atoms either by recombination of simpler atoms or from the ultimate electron units of the discharge traversing the tube. Without reverting to the more commonplace view that these atomic newcomers may have been lurking all the time in the interstices of the electrodes or tube walls, or are even broken-down groups detached from the latter atoms, the conception of creating matter by electrical means will still continue to be a pretty large one. From the enormous amounts of energy liberated when radioactive elements decay we gain some estimate of the tremendous quantities of power which would have to be poured into the atomic crucible. A careful statistician has computed that the great Chicago central-station system produces in all only about one pound of electrons per hour. Evidently, then, competition with genesis is not going to pay on a commercial basis! But if the new claims are

well based, it may nevertheless be that our two splendid bulwarks, the twin laws of conservation of energy and of matter, will have to be rewritten as a joint statement, asserting that while the sum total of matter and energy is a constant for any system, either manifestation of the primordial *Urstoff* may be drawn upon for conversion into the other form.

## Factory-Plant Engineering

Nowhere is the effect of engineering experience better shown than in the design of isolated plants for factory service. Time was when isolated plants were installed in any manner that seemed at the time cheap and convenient, with the usual results of wasteful operation and complaints about the cost of electrical energy. The day of rule-of-thumb and of unwise economy has gone by in such plants, as it has in the larger ones designed for central-station service. An excellent example of the way things are now done is given in an account of a new Detroit installation of this character by Mr. Harry C. Spillman.

There is generally very little of novelty in small plant design, but in every well-planned example there is a chance for at least some features of more than casual interest. In the plant before us two things stand out as conspicuous instances of good sense in engineering. The first is the adoption of absolutely fire-proof construction, so far as anything can be absolutely fire-proof, in the station from floor to roof. In this plant no timber is used, and so far as care and skill can go there should be no interruption of service from fire, a condition too often neglected in plants as small as the ordinary works plant must be. The second point relates to the boiler room, which is designed with the engineering care which makes for low cost of operation. The equipment of water-tube boilers and automatic stokers is installed under a guarantee of 10 lb. evaporation per pound of dry coal of 13,500 heat units. A feed-water meter and coal and ash scales, all regularly used, keep the plant under practically test conditions all the time so that if the plant is operating with poor economy it will be promptly noticed. Steam meters and a CO<sub>2</sub> recorder complete this excellent equipment, scarcely less effective than would be found in the largest central station.

The choice of engines in the plant is also worthy of comment. The desirability of using exhaust steam for heating resulted in the installation of a cross-compound Corliss engine designed for sufficient back pressure to supply steam to the heating system through the winter months. When run at full load non-condensing, but without back pressure, the steam consumption drops to 20 lb. per indicated horsepower, a highly satisfactory figure. The operating conditions seem to have been taken into consideration at every point, and it is worth mentioning that the average power-factor at the switchboard on the heavy mixed load of induction motors and lamps is up to 84 per cent, a figure considerably better than is generally found in a plant of this size. Installations of this sort are object lessons in the desirability of doing things well as a matter of final economy. A poor plant seldom proves to be a safe or desirable investment.



### Local Absorption in Radiotelegraphy

The three conclusions which Prof. A. H. Taylor draws from the facts described in his article on page 350 of this issue of the *Electrical World* are of very marked interest and seem to be sufficiently borne out by the experiences of others in the radiotelegraphic field to warrant study. The havoc brought about by reaction of unprotected wireless transmitters upon power and telephone circuits is very strongly impressed upon the memories of many central-plant officials who have been called upon to repair again and again obscure troubles which were finally traced as results of the activities of some innocent but ignorant amateur experimenter in radio signaling. Professor Taylor's suggestion that these are resonant effects is well supported by the fact that he could eliminate them by changing the wave-length of transmission. In practical radio work it has often been noticed that the so-called "static" charging of nearby wires is much more violent for short than for long waves. It has also been found that small alterations in wave-length of the trouble-making transmitter would change the points along wire lines at which sparking or other indicating actions occurred, thus demonstrating quite clearly the existence of stationary waves of current and electromotive force in the affected circuits. The remedy that Professor Taylor finds effective is one that the difficulties of practice have forced upon commercial and other users of radio, so that now it seems standard practice to install protective devices consisting of grounded pairs of fused condensers further safeguarded by shunting air-gaps to prevent puncture.

Absorption by nearby insulated or grounded conductors results in so many apparently contradictory phenomena that the mechanism of its occurrence is little understood. The study of diversion of energy from receiving antennas is so involved with changes of resonant action that to observe either alone is very difficult, and before many safe conclusions can be reached it will be necessary to consider in detail vast quantities of experimental data covering peculiarities attributable to neighboring conducting systems. Solutions of the problems involved find immediate application in operating radio stations, where there has often been brought up the question of whether metallic towers supporting the antenna should be insulated or grounded in order to afford the best results. In a number of stations several independent antennas are installed, and the effect of one on the others is often a source of argumentative discussion. The real difficulty seems to lie in the fact that a number of conditions which by many are assumed to vary independently actually go along hand in hand in such fashion that to alter one means to change the values of all the rest. Thus it is found that for transmitting on some wave-lengths from some stations it is better to insulate the masts, while for others the most vigorous radiation is had when the towers are carefully grounded.

Radiotelegraphic instruments installed on top of high steel-frame buildings have often been found to give results far in advance of those predicted for them. The indications are that the effective antenna height of such stations is that measured from the aerial's center of effective capacity to the level of the earth's surface rather than the

shorter distance to the building roof. Just how much this depends upon the location of apparatus upon the upper floor of the building instead of at the street is still a moot question, though the results of Professor Taylor's experiments as well as the high receiving efficiencies of several roof-installed stations point decidedly toward the higher position as the one to be preferred.

### Researches in Magnetic Hysteresis

Since iron or steel enters into the construction of almost all electrical machinery and large apparatus, the laws of the loss of energy in the cyclical magnetism of iron and steel are of great practical importance. The process is, however, essentially complex, since the magnetic flux density in iron or steel is no simple linear function of the magnetizing force, but, as is well known, follows a saturation curve. Moreover, in the measurement of the hysteretic power loss we are confronted with certain difficulties, whether we select the ballistic or the alternating-current method. In the application of the ballistic process we are unable to use a null method, and the galvanometer deflection has to be corrected for damping and other disturbing influences. In the application of the alternating-current method we have to correct for the loss in eddy currents. This correction it is difficult to make with precision.

The law of hysteretic energy loss, announced by Steinmetz in 1890, states that the cyclic loss is proportional to the 1.6th power of the flux density, as deduced from Ewing's ballistic measurements. In 1892 Dr. Steinmetz confirmed the law by alternating-current measurements and extended it to dissymmetrical cyclic magnetization. The Steinmetz exponential coefficient 1.6 has been checked by many observers to a degree of precision sufficient for existing engineering purposes and has taken a permanent place in engineering literature. The question has, however, often been raised as to whether it is an empirical coefficient that represents the facts to a first approximation or whether it expresses a true physical law. Many physicists report observations tending to show that the coefficient is not strictly 1.6, but varies slightly in different samples of steel, and also in different ranges of flux density in the same sample. No satisfactorily simple expression of the true law has, however, yet been offered.

A recent contribution to the literature of magnetic hysteretic energy loss, referred to in our *Digest*, has been published by Dr. Fritz Holm, in the form of a doctorate thesis. He employed both the ballistic and the alternating-current method. He found that with symmetric magnetization—that is, equal plus and minus flux densities in the cycle—the exponential coefficient 1.6 is fairly well substantiated, but that when dissymmetrical magnetization is used, by superposing cyclical upon unidirectional magnetization, the exponent is considerably altered, the energy loss for a given cyclic range in flux density being greater at high mean densities than at low mean densities. The question of the accuracy of the exponent 1.6 from the standpoint of physics is thus freely open to doubt, although from the standpoint of engineering it is not yet debatable. It remains to be determined by the physicist what the strict expression is.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Railway and Light Conference on Public Policy

The public policy committee of the National Electric Light Association, through its chairman, Mr. Arthur Williams, has invited the committee on public relations of the American Electric Railway Association to dine at the Union League Club, New York, on Feb. 18, for the purpose of discussing methods of bringing about closer relationships between the two great national bodies in matters pertaining to public policy. The committee of the American Electric Railway Association comprises Mr. Thomas N. McCarter, president of the Public Service Railway Company, Newark, N. J., chairman, and Messrs. Patrick Calhoun, president of the United Railroads of San Francisco; O. T. Crosby, formerly president of the Wilmington (Del.) & Philadelphia Traction Company; James H. McGraw, president of the McGraw Publishing Company, and William H. Heulings, Jr., assistant secretary of The J. G. Brill Company and president of the American Electric Railway Manufacturers' Association. Much of the work of the two committees covers common ground, and it is felt that the interchange of viewpoints between the prominent men of the railway and of the lighting industry will redound to the credit of both and result in joint action and recommendations on questions of great importance.

### Electrical Supply Jobbers at Buffalo

At the quarterly meeting of the Electrical Supply Jobbers' Association, held at Buffalo, N. Y., Tuesday, Wednesday and Thursday of this week, there were 350 registrations at the Hotel Lafayette headquarters. Other hotels housed a number of electrical men who did not find accommodations at the Lafayette.

Mr. F. S. Price, of the Pettingell-Andrews Company, Boston, was elected chairman of the Atlantic Division, and Mr. N. G. Harvey, general manager of the Illinois Electric Company, chairman of the Central Division. Mr. Franklin Overbagh, general secretary of the association, was elected to serve as secretary and treasurer.

Discussion at Wednesday's general session developed the fact that a large majority of the jobbers present were opposed to any changes in the present code provisions relating to fuses. This attitude on the part of the jobbers was brought out in connection with the necessity for defining what their action would be at next month's meeting of the National Board of Fire Underwriters, when the refillable-fuse question, among others affecting electrical material, will be taken up.

As reported by members, the average cost of doing business in 1912 was 16.5 per cent of the gross income, an increase of 0.5 per cent over 1911. May 26, 27 and 28 and Chicago are the time and place determined upon for the next meeting of the association.

Tuesday evening a large number of Jovians attending the convention witnessed a rejuvenation by the Buffalo chapter of their order. The work of initiation was elaborately staged in a local Scottish Rite chapel and impressively carried out by the officiating team, thirty-seven candidates being admitted. Later in the evening a rejuvenation supper, enlivened by a cabaret performance, was attended by several hundred local and visiting Jovians.

Another social event of the meeting was the Lincoln Day dinner, at which Mr. Wallace and Mr. Tonkin, on behalf of the Ansonia Electric Company, entertained a number of the company's branch managers and special agents.

### Government Telegraph Ownership Recommended by Postmaster-General

Postmaster-General Hitchcock in his annual report, transmitted to Congress on Feb. 11, again recommends government ownership or control of telegraph lines. Mr. Hitchcock says: "In the last annual report the opinion was expressed that telegraph lines in the United States should be made a part of the postal system and operated in conjunction with the mail service. It is believed that under proper management such a consolidation would result in important economies and permit adoption of lower telegraph rates. Now that a postal savings system has been established and a parcel post provided for, there would seem to be no better opportunity for the profitable extension of our postal business than through the adoption of a government telegraph system."

### Production of Complex Atoms from Simpler Ones or from Ultimate Electrons

The liveliest scientific interest has been aroused by the remarkable experiments reported before the Chemical Society at London on Feb. 6 by Sir William Ramsay and Profs. Norman Collie and H. Patterson. Subjecting to cathode rays certain discharge tubes containing only hydrogen at low pressure, the investigators found, following the passage of the discharges, evidences of the rare gases neon and helium present with the hydrogen.

Since every precaution had been taken to exclude any foreign gas from the tubes, the presence of the new elements is to be accounted for by derivation in one of the three following ways: First, breaking up of the hydrogen atoms (atomic weight 1) into their constituent electrons under the cathode bombardment, and recombination of these electrons to form the heavier and more complex atoms of helium (4) and neon (20); second, separation of electronic groups from the glass walls or the aluminum and gold electrodes of the discharge tubes, these groups becoming at once, or combining to form, helium and neon atoms; third, production of the new elements directly from the free electrons of the electric current traversing the tube, indicating the actual creation of ponderable matter from the electrical energy of the discharge.

If either the first or third of these explanations be the correct one, experimental evidence is afforded for the first time that complex atoms can be built up out of simpler ones, or, indeed, from the ultimate electrical charges. For several years, of course, it has been well known that the heavy elements like radium, uranium, polonium, thorium, etc., degrade into elements of lower atomic weight with the production of relatively prodigious amounts of energy. The reversal of this transmutation, or the production of complex atoms from light ones, was accordingly expected to be outside of physical limitations imposed by the generation of energy on the scale necessary to bring about the

change, although it now seems likely that the cathode bombardment mentioned supplied the intensity of energy required. If, on the other hand, however, the helium and neon groups are due to the breaking down of the heavier atoms contained in the electrodes or tube walls, the experiments still afford valuable data concerning the degradation of other elements besides the ones already known to be subject to this action.

In a cable interview, Sir Oliver Lodge is quoted as assuming a conservative position concerning the interpretation of the new experiments. This distinguished scientist calls attention to the fact that a very large quantity of gas can long remain occluded in the pores of aluminum electrodes, like those used in the experiments, and that this gas when driven out under the stimulus of cathode excitation may appear to be manufactured, although actually only a reserve supply. Sir J. J. Thomson is declared to incline to the belief that the glass of the experimenters' tubes was the source of the helium and neon observed, pointing out that in his own experiments he discovered the production of similar gases during the first few days' run of the tests, following which the effects ceased unless a new glass tube was substituted.

### Electric Service for Suburban Districts

At the meeting of the St. Louis League of Electrical Interests, Jovian Chapter, held Feb. 11, Mr. S. H. Wallace, manager of the Suburban Light & Power Company of St. Louis, presented a paper discussing the supply of electric service to suburban districts. The speaker traced the history and development of his company's system, describing in detail the construction and methods employed, use of automatic regulators, etc. The growth of the Suburban company's service is exemplified, he pointed out, in the increase of the peak load from about 40 kw in 1901 to 1800 kw at the present time. On one of the substations, owing to motor load, this peak occurs at 10 a. m.

### Annual Meeting of the Electric Club of Chicago

The annual meeting of the Electric Club of Chicago was held on Feb. 6. Reports were received from the outgoing officers and the new officers were installed. Mr. W. M. Connelly, the secretary, reported that thirty-seven regular meetings of the club had been held during the year ended Feb. 1, 1913. At twenty-six meetings speakers were provided. The average attendance was sixty-two, the number of club members in good standing at the present time being 366.

Treasurer John R. Harmon reported that the club's financial resources consist of \$3,000 in bonds of the Commonwealth Edison Company and \$752 cash in bank. Mr. H. G. Hafner reported for the entertainment committee. Officers were elected as follows: President, Mr. George C. Keech, Cooper Hewitt Electric Company; vice-president, Mr. William E. Keily, *Electrical World*; secretary, Mr. Fred M. Rosseland, General Electric Company; treasurer, Mr. Charles W. Forbrich, *Electrical Review and Western Electrician*; managers (in addition to officers named), Messrs. John R. Harmon, Sanitary District; William W. Hinchler, Albert & J. M. Anderson Manufacturing Company; George Markham, Chicago Telephone Company; A. Balsey, Commonwealth Edison Company; H. M. Webber, Chicago Telephone Company.

In laying down the president's gavel Mr. A. A. Gray spoke in especially commendatory terms of the work of Secretary Connelly and Treasurer Harmon. Mr. Keech, the new president, made a brief address in which he announced that the members of the club would be divided into two equal divisions to take part in a contest to secure

new members. The divisions will vie with other in this endeavor, and the result will be announced from week to week. It is expected that by this means the membership of the club will be raised to the limit of 500. Mr. Keech also said that the club would probably offer its services in connection with the plans for the entertainment of the National Electric Light Association during the June convention of that body in Chicago. He announced committee chairmanships as follows: Membership, Mr. Balsey; attendance, Mr. Hinchler; house, Mr. Webber; reception, Mr. Harmon; speakers, Mr. B. E. Blanchard; entertainment, Mr. Markham.

### Testimonial to Mr. W. W. Freeman

As a mark of their esteem and affection for Mr. W. W. Freeman, who retired on Dec. 31, 1912, from the management of the Edison Electric Illuminating Company of Brooklyn after twenty-three years of association with it to become identified with the Alabama Interstate Power Company, the employees of the Brooklyn company presented him with a silver service on the evening of Feb. 10.

The presentation was made at the regular meeting of the Brooklyn Company Section of the National Electric Light Association, prior to which the members of the staff council of the company, with the officers and committees of the section, gave a dinner to Mr. Freeman and to Mr. William J. Burns, the famous detective, who later on gave a two-hour talk to the employees of the company.



SILVER SERVICE PRESENTED TO MR. FREEMAN

Mr. W. F. Wells, the present general manager of the company, was to have made the presentation speech to Mr. Freeman, but on account of a death in his immediate family was unable to be present, and Mr. E. A. Baily, who was Mr. Freeman's secretary and is now secretary to the latter's successor, was called upon to make the address. Mr. Baily paid a high compliment to Mr. Freeman's ability as shown in his rising from the position of stenographer to that of vice-president and general manager of the company. He also spoke of the heavy debt of gratitude the employees of the company are under to Mr. Freeman in connection with the various profit-sharing, pension and other welfare plans which he placed in operation.

The silver service bears an inscription indicating the date and circumstance of its presentation, followed by these lines:

"Honor and reverence and the good regards  
That follows faithful service as its fruit  
Be unto him whom living we salute."

Mr. Freeman, in responding, expressed his appreciation of the gift and the feeling which accompanied it.



## Discussion of Municipal Lighting by I. E. S. and Municipal Art Society

At a meeting of the Illuminating Engineering Society held jointly with the Municipal Art Society in the galleries of the National Arts Club at 119 East Nineteenth Street, New York, on Feb. 12, a paper was presented by Mr. C. F. LaCombe, chief engineer of the Department of Water Supply, Gas and Electricity of the City of New York. The title of the paper was "Municipal Lighting" and particular attention was paid to the street lighting and fixtures, to lighting of municipal buildings and to illumination from electric advertising signs. The speaker described the lighting of the streets of the city as it was a few years ago and then told of the improvements that have been made and are now being planned. The lecture was illustrated with lantern slides showing fixtures as they formerly existed and contrasted them with the ones in use at present. The speaker stated that there are at present in operation in the borough of Manhattan more than 83,000 street lamps whose total candle-power aggregates approximately 15,000,000. The talk was closed with an appeal for the persistent co-operation of the artist and the illuminating engineer and the furtherance of the artistic features in fixture design.

The meeting was also addressed by Mr. Arthur Williams, general inspector for the New York Edison Company; Mr. William Wentz, of the O. J. Gude Advertising Company, and Mr. Charles Roland Lamb, ecclesiastical architect.

Mr. Williams spoke of the value of street lighting and in quoting an eminent authority stated that one arc lamp was the equal of two policemen in rendering the highways of a city safe for pedestrians.

Mr. Wentz followed the career of the electric advertising sign from the time that the first advertisement of this kind was placed on Broadway up to the present day, and described the Great White Way as it now appears illuminated with mammoth flashing signs.

Mr. Lamb spoke of the beautiful lighting effects produced in the city at the time of the Hudson-Fulton celebration and showed a number of lantern slides.

The meeting was preceded by a dinner at the National Arts Club.

## A School to Teach the Selling of Electricity

A school that is probably unique has just been established in Chicago, having been incorporated under the laws of Illinois. It is called the Chicago Central Station Institute, and it is supported by the Commonwealth Edison Company, Federal Sign System (Electric), Illinois Northern Utilities Company, Middle West Utilities Company and the Public Service Company of Northern Illinois. The purpose of the school is to teach young-men students the commercial side of the electric-service industry. A tuition fee is charged, but the student will give about half of his time to practical work in soliciting business, and for this he will be paid. Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, is president of the Chicago Central Station Institute, and Mr. Fred R. Jenkins, formerly general inspector of the Chicago Edison Company, is the secretary and manager of the new school. The directors are Messrs. Frank J. Baker, John F. Gilchrist, Martin J. Insull, E. W. Lloyd and Charles A. Munroe.

The course of instruction covers eleven months and the purpose of the school is to supply the increasing demand of large electrical companies for trained men in their commercial and selling departments. The tuition is \$100 for the full term of eleven months, but for his half-time service in the field it has been arranged to pay the embryo solicitor \$40 a month. The offices and classrooms of the new school are at 112 West Adams Street, Chicago. Applicants for admission must be over twenty years of age, of good moral character and physically sound. They must have at least

the equivalent of a high-school education and must give their entire time on weekdays to the work of the institute from 8:30 a. m. until 5:30 p. m., except for a half-holiday on Saturday. Upon the satisfactory completion of the full course the graduate will receive a certificate to that effect.

The subjects of study include salesmanship, rates for lighting and motor service, electricity in residences and theaters and on the farm, electric motors and factory lighting, signs and decorative lighting, lamps, electrical construction, electricity for stores, accounting and metering, generating and distribution, and isolated plants.

Among the lecturers will be Messrs. W. L. Abbott, P. P. Bird, O. J. Bushnell, W. A. Durgin, John W. Ferguson, H. B. Gear, John F. Gilchrist, M. S. Hart, O. R. Hogue, Dana, H. Howard, George B. Johnson, George Harvey Jones, P. Junkersfeld, E. W. Lloyd, W. D. McJunkin, J. C. Manley, H. I. Markham, W. J. Norton, C. W. Pen Dell and E. O. Schweitzer. Mr. H. L. Lincoln has been engaged as general instructor.

## Electric-Vehicle Prospects in Chicago

Lunching together informally, members of the Chicago Section of the Electric Vehicle Association discussed matters of common interest at the meeting of Feb. 4. Mr. George Harvey Jones, chairman of the section, who recently returned from the Pacific Coast, gave a short account of his observations in California. He said that in Los Angeles a large number of electric passenger cars are in use but not many electric trucks. There would seem to be an opportunity in that city for the use of a much greater number of electric commercial vehicles. Mr. D. C. Arlington, the statistician of the Chicago Section, announced that there are 531 electric commercial vehicles in service or on order in Chicago. Mr. H. E. Niesz told of the location of a new, exclusively electric garage, of which Mr. J. J. O'Brien is proprietor, at 4167 Emerald Avenue. This garage is, perhaps, the first exclusively electric garage to be opened in the industrial region known as the "Stockyards district." It is supplied with electric energy by the Cosmopolitan Electric Company and makes a flat rate of \$20 a month for the storage, washing and minor repairs of commercial vehicles. To this is added a charge for electricity figured at 4.5 cents per kw-hr. for the first 300 hours and 4 cents an hour for all subsequent energy consumption during the month. It is believed that this combined rate will make the garage cost of maintaining an average electric truck about \$40 or \$45 a month.

Mr. James H. Delany, of the Cosmopolitan company, pointed out that there is a great opportunity for extending the use of electric commercial vehicles in the industrial district near the Union Stockyards. The existence of the new garage should make it easier for manufacturers of and dealers in electric trucks to sell their vehicles in the Stockyards district. A discussion followed.

## Public Service Electric Company's Educational Campaign

At the regular weekly meeting of the employees' industrial school of the Public Service Electric Company of New Jersey, Jersey City, Feb. 7, Prof. T. Gilbert McFadden, dean of the electrical course in the Industrial and Technical High School of Hudson County, discussed the fundamental physics of electrical generation, supplementing his lecture with laboratory experiments demonstrating the theories of which he spoke. The lecture was illustrated with numerous diagrams and was delivered in non-technical language.

This address was the initial expression of the co-operation which the educational committee of the Public Service

Electric Company has been able to secure from the Hudson County Board of Education. The meeting was, however, the third of a series dealing with subjects pertaining to the generation of gas and electricity and the commercial uses of these two commodities.

Many central-station companies are spending no inconsiderable amount of time and money in educating their salesmen to become more efficient. The Public Service Electric Company has elaborated on this system and extended it to include all the employees of its offices. The men of the accounting and collection departments come into more intimate contact with the public than the men in any other branch of the company's business. It has been the aim of the management to secure the closer co-operation of these men and to show them the adaptations and applications of electricity so that they may act as missionaries to the public with which they deal.

The success with which this plan has been attended is illustrated in point by the fact that at the close of the last meeting two men from the accounting department and one collector presented Mr. T. F. Bludworth, who was presiding at the meeting, with the addresses of prospective customers for an electric washing machine, a coffee percolator and a flatiron.

In addition to providing weekly instruction for the employees, the company is conducting a boys' class in electricity at night school. To this class is eligible one pupil from each school in Hudson County in which a course in physics is available, and it is declared that these future electrical engineers are the best emissaries the central station has yet been able to acquire.

### Additional Water-Power for Minneapolis and St. Paul

Active construction work has been commenced on the Coon Creek Rapids development in the Mississippi River, 11 miles northeast of Minneapolis, where a 12,000-hp plant is to be erected by H. M. Bylesby & Company, to furnish additional power to their Minneapolis and St. Paul properties. The dam is being built under a fifty-year permit granted by the United States government, which requires that the army engineers supervise the design, construction and operation of the development.

The dam will consist of an earth embankment with core walls 600 ft. long, power house and retaining section 470 ft. long, including sluice-gates, log chute and fishway, and spillway section 1000 ft. long, making the total length of the structure 2070 ft. This work will involve 20,000 cu. ft. of earth embankment and approximately 45,000 cu. yd. of steel-reinforced concrete.

To secure a suitable and safe foundation, 8000 round wooden piles will be driven down to firm foundation. About 1000 tons of interlocking sheet-steel piling will also be used in lieu of a cut-off wall for retention of water in the reservoir and prevention of under-cutting of the dam. In order to provide for the greatest possible head at all stages of river flow, at the same time preventing excessive flood heights, Tainter gates are to be used for regulating the water level in the reservoir. Twenty-eight of these 33-ft. steel gates, each weighing 12,000 lb., will be erected between reinforced-concrete piers built on the spillway portion of the dam. The fishway, designed in accordance with government requirements, will provide for the free passage of fish up and down stream, and the log sluice will afford a convenient means of passing logs by the dam.

The first installation in the power house will aggregate 12,000 hp, transmitting to Minneapolis at 13,300 volts, thus tying in directly without transformers with the general distribution system of the Minneapolis General Electric Company at its Riverside steam plant. The transmission line to Minneapolis will be erected for part of the distance

on private right-of-way and partly alongside the new tracks of the Minneapolis & Northern Railroad.

Within the last three weeks a construction camp has been established at Coon Creek Rapids, accommodation for 400 men being provided. This will be increased later so as to provide for 800 to 1000 men during the spring and summer months. The camp is equipped with its own water supply and sewage system. Following modern methods, a hospital, with a surgeon, trained nurses and attendants, will be available during construction. Matters of water supply, sanitation and policing of the camp will be handled in the same way as if for a modern city. The camp will be lighted by electricity throughout, energy being supplied by the Minneapolis company. Electricity will also be used for driving a considerable portion of the construction plant.

During the construction of the dam there will be distributed for labor and commissary supplies approximately \$600,000. The housing and feeding of the men employed on the construction are in themselves an enormous undertaking, in view of the short time allotted for this work and the relatively short period that the camp will be in operation.

### Power Negotiations at Westfield, Mass.

Negotiations have been continued between the Amherst Power Company and the Westfield (Mass.) board of electric light commissioners in connection with the proposed supply of electricity to the town from the company's hydro-electric system and the shutting down of the existing municipal steam plant as a regular source of electrical service. A new proposition has been made by the company which will enable the town to lay aside \$5,500 per year for depreciation and an additional \$6,000 as profit, if the present plant is shut down, upon the basis of a ten-year contract, giving the municipality an annual saving of \$11,500 over the present cost of serving the public. The company also proposes to keep the existing steam plant of the town in repair and in running order during the decade, with the privilege of operating it as an auxiliary in case of necessity, all operating costs to be paid by the company. It also agrees to give notice at the end of eight years of the schedule of prices proposed for the following decade. The company is prepared to begin service to Westfield by Sept. 1, in case of a favorable decision by the municipal lighting board, and if the proposition is accepted a transmission line will be built through the Westfield Valley to enable the delivery of energy to be made from a central distributing point.

### Extensions to New Haven Single-Phase System

In the accompanying table is shown the increase in single-phase electrification of the New York, New Haven & Hartford Railroad from the beginning of operation in 1907 up to the present date.

NEW YORK, NEW HAVEN & HARTFORD RAILROAD ELECTRIFICATION

Track electrified, miles	111
Power house, hp	1,000
Number of electric locomotives	10
Horse power of electric locomotives	1,000
Electric locomotive mileage	1,000

The recent decision to electrify the division between Boston and Providence will add about 200 miles of track electrification, the proposed territory being a four-track route between Boston and Providence, inclusive of the yards and



sidings necessary to electric movement. The engineering plans for application of the single phase to this territory are practically complete, the actual work of construction being held in abeyance only until indorsement of necessary appropriations to cover the cost.

The New York, New Haven & Hartford Railroad engineering specification for the electrification of the Boston metropolitan district, comprising over 400 miles, is based upon single-phase operation. In addition to the large extensions of the original single-phase electrification of the New Haven system that have been made, others are now in progress, including:

(1) The six-track main-line Harlem River branch, with sidings and yards.

(2) New York, Westchester & Boston two-track and four-track, with sidings and yards.

(3) The extension of the four-track main line to New Haven, with sidings and yards.

(4) Four-track section, Boston-Providence.

All of the above cover passenger, freight and switch operation. The original electrified track mileage of the New Haven system was 114. When the above extensions are completed the total electrified track mileage will be 750.

### Power Development for Montpelier District

The Consolidated Lighting Company, of Montpelier, Vt., one of the Tenney companies, has purchased the Molly Falls Light & Power Company, of Marshfield, Vt., and also water rights at Lamberton Mills and Peacham Pond. The Consolidated company is planning to develop about 3000 hp at Molly Falls by raising the level of Peacham Pond about 8 ft., increasing the area by about 100 acres and storing in the basin the flood waters of the spring. The plans include the building of a power house on the site of the present smaller station at Molly Falls and the installation of a pipe line 1.5 miles long to the Lamberton mill, where the existing dam will be rebuilt and the storage capacity increased as outlined above. The power will be utilized in the Barre and Montpelier district in connection with that furnished by the other plants of the company. The headquarters of the Tenney companies are at Boston.

### Technical Aid for Judges in Trial of Patent Cases

Clause 79 of the new rules of practice for the courts of equity of the United States, which became effective on Feb. 1, provides that with the concurrence of a majority of the circuit judges for the circuit the district courts may make any other and further rules which do not conflict with those already promulgated by the Supreme Court. Under this authority a number of new rules have been drawn up, one of which provides for the position of "assessor" in patent cases, following the German practice. This new rule is as follows:

"In the trial of a patent cause, whenever in the opinion of the court that cause involves intricate technical or scientific questions of fact, the court will, upon the consent of all parties, appoint some disinterested person skilled in the art to act as assessor, the reasonable fee for whose services shall be a part of the taxable disbursements and enforceable as is a master's fee. Such assessor shall sit with the judge at the hearing of the evidence and shall assist the court in its deliberations upon the cause in such manner as the trial judge may request, and any written opinion rendered by the assessor at the request of the judge shall be a portion of the record on appeal."

It is said that the creation of this new position was foreshadowed in a decision by Judge Hand (*Electrical World*, Oct. 28, 1911, page 1081). The advantages of this plan are obvious and its workings will be followed with interest.

### Dissolution of Monopoly in Unpatented Articles

On Feb. 7 an agreed decree was entered by Federal Judge Tuttle at Detroit, Mich., dissolving the so-called boot and shoe last trust, composed of the Krentler-Arnold Hinge Last Company and numerous other last manufacturers with whom it was allied by agreements. It was charged in the government suit against the Krentler-Arnold company that it controlled 75 to 80 per cent of the boot and shoe last business and dominated the entire interstate commerce therein, in violation of law. Instead of manufacturing its patented lasts exclusively, the company issued license agreements to other manufacturers, under which the latter, it is said, agreed to maintain a stipulated schedule of prices.

The purpose of these agreements, it was charged, was to fix arbitrarily and unfairly high prices on both patented and unpatented lasts, the latter forming about 50 per cent of the business. Prices were fixed and unreasonable profits obtained, it was declared, through an organization known as the Cary Club, composed almost exclusively of licensees of the Krentler-Arnold Hinge Last Company.

By the agreed decree, in which the defendants disclaim all intention of violating the Sherman law, they are restrained from continuing the alleged unlawful features of their agreements and from further maintaining the Cary Club.

The decree, in effect, lays down the principle that it is unlawful to tie together patented and unpatented articles so as to fix the price of the unpatented commodity. Neither the government's petition nor the decree questions the right of a patentee to fix the price of a patented last. The government's petition was signed by Attorney-General Wickersham, Mr. James A. Fowler, assistant to the Attorney-General, and Mr. Malcolm A. Coles, special assistant.

### Status of Niagara Falls and Connecticut River Bills

The Connecticut River dam bill and the committee on foreign affairs' bill on the control of the waters above Niagara Falls are still awaiting action in Washington, with the probability that both will be voted on this week or early next week. Considerable opposition to both bills has developed, although provision has been made whereby the state governments will regulate the companies affected as to rates, service, etc. The principal opposition to the Connecticut River dam bill appears to be from the far Western States, especially on the provision enabling the government to impose charges on the grantee.

One section of the Niagara Falls bill stipulates that the water must be used to its full or proper standard of efficiency and that if it is not so used the Secretary of War may revoke the permit after giving five years' notice to the company holding the permit. The Niagara Falls Power Company and the Hydraulic Power Company, the two companies involved, both take water above the falls and discharge it at about the same point below the falls. The former generates 11 hp per cubic foot of water per second used and the latter generates 18 hp per cubic foot of water per second used. The Niagara Falls Power Company is the pioneer company and discharges its water through a long tunnel passing under the city and emerging at a point under the passenger bridge spanning the gorge. The Hydraulic Power Company takes water through a canal and simply drops it over the brink below the bridge mentioned to the power house below. Its equipment is newer than that of the Niagara Falls Power Company and its head greater, and if the performance of its equipment is chosen as standard and the provisions of the proposed bill are enforced, it will virtually require the rebuilding of the stations of the Niagara Falls Power Company. It is probable, however, that any attempt to enforce the standard will involve extensive litigation.



### Governor Ammons on Colorado's Water-Powers

An attendance of 220 marked the Feb. 6 luncheon of the Colorado Electric Club, when the Hon. E. M. Ammons, Governor of the State, addressed the club on the subject of "The Electrical Development of Colorado." Referring to the undeveloped natural resources in metal mines and agriculture, the speaker urged the need for better utilizing the waters of the State, both in the mountain streams for power purposes and by the electric pumping of wells for irrigation. Such pumping, declared the Governor, often proves to be cheaper than gravity irrigation with long ditches and shallow storages, on account of the latter's limited usefulness and large losses by seepage and evaporation. Governor Ammons assailed the position of the federal government in exacting royalty for the use of state waters because they originate partly on government land. This policy, he declared, discriminates against Colorado by denying it ready development of its resources, although Eastern States have in the past been allowed the greatest freedom. The speaker praised the work of Mr. D. C. Beaman toward a solution of the water-power conservation problem for Colorado's benefit and urged state control of water-power rights.

### Government Suit Against Trade Monopoly

The federal Department of Justice filed its third anti-trust suit against the United Shoe Machinery Company at Trenton, N. J., on Feb. 8, alleging monopoly and unfair trade tactics toward the Keighley company. The government's bill asked for the termination of the contract under which the Keighley company gave the United company the exclusive right to lease to shoe manufacturers the in-seam trimming machine, the patent for which the Keighley company holds. A number of individual defendants are also named in the complaint. The government severely arraigned the \$25,000,000 United company and charged that it controls more than 99 per cent of the trade. It is alleged, among other things, to have discontinued the sale of all important shoe machinery and put into effect unreasonable and oppressive licenses and restrictions, which shoe manufacturers are compelled to accept in order to do business at all. The company is also accused of acquiring and suppressing valuable patents, and persons assigning patents to the "trust" are said to have been required to agree to transfer for a specified time all their future patents for or inventions of shoe machinery.

There is pending at Boston a civil suit for the dissolution of the shoe machinery company, and one count of indictments returned against its officers for the alleged violation of the Sherman law. The United States Supreme Court recently dismissed other indictments filed against the same defendants.

### Nebraska Investigates State Development of Water-Powers

The disposition of 250,000 hydroelectric hp, the possible development of the streams of eastern Nebraska, hangs on the result of an investigation which is now being made by the Nebraska Legislature into the feasibility of a plan by which the State will issue bonds, develop the power and sell the energy to the cities of Omaha, Lincoln, Sioux City and other places along the Missouri River. Under existing laws the Commonwealth has no authority to enter upon this field of work, but advocates of state ownership are urging that the Legislature enact the necessary laws and undertake the development. A bill with that aim in view has been introduced in the Legislature, and a committee is now engaged in making the investigation.

Nebraska does not produce a pound of coal or a gallon of oil, and the development of its water-powers is of vital

interest. There is a fall of some 5000 ft. between its western and eastern boundary, and its big rivers are capable of developing large quantities of electricity. Kountze Brothers, bankers, of New York, the Moore syndicate of Detroit and the Babcock-Doherty interests have grants for developing more than 100,000 hp on the Platte River, and the sites are all within transmitting distance of Omaha. Governor Aldrich, however, is opposed to state development, and Prof. G. E. Condra, director of the state conservation work, agrees with him. According to Prof. Condra, the State should grant the power sites to private parties, but should retain supervision over the development. He says that this is the best practical means of securing development without exploitation and sacrifice of the public interest.

### Governor Foss to Fight for Utility Legislation in Massachusetts

In an interview with the press on Feb. 8, Governor Foss of Massachusetts expressed his intention of keeping up the fight with the Legislature over the utilities legislation as long as the issue remains. He is opposed to the bill transferring the control of telephone and telegraph companies to the gas and electric light commission and is not enthusiastic over the proposal to investigate the telephone situation by a special commission, on the ground that it would postpone action on the utilities legislation. The Governor insists that what is needed is a single board to supervise all the public-service corporations; uniformity in carrying out the policy of regulating quasi-public corporations is what he seeks. He said that both the railroad commission and the gas and electric light commission have done excellent work; that the trouble is not with the commissions but with the system, which requires the attention of commissioners to routine work that might be done by subordinates. With all matters grouped under a single commission, the board could give its attention to matters of policy, allowing subordinates to carry out its decisions. The commission should, of course, have the machinery to get at the facts, but in the opinion of the Governor, it should sit in a judicial capacity and pass on the facts laid before it.

### Louisville Merger Interrupted by Gas Disagreement

Although the recent termination of negotiations between H. M. Bylesby & Company of Chicago and Mayor William O. Head of Louisville, Ky., looking toward a merger of the electric and gas companies in Louisville under Bylesby management is said to have placed a quietus upon the project for some time to come, many persons who are thoroughly conversant with the existing state of affairs in the Gateway City insist that the negotiations would not have gone so far as they did only to be stopped completely by disagreement. It is declared that resumption of the matter may be expected in the immediate future and that the Bylesby merger is even now as certain to go through as it apparently was during the most favorable moments of the conference.

The understanding throughout the negotiations was that the city of Louisville would withdraw its opposition to the consolidation and consequent elimination of utility companies in Louisville if the Bylesby interests would supply 35-cent gas from the West Virginia fields of the Chesapeake & Ohio Oil Company according to a tentative offer made by the Chicago capitalists. Mayor Head objected, however, to 50-cent service charges, deposits to guarantee the payment of bills, charges of a dollar for connecting a meter, and other considerations requested by the Bylesby interests in applying for a gas franchise. It is now declared that the merger may be considered unlikely for the remainder of the present administration, or until next November.

## Rules of Electric Service in Wisconsin

At the annual meeting of the Wisconsin Electrical Association recently held in Milwaukee, as noted in the *Electrical World* of Jan. 25, 1913, a paper was presented by Mr. J. N. Cadby, of the engineering staff of the Railroad Commission, entitled "The Proposed Revision of Standards of Electric Service Now Under Consideration by the Railroad Commission of Wisconsin."

Tentative rules for electric service in Wisconsin have been prepared by the commission, modifying existing rules and adding new ones. These rules were explained by the speaker. They relate chiefly to electricity meters and meter testing, although interruptions to service, voltage fluctuation, compulsory inspection of consumers' lamps, recommendation to customers of the most efficient illuminating service, and manner of making bills, are also included in the proposed new standards.

Mr. Cadby said that the fact that three fatal accidents during the year 1912 were due to contact with guy wires may have had some influence in inducing the commission to propose revised standards. The present standards of service have been in use five years. A few requests have been received for exemption from the rules, principally from small companies, some having only twenty or thirty customers. One of the proposed rules requires meter records only from utilities having more than 250 electricity meters. It is also proposed to lengthen the interval between tests for some classes of service. The speaker remarked that practically half of the meters tested by the commission were large instruments in theaters, mines and factories.

Mr. F. A. Vaughn, of Milwaukee, opened the discussion. He spoke as a member of the meter committee of the National Electric Light Association, advocating co-operation between the different societies in the electrical field and between them and the public-service commission. He told of the work of the N. E. L. A. committee, of its "Metermen's Handbook" and the "Code for Electricity Meters," produced jointly by the N. E. L. A. and the Edison Association. He read comments made by the meter committee of the N. E. L. A. on the tentative rules of the Railroad Commission of Wisconsin. That committee deprecates discrimination between large and small companies.

Rule 24 of the proposed list received considerable attention. It provides that utilities shall inspect in a general way customers' incandescent-lamp installations at least once in two years and give customers reasonable assistance in securing incandescent lamps best adapted to the service furnished. Mr. Vaughn, for the N. E. L. A. meter committee, said that such a rule might involve serious complications unless liberally interpreted. Nevertheless, something of the kind might be accomplished. Speaking personally, Mr. Vaughn urged co-operation with the Illuminating Engineering Society and commended the illuminating primer.

Mr. Wheeler, of Eau Claire, doubted the practicability of Rule 24. Mr. Cadby said that the company's representatives might put stickers on blackened lamps. Customers' lamps might be inspected when the meter is tested. Mr. Winslow said that there is a distinction between the company's offering its services and its compelling the customer to accept its lamp inspection. The rule might be modified so that the inspection would not be compulsory. Mr. M. C. Ewing, of Wausau, thought the inspection should extend to motors and perhaps heating appliances as well as to lamps. The inspector should have some knowledge of illuminating engineering and make a report to his company, this report, in substance, to be transmitted to the customer. Mr. Pamperin thought such a plan would not be feasible for small companies. He also pointed out that the inspection idea dated back to carbon-lamp days and lost much of its force in connection with tungsten-lamp installations. Mr. Korst objected to too much paternalism and said that in any event the company should be obliged to make inspection only where it furnished the lamps.

Rule 21, as proposed, elicited some discussion. It provides for a "referee test" of a consumer's meter by the commission on formal application. Mr. Korst said that the complainant should seek redress from the company first. Mr. Cadby said that as a matter of fact the commission was not asked to make many referee tests. But when application was made to it the consumer would have more confidence in the commission, perhaps, than in the company. Referring again to Rule 24, Mr. Cadby said that perhaps the lamp inspection could be done by solicitors, and that this would create a good impression in the mind of the consumer.

## Tariff Hearings on Schedules B and C

The last two issues have contained accounts of the tariff hearings before the ways and means committee of the House of Representatives which had a bearing on the electrical industry. Other features of electrical interest in connection with the hearings are given in the following columns.

### ARC LAMP CARBONS

Among others, Mr. Hugo Reisinger, of New York, testified on the subject of electric-light carbons. Mr. Reisinger said that the National Carbon Company, by procuring from the Fifty-ninth Congress a practically prohibitory duty on electric-light carbons, battery carbons and brushes, had been able to prevent the importation of low-grade carbons entirely and to control 80 per cent of the output of high-grade carbons, composed chiefly of lampblack or retort carbon. Mr. Reisinger then referred to the hearings in 1908, and said it was not disputed that the carbon business was in the hands of a trust. He also claimed that the National company is making excessive profits, on an inflated capitalization. Under the Dingley tariff the duty was 90 cents per 100 carbons, but this was changed to 65 cents per 100 ft. by the Payne-Aldrich tariff, which, the witness said, was really an increase, because under the former tariff the carbons were 2 ft. to 3 ft. in length. The low grade of carbons, made entirely from petroleum coke, on which the duty is 35 cents per 100 ft., cannot be imported at all, even on the free list, owing to cheaper production in this country. The witness asked that the duty be lowered from 65 cents to 20 cents per 100 ft., equivalent, he said, to about 25 per cent ad valorem. The present rate for carbon electrodes, brushes, plates and disks is 30 per cent ad valorem, and for carbon not specifically provided for, 20 per cent. Mr. Reisinger explained, under cross-examination, that he imports carbons from C. Conradt, of Nuremberg, Germany. There is no trust over there, he stated, but four large competitors, and there is some competition in France also. Domestic carbons for inclosed-arc lamps, the witness said, are sold by the trust at \$18 to \$24 per 1000, but cost only \$7 to \$9, compared with imported carbons at \$10 to \$14 f.o.b. at a European port. In the case of carbons for flaming-arc lamps, 24-in. lengths cost from \$30 to \$40 per 1000 f.o.b. European port, with a duty of \$13 additional; such carbons last but seventeen hours in service, while the duty alone amounts to 2.6 cents per trim.

The Rock Island Battery Company of Cincinnati, through its president, Mr. M. S. Rosenthal, filed a statement asking that crude retort carbon, ground or unground, only 15 per cent or 20 per cent of which is produced at home, be placed on the free list. Domestic production of coal-gas retort carbon is said to be very limited.

President Otto Koch of the Corliss Carbon Company of Bradford, Pa., an independent concern, filed a statement saying that for two years his company had been making carbon brushes exclusively, using petroleum coke, a by-product from near-by oil refineries. Three years ago this product was a drug on the market, together with fuel oil,



another by-product, which then sold for 2 cents per gallon. No profits have yet been realized from the carbon-brush business, and the company finds itself in competition with imported brushes; therefore no reduction in the tariff, in its opinion, should be made and an increase is really warranted.

The National Carbon Company of Cleveland, Ohio, filed an extensive statement, signed by President James Parmelee and General Manager J. S. Crider. Since the last tariff law the advent of a long-burning flaming-arc lamp, using electrodes composed of carbon and other chemicals, has changed the situation. The annual consumption of high-grade carbons is about 40,000,000 pieces, of which the company supplies about half, the remainder coming from Germany and France. These are composed chiefly of lamp-black. Its sales from Jan. 1, 1910 to Oct. 31, 1912, were \$1,551,932, and the net profit, after charging off depreciation at 5 per cent on buildings and 10 per cent on machinery and tools, was \$92,638. In 1909, prior to the present law, the average selling price of 1/2-in. by 12-in. carbons for inclosed lamps, which constitute over half the consumption, was about \$23 per 1000, but the average to-day is about \$18.25. Carbons made wholly from petroleum coke are becoming more scarce, since the raw product is less plentiful at home and lampblack is probably cheaper abroad than coke. Any reduction in the tariff was opposed, and a maximum cut of 5 cents per 100 ft. was considered the most that the business can stand. The price of petroleum coke carbons in packages of 1000 ranges from \$8.50 to \$11.50 per 1000 ft. and for lampblack carbons from \$15 to \$25.

For many years carbons were made as pure as possible and contained less than one-fourth of 1 per cent of ash. But the flaming-arc lamp, in which the luminous source is primarily the arc itself, instead of the incandescent electrodes, requires electrodes containing chemicals either in the soft core in the center, in the shell or outside of it. Because of the wide range of shapes, weights and grades the prices range from \$30 to \$160 per 1000 ft. The present duty on lampblack is 25 per cent and on retort carbon 20 per cent, while on some of the ingredient chemicals it is as high as 45 per cent. The following changes were suggested in paragraphs 95 and 96 of the present law:

"95. Beginning with the word 'carbon' strike out balance of paragraph and insert the following:

"Unmanufactured carbon, not specially provided for in this section, 20 per cent ad valorem; electrodes for electric furnace, electrolytic and battery purposes, brushes, plates and disks, all of the foregoing composed wholly or in chief value of carbon, 35 per cent ad valorem; if metal plated or having metal attachments, 45 per cent ad valorem."

"96. After the words '65 cents per 100 ft.,' and before the words 'fiber tubes,' insert the following:

"Flaming or luminous arc lamp carbons or arc-lamp electrodes having flame-producing chemicals in the core, on the surface, or mixed homogeneously into the body thereof, or manufactured in such manner that the weight of any materials other than carbon is more than 5 per cent of the total weight, 45 per cent ad valorem."

In reply to Mr. Reisinger's testimony the company stated that it makes a complete line of carbon products, including electric-light carbons, flaming-arc carbons, carbon brushes, carbon electrodes, carbon specialties and wet and dry batteries, but alleged that it had less than 50 per cent of the business including petroleum coke carbons, high-grade carbons, flaming-arc carbons, carbon brushes, electrodes and batteries. Twelve alleged competitors in carbon products in this country were named. The National company said that while dry batteries constitute about 60 per cent of its annual sales, it supplies not over 40 per cent of the batteries used. It also named seven leading competitors in the dry-battery business. In addition to Mr. Reisinger, the company named six importers of carbon products. The cost of high-grade carbons for inclosed lamps, said the

company in closing, has greatly decreased since it entered the field, and now does not exceed, for the variety chiefly used in street lighting, 75 cents per lamp per year.

#### ALUMINUM

Asking that aluminum be placed on the free list, Mr. J. P. Bartlett filed a short brief. The aluminum industry was declared to be in the hands practically of one concern, the Aluminum Company of America, which controls substantially all the sources of aluminum in the country. The company was also charged with oppressive commercial methods and practices, as evidenced by the suit filed against it by the federal government and the decree entered. The following statement was offered in reference to the Aluminum Company of America's capitalization and profits:

"That company, starting with a capital of \$20,000, increased it to \$1,000,000, of which, according to said petition, an additional \$10,000 was paid for in cash, \$250,000 was to be paid as called for, and \$720,000 was estimated value of certain patents, and that its estimated assets were \$27,000,000, representing (with a possible exception of \$1,000,000) earnings, and including a stock dividend of 500 per cent, or \$16,000,000, declared Dec. 15, 1909, besides cash dividends often declared, those in 1910 admittedly being 17 per cent on said \$27,000,000."

The company, through its subsidiaries, is said to be also the largest consumer of aluminum, discriminating in favor of its own users against outside purchasers. Large bauxite deposits, the chief raw material in aluminum production, exist abroad and large manufacturers of aluminum in bulk are also situated there. By placing aluminum on the free list a large stimulus will be given to the manufacture of aluminum products at home.

The Aluminum Company of America filed a somewhat extended statement in defense of its operations and the present duty of 7 cents per pound. The mineral bauxite is found in Arkansas, Georgia, Alabama and Tennessee. It requires 6 tons each of bauxite, coal and limestone to make 2 tons of alumina, from which 1 ton of aluminum is made. Alumina is made at East St. Louis, Ill., the point of minimum freight haul for the raw materials. Carbon made from petroleum coke is another important raw material employed. Next to labor, electrical energy is the chief requirement in making aluminum, and the company has large electric smelting plants on the Niagara and St. Lawrence Rivers and is commencing another plant on the Little Tennessee River.

The reduction process is slow and complicated and requires a large investment. While bauxite is plentiful and has a market value of \$5 per ton, aluminum in the form of ingot, sheet or wire has a market value of \$400 per ton, owing to labor requirements and the large investment, which amounts to \$1,500 per ton of product turned out annually. Even the interest amounts to 4 1/2 cents per pound. Petroleum coke is worth about \$5 per ton, but the finished carbons cost about \$50 per ton. The smelting process is continuous, requiring three daily shifts. Domestic labor is considerably more expensive than the labor obtainable abroad. Freight hauls on raw materials are also much longer in this country than abroad.

Outside of the United States there are fourteen companies manufacturing aluminum, with a total output of 100,000,000 lb. per annum, although the foreign consumption in 1911 was but 25 per cent of output. Exports to this country have been as follows: 1908, 1,300,000 lb.; 1909, 5,140,000 lb.; 1910, 12,340,000 lb.; 1911, 7,690,000 lb.; 1912, at rate of 18,750,000 lb.

There have been suggestions of aluminum produced at home, but there have been no exports at present or completely fabricated products made from imported ingots. The company asked that the present duty be retained. It also stated that it is not a merger or combination, but has built up its own property and business.



## MICA

A statement by Mr. W. V. Brown of Asheville, N. C., on behalf of the Asheville Mica Company, was placed in the record. The statement included extended testimony presented before the Senate finance committee in April, 1909, on the conditions in the mica industry. At present mica is on a specific basis of 5 and 10 cents per lb. and 20 per cent ad valorem. The importers, it is expected, will ask for a substantial reduction on pure mica, leaving built-up mica as it is.

Production of mica in the Asheville region has gradually increased, while the 1912 production for the whole country will show an increase over 1911 of possibly 25 per cent. The imported competitive mica comes practically all of it from India, where labor is very cheap.

In respect to changes in wording of the tariff law, the statement said it ought to be clear that cut or closely trimmed mica should pay about twice the specific duty that uncut or roughly trimmed mica pays. Very little built-up mica is imported, but if not protected by a tariff equal to the difference between domestic and foreign labor, the domestic industry, declared the statement, would suffer. The 20 per cent reduction made two years ago was declared to be the maximum cut that can be justified, and it was asked that present duties be left unchanged. The comparison in the accompanying table was offered between production costs at home and in India, on a pound basis.

COMPARATIVE DATA ON PRODUCTION OF MICA

	United States	India
Cost of mining	\$0.12	\$0.024
Waste in preparation	0.30	0.060
Labor	0.12	0.025
Total	\$0.54	\$0.109

The average value of imported mica in 1907 was 37 cents per lb. plus a duty of 14 cents, making a total of 51 cents. This refers to the Muscovite species, which is superior to the phlogopite species or Canadian amber.

## FERROALLOYS

Extended testimony on the subject of ferroalloys and their protection by tariff duties was given by Mr. A. C. Morrison, of New York City. The speaker first asserted that there is no freight protection, even on the heaviest products, since a shipment can be made from Europe to our own interior at less than the rail rate from the port of entry to destination. The opening of the Panama Canal will make the situation still more serious, said Mr. Morrison.

The introduction of the electric furnace has revolutionized metallurgical processes and raised the temperature limit from 3500 deg. Fahr. to nearly 7000 deg. Fahr., making possible many new processes. A single electric furnace will sometimes consume electric energy at the rate of 12,000 hp over long periods, and hence it is imperative to be near a source of cheap hydroelectric energy. The water-powers of Europe are responsible for active foreign competition in this field.

Great emphasis was placed on the low cost per horse-power of hydroelectric development in Norway, because of the high heads and even stream flow. Energy is being delivered at the furnace busbars in Norway for \$5 to \$8 per hp-year, compared with \$16 to \$18 at Niagara Falls under old contracts and recent quotations of \$20 to \$24 both at the Falls and in the South and West. The ferroalloys, produced in electric furnaces, are combinations of rare metals with iron, such as electrosilicon, ferrochrome, ferrotungsten and ferrotitanium, and are used in very small quantities to impart special properties to steel. In 1907 ferrosilicon was,

\$107 per ton, but foreign competition, said the witness, forced the price down to \$60, while the present market price is about \$70. Mr. Morrison said his interests owned their own water-power at Niagara but purchased it at Kanawha.

An exhaustive brief was next filed with the committee by Mr. E. F. Price, of the Electro-Metallurgical Company, with works at Niagara Falls, Kanawha Falls, W. Va., and Holcomb Rock, Va. It was strongly recommended that the present duties be left unchanged, and in the event of a tariff for revenue 25 per cent ad valorem was asked. A separate paragraph for electric-furnace ferroalloys was also requested.

## Public Service Commission News

## CALIFORNIA COMMISSION

A decision has been rendered on the application of various public utilities for permission to charge less than the published schedule of rates in certain classes of cases. The commission permits deviations for federal and state governments and the political subdivisions thereof, including public institutions; fairs and other public expositions and celebrations; charity as defined in the opinion in this case, and employees.

The commission has rendered a decision providing that a physical connection shall be established between telephone exchanges of unrelated companies in the northern part of the State. The case was brought about upon complaint of the Tehama County Telephone Company and the Glenn County Telephone Company, which alleged a refusal by the Pacific Telephone & Telegraph Company to afford the desired connection for long-distance service. The commission decided that public convenience required that the physical connections should be made, and it put the expense of such connection on the Tehama County Company and the Glenn County Company. It stated that the rates should be the same as are now in force in long-distance service. The commission further ordered that the telephone companies should arrange for a just division among themselves of the rates, tolls and charges, and in case they are unable to reach an agreement on these points the commission will fix such division as it believes to be just.

## MASSACHUSETTS COMMISSION

In a recent finding reducing the price of gas sold by the Attleboro Gas Light Company from \$1.10 to \$1 per 1000 cu. ft. the Massachusetts Gas and Electric Light Commission rules that the consumer shares an equity in the accumulated surplus, and presents one of the first discussions of the subject, and perhaps the most important, in the history of public-utility regulation. The board says: "Where in a brief term of years a large percentage of the plant investment appears to have been procured out of profits, or exceptionally large dividends have been declared, a suspicion naturally exists that prices have been unreasonably high, and a belief arises that the consumer has therefore acquired some equitable interest in such surplus. Where a company performs a public service with a proper conception of its public duty, surpluses of this character are not likely to develop. While such surpluses may be due in part to skill in management, they often are due in part to the general growth and prosperity of the community. Such is the case with the Attleboro company."

The board points out that there is a growing recognition that a public-service company is not entitled to a return upon the unearned increment in value of its real estate and that investment out of profits resulting from the growth of the community has similar attributes. "It is difficult," says the board, "to see why the reasonable amount or rate of return based upon the full value of a company's property should not be affected in the same manner by that portion of the investment made from what

may be termed the unearned increment in its profits as by the unearned increment of value in its real estate; in other words, the reasonable rate of return upon a company's entire investment is lower where an appreciable part is derived from the two sources described than where it is entirely derived from the contributions of the shareholders in their payments for its stock." The company's contention that 4 per cent depreciation allowance should be made is not sustained by the board. In view of the well-known long life of cast-iron mains, there seems to be a general consensus of engineering opinion that where such mains are kept in proper repair a depreciation allowance of less than 4 per cent is ample for that part of the company's plant. Liberal provision for renewal of meters condemned or otherwise lost, as well as ordinary repairs, has been provided through operating costs. The price fixed, \$1 per 1000 cu. ft., is the lowest thus far set by the board for an output of such moderate size.

## Current News and Notes

**ALTERNATOR FOR WIRELESS STATION.**—Through an error in transcription there appears on page 145 of our issue dated Jan. 18 the statement that a 200-hp Westinghouse synchronous motor is used for driving a 220-volt, 500-cycle Westinghouse alternator at the Fort Myer (Va.) wireless telegraph station. Although the former is a Westinghouse machine, as stated, the latter is of General Electric manufacture.

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**SUGGESTED TRANSPORTATION OF SOFT COAL THROUGH PIPES.**—It has been proposed to pump a mixture of bituminous coal and water through pipes from the Illinois coal fields to Chicago to effect an economy over railroad carriage. Engineers have reported that such a plan might be feasible, but whether it would be practicable financially and industrially is another question. The project does not appear to have advanced beyond the stage of discussion.

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**PROPOSED MERGER OF MUNICIPAL CORPORATIONS HELD TO BE UNCONSTITUTIONAL.**—In response to a resolution introduced into the City Council of Chicago proposing the merger of the city of Chicago and the Sanitary District of Chicago, the corporation counsel of the city has prepared an opinion in which he holds that such a merger of two municipal corporations would be unconstitutional, as in effect granting to the city of Chicago special privileges not enjoyed by other cities in the State. The Sanitary District operates the Chicago Drainage Canal, including a 28,000-kw hydroelectric development.

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**ELECTRIC LOCOMOTIVE HEADLAMPS.**—Electric headlamps may be required on the locomotives of all railroads in the State of Illinois, as it is reported that a bill to this effect may be introduced at the present session of the Legislature. There is no law in Illinois covering locomotive headlamps. Several of the states, however, have statutory provisions on this subject, and in Indiana, it is said, electric headlamps are required. In Wisconsin the headlamp must be sufficiently powerful to enable the engineer to see an object 800 ft. away. The Railroad Commission of Wisconsin has conducted exhaustive tests on different types of headlamps designed to comply with this requirement.

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**PROPOSED PUBLIC-SERVICE COMMISSIONS FOR ILLINOIS.**—No doubt several bills will be introduced in the present session of the Illinois Legislature looking toward the formation of public-service commissions in that State. Probably the most important utterance on the subject will be

that of the joint committee which has been conducting an investigation under the leadership of Senator John Dailey, of Peoria. In addition, the lawmakers will have before them bills introduced by other members. One of the first of these was that fathered by Senator Samuel A. Ettelson, of Chicago, which provides for two public-service commissions, one having jurisdiction over Chicago and the other over the remainder of the State. By the terms of this bill the Railroad and Warehouse Commission would be abolished, and steam railroads, as well as street railways, gas, electric-service, telegraph and telephone companies, would come under the authority of the two new commissions.

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### SOCIETY MEETINGS

**MEETING OF MAINE ELECTRIC ASSOCIATION.**—There will be a meeting of the Maine Electric Association at River-ton Park, Portland, Maine, on Feb. 24. The secretary-treasurer is Mr. W. S. Wyman, Augusta, Maine.

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**ANNUAL MEETING OF THE CONTRACTORS' ASSOCIATION.**—The next annual meeting of the National Electrical Contractors' Association will be held at Chattanooga, Tenn., from July 16 to 19. The secretary of the association is Mr. W. H. Morton, 41 Martin Building, Utica, N. Y.

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**GEORGIA SECTION, N. E. L. A., TO CONVENE AT MACON.**—Macon will be the next meeting place of the Georgia Section of the National Electric Light Association, which holds its annual convention on Aug. 14, 15 and 16. The New Dempsey Hotel will be headquarters for the gathering.

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**ARKANSAS UTILITY OPERATORS TO MEET IN LITTLE ROCK.**—At a meeting of the executive committee of the Arkansas Association of Public Utility Operators at Little Rock, Ark., on Feb. 3, it was decided to hold the annual convention of the association at Hotel Marion, Little Rock, Ark., on May 13, 14 and 15.

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**MEETING OF NEW YORK COMPANIES' SECTION, N. E. L. A.**—At the regular monthly meeting of the New York Companies' Section of the N. E. L. A., to be held Feb. 17, Mr. J. W. Lieb, Jr., third vice-president and associate general manager of the New York Edison Company, will speak on rates, and Dr. W. H. Tolman, director of the American Museum of Safety, is scheduled to tell how to prevent 50 per cent of industrial accidents.

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**INTERIOR ILLUMINATION.**—At a meeting of the Philadelphia Section of the Illuminating Engineering Society to be held on Feb. 21 at the Engineers' Club, 1317 Spruce Street, Mr. Preston S. Millar, president of the society, will present a paper on "The Illumination of Interiors." This paper will be fully illustrated with models, showing rooms with various types of lighting units. Preceding the meeting a dinner will be served at the Engineers' Club at 6 o'clock p.m.

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**I. E. S. AND A. I. E. E. BOYLSTON MEETING.**—Feb. 17 in the Edison Auditorium, 39 Boylston Street, Boston, a joint meeting will be held of the New England Section of the Illuminating Engineering Society and the Boston Section of the American Institute of Electrical Engineers. Papers relating to arc lamps will be presented as follows: "The Mercury Arc Lamp," by Mr. Percy H. Thomas, New York; "Ornamental Magnetite Lamps," by Mr. C. A. B. Halvorson, Lynn; "The Inclosed Flame-Arc Lamp," by Mr. W. H. Darrac, Pittsburgh.

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**JOINT MEETING IN MILWAUKEE.**—The Chicago Section of the Illuminating Engineering Society will hold an all-day meeting in Milwaukee on Feb. 22. It is probable that



the meeting will be begun about 10 a. m. and held in the Milwaukee Auditorium. Papers will be read by Mr. M. Luckiesh, of Cleveland, on "Color of Useful Light," and Mr. F. A. Vaughn and Dr. Nelson M. Black, of Milwaukee, on "Conservation of Eyesight." The Milwaukee Section of the A. I. E. E., the Milwaukee Section of the N. E. L. A., the Milwaukee Electrical League and other societies will participate in the meeting.

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**ANNUAL BANQUET OF PITTSBURGH SECTION, A. I. E. E.**—The seventh annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers was held at the Hotel Schenley, Pittsburgh, Pa., Feb. 8. About 400 attended and addresses were made by Mr. W. S. Murray, representing Mr. R. D. Mershon, president of the Institute, who is absent on the Pacific Coast; Mr. S. B. McCormick, who spoke on "The First Arc Light"; Mr. M. Knowles, whose topic was "Conservation and Its Relation to Hydro-electric Development," and Dr. W. Riddle, who gave a humorous talk on "Entropy and Its Relation to the Ultimate Disappearance of Energy."

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**A. I. E. E. RECEPTION.**—The closing feature of the mid-winter convention of the American Institute of Electrical Engineers will be a reception and dance at the Hotel Astor at 9 p. m. Feb. 28. As this function takes the place of the annual banquet usually held in February, it will be the social event of the season for the Institute membership, giving excellent opportunity for the greeting of old friends and the making of new acquaintances. Tickets to the reception, at \$2.50 each, may be obtained from Honorary Secretary Ralph W. Pope or at the information bureau of the convention at the Engineering Societies Building, 33 West Thirty-ninth Street, New York.

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**NEW YORK ELECTRICAL SOCIETY MEETING.**—At a meeting of the New York Electrical Society to be held in the Engineering Societies Building, New York, on Feb. 17, Mr. William J. Hammer will describe his collection of electric lamps which was recently presented by the General Electric Company to the Association of Edison Illuminating Companies and is installed in the headquarters of the American Institute of Electrical Engineers. This address will be followed by an informal talk by Mr. Antoine Pollak on the Pollak-Virig rapid telegraph system, which will be shown in operation. A smoker and a reception to President Henry L. Doherty will be held in the rooms of the A. I. E. E. at the conclusion of the demonstration by Mr. Pollak.

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**SYMPOSIUM ON ELECTRICAL INSPECTION METHODS.**—At a meeting of the Kilowatt Club of Brooklyn on Jan. 27 the three men who control the electrical inspection activities of the metropolitan district of the city of New York were present. Mr. H. S. Wynkoop, electrical engineer of the city, spoke on the matter of inspection from the standpoint of the municipality, and Messrs. J. C. Forsyth, chief inspector of the New York Board of Fire Underwriters, and G. E. Bruen, chief inspector of the Suburban Fire Insurance Exchange, treated the subject of inspection historically, practically and with consideration for future requirements. Mr. W. F. Wells, general manager of the Edison Electric Illuminating Company of Brooklyn, was also present and voiced the spirit of co-operation between contractor and central station which is now a prominent characteristic of "electrical Brooklyn."

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**INSTITUTE OF RADIO ENGINEERS.**—At the annual meeting of the Institute of Radio Engineers the following officers were elected to serve for the year 1913: President, Mr. G. W. Pickard, Amesbury, Mass.; vice-president, Mr. R. H. Marriott, New York, N. Y.; secretary, Mr. E. Simon, New

York, N. Y.; treasurer, Mr. J. H. Hammond, Jr., Gloucester, Mass.; managers, Mr. J. L. Hogan, Jr., New York, N. Y.; Dr. J. S. Stone, Boston, Mass.; Mr. R. A. Weagant, Aldene, N. J., and Mr. L. Espenschied, New York, N. Y. At a meeting of the board of managers shortly afterward Dr. A. N. Goldsmith, of the College of the City of New York, was appointed editor of publications. At the February meeting of the Institute, held at Columbia University, Mr. Frederick A. Kolster, of the Radio Service, United States Department of Commerce and Labor, presented an interesting paper on the effect of distributed capacity in inductance coils for radio signaling. Copies of the first number of the *Proceedings* published by the Institute have been distributed. The standardization committee anticipates publication within a short time of a list of symbols and definitions agreed upon. The next meeting will be held as usual on the first Wednesday of the month.

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**SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.**—Announcement has been made heretofore in these columns of the conference which the Society for Electrical Development, Inc., is to hold at the Engineering Societies Building, New York, on March 4 and 5, to which the entire electrical industry is invited. The invitation is also extended to advertising agencies and magazine publishers. The object of the meeting is to obtain as full a discussion as possible from the various branches of the electrical industry on the plans that will be proposed for carrying on the work of the society. Among the plans that will be suggested will be one for a broad educational publicity campaign to be carried on through such mediums as home and trade journals of every kind. Another plan which will be discussed is one for the establishment of a press bureau for the dissemination of reading matter relating to electrical subjects. The creation of a traveling, or field, department for the purpose of conducting general educational work pertaining to the electrical industry among architects, builders and manufacturers is also under consideration. The list of those from whom papers and suggestions have been invited includes Messrs. H. L. Doherty, T. C. Martin, F. H. Gale, R. P. Bolton, George Harvey, William D. McJunkin, J. M. Wakeman, Hugh Chalmers, W. E. Robertson, A. W. Burchard, L. A. Osborne and J. C. McQuiston and many others.

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**BROOKLYN COMPANY SECTION, N. E. L. A.**—One of the largest meetings in its history was held by the Brooklyn Company Section, N. E. L. A., on the evening of Feb. 10. The presence of the feminine employees of the company at a section meeting for the first time contributed in a large measure to the enjoyment of the evening. The pleasure that attended the excellent program was tempered noticeably, however, by the fact that the occasion was somewhat in the nature of a farewell to Mr. W. W. Freeman, who retired on Dec. 31, 1912, as vice-president and general manager of the company to become identified in a similar capacity with the Alabama Interstate Power Company. Following the reading and discussion of a paper on the production of copper by Mr. William H. Grove, of the company's engineering department, a handsome silver service was presented to Mr. Freeman by the employees of the company. In accepting the gift, Mr. Freeman spoke feelingly of his long association with the company and of the warm greetings and tokens of regard he had received from the employees at all times, and especially on this occasion. He expressed the hope that his affairs will permit him to visit the section meetings of the Edison Electric Illuminating Company of Brooklyn at frequent intervals. After Mr. Freeman's talk the audience was favored by Mr. William J. Burns, the well-known detective, with reminiscences of his stirring career. Music, vaudeville and refreshments concluded the program.



# Isolated Plant of Gasoline Engine Factory

**Features of electrical and steam-heating station  
of Continental Motor Manufacturing Com-  
pany, Detroit, Mich. By Harry C. Spillman**

**T**HE necessity for sufficient and reliable power in industrial establishments possessing isolated plants has brought with it the realization that whereas a small engine and boiler tucked away in some obscure corner were equal to power requirements a few years ago, these must now give place to better and more modern equipment, and the isolated plant itself must follow the design of modern central stations in many features.

The Continental Motor Manufacturing Company's Detroit factory is modern in every detail and its power plant has many features seldom found in an industrial generating station. This company manufactures gasoline engines for automobiles, and as it operates an extensive machine shop its power requirements are very important. The factory contains nearly 300,000 sq. ft. of floor space and every department and building is designed for future extensions.

## STATION DESIGN

In designing the power plant careful consideration was given to a location which would make possible an independent siding for handling coal and be central in respect to the factory, so that the transmission and piping lines would not be too great in length. The plant also had to be placed out of the way of the future growth of the factory and have ample room for its own expansion. All these conditions were carefully thought out before the actual design of the plant was started.

Special attention was given to the architectural details of the power house, as it is very conspicuous in its location. The building is a structural steel frame with pressed-brick side walls, cement being used for all window sills, wall coping and ornamental work, thus avoiding the use

of cut stone and still making possible a very attractive building. The floors are of reinforced concrete having a live load of 400 lb. per square foot and are of sufficient strength to allow small machines to be placed directly on the floor without a foundation. This stable construction also does away with the necessity of placing shores under the floor when moving machinery. By the installation of "Fenestra" steel sash, which can be opened and closed with sash operators, an unusually light and airy building is secured. The roof is made of "Hy-rib" with a cement coating, upon which is laid four-ply tar and gravel roofing. The building is strictly fireproof, not a stick of timber being used. Steel work starts at the floor line of the basement so as to do away with heavy foundations above the basement floor.

A main tunnel, which is 8 ft. high by 9 ft. wide, is constructed from the power house to the factory and extends to all parts of the main building. There are branches from this main tunnel to each of the seven other buildings. The east side of the tunnel is given up entirely to wires and the west side to piping, including low-pressure steam piping, return piping, live steam pipes, air, gas, city-water and hot-water pipes for industrial purposes. This allows easy access to all pipes and wires and at the same time places them out of the way for future extensions of the buildings.

## BOILER ROOM

The boiler room has large windows and is faced in white-sand lime brick, which makes a light, airy room. The present equipment consists of three Wicks vertical water-tube boilers, each having 2500 sq. ft. of water heating surface and being rated at 250 hp. The boilers are arranged in a

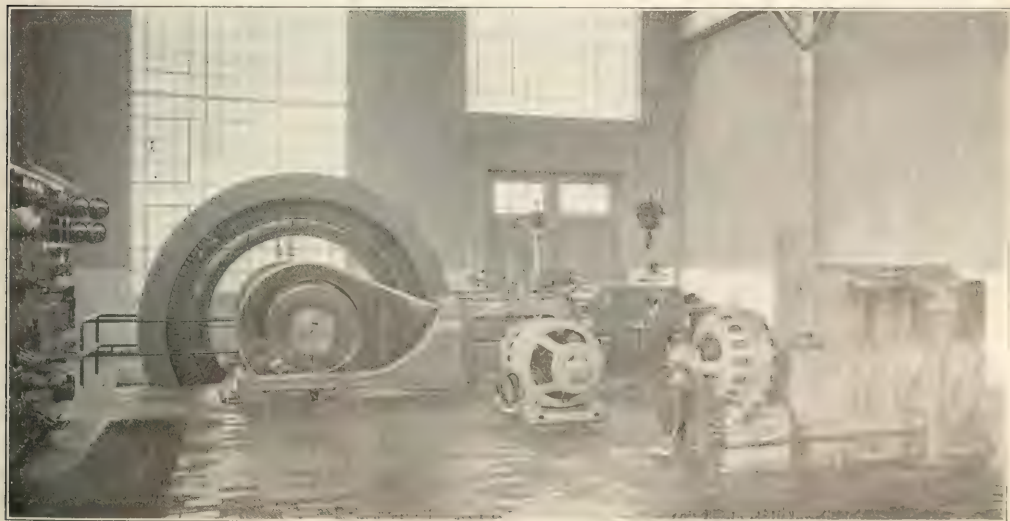


FIG. 1—GENERATING EQUIPMENT OF CONTINENTAL MOTOR MANUFACTURING COMPANY

single row and are designed for 150-lb. steam pressure. The latest improved, heavy-duty type of Murphy stokers are used and are operated by a small inclosed engine. This equipment is guaranteed to evaporate 10 lb. of water from and at 212 deg. Fahr. per pound of dry coal containing not less than 13,500 heat units by calorimeter test. The boilers are fed by two 10-in. and 6-in. by 12-in. outside, center-



FIG. 2—EXTERIOR OF STATION AND WATER TOWER

packed, duplex plunger pumps made by the Deane Steam Pump Company. A steel breeching connects the boilers to a stack which is 8.5 ft. inside diameter at top and 150 ft. high. This stack was erected by the Weidherholt Construction Company and consists of tile facing, both interior and exterior, with a reinforced-concrete core. This gives the chimney all the advantages of a reinforced-concrete stack with a good firebrick lining and also imparts to it an attractive appearance not possible to be obtained with concrete. The name "Continental" is laid in white enamel brick and the letters project 1 in. beyond the face of the stack, so that the rain washes off the dust from the letters and keeps them clean.

#### COAL CONVEYOR

A monorail coal conveyor system is installed which runs over the boilers and extends out in the yard, supported on a steel trestle. This trestle is built directly over the railroad siding, and part of the trestlework is inclosed so as to form a storage bin which allows coal to be unloaded directly from the car and either stored in this bin or placed in the metal bins directly over the boilers. The operator rides in the cab and has full control over the conveyor. Large pits are built in front of each boiler so that the fireman can pull the ashes into these pits, and by means of a switch on the monorail the same conveyor can be used to dispose of the ashes. This conveyor is operated on direct current at 110 volts and was designed and erected by the Shaw Crane Company. With the above-mentioned conveyor was furnished a Brown hoist single-rope grab bucket having a capacity of 24 cu. ft. This system is capable of unloading a car of coal and placing it in the bin in two hours. The conveyor will fill the boiler-room bins in about the same length of time with sufficient coal for a twenty-four hour run. This makes a very inexpensive arrangement for a small plant and saves the labor of two men.

#### PIPING SYSTEMS

All the condensation, drips, etc., are returned to a Cochran open feed-water heater rated at 1500 hp. This feed-water heater is located in the boiler room near the pump so that when the power house has increased to double its present size it will be near the center of the room. The blow-off piping is located in the basement, and extension stems are provided on the valves so that they can be operated from the boiler room. This piping is connected to a cylindrical blow-off tank which has a 5-in. vent.

The steam header, which is supported on I-beams near the fire wall directly back of the boilers, extends into the basement, where the ends are connected together, making a complete loop. Valves are placed in the header at intervals so that any section of the header may be closed off for repairs and the steam can be fed around the opposite way to supply the engines and factory. This is a very flexible arrangement, and when the plant is extended another loop can be installed and tied in with the present one.

Iron ladders and grating are placed around the water gages and along the steam header so that the valves are accessible. All the other valves are near the floor within easy reach of the firemen. Every pipe line has the necessary outlets for future extensions, so that an addition can be made without destroying any of the present installation.

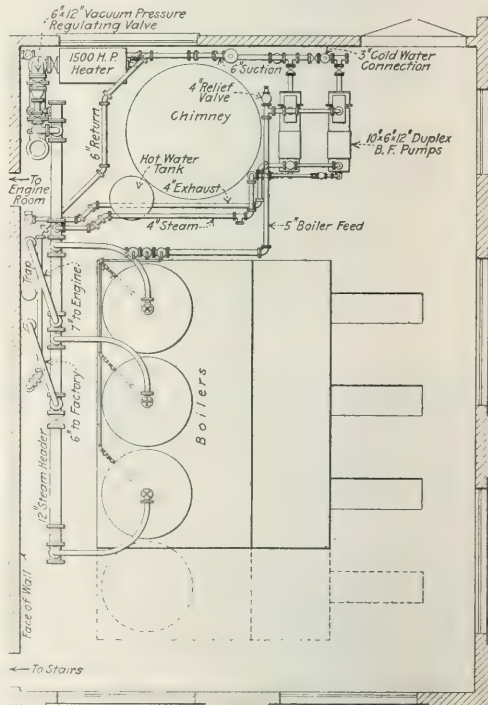


FIG. 3—DETAILS OF BOILER ROOM PIPING

#### ENGINE ROOM

Special attention was given to the engine room, so that there is ample room around each unit and all pipes and valves are placed in the basement where they are very accessible. Attractiveness was not lost sight of, as the side walls are wainscoted with white enamel brick, having yellow pressed brick above, and the entire floor is cov-

ered with 6-in. by 9-in. red tile laid in white mortar. To add still further to the attractiveness of the room the engine pit is lined with white enamel and the railing is made of tubing, which is painted black and has polished brass fittings. The machinery is painted a silver gray, which gives a harmonious blend of color pleasing to the eye.

From the above it may be realized that the engine room



FIG. 4—COAL-HANDLING EQUIPMENT

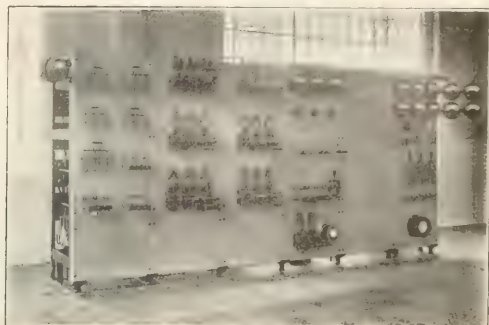


FIG. 6—SWITCHBOARD

is made very attractive and at the same time this is done without a great outlay of money. The engine, which was designed for 23-lb. back pressure so that the exhaust steam can be used for heating during the winter months, is a heavy-duty Corliss cross-compound unit 20 in. and 30 in. by 36 in., running at 120 r.p.m. and rated at 600 indicated

house steam turbine directly connected to a 25-kw, 110-volt generator running at 3500 r.p.m. and also by a 40-kw motor-generator set running at 830 r.p.m. The small steam turbine set is also used for supplying energy for the monorail coal conveyor so as not to interfere with the regulation of the main generator. Air is furnished by means

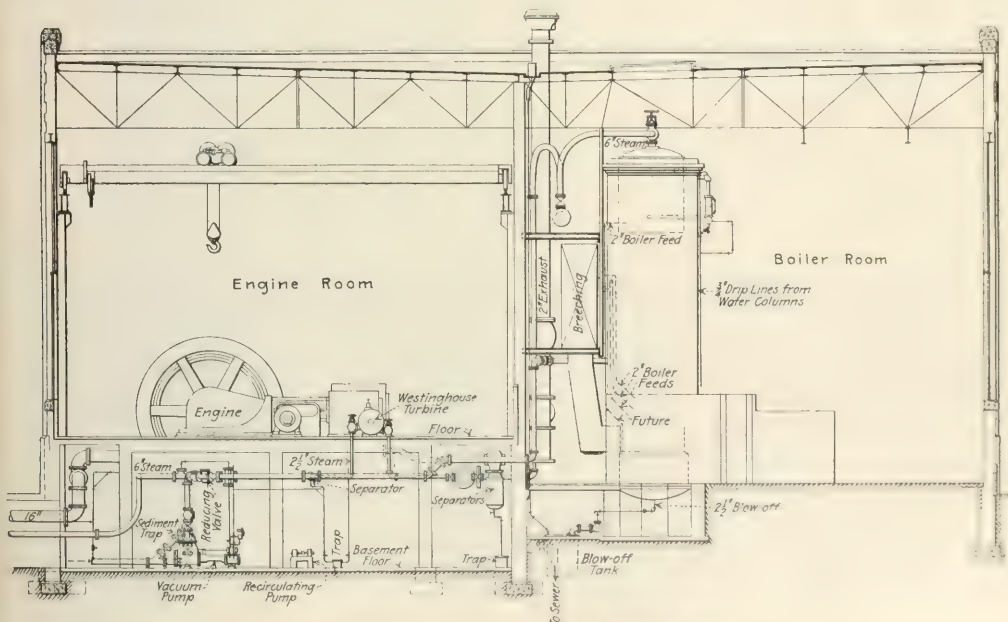


FIG. 5—CROSS-SECTIONAL ELEVATION OF POWER HOUSE

hp. It was furnished by the Hoover-Owens-Rentschler Company and is guaranteed to carry 50 per cent overload. The steam consumption at full load when exhausting against atmospheric pressure is 20 lb. per indicated horsepower. A gravity oiling system, complete with overhead tank and circulating pump and filter in basement, feeds oil to all the bearings.

of a 300-cu. ft. single-stage air compressor directly connected by means of gear and pinion to a 60-hp Westinghouse motor furnished by the National Brake & Electric Company. This compressor starts and stops automatically at any predetermined range of pressures and also closes the water-circulating valve so that water is not circulating around the cylinders when the compressor is idle.



There is ample space in the engine room for another unit, which will be installed in the near future. The entire engine room is covered by a 15-ton Shaw hand-operated crane with two speed hoists and an automatic brake.

The switchboard is made up of six panels of gray Tennessee marble with the grain running diagonally and is made self-supporting by means of a metal framework extending 20 in. back of the board. The front of the board rests on bronze legs finished in black and about 4 in. high. All the trimmings have a black oxidized finish except the switches, which are of polished brass. The swinging bracket contains one frequency meter, a power-factor indicator, and alternating-current and direct-current voltmeters. The generator panels have both alternating-current and direct-current ammeters, voltmeters, an indicating wattmeter, a watt-hour meter, etc.

Each building has its independent circuits for both motor and lamp loads. The motor circuits are controlled by I. T. E. type "LL" circuit-breakers non-closable on overloads, and each circuit has a special switch which connects the indicating wattmeter and power-factor meter in circuit. The average power-factor at the board is 84 per cent, and the lowest on any circuit is 73 per cent. The switchboard is illuminated by means of lin-o-lite lamps, in a manner similar to that used for showcase illumination, in preference to the older bracket lamps.

All the wiring is in conduit and the latter is kept away from the steam pipes so that they do not have to cross each other. The leads from the generator to the switchboard consist of four pieces of  $\frac{1}{4}$ -in. by 4-in. copper well taped and suspended on porcelain insulators. All transmission leads are carefully calculated for 3 per cent drop, which gives the same voltage at all points in the factory.

Both the boiler room and the engine room are illuminated by mercury vapor lamps with red reflectors which radiate a white light similar to daylight and make an ideal illumination. Floor receptacles are distributed around the engine room for extension plugs and wall receptacles are used in the boiler room and the basement.

A Venturi water meter is placed in the feed-water line and a CO<sub>2</sub> recorder is to be installed in the breeching and steam meters in the different steam lines. The coal and ashes are carefully weighed each day by means of a scale on the conveyor so that the twenty-four-hour log gives the necessary data for a complete power-house test, and if there are any leaks they are readily discovered.

Almost all manufacturing concerns have a tendency to make their buildings as plain as possible, and this also is a fault of many engineers. As a rule a plain building is unsightly. It required only a few thousand pressed brick for facing the front and side of the power house and a small amount of plaster for the panels to make the station attractive. The entire outlay in excess of what common brick walls without cement trimmings would have cost was less than \$500, and the satisfactory appearance more than offsets the small expenditure.

### Agricultural College Men May Study Illumination

In the proposed agricultural engineering building at Ohio State University, Columbus, Ohio, it is planned to provide for an "illuminating room." Here electric lighting, ordinary gas lighting, acetylene lighting and other forms of illumination will be demonstrated and tested, with the particular view of their applicability to farm buildings and yards. This is probably an innovation in buildings of this character for agricultural colleges. The new building will be three stories high and cost about \$125,000. A novelty, as planned, is a deck roof over a wing of the building whereon windmills may be erected and tested. Prof. H. C. Ramsower is in charge of the agricultural engineering work at the university.

### Electric Express Handling at the North Station, Boston

A conspicuous illustration of the flexibility and efficiency of electric trucks of the industrial type in the handling of express matter is furnished by the installation of the American Express Company at the North Station in Boston, Mass., one of the largest and most active steam railroad terminals in America. For the past ten months a considerable part of the work of transferring express shipments between trains and the receiving and dispatching rooms at the terminal has been accomplished by a fleet of Buckwalter electric baggage trucks, and the installation has been so successful that the present equipment of sixteen machines is to be increased to twenty-four of the same make at the earliest possible moment. Four of the trucks are owned by the National Express Company.

All of the trucks are of the so-called drop-frame type, 12 ft. long over the body, 44 in. wide and equipped with two platforms carried respectively 33 in. and 10 in. above the floor. Each truck is provided with two end standards carried to a height of 7 ft. above the floor and has a load rating of 4000 lb. on a maximum grade of about 12 per cent. The width over wheel hubs is only 45.5 in., and each truck weighs unloaded, with battery, about 3000 lb. A single motor of the series-wound type drives the truck by double-reduction gearing, the motor being located beneath the upper platform at one end and the battery at the other.

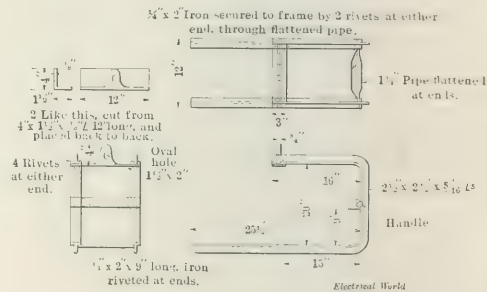


FIG. 1--DETAILS OF BATTERY CRADLE

The battery equipment consists of twelve cells of the United States Light & Heating Company's "WB-15" type and weighs about 850 lb. The speed varies from 4 miles per hour loaded to 6 miles per hour empty, and double-end control is provided.

Each truck is equipped with four wheels having 27.5-in. by 3.5-in. Goodyear tires, and the wheels are connected with the steering lever at each end in such a manner that all are simultaneously moved by a single turn of the handle by the operator. This arrangement facilitates handling the truck in an extremely limited space. The double-end control permits operation on narrow platforms and runways without turning the truck around, thus relieving congestion and minimizing the possibility of accidents. In operation the attendant simply inserts the steering and controller handles in their respective sockets on the end of the truck which happens to be pointed toward the destination. The operator stands on a hinged platform at either end, the platform being so sectionalized that unless the man in charge of the truck stands squarely on each section the machine cannot be started. The removal of the operator's right foot from one of the platform sections immediately applies the brake, assuming that the man is facing forward. Three forward and reverse speeds are provided, with rheostatic control governed by switch handles which are inserted in sockets at either end.

The brake is the double-expanding internal type, and the truck can be stopped when operating at full speed loaded in

about 8 in. The trucks were manufactured by the Elwell-Parker Electric Company, of Cleveland, Ohio.

The charging of the truck batteries, inspection and maintenance of the equipment are handled in a corner of the American Express Company's sorting room at the North Station, fronting on the Nashua Street side of the terminal. Electric trucks and teams in the company's street service

plete truck can be raised well above the floor level, to enable examination and light repairs to be made quickly. Three trucks can be lined up at once for inspection or removal of batteries, despite the limited area of the garaging space. A battery can be disconnected, removed from a truck and another put in its place inside of three minutes, and a battery can be lifted from the floor and set in position on the

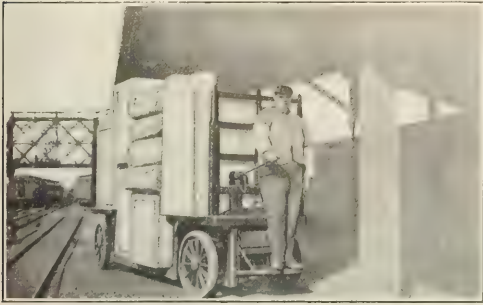


FIG. 2—ELECTRIC EXPRESS TRUCK

receive and deliver merchandise at this point, making in many cases a complete electric transfer of shipments from express car to consignee, or vice versa. As the industrial trucks are in service day and night, twelve extra batteries were purchased when the installation was made last spring, and the facilities for rapid transfer of batteries to and from trucks are noteworthy. Batteries not mounted in trucks are parked on 8-in. by 12-in. wooden blocks at one side of the room close to the wall, and twelve charging circuits are brought to these stands from a switchboard mounted in the office of the superintendent of truck service, Mr. G. B. Lipphardt.

The battery stands are treated with asphaltum, and a 6-in. by 6-in. wooden bumping block 30 ft. long is installed on the floor outside the row of batteries to protect the latter against blows from passing vehicles or merchandise. The blocks are spaced 22 in. apart on centers and are about 3 ft. long. Batteries are transferred to and from the stands by a 1-ton hand-operated chain hoist traveling in a 6-in. I-beam overhead runway attached to the ceiling and about 50 ft.

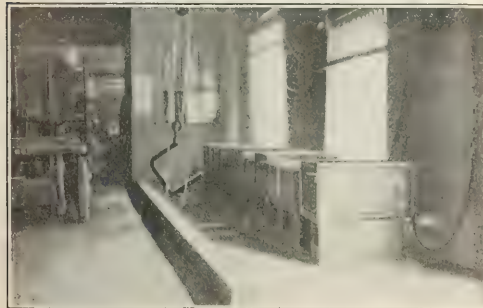


FIG. 3—PARKING BATTERIES

long, including a right-angled turn into the center of the room which facilitates rapid handling through the elimination of extra movements of the trucks. Fourteen batteries can be parked in the charging division at one time. A 31-in. by 90-in. pit 6 ft. deep with removable cover is located in the floor to enable the under side of the trucks to be inspected, and eye-bolts in the ceiling above the pit are shortly to be equipped with chain hoists by which a com-



FIG. 4—HANDLING BATTERY BY HOIST

truck frame in about thirty seconds. Wooden battery boxes with reinforced steel corners have been found preferable to those of steel construction, as the former are more easily ventilated and kept clean.

A special feature of the battery-handling equipment is an angle-iron cradle illustrated in the accompanying drawing which is used in transferring the cells from the trucks to the stands and vice versa. The cradle consists of two U-shaped 2.5-in. by 2.5-in. by 5/16-in. angles, the upper portions being 16 in. in length and the lower 25.5 in. long, spaced 12 in. apart horizontally, with a clearance of 20 in. between each prong. At the front ends of the upper prongs a 3-in. by 3/8-in. cross-bar is riveted, the latter consisting of two back-to-back angle irons with the stock cut away from the center, leaving a lug in which a 1.5 in. by 2-in. oval hole is drilled for the reception of the hook of the hoist. The lower prongs are cross-braced by a 1/4-in. by 2-in. strap, 9 in. long, riveted to the prongs at a point 15 in. from the bend, and a 1 1/4-in. iron pipe with flattened ends is carried across the back of the cradle from side to side, serving as

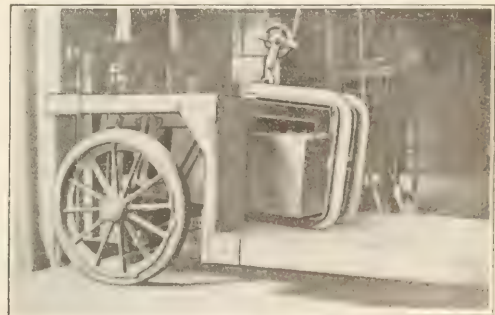


FIG. 5—REMOVING BATTERY FROM TRUCK

a handle and protected from the battery by a 2-in. offset strap on the inside.

Energy for charging the batteries is taken from the local power plant of the terminal at 115 volts. The switchboard consists of three panels 7 ft. long by 5 ft. high, each containing an installation of Cutler-Hammer controlling apparatus, central-zero ammeter, voltmeter, circuit-breakers and fuses. All cables running to charging points are num-



bered with brass disks, and each circuit is equipped with a pilot lamp showing its operative condition. Plug switches are provided to throw the ammeter and voltmeter into any circuit as desired. The rheostats are mounted on an iron frame at the rear of the board. A maximum-demand meter is placed behind the switchboard as energy is purchased from the terminal plant, and a recording wattmeter is also

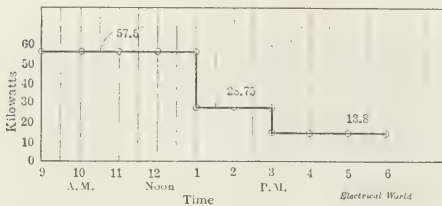


FIG. 6—TYPICAL LOAD CURVE CHARGING TEN TRUCK BATTERIES

in service. Three batteries are usually charged in series. The batteries are never allowed to run below 26 volts and 50 amp each on charge. In a typical charge the battery is supplied with energy at the 50-amp rate for four hours, at 25 amp for two hours and at 12 amp for three hours, the length of time at each rate depending upon the response of the battery. Two men are assigned to the work of charging and battery inspection, and ordinarily charging is carried on the plant as a day load. All batteries are fully charged before being placed in service. In general, one truck is kept in the garage at a time for overhauling, a bench being provided for this purpose in the switchboard room. Thus far the cost of repairs has not exceeded \$1 per truck per month, and the cost of energy per truck per month has averaged about \$2. A truck averages from 20 to 25 miles on one charge of a battery, and each battery, having a capacity of 196 amp-hr., operates as a rule two days per charge. The average monthly truck mileage is 7200 and the corresponding energy consumption 2800 kw-hr.

The conditions at this station are among the most severe in the country, there being 738 inward and outward trains every twenty-four hours. The station contains twenty-three parallel train tracks under a single roof, with intermediate and side platforms varying from 7 ft. to 16 ft. in width, the usual width being 7.5 ft., allowing for center columns. At one end of the station the trucks are obliged to surmount a 12 per cent grade 60 ft. long, including a 90-deg. turn near the top. Express rooms are located at each end, and the outer platforms leading to the trains are level with the floors of the cars, but as only a small percentage of the total tonnage is loaded into the cars on this level, the freight trucked to and from the trains has to be transported up or down the incline above mentioned or over a less steep grade at the opposite end of the building.

At the foot of the 12 per cent incline is a gate where passengers are constantly crossing the path of the trucks, and the safety features of the latter are important at this point. When coming down the incline the operator can jump off the truck and stop it within 2 ft., even though the truck is operating at full speed and under full load, through the automatic application of brakes which results from the operator's leaving the platform. Not a single accident has yet occurred in the use of the trucks in this station, despite the fact that their route traverses at right angles the entrance to and the exit from every train track in the station. This is an important source of economy in operation, as it is not an uncommon occurrence for a passenger to be injured by the ordinary hand-operated trucks, and such an accident usually requires a settlement by the claim department. Only one man per truck is necessary even on the 12 per cent incline, whereas with the old hand trucks it was necessary to use two men per truck, with additional helpers when on the 12 per cent grade. The labor question was

formerly a serious one at this point, as the work was so heavy that the men were continually quitting, making it necessary to employ green attendants and thereby handicapping the service. A great saving has also been shown in decreased damages. Packages often dropped off the old hand trucks, but this trouble has been entirely overcome with the electrically driven outfits, as all jolts and shocks are absorbed by the solid rubber tires and the flexible construction of the frames. Faster time can also be made over rough concrete walks and platforms on account of the diminished jarring of the truck, a speed of about 2 miles per hour being the maximum which is safe with hand trucks.

Closer connections can be made with trains on account of the higher schedule speed of the electric truck. Time is also saved in sending men to trains on heavy jobs, and as they return to the transfer room on the truck instead of walking, as in the old days, the tendency is for a much larger output to be produced and with less effort for the men. Any point in the station can be reached in three minutes, and the trucks discharging and loading at the terminal in the outside street make much shorter stops as a result of the installation of electric service. The electric equipments require less space than the hand-operated trucks and perform about double the work of the latter. In the movement of express matter to and from trains one truck and one man do the work of four men and two hand-drawn trucks, not including loading and unloading. A better class of men apply for work with the electric trucks than formerly operated the hand trucks.

In the operation of the trucks all are carefully examined before being placed in service, and each truck is provided with a number 3 in. high to facilitate reference to it by passengers and employees. Operators do not apply full power in starting, but work the controller on the step-by-step plan common in street-railway work. Operators are not allowed to enter into conversation with anyone while running a truck and are required to watch gateways and passages with great care while on the running board. When operating on the main platform at the bumper ends of the train tracks the trucks take the middle of the course except that in passing others those operating on the main platform are given the right-of-way over those approaching from

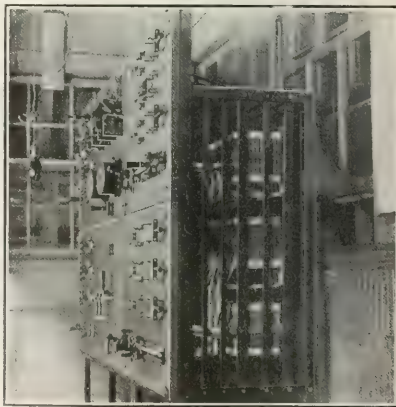


FIG. 7—BATTERY-CHARGING SWITCHBOARD

trains. Running backward in the station proper is also prohibited in the rules given to operators of trucks, and no running of trucks with trailers is permitted. Trucks proceeding in the same direction are required to keep 15 ft. apart, except when otherwise ordered by special authority. The express service of the American company at the North Station is under the supervision of Mr. H. F. French, agent.



## The Retail Dealer and Electric Appliance Sales

To collect information useful to the whole industry on the subject of electric-appliance sales and present conditions in the trade, the *Electrical World* recently mailed letters of inquiry to 3200 retail dealers and contractors whose names appear in the McGraw Electrical Directory. The list included cities and towns of various sizes in every state and section of the country, thus insuring not only thoroughly national representation in the opinions expressed but the reflection as well of the views held in both large and small communities.

The questions asked are given in the accompanying table, together with a tabulation of the replies received from the dealers. Frank statements in reply have been encouraged by assurance that the individual sources of the comment and information received would be treated with all confidence.

As set down in the following paragraphs, the replies received from the 424 representative retailers who answered have been carefully classified and analyzed, in the belief that effective light may thus be shed on present conditions in the electrical trade and the readjustment needed to place trade relations on a more stable basis.

In answer to the first question, relating to the device most satisfactory to retail, the replies were, as might be expected, overwhelmingly in favor of the electric iron. Of the total number, 304 gave the iron first place, the next contestant for honors being the electric toaster with 36 votes. Other appliances receiving mention were as follows: Motors, 25; vacuum cleaners, 20; electric fans, 18; lamps, 15; washing machines, 14; electric stoves, 13; percolators, 7; warming pads, 6; radiators, 3; curling irons, 1. Similar estimates of the relative values of other appliances besides irons were afforded by the replies to the fourth question.

The greatest difficulty met by the retailers in building up a profitable flatiron business, according to the results of the canvass, seems to lie in the activity of central stations in selling devices at cost or even below cost in order to further the consumption of electricity. Some of the comment received from dealers on this policy of the central station is particularly bitter and indicates that the ill feeling engendered between local branches of the industry may embarrass other relations essential to the development and prosperity of both parties.

As one correspondent pointedly asserted, the customer quite naturally expects that the central station will prefer to sell him a device that consumes a large amount of electricity and he is not to be blamed if he at once suspects any price cutting which can be attributed to this motive. From the dealer, however, who has no further interest than the sale of appliances and the making of a satisfied customer, the purchaser expects unbiased advice; and later, feeling that he is getting an economical, efficient iron, he will have no fear about making liberal use of it.

In a case cited by the writer already quoted the central station a year ago gave away, absolutely free, 200 irons. When the first month's bills came to these 200 users the increases evident caused much dissatisfaction and criticism of the company's intentions in giving away the irons. Even now the customers who kept the free irons, according to the correspondent, do not use them nearly so much as they might have done had they bought the irons in the first place. "We know," writes one contractor, "that the electrical dealer can sell heating and cooking devices more easily than a central station, and the only reason for this is that the consumer knows (or at least he thinks) that if he purchases from a dealer he is getting a device that will consume the least amount of energy."

Cheap and consequently poorly constructed irons, such as are sold by the department stores and hardware dealers, are also credited with injuring the legitimate business of electrical supply dealers. The low price at which these goods can be profitably sold embarrasses the dealer with a

first-class article, and, later, the poor service given by the cheap iron destroys confidence in electrical devices in general. Several correspondents also cited the central-station rate for electricity as being too high for the economical operation of irons.

The generous guarantees proffered by certain manufacturers seem to be another difficulty in the way of the small dealer, whose margin of profit is already pared to the livable limit by sale conditions. The iron itself may be injury-proof, but such incidents as blown fuses, broken cords, etc., which follow in the wake of its installation sometimes prove expensive to the local dealer, on whom the customer depends to make good the sweeping guarantees of the maker. Blowing of fuses caused by the extra current demand of the irons, breaking of cords, attachment plugs, etc., are all accidents which, although clearly outside the makers' guarantee, cannot be so easily explained away to the customer's satisfaction, nor can he be convinced that he should pay the cost of sending a man to make such repairs. Rather than argue his position as to the extent covered by the

### TABULATION OF REPLIES RECEIVED FROM DEALERS IN ELECTRICAL DEVICES

#### 1. What energy-consuming device is the most satisfactory to retail?

Electric irons, 304; vacuum cleaners, 20; fans, 18; washing machines, 14; stoves, 13; percolators, 7, etc.

#### 2. What is the greatest difficulty, if any, you are meeting in building up a profitable flatiron business?

Cutting of prices by central stations to cost and below cost. Competition from poorly constructed and cheap devices. Unlimited guarantees of manufacturers.

#### 3. What is the greatest assistance you are receiving in building up flatiron business or sales of other devices?

Assistance of manufacturers, general and local advertising. Dealers' sales effort and advertising. Central-station activity. Window and store exhibits. Also complaints of "no assistance from any source."

#### 4. What electric heating or cooking devices, besides flatirons, do you find it most profitable to retail?

Toasters; percolators; electric ranges; luminous radiators; grills; stoves.

#### 5. Are you actively promoting the sale of any one line, or are you carrying in stock various makes of electrical devices?

Carrying only single line, 122; various makes, 265.

#### 6. Do you find that most customers ask merely for "electric irons," or is there a demand for some one make? If there is a decided preference for a particular make, to what do you attribute this demand?

Ask for merely "electric irons," 277. Demand special make, owing to popular advertising, 71; owing to previous experience, quality, etc., 35.

guarantee, the dealer sustains the cost of the repairs and thus absorbs his own profit.

While a number of dealers flatly insist that they have received "no assistance of any kind" in furthering their iron and apparatus sales, the majority stand ready to admit that the advertising done by the manufacturers has awakened the public's interest in the use of electric devices. The answers received to the sixth query, however, show that, in an overwhelming proportion of cases—277, in fact—customer enters the store and asks simply for "an electric iron," leaving the selection to the dealers' judgment and experience. Only seventy-one dealers reported that their customers demanded a special make of iron as the result of national and local popular advertising. Thirty-five others traced the demand for a particular brand to the customer's previous experience with the same make or the advice of a friend. In at least six places from which responses were received local pride in a nearby electrical factory controlled the choice of purchase. Many of the dealers reported that their own advertising in local papers was especially effective, although they profited also from the campaigns conducted by the central station. Others in-

sisted that for their greatest assistance in making sales they depended upon the efforts of their own salesmen and their display windows. Satisfied customers and free trials of the apparatus were also cited as useful factors. In the language of the dealers themselves, "customers rarely ask for a particular make and can be easily influenced from one to another by the salesmen." "The choice of the iron purchased is usually left to the dealer's judgment." "Most customers want the iron the dealer recommends." "Few laymen know that there is any difference in electrical devices."

### Local Absorption in Radiotelegraphy

By A. H. TAYLOR

The general absorption of electromagnetic waves by the medium traversed has been studied for the conditions prevailing in practical radiotelegraphy at sea by Austin.<sup>1</sup> Unless this absorption over land areas is much greater than over water, it is not of serious importance to the amateur operating over distances not exceeding 50 miles and with wave-lengths not less than 300 m (985 ft.). By local absorption certain phenomena caused by purely local conditions at sending or receiving stations are referred to.

H. True<sup>2</sup> has studied that form of local absorption due to earth currents and shown that it may be partially avoided by the use of a false ground. There are other local effects, however, which are of more immediate importance to the amateur, who must often take conditions in a given building or neighborhood as they are and make the best of them. Among these effects are those caused by the proximity of energy-transmission, lighting and telephone circuits and of grounded conductors such as gas, steam and water pipes.

#### ABSORPTION DUE TO RESONANCE EFFECTS

Some field tests in connection with the departmental radiotelegraphic apparatus at the University of North Dakota necessitated the use of a rather short wave-length, namely, 245 m. This length was obtained by allowing the aerial to discharge directly through the spark-gap to earth, as in the original Marconi experiments. The spark-gap was about 3 cm long and the primary of the induction coil absorbed 300 watts. The ammeter in the aerial circuit indicated somewhat less than 1 amp. The aerial at that time consisted of four wires, spaced 2 ft. apart, run up from the second floor of Science Hall to a pole on the roof, with a total height of 30 m. The aerial was slightly bent, but at no point except at the base did it approach the building nearer than 10 ft. The alternating-current circuits used with the induction coil had no connection with the lighting system of the building, which is operated on 220 volts direct-current energy. Nevertheless, this particular wave-length set up current surges in the lighting circuits of the building, which resulted in the blowing of several fuses, the starting of two motors and the burning out of several tungsten lamps. Altering the wave-length eliminated these undesirable effects, but it is quite evident that a very considerable amount of the radiant energy of the aerial could have been absorbed without causing a catastrophe of such a nature as to call attention to the presence of these surges in neighboring circuits. The trouble was also avoided without changing the wave-length of the aerial by altering the free oscillations in the lighting circuit considered as a Lecher system. This was accomplished by putting two condensers of 1 mf. capacity each across the line at two experimentally determined points. It is quite likely that similar effects occur in the neighborhood of aials used for receiving only, resulting in the elimination of large areas of energy from the wave front.

#### ABSORPTION BY INSULATED CONDUCTORS

Since the above-mentioned experiments were performed, a new aerial with a free wave-length of 450 m has been erected. This is operated by a loose Tesla coupling, the energy being furnished by a self-controlling transformer which is used in connection with a rheostat. Two alarm clocks operate switches controlling an automatic sending device which repeats a sample message of a few words, containing all the letters of the alphabet. This makes possible the study of receiving conditions at distant stations; for instance, at the author's home in the city of Grand Forks, 3 miles from the university, using small sending power and a very short single-wire receiving aerial. At first the receiving apparatus was installed in a tool-house well removed from all overhead conductors, and a receiving aerial 10 ft. high was found necessary in order to read clearly signals sent from the university with 50 watts indicated power on the primary of the transformer. The wave-length was about 460 m. Later the apparatus was moved into the house, which is connected with the city alternating-current lighting system. The same signals were then received at the same intensity with a 3-ft. aerial, as indicated by shunting the telephone. The intensity of these signals, however, was greatly increased when this aerial was brought near an electric lamp. Evidently, the lighting system acted favorably as a collector and reacted on the aerial by induction. This point was tested by disconnecting the lighting system, and in consequence the signals were greatly reduced in intensity. It is evident that any speculation as to the radiant efficiency of the sending station based on indoor observations would have been far astray.

#### GROUNDING CONDUCTORS

It was suspected that the proximity of grounded conductors would have an unfavorable effect. Such was found to be the case, for with the apparatus installed in two different houses having gas illumination, no audible signals were received until the aerial was raised to a height of 15 ft., that is to say, several feet above the second-floor level, even though 150 watts was applied to the sending transformer. When the apparatus was moved to the second floor, the height of the receiving aerial above the ground remaining the same, the signals were very loud. The ground connection in this instance was on a second-floor radiator. The indications were that the portion of the aerial between floors was inactive in the first experiment; indeed, it was detrimental, because its lateral capacity effect to surrounding grounded objects acted as a shunting capacity around the detector circuit. The detector used in these experiments was a carborundum crystal of unusual constancy and fair sensitiveness. The coupling was a loose auto-transformer device, adjusted for maximum strength of signal.

The inferences to be drawn from these three cases are as follows. First, conductors in the immediate vicinity of radio-electric stations should be examined for resonant surges which may be followed by dangerous arcing and which, in any event, absorb a considerable portion of energy. If the wave-length radiated is not changed, these surges may be prevented by capacity loads<sup>3</sup> placed at suitable points on the circuits. The condensers should be fused to prevent short-circuit in case of a puncture being formed. Second, the presence of insulated overhead circuits may be favorable for the reception of signals with short aials when these aials are close to such circuits. In general, however, these circuits would absorb considerable energy which would not be re-radiated to an aerial. Third, in a building containing grounded circuits it is best to locate the receiver as high as possible. Some experiments made with 150 watts sending power with a receiving station 35 miles distant seem to confirm this point.

<sup>1</sup>Bulletin of the Bureau of Standards, Vol. 7, No. 3.

<sup>2</sup>Dissertation for doctor's degree, University of Göttingen, 1910.

<sup>3</sup>It is best to put two capacity units in series and ground the middle point.



# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electric Ice Making in Minnesota

Among recent contracts closed by the Minneapolis General Electric Company is one for a ten-year period with the Minneapolis Artificial Ice Company covering 180 hp. The Twin Cities lie in the center of a district containing countless beautiful little lakes of glacial origin, and with the brisk winter weather enjoyed by the North Star State the natural-ice crop is one that "never fails." The superior advantages and economies of electric ice making are such, nevertheless, that the central station can successfully compete, even here, with the free dispensation of old Boreas himself. Several electric ice-making plants are already in operation in Minnesota.

## Justifying Distribution-Line Extensions

In a discussion of the problems of justifying and building line extensions for reaching new customers and districts, before the Wisconsin Electrical Association, Jan. 15, Mr. C. R. Phenice, general superintendent of the Wisconsin Public Service Company, referred to the custom of some companies in running a new line or an extension of an old one if they can see that the initial cost of the line will be covered by two years' gross revenue from it. But whether this criterion will in reality make or lose the company money, said the speaker, must be determined for each individual case. A utility whose percentage of net earnings to gross earnings is 35 or 40 can afford to run farther and do more generally in the way of new lines and the taking on of new business than one whose ratio is 10 or 15 per cent.

In any event, the problem of just how far to run a new line or how much money to spend reaching out for new business of uncertain character is very important. The central station's duty to its public is to reach everyone who desires its commodity, provided that in so doing a heavier burden is not imposed on those already served. The question when to build and when not to build is a vital one.

A careful study should be made of the respective streets to determine those that will build up the most rapidly; which with high-class residences and which with more moderate-priced dwellings. Very often these conditions are more or less established before a line is attempted. Factories, for example, establish themselves in outlying districts and form a nucleus for residences built for their workmen.

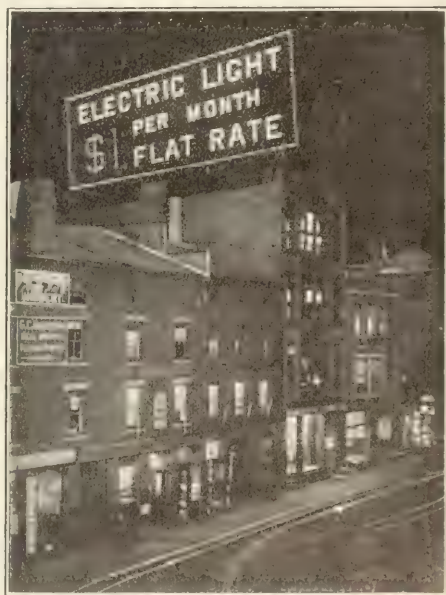
Much money has been wasted by mistakes in determining where the demand for electric service is going to grow in any particular district. Many times a trunk line has been built down one street or thoroughfare only to find that this trunk line has to be duplicated by another only one or two blocks away, in order to serve the community properly.

Having determined where the growth is going to be, and having studied the character of the occupants by means of soliciting, investigating their probable early adoption of electric service, the next step is to determine the most direct means of reaching them. Considerations of route include study of streets, alleys, pavements, parkways, trees, and the attitude of the frontage owners and city officials. A great deal of thought should be given this subject, and it should be borne in mind that it is not always the shortest route to a given center of distribution that proves the best.

## Flat-Rate Campaign at Fall River, Mass.

A highly successful flat-rate campaign for residence-lighting business has been under way at Fall River, Mass., since last June, the work having been advertised by effective newspaper displays and by a large electric sign illustrated in the accompanying photograph. The sign is located on the roof of a downtown building and is 32 ft. long, 10 ft. deep and stands 6 ft. above the cornice. It contains 614 4-cp metallized-filament lamps, 398 of which are in the letters and 216 in the border.

With the aid of five extra solicitors the company has secured 600 additional customers in the past six months.



CENTRAL-STATION OFFICE AND SIGN, FALL RIVER, MASS.

The newspaper advertisements emphasize the schedule rate of \$1 for four 25-watt lamps per month, burning without regard to hours of use, but connected under an indicator, which limits the demand at any one time. The wiring is done under the company's supervision at a nominal charge.

## Central-Station Oil-Well Pumping in Texas Field

One of the paradoxical conditions of the oil industry is now being witnessed in the pioneer Spindle Top field of Texas, where crude oil is being discarded as fuel for the operation of pumping engines, in favor of pumping the wells by electricity. Naturally it might be expected that oil producers would find their own product cheap and advantageous to use, but since the recent advance in the price of the fuel, it is found much more economical, it is claimed,



to operate the pumps by motors than by burning oil to generate steam.

Recently fourteen electric motors have been installed on Spindle Top, and they are pumping more than twenty-five wells. It is claimed by those who have adopted this power that they are saving from 25 to 75 per cent in operating expenses, as compared with steam power where fuel oil was used. The motors employed are arranged to develop 10 hp when pumping and 30 hp when "pulling" wells. By changing over a switch the motor is transferred from the lower to the higher power, with double speed. Motors are also being used to pump salt water from the wells into reservoirs.

The adoption of electricity for power purposes in the Spindle Top oil field is attracting much attention among the oil men of other producing territory in Texas and nearby states.

### "Swarm of Fireflies" at Mobile's Carnival

Elaborate electrical decorations made brilliant the streets and public squares of Mobile, Ala., during the city's carnival celebration held the week of Feb. 3. Streamers of colored lamps formed a blazing canopy over Government and Royal Streets.

In Bienville Square the great oaks surrounding the fountain were selected as the background against which, intertwined among the boughs, hundreds of twinkling incandescent lamps "glittered like a swarm of fireflies tangled in a silver braid." A system of flashers controlled the lamps, switching on and off alternate groups so as to simulate the indiscriminate flashing of firefly lanterns amid the foliage of the great trees. To secure the necessary contrast, the white lamps on the decorative posts bordering the plaza were replaced with deep red globes during the "firefly" exhibition.

The fountain in the square was converted into a beautiful electrical display during carnival week by illuminating it with varicolored light thrown by a powerful projector with revolving color screen, mounted directly over the flowing streams of water.

### "Brighter Brooklyn" Hint Books for Contractors

Realizing that every electrical contractor in Brooklyn is jointly interested with it in the city's electrical development, and that any plan likely to result in increased efficiency in securing new business or handling customers should therefore be of mutual advantage, the Edison Electric Illuminating Company of Brooklyn is about to send to each electrical contractor in its territory what it calls the

BOOK No.	Date.....
Contractor.....	
makes the following report:—	

PERFORATED REPLY CARD FROM CONTRACTOR'S HINT BOOK

"Brighter Brooklyn Red Book for Electrical Contractors." This is a pocket-size loose-leaf memorandum book, with a neat cover of red leather. The book contains a number of detachable postal cards addressed to the company, the purpose of these cards being to provide the contractor with a ready means of transmitting to the company any information which he believes might be of mutual value. The

foregoing is part of the explanation that is given on the flyleaf. The latter also bears the name and address of the contractor to whom the book is sent, together with the following sentences:

"Carry this book with you, jot down and forward notes, suggestions, 'leads,' complaints. All cards received will be given prompt attention and you will be notified of the results of our investigation, a complete record of which will be kept in our office. By using this book you may accomplish two things: (1) Increase the satisfaction of customers with service conditions; (2) obtain more customers. It is hoped that you will take an interest in this matter and that we may hear from you frequently."

This bears the signature of the general sales agent. On the side intended for remarks the cards are stamped simply with the number of the book, a date line and the words, "Contractor ——— makes the following report." When the contractor runs out of cards more will be sent to him by the company upon his request.

The idea is an outgrowth of a similar notebook that has been in successful use by the Brooklyn company's employees for a number of years. On the first day of each year every employee receives a vest-pocket size notebook with detachable leaves, each of which bears simply the number of the book. A record is kept of the names of the various employees and of the books assigned to them.

Suggestions of any kind for improving the company's service or increasing its business are turned in to the general sales agent on the pages of the book and "lead slips" issued to solicitors when the suggestion contains data referring to prospective customers.

At the end of the year cash prizes are given to the three employees who have turned in the greatest number of leads resulting in the signing of contracts. During 1912 the employees turned in 4643 of these "leads," of which 1833 resulted in original contracts being signed, forty-five in renewal contracts and four in the sale of fans. Three "leads" turned in brought about the sale of as many flat-irons.

### Electric Rates and Classification of Customers\*

When a business is subjected to unlimited competition all its rates automatically seek a level where they give the owner barely a minimum return, for when they rise above this level more competition develops, and when they fall below it competition ceases until they rise again.

In the case of public-service monopolies, however, it is expected that public sentiment, the courts or commissions will regulate the rates to a point at least as low as they would have been in the long run if subject to competition.

The degree of monopoly of public-service corporations is greatly overestimated, since most of their monopoly is in form only. A company may have exclusive rights to supply electricity for lighting, motors, heat, etc., but it has no monopoly in the supply of light, power, or heat as such, for it, respectively, has as active competitors candles, oil and gas; animal power, gas and oil engines and steam engines, and gas, oil, coal and blankets. Thus it finds tremendously active competition in substance—competition which seriously affects its business the moment it raises its prices above a certain point.

Below this the company may have a monopoly, but public sentiment requires that its prices shall, in the long run, be lower than if the competition were unlimited, and this point is where all the prices together produce just a fair return on the investment.

#### DIVISION OF COSTS

The question of division of costs among different customers or classes is entirely separate from the question

\*Prepared by a member of the rate research committee of the National Electric Light Association.

of total costs or fair return. Having decided what a fair return on the investment is, the question is still open, How shall rates to produce this income be adjusted between different classes of customers?

The first answer (and a theoretically correct one) is that each customer shall be charged at least what it costs to serve him. But this distributes only a small portion of the costs. For example, if a farmer kill a calf and skin it, what is the cost of the veal and what is the cost of the hide? The cost of curing the hide is clearly part of the cost of the hide, and the cost of storing and selling the meat is part of the veal cost, but the original cost of the live calf and of the labor of killing and skinning are joint costs which may belong to either. Again, if a railroad train is going anyway, the extra cost if a passenger gets aboard is very small. The only extra expense in such a case is the little extra coal used in hauling his weight.

In many businesses—and especially such a business as electric service—most of the expenses are the same whether any particular customer uses the service or not, and it is only certain small expenses that are necessarily part of the cost of each customer. These latter are sometimes grouped under the general term "increment costs"—the cost incurred by adding that customer to the system, or saved if he is disconnected. The remaining and greater portion are "joint costs," which belong to the customers as a whole.

#### INCREMENT AND JOINT COSTS

Increment costs should be apportioned to individuals or the special classes that cause them.

Joint costs must be divided between all the customers. Here the question is, How much of the cost of the calf shall be paid by the purchaser of the veal and how much by the purchaser of the hide?

No absolute accountant's line can be drawn between increment and joint costs. For instance, in railroad freight, suppose a given traffic goes south. So long as cars come back empty the increment cost of extra freight north is only the handling and a little coal. All the rest is joint expense to be divided in some way among all the traffic. The moment the traffic north becomes big enough to require extra trains, then the increment cost in that particular case is high, and at that moment increment cost for freight in empty trains now going south becomes small.

It follows that the increment cost incurred by a customer is usually very small, unless we can be sure that he is always the "straw that breaks the camel's back." The fact that he happens to cost a great deal should not be charged against him unless it is always going to require that extra expense to serve him. Unless he, or his class, is always going to involve an expense, it is a joint cost and not an increment cost.

#### DIVISION OF JOINT COSTS

It is important to remember that for electric companies and most public services these joint costs are by far the most important portion of the total expense. It makes little difference to an electric company whether a particular lamp or motor runs or not, for the effect on 90 per cent of the expenses would be practically nil. These joint costs must be divided in some way between the customers that jointly use the service.

The simplest method is to select some unit, as the kilowatt-hour, and divide all costs in proportion thereto. Here there is no difference of interests as between owner and public in choosing the unit, but there will naturally be a difference as between portions of the public. Whether an electric company charges per lamp connected or per kilowatt-hour makes a great difference as between stores and residences, even though the rates are such that the electric company gets the same return on its whole investment.

Now, a class, like an individual, might possess the power to bribe the managers or to exert improper influence. But this case is so rare that it is a fair assumption that when

the government establishes one rate for letters and another for books, when a telegraph company makes one rate for regular telegrams and another for night letters, when an electric company makes one rate for motors and another for lamps, these differentials are made in the interest of the public as much as in the interest of the corporations. Why, if the rate of return is fixed, should the owner make class differentials except to do more business at the same rate of return? And is not this just what the public wants him to do? Or, even if these differentials do increase the rate of return, is not this for the ultimate public advantage by making possible reductions of price that would not have been possible otherwise?

Every business, beginning with Uncle Sam's, makes these classifications or class rates, the results of which are undeniably good. There is, however, a feeling that these classifications are necessary evils that should be allowed only as a temporary expedient. Simplicity is, of course, an advantage, if not gained at too great a cost, but a certain school of thought has lately taken to laying undue emphasis on the evil side of classifications of rates, without realizing the absolute necessity of the classification or the great injury that would result to the public if it were given up, and in most cases these attacks on classification of rates have been merely a cover for attacks on company's profits.

#### ANALYSIS OF RATE SYSTEMS

The various well-known formulas for analyzing costs, such as the "demand" method, etc., are most useful tools in considering what may be the effect of changes in the business, but obviously a complete analysis would involve a tremendously complex formula. Cost per kilowatt-hour, for example, does not take into account the fact that underground service costs more than overhead. A complete formula would have not one or two but possibly hundreds of terms; and, no matter which formula is used for analyzing costs, it is still true that most of the costs are joint costs not necessarily incurred by any particular customer or customers.

The best result will be obtained, of course, when the burden on the customers is least; that is, when the central station gets as much business as possible over which to divide the joint costs so that the burden on each customer shall be least.

In any case it is obvious that the rate made for the new business should take as much of the joint costs as it will stand. This is clearly no injury to the new business, because it need not take the supply unless it wants to and will not unless it gets some advantage. On the other hand, if new business were asked to share the proportion of joint costs paid by the old business, it might not be secured at all and then would not pay anything toward joint costs, instead of paying something.

#### CENTRAL STATION AND ISOLATED PLANT COSTS

In a recent article in the engineering press, it was stated that the central station's operating costs are 1 cent per kw-hr., although the real cost is usually less. The general expenses are taken at 2.5 cents per kw-hr., probably including accounting and distribution expenses, maintenance of lines, etc. The article does not give figures for the fixed charges on the central station, but says that they are three times what they would be for an isolated plant. If the latter are the latter as 2 cents per kw-hr., making the charges for the central station 6 cents per kw-hr. and the total central station cost 9½ cents per kw-hr.

Then the costs of an isolated plant are given as: Operating cost, 1 cent to 1.5 cents per kw-hr.; fixed charges, 2 cents per kw-hr.; general expenses nothing; total, 3 cents to 3.5 cents per kw-hr. It is, of course, absurd that an isolated plant has no general or supervision and management expenses and that such services should not be included in the cost.



The costs for the central station, however, are the average costs, made up of all sorts of expenses, and because they may average 9.5 cents it does not mean that service for each new customer will also cost 9.5 cents. Each new customer may add something to the total costs, but this addition will have no relation to the average cost of serving the old customers.

#### CUSTOMER'S DEMAND USED AS AN INDEX

Naturally the new customer should contribute as much as possible to joint costs, being made to pay "all his traffic will bear," even if he is charged as much as the others. Now, in order to determine what he can actually afford to contribute toward joint costs, it is necessary to figure what it will cost him to make electricity himself, and in most cases like this the things which determine his costs are his demand, his consumption and his size. In other words, we may use as a basis to figure his costs the demand formula above referred to. Hence, in publishing a rate to attract these customers, it is natural to make it on a demand basis, so that each shall pay as much as possible of the joint charges and reduce their burden on others.

But while the demand system furnishes a measure of the total station costs, it is not for that reason that it is used in making prices, but because it furnishes a measure of the value of the service to the customer. If in any particular case the demand system did not furnish this measure, we might use some other measure in order to apportion to him as much as possible of the joint costs, so that the supply to him should be of the greatest benefit to the other customers. Thus even when there is no question of the customer making his own electricity, the demand theory is still apt to furnish a measure of how much the new business can contribute to joint costs.

There is sometimes difficulty in understanding why a large customer can be supplied at so much less than the average price, but another analysis may make it clear.

The central station could build a new small station for a customer close to his mill, duplicating his plant, and by running it exactly as he would run his plant could meet his costs exactly. Then as a next step by combining the loads it could effect a saving and make a profit. In any case it could not lose, because even in the worst case it would operate exactly as the customer would have operated.

#### BASIS OF VALUE OF ELECTRIC SERVICE

The value of electric-light service is not what one would pay for electric light rather than go without electric light at all, but what he would pay that particular company for the service rather than get an equivalent service in some other way. The value of the service is never above what a competitor offers it for, and regulation of prices is merely to determine what the value of the service from the company in question would have been if no monopoly had been granted; in other words, what the company would have charged in the long run if subject to competition.

Whenever the return on investment is higher than is reasonable and equitable, competition will naturally spring up, and the authority that grants the monopoly requires that there shall be a reduction of rates applicable to those classes whose price would have been reduced by such competition. Subject to this exception, each price should be such as to produce the greatest amount of business and make the burden of joint costs least. The final result will be obtained by basing all rates either on actual value of service or on what this value would be under free competition. This results in practice in a simple, general rate such as obtains in most of our cities, with special classifications for power use and for large customers, etc.

It will be for the interest of owners, as well as of the public, to adjust rates along these lines, and if rates are made public and open to all alike, under like conditions, and so long as these conditions are made in good faith and without ulterior motive, any such proper discrimination in

rates is justified and should inure to the advantage of the public as a whole.

#### ADJUSTMENT OF THE DIFFERENTIAL

If the differential is between customers or classes who compete with each other, the burden of proof should be on those who propose or advocate the differential, and it should not be allowed unless it is shown that it is necessary, and then it should be no greater than necessary. The differential between large and small customers is of this nature. It is necessary, and in fact it would be better for the small customers if the differential should be made even larger, so as to get the big users to contribute something toward joint costs, instead of nothing, as happens when they do not use the service. But the differential should be watched carefully, because an error in adjusting it will merely transfer business from one class to another without really producing new business.

One rate for residences and another for stores would never transfer business and would seldom be open to criticism. On the other hand, one rate for two-family houses and another for single houses might transfer business from one to the other and in general might be undesirable. One rate for ice making and another rate for water pumping would hardly ever transfer business and hence is fully justified. But one rate for drug stores and another for saloons would be apt to transfer business. A rate for newspaper offices different from that for ordinary printing offices would again be subject to suspicion. On the other hand, the rate for hotels might be different from that for factories without much chance of any transfer of business.

#### RULES FOR THE COMPANY AND FOR THE PUBLIC

The following rules will show how the methods already mentioned can and should be applied:

*For the Company.*—Adjust the rate to various classes so as to get the greatest volume of business among which to divide joint costs. In order to do this, first make sure that no class is supplied at a loss and that each class bears as much as it can contribute (or would have paid under free competition) toward the joint costs. This means making the rates proportional to the value of the service less the savings due to monopoly.

This should result in a single general rate for the general public at least as low as would have been obtained under free competition.

It should result in class rates for motors, street lighting, charging of batteries, cooking, etc., lower in many cases than the general rate, and should result in differentials for large customers, all of these class rates and differentials being only as low as necessary in order to get the business.

The differentials for large customers should be low enough to get the business now done by isolated plants.

*For the Public.*—Allow the company to make any change it likes as between customers or classes who do not compete with each other.

When a change is proposed which makes a difference between customers or classes that do compete with each other, allow the change only when it is clear that the result will really produce new business and not merely transfer business between competitors.

When the rates produce more than a fair return, provide for reducing the rates to those classes which would have obtained a reduction if competition had been free.

This is the line along which companies are now developing. The only weak point in their present situation is that they are not making the differentials in favor of large customers (and of certain uses, such as cooking, etc.) large enough to get the business. The result is that the small customers now pay more toward joint costs than would be necessary if the rates for big customers were made low enough to shut down every isolated plant whose owner knew his costs and was not running it for his own pride or amusement.



# Illumination and Wiring

## Minor Inconsistencies in the National Code

Some of the minor inconsistencies in the National Electrical Code for wiring construction were brought out in the discussion at the recent convention of the Western Association of Electrical Inspectors at St. Louis.

In conduit systems, for example, the rules require No. 12 gage junction boxes but only No. 16 gage cut-out cabinets. It is also a general code requirement that No. 18 wire be fused at 3 amp, yet No. 18 flexible cord and No. 18 fixture wire are employed generally without such restriction. Discussion at the convention led into arguments both for and against legitimatizing this small size of wire, since as pointed out by those opposed to its use final lamp sockets are now very readily and generally utilized for the connection of household appliances having high rates of energy consumption.

Early practice, as the discussion brought out, contemplated short-circuit protection in allowing a 6-amp fuse to protect No. 18 cord or No. 18 fixture wire, both of which were then permitted for supplying single lamps. The use of household devices, however, now involve loads considerably larger than that set by the National Electrical Code table as a safe limit for No. 18 wire.

## A Comparison of Direct and Semi-Indirect Lighting

At a recent meeting of the Illuminating Engineering Society in London some interesting photographs which had been taken by artificial light were shown by Mr. V. H. Mackinney.

Two of these photographs represent the same room. In Fig. 1 it is illuminated by a cluster of tungsten lamps in holophane reflectors. The other illustration (Fig. 2)



FIG. 1.—DIRECT ILLUMINATION WITH TUNGSTEN LAMPS

shows the room lighted by tungsten lamps in a holophane inverted prismatic bowl. The amount of light given to the lower part of the room with the semi-indirect lighting fixture is distinctly less than with the direct system of illumination, but the distribution is much better. It will be noticed that the shimmer of the tablecloth under the direct lighting is apparently more marked, but that the semi-indirect unit

still gives a certain amount of shimmer. Semi-indirect lighting is not entirely shadowless. It has been computed that this unit reflects about 75 per cent of the light upward and transmits practically all the remaining 25 per cent downward into the room as direct light.

The effect of the semi-indirect unit is distinctly soft and restful. The group of three reflectors shown in Fig. 1



FIG. 2.—INDIRECT ILLUMINATION IN THE SAME ROOM

stands out quite sharply, but there is nevertheless a slight haze around them, analogous to glare. The semi-indirect unit is shown clearly and distinctly with no trace of glare. Neither of these two photographs has been retouched in any way, and both were taken by the artificial light of the tungsten lamps alone.

## Indirect Illumination for General Offices

At the meeting of the Chicago Section, Illuminating Engineering Society, Jan. 15, Mr. J. P. Malia, chief electrician of Armour & Company, Chicago, and Mr. T. H. Aldrich, supervising engineer of the National X-Ray Reflector Company, Chicago, presented a paper on indirect illumination for general offices, discussing in detail the extensive tests made prior to the selection of a new system of illumination for the offices of Armour & Company at the Union Stock Yards, Chicago.

There are 1200 employees in these offices, the total floor area being 113,750 sq. ft. Most of the office space consists of large open areas, but there are twenty-eight private offices. In arranging these rooms much attention was originally given to provisions for natural light, ventilation and lighting. The walls and ceilings are covered with a light-colored matte-surface paint. The walls are a light-green tint extends up to a line 7 ft. 9 in. from the floor. The ceilings are 15 ft. 9 in. high.

The former system of illumination employed Ernest lamps on a distributed-outlet system with four outlets per bay in bays about 17 ft. by 17 ft. This system cost 2.1 watts per square foot. It was decided to change this system because of the employees' dissatisfaction with the lighting, the inconvenience of frequent lamp outages, low illumination efficiency compared with tungsten lamps, and the high cost of renewals and cleaning.

Three kinds of lighting were given thorough trials. These were: (1) Indirect lighting with one-piece corrugated

mirrored reflectors; (2) semi-indirect lighting with a light-density opal reflector turned upward, and (3) indirect lighting using white-enameled steel reflecting bowls.

Trial installations of the three systems, direct, semi-indirect and indirect—were made in December, 1911, and January, 1912, and were kept in operation for six months before decisions were made as to the system to be adopted. During that time numerous tests were made for illuminating efficiency, using two Sharp-Millar photometers, frequently calibrated at the Armour Institute, to determine the average illumination. A bay near the center of the office space was chosen for the average illumination tests.

Illumination efficiencies, or the percentage of lumens generated which was found effective on a horizontal plane 34 in. above the floor for the three systems, were as follows: Direct (satin-finish, prismatic, concentrating), 55 per cent; semi-indirect (light-density opal), 50.7 per cent; indirect (mirrored reflectors), 38 per cent.

Tests for depreciation in illumination caused by dirt were also made after several months' use. These tests showed that the depreciation caused by dirt is practically the same for all three of the systems examined, and under the conditions of this office it averaged about 10 per cent per month. Mr. Aldrich stated that he had found similar results in a large office building on Michigan Avenue, Chicago.

Some interesting tests were made on the time required to clean lamps and reflectors. The lighting unit consisted of one lamp and its reflector in each case. The time of one man required per unit, for a run of thirty-six units, was as follows: Indirect, 2.25 minutes per outlet; semi-indirect, 6 minutes per outlet; direct, 6.5 minutes per outlet. This difference was partly due to the mechanical arrangements of the various units and partly to the prisms or creases on the direct and semi-indirect reflectors.

The committee for Armour & Company in charge of the proposed change consisted of the general office manager, assistant office manager, superintendent of motive power, assistant superintendent of motive power, and chief electrician. After considering the opinions of the employees working under the different systems, the cost of operation and maintenance, and first cost, the committee decided unanimously in favor of the indirect system. There was less than 7 per cent difference in the installation costs of the three systems proposed. It was found that even though the intensity in foot-candles was lower with the indirect system, it was preferred by the employees. This was attributed to the diffused character of the light, making shadows and the glare from paper surfaces less prominent than with the other systems under test.

The average illumination from the indirect-lighting equipment, with the reflectors and lamps clean and new, was 3.76 ft.-candles. Under average working conditions this illumination is, of course, lower. About 1.25 watts is expended per square foot.

In conclusion it was pointed out that in large office spaces of this kind, with ceilings from 13 ft. to 16 ft. high, considerable saving in wiring would result by having one outlet per bay instead of four, and that by hanging the lamps and reflectors lower the light from each reflector could be made to cover the area of the whole bay. Such an arrangement would also look better. Lamps of 400-watt or 500-watt sizes could be used, instead of 100-watt units, thus increasing the efficiency and lowering the renewal cost.

#### Discussion

In the discussion Chairman F. A. Vaughn, Milwaukee, questioned the advisability of using one outlet per bay for office and drafting-room lighting of this kind. For such places he thought the more diffuse the light the better, the ideal condition being a uniformly illuminated ceiling. Dr. M. G. Lloyd, Chicago, called attention to the fact that reflection from the ceiling follows more nearly the laws

of diffuse reflection than the laws of specular reflection.

Mr. J. R. Cravath, Chicago, agreed with Mr. Vaughn that approximate uniformity of ceiling illumination is desirable for general offices in order to minimize the two things most to be avoided in office lighting—namely, glare from paper and sharp shadows. These two features were responsible for the great popularity of indirect lighting among employees, though often the true reasons are not appreciated by the manufacturers or the users. By hanging indirect fixtures low enough with very high ceilings, reasonable uniformity of ceiling brightness might be obtained, but in general the plan of using one outlet per bay should be applied with much caution for office lighting. If the very best results in comfortable illumination and the highest human efficiency are sought, one can afford to sacrifice some illuminating efficiency, but, of course, it must be recognized that the illuminating efficiency is lower if the ceilings are made relatively bright around the edges. This is simply the price one must pay for the best results.

Mr. Vaughn questioned the desirability of wall colorings mixed with oil because they are more glossy than calcimine. Mr. Aldrich replied that paints can be obtained which do not give a glossy surface, and that paints are becoming popular because they can be washed.

Mr. Malia in conclusion emphasized the point that all of the men working under the indirect system chosen preferred it to the others.

#### Lighting an Art Room

The special conditions which present themselves in the illumination of rooms to be used by art classes in molding, drawing, etc., are always matters of keen interest to the illuminating engineer. The illustration presented herewith shows such an installation in the art room of an English school. One of the most important problems in this case was the arrangement of shadow. There has been con-



ILLUMINATION IN ART STUDIO

siderable controversy as to whether indirect lighting is suitable in such cases or not. It has been maintained by some engineers that the effects were nearly shadowless, while others contend that the shadows are present but are soft and agreeable and resemble daylight.

The kind of shadow desired by an artist may be expected to vary according to the subject. A recent article in the



*Illuminating Engineer* (London) describes a method of lighting art rooms at the Training School College in the city of Leeds and pays careful attention to this point. The method of varying the shadow consists in using a collection of tungsten lamps in holophane globes hung from the ceiling. As a rule, the model sketched by the students is placed immediately under the chandelier, so that it may receive the brightest light in the room. The switching arrangements enable four, eight or twelve lamps to be lighted. In this way the illumination can be varied between wide limits and the intensity and abruptness of the shadow may be adjusted. In the room shown in the photograph a collection of twelve tungsten units is employed, and with all lamps lighted an illumination of 15 ft.-candles is obtained immediately under the light.

### Requirements for Proper Grounding

The thoroughness of the ground connection established is of prime importance, said Mr. W. J. Canada, engineer for the Rocky Mountain Fire Underwriters' Association, Denver, Col., in discussing the grounding of secondaries before the recent convention of the Western Association of Electrical Inspectors at St. Louis.

The "ground" must be of such size as neither to burn loose in case of dead ground on opposite primary nor to deteriorate from the passage of such current as the blowing of the largest primary fuse may necessitate. Failure to blow the fuse must, of course, subject the secondary to some voltage rise. If 200 amp be taken as about the largest primary fuse in any given system, the ground on that feeder should easily accommodate that current.

Since the grounding should be permanently good enough to prevent more than, say, 25 per cent voltage rise on the secondary, it is evident that with 200 amp flowing from a primary-secondary contact to a ground 500 ft. away, at least No. 4 ground wire and neutral would be necessary. A No. 6 wire would cause a 40-volt rise. Resistance in the ground connection, even as small as 1 ohm, would cause a 200-volt rise which might readily be dangerous and certainly does not accomplish the full purpose of grounding.

It seems quite evident that for real protection primaries must be generally much smaller than of 200-amp capacity, or, far better, that grounds on secondaries to this primary should be in such numbers and thoroughness as to give much less than 1-ohm resistance. The large proportion of companies using driven-pipe grounds would indicate that these have given absolute satisfaction in these respects, were it not that a majority of these very companies state their distinct preference for the ground to water mains, as being more thorough and rugged.

One engineer representing a large number of important operating companies writes: "Ground plates are better than nothing, but the ordinary connections to water mains if properly made are entirely satisfactory, and driven pipes can be made satisfactory where soil is moist and where enough pipes are driven."

Many in substance write: "We regard grounds to water pipes as very desirable, but they are not permitted by our water company." Others add: "We use driven pipes [or cones, or plates]. These methods are not highly satisfactory, but we feel that by placing such grounds close enough the combined effect of all gives us a decided element of protection." A few companies claim to find their practice of grounding secondaries frequently to rail returns satisfactory protection.

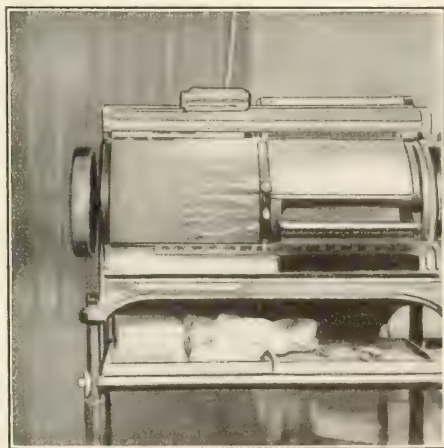
It generally appears that in very wet places the driven-pipe ground, if in sufficient numbers and well spaced, will give the necessary low resistance and fair life. In all other cases, and especially where few grounds must be depended on for protection against crosses with heavy primaries, the water-main ground is without rival. Such cities as Denver

or Los Angeles could not get effective service from other forms of ground. Only the best available grounds should be made, since the neutral may, by a direct cross with the primary, be raised to a sufficient potential above water or gas pipes in buildings to cause fire—and indirectly life—hazard, by break-down in such piping systems or by high resistance contacts with them.

Another difficulty, rare but still to be considered, is that caused by small grounds such as pipes, cones or plates, even though reasonably numerous, in locations where soil freezes to a considerable depth. In this case the earth surrounding the "ground" becomes practically an insulator. The grounding loses its value, and in the event of surface thaw severe shocks have been given between this poor ground and the better-conducting top surface.

### Adapting a Portable Lamp to a Multigraph Machine

The accompanying illustration shows a multigraph machine used in a small typewriting office without natural light, the machine having been equipped with an 8-cp tungsten lamp to improve operating conditions. The lamp was placed in a small fixture carried under a shade by a clamp attaching it to the machine frame. A cord and plug enable the device to be used at any point on the premises.



PORTABLE LAMP ON MULTIGRAPH

When adjusted for service the lamp provides good illumination on the working field of the machine, with practically no glare in the operator's face. Both the comfort of the attendant and the speed of his production have been materially improved by the use of this subdivided local illumination. The cost of operation is about 1 cent per day.

### Recent Telephone Patents

#### PAY-STATION COIN-COLLECTOR SYSTEM

In recent years there has been developed a pay-station system employing coin collectors wherein a coin must be deposited before a signal can be given to the operator. These are known as prepayment stations. They must have a means, under control of the operator, for causing a coin to be collected or returned according to the result of the call. A patent granted to Mr. A. F. Dixon, of New York City, describes a prepayment pay station collector adapted for coins of several different denominations. The device has a single slot to receive all coins. Any standard coin will



operate the signals. After a coin is deposited a lever is pulled, which causes the coin to be gaged by a coin plate, and if it is of a standard size contacts will be made to signal the operator. The coin then will be dropped to an intermediate receptacle. The operator responds and returns the coin and asks for the proper deposit. This is necessary as the operator is not upon the line to check the code signal indicating the denomination of the coin at first. As the coins are now dropped and the lever pulled, a code wheel is set in motion which indicates the denomination. Each coin must be disposed of from the intermediate receptacle. This is accomplished through a polarized electromagnet, responsive only to special currents introduced by special keys. Current of one polarity sends the coin to the hopper, while current of the opposite polarity sends it to the return chute. This patent is assigned to the Western Electric Company.

#### TELEPHONE CIRCUIT SYSTEMS

Mr. E. R. Corwin has had six patents granted to him for circuit systems. Four of these patents relate to a system employing automatic ringing and listening cord pairs. By this is meant that the usual manually operated ringing and listening keys are superseded by relays. When a connection is to be put up the answering cord is plugged to an answering jack in the usual way, and the operator may immediately talk to the calling party. When she has learned his wishes and plugged to the desired number, ringing continues intermittently until response, or for a predetermined period. The ringing relay is controlled by a lock-out relay for cutting off the ringing current, and this latter is in turn controlled by the called-party supervisory relay. In another system a motor is used to control the maximum duration of the ringing period, which is terminated when the motor has made a certain predetermined number of revolutions. Of the other two patents, one describes a particular arrangement of busy-test circuit employing a split induction coil with a split receiver connected to its middle, the receiver in turn having its middle terminal grounded. The other patent describes an interchange trunk terminating in a plug at one end and in jacks at the other. The trunk has a condenser in each side of its line so as to provide for a talking circuit without metallic connection between the two ends.

#### SECTIONAL SWITCHBOARD

While heretofore all large telephone switchboards have been built up of sections placed end to end, each section has in itself been of considerable size and on this account it has therefore been customary to build special sections to meet the demands from small plants. Recently the idea has been conceived of producing small unit sections,

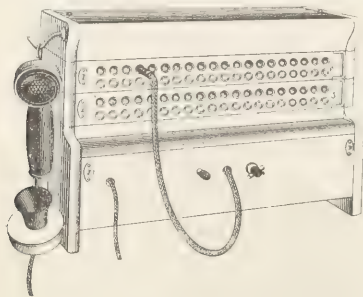


FIG. 1—SECTIONAL SWITCHBOARD

which may be built together after the manner of a sectional bookcase to meet the demands of these plants. It is such a unit switchboard that is described in a patent issued to Mr. E. S. McLaren, of East Orange, N. J. The patent is assigned to the Western Electric Company. An idea of the

size of the sections is conveyed by the cuts, which show two views of the switchboard. It will be noted that the base section carries the cord and operator's equipment, while the line sections bearing various standard equipments

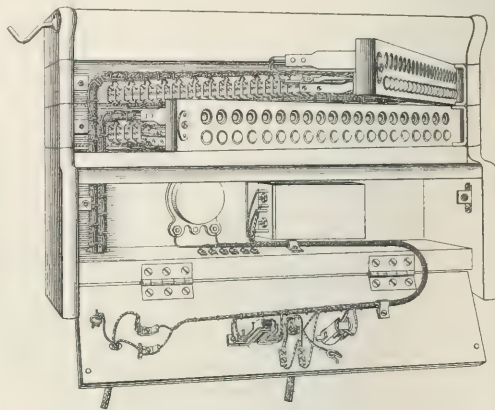


FIG. 2—ARRANGEMENT OF WIRING AND SECTIONS

may be piled upon this, one upon the other, until the desired capacity is reached. The board is surmounted by a top section, as shown in the illustrations.

## Letters to the Editors

### European Wiring Practice

To the Editors of the *Electrical World*:

SIRS:—Mr. A. H. Bernhard's article on "European Wiring Practice," which appeared in the Jan. 11 issue, calls for some comment. Not being personally acquainted with French and Italian practice, I cannot comment intelligently on the construction work of either country, so that my criticism will be limited to Austrian and German practice, which are almost identical. The centralization of fuses on panelboards and the fusing of every 6-amp lamp circuit has been standard practice in both Germany and Austria for the last two decades. In the case of movable lamps or fixtures, however, a second double-pole fuse is called for, which is oftentimes installed in the ceiling rosette. This additional fuse is required because of the greater possibility of trouble in lamps which are movable. Other peculiarities in wiring are found in residences the walls and ceilings of which are covered with valuable paintings or tapestries. In such dwellings the mains are run in the corridors and the fused conductors leading to the chandeliers are brought in through the walls and are not supported by knobs or any other medium to the ceiling, but are draped between the outlet and the chandelier. The switches controlling the lamps are located either outside the door in the corridor or on the chandelier itself, and the fuses and mains in the corridor are properly covered. Dead wires are symmetrically draped in the room with the live wires leading to the chandelier so as not to mar the artistic arrangement of the room. Wooden molding is expressly prohibited, as is also the common practice in this country of having the conductors sustain the weight of the lamp and fixture. In Germany and Austria a suspension wire is used in addition to the two conductors, and its function is to relieve the conductors of the weight of the lamp and fixture. In both countries the rules promulgated by the engineering societies are strictly enforced, and trouble or fire from short-circuits is almost unknown.

Schenectady, N. Y.

L. LUSTIG.

## Variations in Wireless Signals

To the Editors of the Electrical World:

SIRS:—It is possible that your readers will be interested in the following four suggestions concerning the causes for the well-known daily variation in wireless telegraph signals:

First—That the current transmitted in wireless communication travels over the surface of the earth as a static charge, setting up an electromagnetic field in the air above, exactly the same as the field of force around an ordinary conductor carrying the same kind of charge.

Second—That the real regulating factors in wireless transmission are to be found by an investigation of solar, terrestrial and nocturnal radiation, and of convection currents.

Third—That a careful investigation of the "dew point" of the air at the transmitting station and at different points between the transmitting and receiving stations will show that the upward and downward radiation of vapor, as the temperature fluctuates around the dew point, will correspond with the greatly fluctuating strength of signals during darkness.

Fourth—That at or near sunset, at a given transmitting station, there is a short period of time when the atmosphere is in a stable condition—that is, without any circulation or radiation either upward or downward—and this condition may be the cause of the great increase in energy transmission noticed daily at this time.

WALTER N. FANNING,  
Chief Electrician U. S. Navy.

Vallejo, Cal.

## The "Kelvin" and the Kilowatt-Hour

To the Editors of the Electrical World:

SIRS:—An item in the *Digest* in your issue for Jan. 25 calls attention to the proposal to give the name "kelvin" to the kilowatt-hour, a proposal that has not proved acceptable to many engineers and scientists wishing to honor Lord Kelvin.

It is well known that Lord Kelvin was one of the main founders of the c.g.s. system of units, as well as of their decimally related prototypes in the practical, or ohm-volt-ampere, system. Electrical engineers all the world over will agree that his name is certainly entitled to a permanent place in electromagnetic units. It may be taken for granted that not only the Americans, as part of the English-speaking peoples, but also electrical engineers in all countries, desire to see an honorable place given to the name of "Kelvin" in electrical metrology. Moreover, no action in the matter can give universal satisfaction save international action because such a man belongs to international science and to the whole world, rather than to any one country. Such action, should, therefore, be considered from the international standpoint.

It will be remembered that at the international electrical congress of 1889, in Paris, the "joule" was adopted as the practical unit of electrical energy and the "watt" as the unit of electrical power. These were ratified by the Chicago congress of 1893 and by other congresses since that date. If we possessed a decimal division of time, it is reasonable to suppose that the joule, perhaps with the aid of decimal prefixes, would have been introduced into the electrical industry. But the fact that we all inherit a sexagesimal system of time prevented the joule from coming into industrial use, the watt-hour having been speedily adopted, by common consent, in many countries, without any formal recognition from international congresses. The dials of a large number of energy meters in service bear the word "watt-hours," and such meters are commonly called "watt-hour meters." Since, however, the watt-hour, equal to 3600 joules, is a relatively small unit of energy, decimal

derivatives came into use, notably the "kilowatt-hour" in Great Britain and North America and the "hectowatt-hour" in France and some other European countries.

In 1890 the English Board of Trade took up the question of industrial electrical meters and standards. It appeared inexpedient at that time to introduce the name "kilowatt-hour" into British practice. That unit was retained, however, under the title "Board of Trade unit." This name has not given general satisfaction, partly because it is not self-explanatory and partly because its common abbreviation, "b.t.u.," conflicted with that of "British thermal unit." In 1892 an attempt was made in England to apply Lord Kelvin's name to the kilowatt-hour. The attempt met with very little success, although the "kelvin" was adopted in provisional orders by the Board of Trade about that time, and has never been withdrawn so far as we are aware. A few engineers in England continued to use the "kelvin" as the name of the "kilowatt-hour" of electric energy, but the term fell into desuetude. Very recently the suggestion has been revived in Great Britain.

In all countries except Great Britain and her colonies the watt-hour and its decimal brother—the hectowatt-hour, kilowatt-hour or myriawatt-hour—are well established in industry, and they are systematic and self-explanatory. It is open to question whether it would be possible to substitute the "kelvin" for the "kilowatt-hour" in the United States, however desirous the American electrical engineers might be to join any international movement for that purpose, so firmly is the kilowatt-hour now rooted in American literature, commerce, usage and law. Perhaps this very real difficulty in America might also be encountered in other countries. If it was not easy to make such a change in England in the *fin-de-siècle* days commencing with 1892, with no very strong leaning to the "Board of Trade unit," and with a juvenile industry, how much greater would be the difficulty at this time, with a large industry and the watt-hour well established!

Assume, however, that the change could be effected in all countries, and consider merely the merits of such a change. In the first place, all of the other internationally accepted units—ohm, volt, ampere, coulomb, farad, joule, watt and henry—stand each for a unit in the practical system. The "kelvin," used as proposed, would be the first name assigned to a decimal multiple of a unit. It would not represent the unit of energy in that system—which is already denominated the joule. It would not even represent the industrial unit of energy, first cousin to the system—the watt-hour. It would merely be a synonym, or abbreviated alternative, for a thousand watt-hours. Its use could not drive out the watt-hour. We should all have to learn, teach, grasp and remember the watt-hour, as part of the whole system, and then we should have to remember, by an additional mental effort, that the "kelvin" was the name adopted internationally for the "kilowatt-hour." Is not this a derogatory function for the great name of Kelvin? The other units of the system fill a need for a name. Thus, without the ampere we should probably have to substitute either "coulombs per second" or "volts per ohm." The established units economize mental effort. But the "kelvin," used as proposed, while it would replace a four-syllable word by a two-syllable word, would not fill a gap in the system and would cause unnecessary mental effort. It should take the "kelvin" as a unit of energy, it should be for the "watt-hour," or basic industrial unit, and we should use the "kilo-kelvin" instead of the "kilowatt-hour." There would be no particular economic advantage in so doing; but at least it would be a logical step. It would also avoid using Kelvin's name for a mere abbreviation of a decimal multiple to a fixed unit. Besides, if the industry advanced to larger units in the future, such as the myriawatt-hour, the change would not then displace the kelvin.

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# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Distribution-Line Construction Problems

Construction and maintenance troubles may be considered almost reciprocal, said Mr. C. R. Phenicie, general superintendent of the Wisconsin Public Service Company, before the Wisconsin Electrical Association at its recent convention, for if careful and first-class work has been done on original construction, the problems of maintenance will be comparatively easy, becoming little else than a regular inspection of the system for a number of years at least. Mr. Phenicie then went on to enumerate some of the details which, in his opinion, make for the best construction.

Considerable care and effort is warranted, he said, in keeping the phase relation the same throughout an entire distributing system. Arc circuits, primary single-phase lines and three-phase lines should always occupy the same relative position to each other whenever they appear on the same pole lines. The line carrying the highest voltage should be at the top of the pole. Circuits carrying more than 5000-volt pressures should never be placed on the same arm with other circuits, and, if possible, not on the same arms with each other.

Liberal climbing space should always be allowed on poles, not only as a means of safety to workmen but from the fact that this arrangement allows future space for transformers, fuses, lightning arresters, etc., to be placed along the line.

Transformers supplying motor service should be of the three-phase rather than the single-phase type, declared Mr. Phenicie. The result is a saving in both cost and weight and means higher efficiency. The author also believes, although aware that there is much difference of opinion, that transformer secondaries may profitably be banded together, even though the transformers themselves may be located a considerable distance apart. Better regulation is obtained, he said, and copper investment is decreased.

Mr. Phenicie also insists that with modern transformers a fixed rule of using should be adopted. It is the Wisconsin company's practice to fuse each transformer to one and a half times the normal full load of the transformer in amperes, although practice varies with different companies. However, it is never advisable to allow a repair man or lineman to put in the fuse which he happens to have in his pocket, even if at the risk of continuing an interruption a few minutes longer. It is considered good practice to step each transformer pole to the ground and to place the cut-outs so they are at the lowest point on the pole of the circuit of which they form a part.

Never place primary and secondary wires on the same arms, added the speaker, even though additional cross-arms, meaning additional expense, are necessary. Primary and secondary wires on adjacent poles are liable to give patrons a pyrotechnic display in their homes that they will not in the least appreciate and for which they may demand payment. Service wires into a customer's premises should be carefully spaced. These service wires will necessarily be placed with considerable slackness or sag at times, and since this is the case correspondingly greater care should be given to spread them properly, although the speaker argued against buck arms for this purpose. Buck arms are weakening and disfiguring at the best for line structures and should be avoided except for right-angle turns of the lines themselves. For service wires some of the malleable-

iron galvanized spreaders should be used, many types of which are available for this purpose. Avoid boring holes in poles and arms as much as possible, added Mr. Phenicie, and whenever a device with sufficient holding strength can be found to take the place of a bolt or pin it should be used.

## Oil-Piping Layout for Transformers Using Thin Oil

BY FRED BUCH

Pumping oil into water-cooler transformers or back to a storage tank without the use of an air compressor has been made possible by a new and very thin insulating oil recently placed on the market. With the thick oil, which is still used almost exclusively, air bubbles necessarily gather in the oil while it is being pumped into the transformer, and to draw these off a connection from the air compressor is fitted into the cover so as to create a vacuum. With the new thin oil no vacuum connection is required, the air naturally rising to the surface and escaping through the raised cover of the transformer. Moreover, since the thin oil flows more freely in the pipes the sizes of the supply and return headers may be reduced, 1-in. or 1.5-in. pipe being ample for even the largest systems. The oil is handled exclusively through the pump connected with the filter press and is pumped into the top connection of the transformer and drawn off through the bottom, the

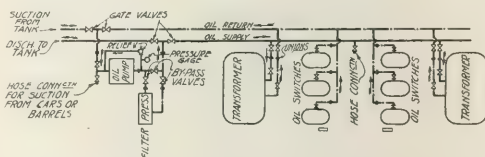


FIG. 1—LAYOUT OF PIPING FOR OIL SUPPLY AND RETURN

connections at the pump being arranged so that the oil may be pumped from the transformer to the storage tank direct, thus doing away with the overflow header formerly required for carrying off the oil. As this latter header was generally made of 4-in. pipe and ran practically the full length of the power house, it will be seen that a material saving has been made, both in cost of installation and in space.

Another advantage possessed by this thinner oil is that it can be used for oil switches and arresters, thus doing away with a storage tank. On former systems the oil-switch tanks were generally filled and emptied by hand, while now this may be done with the pump by simply providing connections with hose valves in the transformer headers.

### PUMP AND FILTER PRESS

The oil pump and filter press may be bought in one unit or purchased separately and piped up as required, care being exercised to have a by-pass connection, as shown in the diagram (Fig. 1). A pressure gage and relief valve should form part of the filter press outfit, and the relief valve should discharge back to the suction end of the pump, as shown, so that the latter can never get up pressure enough to burst the blotters in the press, the excessive oil simply returning to the pump. For a detailed description of the



press the reader is referred to the excellent bulletins now obtainable from the makers.

To get the simplest and most effective layout, the suction and discharge connections should be arranged as shown, the pumping connections thus obtained being as given in the following table:

TABLE OF PUMPING CONNECTIONS

Suction from	Discharge to	Via
Tank cars or barrels.....	Storage tank, transformers, oil switches	Pump only, or pump and filter press
Storage tank.....	Transformers, oil switches, back to tank, barrels	Pump only, or pump and filter press
Transformers.....	Storage tank, back to transformers, oil switches, barrels	Pump only, or pump and filter press
Oil switches.....	Storage tank, back to switches, barrels	Pump only, or pump and filter press

Thus it will be seen that any desired combination can be made by simply opening or closing a few valves at the pump.

Oil may be taken from tank cars or barrels through a 1-in. hose, for which a valve is provided at the pump, and discharged directly into the transformers or switches without being treated; or, if necessary, it may be run through the filter press and freed of all moisture and suspended matter as fast as it is taken from the barrels, the filter presses now on the market handling from 12 gal. to 18 gal. per minute at a maximum pressure of 120 lb. per square inch.

Oil may be pumped into the storage tank, treated or untreated, to be kept until needed elsewhere; it may be returned from the transformer or switches to the tank, or it may be taken from the transformer, treated and returned while the former is in full operation. All this is accomplished through two headers only—one for suction and one for discharge.

It will be noticed in the diagram (Fig. 1) that all suction valves have been placed close together at the suction end of the pump, and all discharge valves have been similarly located at the discharge end of the filter press. This is important, as it greatly facilitates matters for the operator. Were the valves more scattered, as is often the case, confusion might arise.

To insure correct manipulation each valve should be fitted with a brass nameplate designating whether it is a suction or discharge connection and what it connects. The suction valves and suction piping should also be painted a certain color up to the suction end of the pump, and the discharge valves and discharge piping should be painted

made up of standard galvanized wrought-iron pipe and fittings, and the suction piping carrying the oil to be treated should consist of standard black wrought-iron pipe and fittings. Brass ground-joint unions and screwed valves should be fitted wherever required so that any part of the piping or apparatus may be easily and quickly removed or re-installed. All valves should be of the screwed-gate type.

The headers should be carried along the wall, if possible, so that they may be given a slight slope throughout and bleeder connections should be fitted at the lowest points to facilitate drawing. The wall should therefore be kept free from obstructions and the switch cells, etc., built several inches clear of it. Whether this can be accomplished or not, the headers should be run at the rear of the transformers so that the

latter may be pulled out and away from the electrical connections for overhauling without interfering with the piping systems. Where the transformers rest on piers, the piping may be run below the rails, but where they are run on the floor level the pipes must be carried high enough above the

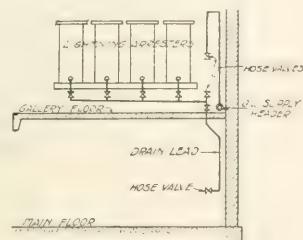


FIG. 3—OIL PIPING TO LIGHTNING ARRESTERS

floor to allow for the installation of the large U-bolt or I-bolt in the wall for pulling the transformers back into place. There should be enough clearance for the heavy block and tackle used in connection with the overhead crane for pulling back the transformers.

All pipe connections to the transformers and oil switches should be made as flexible as possible and in a manner that will allow considerable adjustment in any direction because of the difficulty of re-connecting apparatus during re-installation. In re-locating a transformer, for instance, it will be found almost impossible to place it exactly as it stood before, even when jack screws are used. It becomes necessary, therefore, to make allowances for this and design the piping details accordingly. Fig. 2 shows the branch connections from the headers to the transformers taken out of the top and bottom of the lines instead of from the sides. A nipple and elbow are provided so that the connections may swing up or down about the center of the header and at the same time to the right or left without disturbing the headers, thus easily compensating for any misplacement of the re-located transformer.

The filling-in flange shown in the emergency discharge (Fig. 2) is also intended to overcome this difficulty. The pipe embedded in the concrete floor is absolutely rigid, and the large diameter and short distance from the center of valve to the floor line do not permit flexible joints. The transformer must therefore be "jacked" over until the bolt holes meet, and a filling-in flange and heavy paper gaskets soaked in oil are then inserted before the flanges are bolted. Four 1-in. holes for  $\frac{3}{4}$ -in. bolts are considered sufficient for this joint, as the emergency discharge is seldom used and the oil leaking through the joint will be carried off through the drain connection in the transformer pit.

The valves shown next to the transformer are furnished with the latter, as it is usually shipped from the makers full of oil. The valves next to the headers and the adjacent unions are necessary for two reasons: First, a transformer is usually placed under load as soon as it is in position and before the other transformers are located; second, a transformer may be withdrawn for repairs at any time while the system is in full operation, and in each case it becomes necessary to shut off the oil line. This also applies to the oil switches and lightning arresters as well.

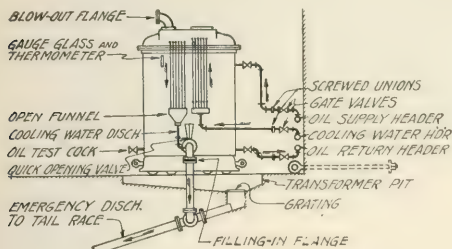


FIG. 2—DETAILS OF PIPING AT TRANSFORMER

another color from the discharge ends of the pump and filter press to their destination. With the system thus marked there should be no chance for error, as the operator can see exactly what connections he is making.

#### PIPING

The discharge line from the pump to the transformers and all piping through which treated oil flows should be

## TRANSFORMERS

Transformers should be set on rails mounted on piers with a catch basin beneath, or the rails embedded in the floor surfacing and a pit built under the transformer to collect the escaping oil in case of an explosion. Each transformer should be inclosed in a separate fireproof chamber, and the piping connections should be made as just described. The large emergency discharge with the quick-opening valve on the transformer is piped into the tailrace as shown in Fig. 2, and the drain from the transformer pit is also connected into the same. Where the cooling water is wasted this, too, may be discharged into the same connection, as shown. The pipe in the line to the tailrace should be the full size of the quick-opening valve. It should have a good slope, be as straight as possible and free from valves so that it cannot be shut off under any circumstances. It is the purpose of this pipe to carry off the burning oil in case of fire or in case the transformer explodes, as well as to discharge oil that has become useless. The section embedded in the concrete may be ordinary soil pipe.

The transformers should be supplied with gage glasses, thermometer, electric alarm, a blow-out flange in the top cover and water-cooling coils of seamless brass tubing, as described in an article by the writer in the *Electrical World*, Dec. 7, 1912. If iron coils are used, special provision must be made to free the cooling water of air, as otherwise corrosion of the coils will be very rapid.

## LIGHTNING ARRESTERS

Lightning arresters insulated with the transformer oil should not be connected to the transformer oil piping on account of the electrolyte which may spill and accumulate in the arrester tanks, especially if the latter are filled from the top. This electrolyte, if it once gets into the piping system, cannot be separated from the oil with the filter press and would ruin the entire system. A piping system similar to the one in Fig. 3 should be installed. With this arrangement the supply header is brought to a point at least 12 in. above the top of the arrester tank and then returned, a hose valve being fitted within easy reach. Another hose valve should be installed on the drain line, and when a tank is to be filled the two should be connected with a hose and the pump put in operation. Should the operator by chance open a wrong valve and thus permit the dirty oil from a full tank to flow back, there is no possible chance for the electrolyte to get into the supply piping on account of the loop rising above the oil level. When the connecting hose is removed the heavy electrolyte must necessarily fall out.

To drain an arrester tank, a barrel or other empty vessel should be placed at the outlet end of the drain line on the main floor and the valves opened. The valve in the drain lead, just above the gallery floor, should be used while

flexible, as the tanks usually rest on an angle-iron frame and, being accessible, are not likely to be disturbed once they have been put in place.

## OIL SWITCHES

Where transformer oil is used for insulating the high-tension transformer and line switches the supply connections to the latter cannot very well be made into the tanks

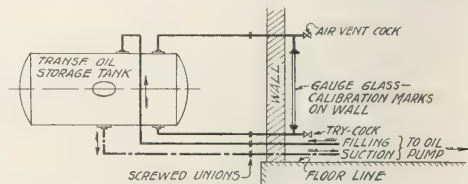


FIG. 5—STORAGE TANK WITH AIR COCK AND GAGE GLASS INSIDE OF POWER HOUSE

directly on account of interference from electrical connections. Instead, a branch with a hose valve should be provided at each set of switches as shown in the diagrammatic layout, Fig. 1, and in detail in Fig. 4, and the tanks filled from a hose. The oil return, however, may be piped up completely, as these connections are at the bottom of the tanks, where there are no electrical connections.

There should be ample adjustment in these pipes so that they will readily swing in any direction, as the switches are usually lined in multiple to suit the electrical requirements and the pipe connections made afterward. With "stiff" connections it is especially difficult to make connections when re-installing the apparatus, and the arrangement shown in Fig. 4 will be found to overcome the difficulty. The arrangement of hose valves which connect the supply and return header and fill the tanks through the latter, as shown in Fig. 3, may be applied here if desired.

## STORAGE TANK

If possible, the oil storage tank should be so located that the transformer may be emptied into it by gravity and the tank filled from barrels without the use of the pump. Where this cannot be accomplished a pump must be used, and if connections are provided as shown in Fig. 1 a pump can readily be employed. The tank should hold from one and one-third to one and one-half times the amount of oil contained in one transformer in addition to the quantity of oil to be stored for the switches. A filling pipe, an air vent into the top and provision for a suction outlet at the bottom are the only connections required. The tank should be fitted with gage glasses and a manhole.

When the tank cannot be located in the power house or near the pump the air-vent cock and gage glasses should be brought to a point where they will be in view of the operator of the oil pump. Fig. 5 shows a typical layout. In this case calibration marks were made on the wall adjacent to the gage glass for every ten barrels of oil dumped so that it would be an easy matter to gage the amount of oil stored in the tank.

## Single-Phase Alternator as a Synchronous Motor

Can a 75-kw., 2200 volt. single-phase alternator be operated as a synchronous motor? What equipment is required to start the machine from rest and place it in service?

W. O. R.

filling only, the idea being to keep it closed so that no oil can escape or be wasted down the drain lead. A hose valve at the bottom end is provided so that one man may drain the tanks alone, opening or closing the valve at will whenever a barrel is filled and thus eliminating all necessity of climbing to the gallery floor or keeping a man there to manipulate the valve.

No special provision need be made to make the pipe joints

After being brought to full speed and connected in parallel with the supply system, the single-phase machine will give excellent service as a synchronous motor. However, it is not self-starting. The most satisfactory starting equipment will include a special self-starting single-phase motor for bringing the main machine to full speed.

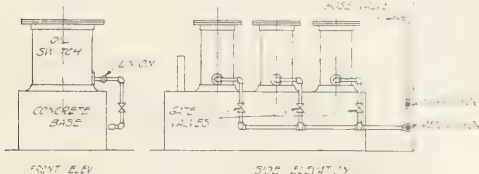


FIG. 4—DETAIL OF PIPING AT OIL SWITCHES

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Magnetic Hysteresis.**—FRITZ HOHM.—An account of an extended series of experiments on the validity of Steinmetz's hysteresis laws. While his law that the hysteresis loss is proportional to the 1.6th power of the maximum induction was found to represent the fact very satisfactorily, yet the other law of Steinmetz—namely, that the hysteresis loss depends only on the difference between the limiting values of the magnetic induction and not on their absolute values—was not found to be exact. The author describes an extended series of experiments made with direct current and the ballistic method, and also gives results of experiments made with alternating current which confirmed his former results. The chief result of his experiments is the proof that hysteresis loss during cyclic processes with the same difference between the limits of magnetic induction may be very different if the absolute values of the inductions are different. An application is made to the magnetic process in the rotor of an alternating-current series motor.—*Thesis for degree of doctor of engineering at the Institute of Technology, Berlin, 1912.*

**Armature Construction.**—R. LIVINGSTONE.—The first part of a paper illustrated by diagrams on some mechanical points in armature construction. In the present instalment the author deals with press fits, armature hubs and end plates for lamination.—*London Electrician, Jan. 24, 1913.*

**Steam Turbo-Generators.**—H. G. REIST.—An illustrated article dealing briefly with recent tendencies in the design of high-speed alternators. The present approximate limits of output for 25-cycle and 60-cycle designs are specified, although these may change as other methods of construction are adopted. The review touches on the following points: effect of high internal reactance on the ability of the machine to withstand short-circuit strains; methods of supporting and insulating armature coils; rotor designs for providing maximum copper space; rotor coil construction, insulation and support; punchings or forgings for revolving structure; critical speed; successful schemes for ventilation.—*Gen. Elec. Review, February, 1913.*

### Lamps and Lighting

**Reduction of Cost of Electric Lighting in Germany.**—A diagram showing the reduction of the cost of electric lighting of an average four-room residence in Berlin during the period from 1890 to 1912. The reduction is due to two different causes. The first is the reduction of the rate charged by the Berlin Electricity Works, which was 15 cents per kw-hr. from 1890 to 1898, 13.75 cents from 1899 to 1903, and 10 cents from 1904 to 1912. The second cause is the improvement in lamps. The cost for the yearly lighting in a four-room residence is as follows: With carbon lamps, from 1890 to 1898, \$55, and from 1899 to 1901, \$50; with Nernst lamps, from 1902 to 1903, \$25, and from 1904 to 1906, \$17.50; with metallic-filament lamps, from 1907 to 1911, \$12.50, and with the new ductile tungsten lamp in 1912, \$10.—*From A. E. G. Zeitung, in London Electrician, Jan. 24, 1913.*

**The Rating of Incandescent Lamps.**—A. J. MAKOWER.—From numerous tests of lamps of various makes on the market in Great Britain the author concludes that the most usual specific power consumption of metallic-filament lamps at present on the market lies between 1.4 watts and 1.6 watts per horizontal cp (British), and that it is not infre-

quent to find lamps giving even higher figures than these. "The rating of lamp filaments has evidently greatly changed since their introduction, and although a reference to the makers' catalogs would lead one to expect the power consumption of these lamps to lie between 1 watt and 1.25 watts per cp, it is a comparatively rare occurrence to find lamps that give even so good a consumption as the higher of these figures." While a longer life and a better color of the light may justify this change, the author thinks that the figures for efficiency still appearing in catalogs of manufacturers should be changed. The introduction of metallic-filament lamps has apparently had a most demoralizing effect on the grading of carbon-filament lamps, and the variations that are found in batches of lamps of this type will be surprising to anyone who has not carried out systematic tests. The author recommends drawing up some standard specifications by an authoritative body, like the British standards committee.—*London Electrician, Jan. 17, 1913.*

**Rating of Carbon Lamps.**—T. MATHER.—The author confirms the very unsatisfactory state of affairs regarding lamp ratings, more especially as regards carbon lamps, as sketched by Makower (see preceding abstract). Some results of tests made by the author are given, and it is concluded that "the lamps were obtained from dealers of repute, and the fact that only one batch out of six was reasonably satisfactory shows that the fault lies with the manufacturers by whom the lamps are marked. There is little doubt that the public are being defrauded by the incorrect description of lamps, and in the interests of the industry as a whole steps should be taken to prevent its continuance."—*London Electrician, Jan. 24, 1913.*

**Lighting of Churches.**—An article by J. N. La Balle on the use of indirect lighting in churches, and an article by R. V. Ely on illumination of the church chancel.—*Lighting Journal, January, 1913.*

### Generation, Transmission and Distribution

**Steam Turbines.**—ERNST BLAU.—A discussion of the use of steam turbines in mines for driving generators and for various other special purposes.—*Elek. und Masch. (Vienna), Jan. 26, 1913.*

**Driving Planers and Slotters.**—CHARLES FAIR. An article on the application of direct-connected reversing motors to planers, slotters, key-seaters, lathes, wire-drawing and tube-drawing machines, boring mills and other classes of reversing drive now commonly operated through belts or clutches. The author shows the increase in production and the saving in power which can be achieved with this form of drive and discusses the best methods of connection.—*Gen. Elec. Review, February, 1913.*

**Electric Power in Tin Mines.**—H. THIEME.—The first part of an illustrated description of the hydroelectric plant of the tin mines at Takkah, in the Malayan States. The power plant contains two turbine driving pumps, three phase generators. The voltage is 400, and for transmission it is raised to 9000; at the substation it is again reduced to 400. There are two single induction motors driving the compressor for supplying compressed air for the air-lift system and the centrifugal pump. The article is to be concluded.—*Elek. Zeit., Jan. 23, 1913.*

**Transformation from Three-Phase to Single-Phase.**—W. W. LEWIS.—No scheme of connections can effect an exact



transformation from balanced polyphase power to single-phase; but some schemes are better than others in the approximation, while some which have been seriously proposed are utterly impracticable. The author analyzes and compares some of those which have been lately proposed, and the results of his discussion are applicable especially to the electric welding industry, in which excessively heavy single-phase loads are often placed on the system and in which therefore a close approximation to even distribution is essential to safe operation of the three-phase system. From the discussion of ten different methods, it is concluded that only one has sufficient merit to warrant its use. This is the simple connection of the transformer across one phase, the generator being connected either in star or delta.—*Gen. Elec. Review*, February, 1913.

Installations, Systems and Appliances

**Large Lighting Battery.**—F. H. WHYSALL.—A paper read before the (British) Institution of Electrical Engineering on the results obtained over two complete years' working of the 12,000 amp-hr. battery installed at the Manchester Corporation Electricity Works, Dickinson Street, in March, 1910. The battery consists of 210 cells, each cell containing thirty-eight positive plates and thirty-nine negative plates. The different methods of battery regulation are illustrated in Fig. 1, with special reference to the question of the use of regulating cells (Diagram B) rather than booster regulators. The chief duty of the Dickinson Street battery is to take 3000 kw off the lighting peak. It is also

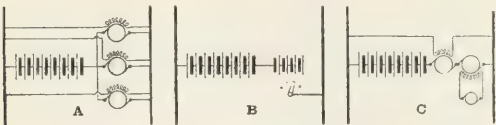


FIG. 1.—DIAGRAM SHOWING ALTERNATIVE METHODS PROPOSED FOR BATTERY REGULATION

looked upon as a standby. But its chief duty is load leveling, and it was therefore decided to have three hand-regulated reversible boosters, as shown in Diagram A, and to run them in parallel at times of maximum discharge. At other times one or two would be used as required. At Dickinson Street the battery was also arranged for use on the traction supply, and for this duty a series-parallel arrangement was made of an extra busbar and change-over switches for one booster. The boosters worked quite satisfactorily on the traction load with automatic exciter regula-

TABLE SHOWING SAVING ON WORKS COSTS FOR ONE YEAR

Year	Output to Feeders	Coal Used, Tons	Average Price of Coal	Including Coal Cost, 1910 and 1909	Total Cost per Unit Output to Feeders, Cent	Saving in 1910-11 Absolute	Total Saving, £11 Absolute	Total Saving, £11 with Coal at \$2.72	Commercial Efficiency, Per Cent
1909—no battery	25,818,992	40,681	\$2.72	...	0.736	...	...	...	...
1910 — with battery	29,042,985	39,418	2.75	\$820.	0.710	\$38,100	\$38,920	70.6	...

tion, as shown in Diagram C, but the saving effected in works costs was not so great as when the battery was used on the lighting load alone. The improvement due to the use of a battery in a steam plant is wholly from the improvement of the load-factor. The author discusses the following items in detail: Saving in standby boilers required equivalent to one-hour rating of battery, owing to extra time available to raise steam and owing to possibility of applying load gradually; saving in capital expenditure and corresponding annual charges thereon; saving in wages

of running staff; saving in cost of peak-load units; saving due to "buffering"—that is, load leveling—enabling all units to run at their most economical load. The results obtained in actual practice show a saving on works cost which is given in the accompanying table. The author concludes that, provided the battery is installed to reduce generating plant, it is a sound commercial proposition when considered in connection with a large lighting load. Peak-load units are costly to generate, and allowance is made for this in fixing the charges for lighting. Daylight units are much lower in price because the cost of generation is much less, thus in effect the battery is charged at daylight costs and discharged at lighting rates. If some of the larger consumers on public supply mains only realized this, they would install batteries of their own, buy energy at motor-service rates and cheapen their own lighting service by arranging with the supply authorities for a "restricted-hour" supply; that is, they would take no energy from the mains at peak-load time. Batteries hitherto have usually been installed by consumers only for the sake of making the service reliable and independent of accidents outside their own premises. It does not matter how short a period of time during the day, or the year for that matter, a supply is demanded, equipment must be installed to meet it, and it has been found that for all duty of less than 8 per cent daily load-factor—that is, of less than two hours' demand during the twenty-four hours of the day—the matter is in no doubt. It most certainly pays to make storage-battery provision for this. Beyond this point one must look to advantages other than direct saving in capital cost and running charges to justify the extension of the principle.—*London Electrician*, Jan. 24, 1913.

**Artificial Insulating Materials.**—H. PASSAVANT.—A paper read before the Berlin Electrical Society on the purpose and the applications of artificial insulating materials in the construction of electrical apparatus. The author discusses especially the systematic complete protection of apparatus by insulation in comparison with apparatus with metallic frames. He discusses the most important requirements of artificial insulating materials and gives the results of tests which show that the artificial insulating materials now available on the market already satisfy severe requirements, especially if in the design of the apparatus the special features of the insulator are properly taken into consideration. A number of designs of the Berlin Electricity Works are described and special attention is called to the use of artificial insulating materials in the construction of electric-heating apparatus. In the manufacture of artificial insulating materials it is important to insure perfect uniformity of manufacture and non-aging qualities during life. Regulator tests should be made to insure that the electrical constants of the materials have not changed.—*Elek. Zeit.*, Jan. 23, 1913.

**Turrill Regulator.**—A note on a British patent (No. 627, 1912) of the British Thomson-Houston Company and A. P. Young. In order to keep the generator pressure at a safe value in the event of abnormal pressure rise or fall on the system, an electromagnet is connected across the supply mains. This magnet controls an armature carrying a contact connected to an excited busbar against controlling springs, so that normally it is free of an upper and lower fixed contact connected to one end of the winding of the magnet and to the second excited busbar respectively. The armature of the magnet is carried by a pivoted lever retaining catch for a spring-controlled switch, which is released by excessive pressure variations. It prevents further action of the automatic regulator by breaking the relay circuits and makes connection with intermediate portions of the generator-field resistors.—*London Elec. Eng'ing*, Jan. 23, 1913.

**Aluminum Arresters.**—R. T. WAGNER.—A second article on the construction, installation and maintenance of aluminum arresters and their auxiliaries. In the present instal-

ment the author takes up the question of the location of arresters for indoor and outdoor use, and deals in a practical way with installing, wiring and connecting up.—*Gen. Elec. Review*, February, 1913.

### Wires, Wiring and Conduits

**Protection of Transmission Lines.**—E. PFIFFNER.—An article on the theory and practice of protecting transmission lines. The author concludes that overhead lines should be earthed through non-inductive resistance in order to carry off any static charges. In general there is no danger to overhead transmission lines from the amplitude of voltage rises so that in general no protection against them need be provided; on the other hand, as a protection against dangerous voltage drops condensers should be provided. For cable networks and machines and apparatus in which large magnetic energies are set free on disconnecting or sudden changes of load, properly designed dischargers with a sufficiently small discharge resistance are recommended.—*Elek. und Masch.* (Vienna), Jan. 26, 1913.

**Capacity of Double Three-Phase Lines.**—C. FELDMAN AND A. C. LOOS.—In high-tension systems it sometimes happens that two lines have to be placed at a near distance from each other. The calculation of the mutual inductance and self-inductance is well known. The calculation of the increase in capacity due to the presence of the second line is more difficult. The author gives simple formulas for the calculation of the capacity of such lines, making use of certain mean geometrical distances. Similar mathematical methods may be used for the calculation of the inductance of such lines.—*Elek. Zeit.*, Jan. 23, 1913.

### Electrophysics and Magnetism

**Calculating the Combined Resistance of Shunt Coils.**—H. W. BROWN.—A description of a new device for calculating the combined resistance of two or more shunt circuits as shown in Fig. 2. The mode of operation is as follows: Take as an example two circuits, one of 75 watts and the other of 25 watts. The thread hanging from A would be stretched across to 75 on the right-hand side of the scale, and that from B to 25 on the left-hand side. Where these two threads cross, the combined resistance of the two circuits can be read off by means of the horizontal lines. It will be seen that the range of the device can be extended and that the percentage of current in each circuit can be

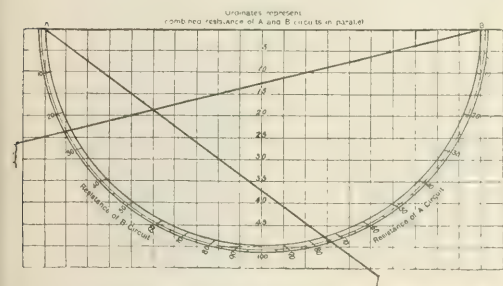


FIG. 2—DEVICE FOR CALCULATING JOINT RESISTANCE OF PARALLEL CIRCUITS

read off by means of the vertical lines. It is easy to see how the device is constructed.—*London Elec. Review*, Jan. 24, 1913.

### Electrochemistry and Batteries

**Electric Steel Furnace.**—C. H. VOM BAUR.—An illustrated article on the first combination induction furnace in operation in the United States. One of the diagrams given illustrates the increase of the efficiency with decrease of the time necessary to bring the heat to the melting point.—*Met. and Chem. Eng.*, February, 1913.

### Units, Measurements and Instruments

**Recording Instruments.**—A. PALLM.—An illustrated description of new recording instruments made by Hartmann and Braun. The chief feature is that the record is obtained in rectangular co-ordinates while a rotary system of measuring instruments is used. Fig. 3 shows the arrangement: A is the vertical axle of the rotating coil S. Co-axial with A is the segment C of a cylinder which is embraced on one side by the handle H. The recording strip R is drawn by

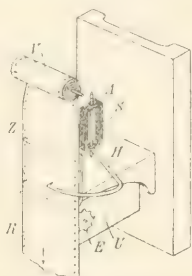


FIG. 3—DIAGRAM OF RECORDING INSTRUMENT

means of the clockwork U from the supply roll V over the cylinder surface so that it is curved and the point at the end of the handle records directly on the record strip, the lengths recorded being in constant proportion to the angle of deflection of the coil. This arrangement permits a very satisfactory utilization of the interior space of the recording instruments so that it is possible to place various measuring instruments from a voltmeter up to a triple wattmeter into one and the same frame of moderate dimensions. The construction of the clockwork, the recording mechanism and the combination of this recorder with various types of measuring instruments are described.—*Elek. Zeit.*, Jan. 23, 1913.

**Measuring the Inflammability of Coaldust.**—An account of the second report of the mine explosions committee to the British Home Secretary on experiments made to determine the inflammability of various coaldusts. The method of investigating chiefly followed by the committee de-

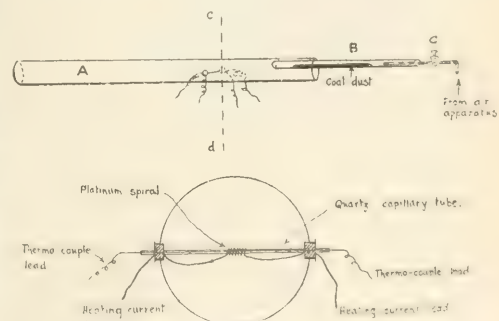


FIG. 4—INSTRUMENT FOR TESTING COALDUST

pends upon the destructive distillation of different varieties of coal under different conditions. Accurately weighed quantities of the dust are blown upon a platinum spiral maintained at the same temperature in each case, and their relative inflammabilities are judged by the impulses given to a ballistic pendulum by the sudden expansion consequent on the inflammation of the dust clouds. In Fig. 4 A is a glass cylinder, open at both ends. A platinum coil closely wound onto a tube of thin-walled quartz of capillary bore passes horizontally across a diameter of the cylinder.



Through the bore of the quartz tube a platinum and platinum-rhodium thermocouple passes. By means of suitable connections an electric current can be passed through the spiral, so that it can be heated to any temperature up to about 1400 deg. C. and maintained at a constant temperature by the adjustment of an external resistance. The coal dust to be tested is blown across the heated spiral as a cloud of fairly uniform density, successive trials being made until a temperature is found at which general inflammation of the dust cloud takes place. The French mining authorities have carried out experiments dealing with the same problem, and their index of inflammability is the size or length of the flame produced when a given quantity of the dust is blown through a vertical porcelain tube of 25 mm internal diameter and 10 cm long, heated to a temperature of 900 deg. C. The Home Office committee has made similar experiments, using an electric furnace and photographing the flame. The experimenters found that, provided all the experimental conditions were maintained rigidly constant, the size and type of flame obtained from one particular coal remained remarkably constant from one experiment to another. Comparison between one coal and another by means of the photographs of their flames can, therefore, be relied on.—*London Elec. Review*, Jan. 24, 1913.

#### Telegraphy, Telephony and Signals

*National Telephone Arbitration.*—The lengthy arbitration between the National Telephone Company and the British Post Office has been brought to a close by a judgment awarding the company the sum of \$62,576,320 for the whole of its undertaking. The company had claimed \$100,000,000. The British government has thus acquired "a most valuable system at a price which, though just, is certainly moderate." It is thought that many of the points covered in the judgment should have an important bearing on future arbitrations of this character as they set certain precedents.—*London Electrician* and *London Elec. Review*, Jan. 17, 1913.

*Condenser Shunted to Telephone in Wireless Telegraphy.*—In practically all systems of wireless telegraphy the telephone receiver has superseded all other forms of reception, and the best results are obtained when the telephone is shunted with a capacity. The author investigates in detail the function of this capacity. His chief results are that the value of the capacity used as a shunt to the telephone which produces the maximum intensity in the telephone is not independent of the break in the primary current at the sending station; that in the general case where circuits in parallel with the telephone have a large resistance this maximum is due to resonance in the telephone circuit alone, and that the "harmonics" in the break, and not the frequency of the break itself, may be the most important factor in determining the value of the capacity to produce the best effect for any one telephone.—*London Electrician*, Jan. 17, 1913.

*Junction Boxes.*—A. EELING AND R. DEIBEL.—A translation of their German paper recently abstracted in the *Digest* on junction boxes or the like, with constant insulation of high value, for installations operating at low voltage. The authors show that the insulation materials hitherto used are not very well suited to low-tension connecting apparatus, and a new principle is disclosed, namely, connection above the surface of oil, which is independent of all conditions of the weather and by which permanently good insulation values may be guaranteed. The application of the new principle is explained by referring to illustrations of several types of apparatus that have given excellent results.—*London Electrician*, Jan. 24, 1913.

*Receiving Antennas.*—E. LEIMER.—A description of various arrangements and devices which can be used as antennas for the reception of Hertzian waves, with special reference to convenience and simplicity of arrangements.—*Elek. Zeit.*, Jan. 23, 1913.

## Book Reviews

*ELECTRIC LIGHTING AND MISCELLANEOUS APPLICATIONS OF ELECTRICITY.* A Textbook for Schools and Colleges. By William Suddards Franklin. New York: The Macmillan Company. 300 pages. Price, \$2.50.

An elementary textbook of electrical engineering for schools. The subjects covered are numerous and have, therefore, to be treated briefly and without great detail. The chapters relate to the following subjects: Installation and operation costs; electric distribution and wiring; alternating-current lines; photometry; electric lamps, shades and reflectors; interior illumination; street illumination; electrolysis and batteries; telegraph and telephone; dielectric stresses; problems. Like all of Dr. Franklin's writings the book is characterized by directness and originality of style. It is illustrated with simple and clear diagrams. The mathematical treatment is largely arithmetical, rather than algebraical. The volume will recommend itself to high schools and colleges in which a general outline of electric lighting is taught.

*THE METRIC SYSTEM IN ALL ITS BRANCHES.* By Henry G. Bayer. Published by the author at 232 Greenwich Street, New York. 94 pages, 13 illus.

A little book, probably the most comprehensive of its kind, that presents in a concise form a vast number of accurate data of value to all persons engaged in any scientific, commercial or educational work that necessitates the conversion of foreign measures into the United States equivalents or vice versa. There is a short introduction reviewing the history of the metric system, telling some of its advantages and giving a list of the countries which have adopted it as a standard. This is followed by five chapters in which the system is clearly defined, its etymology is recounted and the metric units of length, surface, volume, capacity and weight with their multiples are explained. Each chapter contains numerous conversion tables, many of which are extended to include the metric equivalents for decimal and fractional parts of the United States units. In addition to the foregoing are three useful chapters containing a description of miscellaneous units, such as tables of foreign money and the United States equivalents and the units of work, force and heat. The various thermometer scales are also described and complete formulas for converting the reading on one scale to its equivalent on any of the others are a part of the book.

*THE THEORY OF ENGINEERING DRAWING.* By Alphonse A. Adler. New York: D. Van Nostrand Company. 289 pages, 273 illus. Price, \$2.

Descriptive geometry, the subject matter of the book at hand, has been presented in numerous textbooks in ways very similar. It is, therefore, of interest to note a departure from the trodden path, and particularly so as the author seems to have succeeded in presenting the subject in a clear and logical way. The usual practice is to start with a set of definitions, to consider in detail the orthographic projection of a point, and then, on the foundation thus laid, to build the theory of the projection of lines, surfaces and solids. In this volume the order of presentation is reversed, and the reader is asked to consider first some concrete object—a box, for instance—the study of which furnishes material of use in the later discussion of its bounding surfaces and lines. The book is divided into four parts. Part I treats of oblique and orthographic projections, Part II contains a variety of problems on the subjects treated in Part I, Part III considers perspective projection, and Part IV the pictorial effects of illumination in projection drawings. The treatise is prepared in such a way as to make the subject easily understood by the beginner. It will also serve as a handy reference book.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Electric Hair Drier

An electric hair drier of simple design is being placed upon the market by The Sanax Company, Inc., of New York City. The heating unit is located in the barrel of the blower and is so arranged that it may be taken out and replaced in a very short time. The heater is instantaneous in operation and a strong blast of either hot or cold air may be had immediately after connecting the blower into the circuit. Switching arrangements are provided for controlling the temperature of the outflowing air.

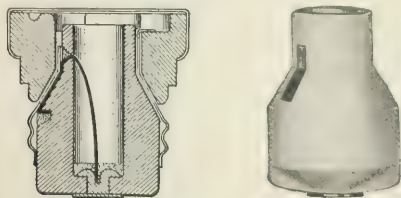


ELECTRIC HAIR DRIER

Aluminum has been used wherever possible in the construction of this device. The weight of the apparatus is about 2 lb. It is stated that no special wiring installation is necessary as the blower may be connected to any ordinary wall socket or lighting fixture. The cost of operation is said to be approximately 2 cents an hour.

### Fuse Plugs with Renewable Core

Ordinarily when a fuse blows the whole fuse plug has to be thrown away. A considerable improvement is accomplished in a fuse plug designed and manufactured by the H. T. Paiste Company, Philadelphia. It is made in two



FIGS. 1 AND 2—SECTIONAL VIEW OF FUSE PLUG AND THE RENEWABLE CORE

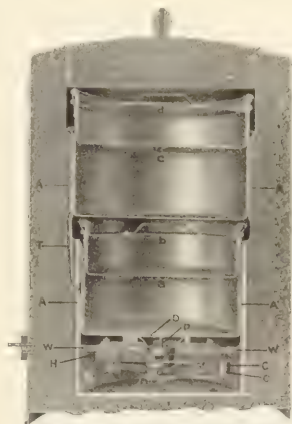
parts, a permanent mica cap holder with brass screw shell and a removable porcelain core containing the fuse. When the fuse blows the core is taken out and a new one slipped into the holder. In the core one end of the fuse strip is soldered to the bottom contact rivet; it is then carried up through the hollow center of the porcelain, out through the side, then bent over, and the outside end is cemented fast.

When the core is slipped into the holder and screwed into a cut-out the outside part of the fuse strip is forced tight against the brass sleeve of the holder and completes the circuit. The plugs are made in standard sizes for all emfs up to 125 volts.

### Automatic Electric Cooker

A photographic section of an automatic electric cooker which is being manufactured by the Berkeley Electric Cooker Company of Berkeley, Cal., is shown herewith. All of the cooking vessels illustrated in close contact with the walls are made of aluminum. The heat conducting and distributing medium used between the electrical heating elements and the food receptacles is live steam.

Referring to the illustration, the double-walled hermetically sealed steam chamber is marked *A-A-A*. In the bottom of this chamber the small quantity of water shown at *W-W* is boiled and partially changed to steam by the heat from the heating unit *H*. When the steam pressure in the sealed chamber is sufficient to overcome the spring in the diaphragm *D*, which is constructed like the bottom of the oil can, it snaps downward, acting upon the pin *P*. The movement of this pin opens the switch contacts *C* and interrupts the energy supply. A subsequent reduction of



AUTOMATIC ELECTRIC COOKER

pressure allows the diaphragm to return to its original position, and this action again closes the switch contacts and continues the heating.

An interesting feature in connection with the cooker is the timing attachment by means of which the heating unit may be switched automatically into the circuit at any predetermined hour. This is accomplished through an alarm clock arranged in the electric heater circuit.

It has been stated that the cost of cooking the food depends upon its quantity and specific heat. For instance, 5 lb. of food material, including a roast, two or three kinds of vegetables and a pudding, may be cooked in about 10 hours if the roast require it, with an expenditure of 600 watt-hr. to 700 watt-hr., or at a cost of from 6 to 7 cents, if the rate is 10 cents per kw-hr. At a 7-cent rate the cost would be from 4 cents to 5 cents.

The cooker completed stands 24 in. high and its shipping weight is 54 lb. The heating unit has been designed to consume 550 watts and may be connected at an ordinary lamp socket.

### Floor Outlet Boxes

One of the important advantages of the so-called Acme floor outlet box is the vertical and horizontal adjustments, of which the latter may be effected after the finished floor is laid.

The boxes are all hot-dipped galvanized, each equipped with a rabbeted frame, permitting the removal of the cover without disturbing the floor. They are adapted for all standard makes of flush receptacles. They are thoroughly machined, and all the parts of the device are interchangeable.

This floor box is manufactured by the H. Krantz Manufacturing Company for John Fountain, Inc., 160 Seventh Street, Brooklyn.

### Electric Welding by "First Intention"

Electric welding by "first intention" is accomplished with the portable electric welders manufactured by the Indianapolis Switch & Frog Company of Springfield, Ohio. The single electrodes used on these welders are made of special steel and furnish both the high-temperature arc required for welding and the fluxing steel.

In order to obtain a satisfactory weld, the bodies to be welded together must both be in a semi-molten condition, and the heavier piece must not conduct away the heat so fast that the metal brought in contact with it is chilled before the two pieces have a chance to weld. The manufacturer has found that a satisfactory weld is obtained only when the piece to be welded is the cathode. This peculiarity may be explained by the fact that the cathode of an electric arc is always the hotter, thus getting around the difficulty mentioned above.

The material of which the electrode is made is also responsible for the successful action of the electric welder. An alloy of specially treated machine steel, tool steel and Norway iron in definite proportions makes up the composition of the electrode. The special treatment of the electrode probably prevents the iron being converted into iron oxide by the intense heat of the arc.

The apparatus used with this welder is very simple, consisting of a conductor (fastened to a pole to be hooked over trolley wire), a ventilated set of resistance grids, a circuit-breaker, an electrode holder and switches for cutting out

Taking the case of filling one elongated hole, the following data were supplied by the company. An acetylene welding company is reported to have said that for labor, material and gas it would cost about 63 cents per hole. In comparison, assuming labor at 40 cents an hour and power at 0.5 cent a kw-hr., the following approximation was arrived at by the Indianapolis Switch & Frog Company for electric welding: Two sticks of special steel, 14 cents; power, 4 cents; labor, 8 cents; overhead charges, 10 cents;

#### COMPARATIVE DATA ON ELECTRIC AND ACETYLENE WELDING

	Electric	Acetylene
Tapered keyway and thread on G. E. 1000 armature shaft)	45 min.	3½ hrs
2-in x 8 in. weld on worn-down armature shaft (same as above)	1½ hrs.	6 hrs
Filling three holes 1 in. in diameter by 1.125 in. deep.	15 min.	1 hr.

total, 36 cents per hole. The time saved and the simplicity of operations make the electric welder worthy of consideration.

### Exhibit of Historical and Modern Telephone Apparatus

A permanent exhibit of historical and modern apparatus has been arranged by the Western Electric Company in conjunction with the American Telephone & Telegraph Company. The historical section shows the development of the telephone from its earliest stages up to the present time, and includes the smoked-glass records of sound waves made by Alexander Graham Bell in 1874, parts of Bell's original telephone of 1876, and a number of instruments showing the gradual improvement of the apparatus. This section also includes the switchboard used by Mr. Bell in opening the New York-Chicago line in 1892 and the receivers and transmitters which were used on the occasion of the opening of the long-distance telephone line between New York and Denver in 1911.



PORTABLE ELECTRIC WELDER

resistance. The arc used in connection with most of these outfits operates at 36 volts and about 170 amp.

On the authority of the manufacturer of the electric welder here described the figures which appear in the table in the other column are given as the comparative periods required for welding with the electric and acetylene machines.



FIG. 1—EXHIBIT OF HISTORICAL TELEPHONE APPARATUS

The modern-apparatus section contains switchboards with connections to a number of telephone sets, so that service demonstrations may be made to visitors; intercommunicating systems, and telephone train-dispatching apparatus in operative condition. Miscellaneous telephone apparatus, such as combined jacks, cords, plugs and repeating coils, as well as samples of telegraph apparatus, are exhibited in a

large showcase. In other showcases are samples of the various supplies manufactured by the Western Electric Company, including electric household goods of all kinds, such as vacuum cleaners, sewing-machine motors, heating devices, bells, lamps, sockets and switches, insulators and insulating material.

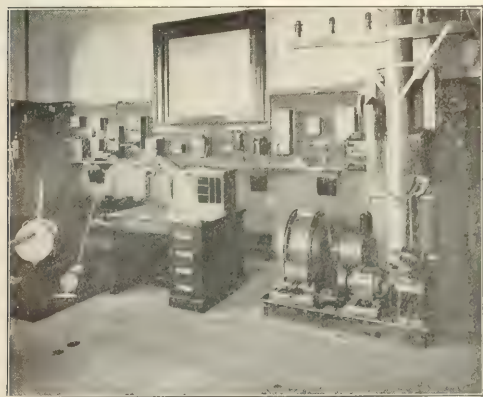


FIG. 2—EXHIBIT OF TELEPHONE APPARATUS AND APPLIANCES

This interesting exhibit of telephone and other electrical apparatus is displayed at the Western Electric Company's offices, 463 West Street, New York City.

### Underfeed Stokers

The stoker illustrated herewith is somewhat different from other types of underfeed stokers, the moving grates extending across the entire width of the furnace at an incline of about 20 per cent. The grates have a continual reciprocating motion in opposite directions for adjacent retorts, which forms a shearing line between each pair, preventing the formation of clinkers above the air openings. In some types of stokers which use dead plates or stationary tuyeres for supporting the fuel the clinkers prevent free flow of gases, which causes a reflex action, tend-

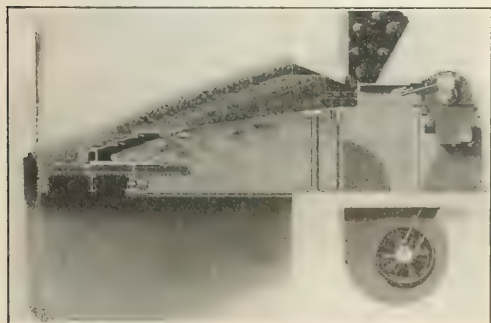


FIG. 1—SECTION OF UNDERFEED STOKER

ing to melt the iron. The shear between the moving retort side and the side wall of the furnace keeps the brickwork free. The crusher action of the pusher noses at the bottom of the overfeed grates is effective in preventing the accumulation of clinkers of large size at this point.

There is only one plunger for each retort, making the construction and operation very simple. An obstruction

caught in front of a plunger will block that plunger only and it cannot do other damage than the shearing of a pin which forms the safety device and which can easily be replaced.

The simple driving mechanism of this stoker is entirely visible from the outside and easily accessible, and the air

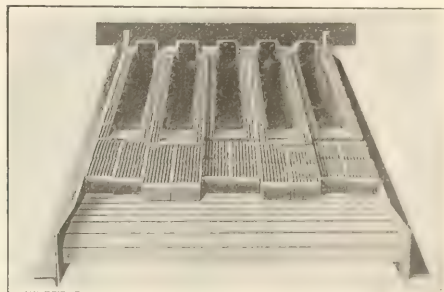


FIG. 2—FRONT VIEW OF STOKER

space underneath the stoker may be reached through the door or through the opening in the front air plate on the side door. The moving retort sections are large and massive and are readily accessible. Whole sections may be disconnected at will from the driving mechanism, and removed or replaced without further disturbing any other part or section. All parts are interchangeable.

Among other features may be mentioned the small amount of head-room required, which permits ample combustion space, and the complete separation of ash pit and fireroom, which prevents obnoxious gases and dust from entering the fireroom. This stoker is manufactured by the Sanford Riley Stoker Company, Ltd., Worcester, Mass.

### Outdoor Transformers

In the accompanying illustration is shown the type of bushings used on outdoor transformers built by the Moloney Electric Company, St. Louis, Mo. The insulators are designed to secure continuous operation under severe weather conditions, such as during rain, sleet and snow.



TRANSFORMER BUSHING

It is stated that transformers equipped with these insulators have been giving perfectly reliable service for the past three years on the Pacific Coast, where the precipitation of moisture is very great in some localities, and in parts of Canada where extreme weather conditions are encountered. These transformers are built for all commercial voltages up to 44,000 in both single-phase and three-phase units.



## Electrical Features of Commercial-Vehicle Automobile Show in Chicago

Among the exhibitors of electric vehicles at the second, or commercial-vehicle, week of the National Automobile Show in Chicago, on Feb. 10-15, were the following: Baker Motor Vehicle Company, Cleveland, Ohio; Buffalo Electric Vehicle Company, Buffalo, N. Y.; General Motors Truck Company, Pontiac, Mich.; General Vehicle Company, Long Island City, N. Y.; Kentucky Wagon Manufacturing Company, Louisville, Ky.; Studebaker Corporation, Detroit, Mich.; The Lansden Company, Newark, N. J.; Walker Electric Vehicle Company, Chicago, Ill.; Waverley Electric Company, Indianapolis, Ind.

A few features of special interest may be enumerated.

To relieve the driving axle of the weight of the motor, the Buffalo Electric Vehicle Company suspends its motor about midway between the front and rear axles in a special support. This support allows longitudinal motion of the motor as well as side thrust. The motor is connected to the differential gear without the use of universal joints.

The General Motors Truck Company exhibited a 3-ton chain-driven truck having the motor fastened rigidly to the frame. A half-spiral, flexible steel shaft connects the motor with the countershaft. This flexible shaft eliminates the sudden jar of starting to a great extent and is said to give a decidedly increased life of tires. A water-proof cable, tested for 2300-volts, connects the motor with the controller, which is under the hood, thus avoiding the chance of a ground on the frame.

Morse silent-chain drive is used between the motor and the countershaft on the General Vehicle Company's trucks.

One of the new features of the Studebaker commercial trucks is their worm-drive. A reduction of eleven to one is secured in a fairly small space. Timken roller bearings are used in this drive.

Battery removal and replacement is hastened in the Lansden truck by having two doors on the battery case, which is from 12 in. to 14 in. above the ground. When a battery is to be recharged the truck is run into the garage and the discharged battery taken out on one side while a newly charged battery is introduced from the opposite side. The service foot brake cuts off the power before applying the brake, at the same time returning the controller handle to the neutral position.

The Walker Electric Vehicle Company has a new partial delivery-type truck. Half of the batteries are under the hood and the other half are on or under the body.

The following electrical accessories manufacturers had booths at the show: Atwater-Kent Manufacturing Company, Badger Brass & Manufacturing Company, Briggs Magneto Company, Champion Ignition Company, Edison Storage Battery Company, Electric Storage Battery Company, Gould Storage Battery Company, Gray & Davis, Inc.; Hartford Suspension Company, Heinze Electric Company, Ignition Starter Company, Kokomo Electric Company, Marburg Brothers, Inc.; Motsinger Device Manufacturing Company, National Coil Company, Philadelphia Storage Battery Company, Pittsfield Spark Coil Company, Remy Electric Company, Splidfors Electric Company, The Esterline Company, United States Light & Heating Company, Vesta Accumulator Company, Warner Manufacturing Company, Westinghouse Electric & Manufacturing Company, Willard Storage Battery Company.

The Atwater-Kent Company has put out a silent timer and distributor with an automatic spark advance.

The rated output of the Edison storage battery has been increased to 450 amp-hr. with a weight of 30 lb.

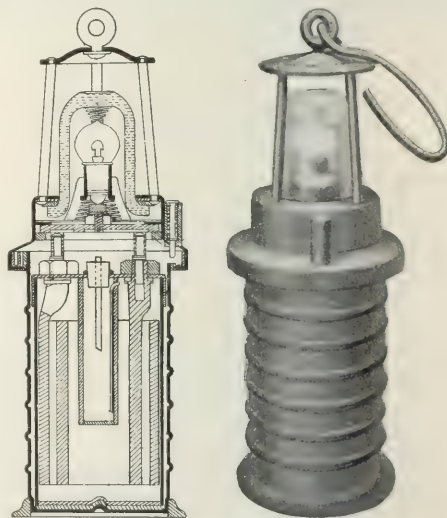
The Hartford Suspension Company, Ignition Starter Company, Remy Electric Company, Esterline Company, United States Lighting & Heating Company and Westinghouse Electric & Manufacturing Company had displays of their electric starters and lighting generators showing the connections made with batteries, switches and lamps.

The Remy Electric Company has a new low-speed lighting and ignition outfit on the market weighing 35 lb. The regulation of the generator is accomplished by means of a third brush set about 30 deg. from one of the other brushes and connected to the shunt-field circuit.

Both the Westinghouse Electric & Manufacturing Company and the Edison Storage Battery Company exhibited vibrating-type rectifiers, working on the principle of a polarized relay, which are less expensive than the mercury-arc rectifiers and more durable.

## Miner's Electric Safety Lamp

The British government recently offered a prize of \$30,000 for an electric lamp which would meet all of the requirements of mine service in a satisfactory manner. This prize was awarded to Mr. F. Faerber, of Dortmund, Germany, for the lamp shown in accompanying illustrations. The so-called "Ceag" lamp consists of a storage battery inclosed in a corrugated tin casing with a rotating and removable top part, the latter being surmounted by an incandescent lamp inclosed in a heavy glass cover. The storage battery is insulated from the casing with celluloid.



FIGS. 1 AND 2—ELECTRICALLY OPERATED SAFETY LAMP FOR MINERS

The battery electrodes are cylindrical and are placed concentrically. It is said that this scheme prevents warping of the plates. In the center of the battery is placed a metallic cylinder, which serves as a gas chamber and exhaust. The openings allow the escape of gas but retain the electrolyte.

The top part of the lamp is held in place by means of a bayonet joint on the bottom casing and may be locked by a magnetic lock. The light is switched on and off by revolving the top part with regard to the base. The incandescent bulb is protected by a heavy glass dome surrounded by four iron bars and is mounted between spiral springs to reduce film breakage.

The lamp is rated at 1.5 cp, 2 volts, and will operate for a period of sixteen hours on one charge. The total weight of the lamp is 5 lb. It is stated that the cost of operation for one sixteen-hour period is about 2.5 cents. The lamp has been placed on the market in this country by the Manesmann Light Company of America, 55 John Street, New York.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Will Transmit Energy to West Virginia Coal Mines.**—If present plans are consummated, mining operations at more than 220 coal mines in Kanawha, Raleigh and Fayette Counties, W. Va., from which some 18,000,000 long tons of coal are produced each year, will be conducted before the close of 1913 by electrical energy from the steam generating station which the Virginian Power Company is building at Cabin Creek Junction, on the great Kanawha River, 15 miles southeast of Charleston, W. Va. This station will have an initial equipment of two 10,000-kva Westinghouse-Parsons turbo-generating units. Later on two more units of the same rating will be added. Babcock & Wilcox boilers will be installed. Three-phase, 60-cycle energy will be generated at 6600 volts, and this will be stepped up to 44,000 volts for transmission. The main transmission line from the Cabin Creek station will go to Beckley, a distance of 45½ miles. Steel towers furnished by the American Bridge Company will be used to carry this line. The distribution system, which will be about 115 miles in length, will be supported by steel poles supplied by the Franklin Steel Company. It is possible that a line to Charleston will be built. About 8000 kw of the plant's output has been contracted for to date by the various coal-mining companies. It is expected that the Cabin Creek plant will be in operation by July 1, 1913. In addition to the steam station, the company is contemplating construction of hydroelectric stations at several of the water-power sites which it controls on New River. Of these sites, those of greatest possibilities are at Bluestone Junction, where 125,000 hp is available; at Gauley Bridge, where 35,000 hp can be developed, and at Richmond Falls, about 10 miles above Bluestone Junction, where 15,000 hp is available. The Virginian Power Company was incorporated last fall under Massachusetts laws, as noted in these columns Oct. 5, 1912, with a capitalization of \$10,000,000. Its president is P. G. Gossler, of A. B. Leach & Company, New York; its vice-president is George P. Tobey, and its secretary and treasurer is Wilbur Tusch, both of whom are associated with A. B. Leach & Company. Mr. Gossler is also chairman of the board of directors of the Columbia Gas & Electric Company, which operates the public utilities in Cincinnati. The latter city is about 190 miles from the Virginia company's water-power sites.

**Toledo Railways & Light Changes.**—At the annual meeting of the Toledo Railways & Light Company, held on Feb. 10, following postponement from the regular date, Jan. 16, L. E. Beilstein and R. C. Pugh, of Toledo; W. H. Netherlands, of Louisville, and W. E. Hutton, of Cincinnati, resigned from the board, and P. E. Schilling, W. J. Marshall, W. R. Hodge and H. S. Swift were chosen in their places. The newly elected directors are employees of the company and it is planned to replace them later upon the board with representatives of Henry L. Doherty & Company, who, as previously noted, will operate the reorganized property as the Toledo Traction, Light & Power Company. A meeting is to be held on Feb. 27, at which the permanent members of the board will be chosen and new officers elected. Approval was given at the annual meeting of the action taken by the reorganization committee for reorganizing the company. All of the securities of the underlying companies were taken over by the Toledo Traction, Light & Power Company, with the exception of some \$2,300,000 bonds of the gas and coke subsidiaries. The property will be operated under three departments, one taking charge of the street-railway system, one of the lighting business and the third of the electric interurban lines. Approval was given at the meeting of the contract with the Doherty Operating Company for managing the properties.

**The Copper Situation.**—The January statement of the Copper Producers' Association shows that the surplus of

metal is still increasing, owing to the excess of production over deliveries. The surplus has shown a progressive increase since last August from some 46,700,000 lb. to the present quantity of about 123,200,000 lb. Total deliveries in the same period fell from a maximum of 149,200,000 lb. in August to a minimum of 123,700,000 lb. the following month, remaining very near the latter figure for the ensuing four months and touching 125,600,000 lb. in January. Production, except for November, has remained not far from the January figure of 143,500,000 lb. Domestic consumption touched the high mark for the year in October, reaching 84,100,000 lb., falling off, however, in both November and December, but rising again to 65,200,000 lb. in January. The drop from October to December amounted to 30 per cent and accounts for the break in the market which came after the opening of the year. In view of an increase in the domestic deliveries in January the course of the market in the near future is uncertain, but it remains a fact that 16-cent metal allows the producers at least a reasonable profit, and perhaps more, and therefore a higher figure represents simply a needless burden on the consumer.

**United States Light & Heating Company's Plant Busy.**—An executive of the United States Light & Heating Company was quoted last week as follows: "At present business with us is exceptionally good; in fact, we are unable to handle all the orders on our books. Our plant at Niagara Falls is turning out electric starters at the rate of approximately 1500 a month, and we have orders for thousands of these devices which are to be placed later. Contracts covering many years have been closed with several of the big automobile companies to supply them with our starters and lighters. While this new branch of our business is showing a big gain, our car-lighting business continues good. Total shipments for December were \$268,000, and for January they are expected to amount to between \$325,000 and \$350,000. We intend to increase our monthly output, so that we shall be in a position to meet the constantly increasing demand for our products."

**Kentucky Utilities Buys Richmond (Ky.) Company.**—The Kentucky Utilities Company, which is controlled by the Middle West Utilities Company, has purchased the Richmond (Ky.) Electric & Power Company. L. B. Herrington, president of the Richmond company, is also president of the Dix River Power Company, which, as stated in these columns April 13, 1912, is planning to build a 20,000-hp hydroelectric station on the Dix River in Boyle County, Ky., near its confluence with the Kentucky River. According to the terms of the recent Richmond sale, the Richmond property is to be operated under Middle West management along with stations in Somerset, Lawrenceburg, Versailles and other Kentucky cities which have been purchased during the past few months and which may ultimately be turned over to the Kentucky Utilities Company.

**Thompson Electric Company's Plans.**—The Thompson Electric Company, of Cleveland, Ohio, has increased its capitalization from \$10,000 to \$50,000 to provide funds for the increased business it is doing. The company is to manufacture automatic safety cut-out hangers for arc lamps and large tungsten units and clusters, and will shortly place upon the market a high-voltage series cut-out hanger for street lighting. A. J. Thompson is president of the company and Charles E. Pope, who was formerly mechanical engineer for the National Malleable Castings Company of Cleveland, is secretary and treasurer.

**New York Edison's Annual Meeting.**—Edgar Palmer, president of the New Jersey Zinc Company, was elected a director of the New York Edison Company, to succeed his father, the late S. S. Palmer, at the annual meeting this week. The other directors were re-elected.



**Electric Storage Battery Company's Twenty-fifth Anniversary.**—Celebrating its twenty-fifth anniversary and at the same time repeating on a more elaborate scale the hospitality displayed in former years during the Automobile Show, the Electric Storage Battery Company, of Philadelphia, gave a handsomely appointed dinner at the Midway Club in Chicago on Feb. 5. There were about 200 men present, and they included manufacturers of and dealers in electric vehicles, "Exide" distributors and other friends of the company. The word "Exide" was displayed in letters of electric light at one side of the room. It was expected that Mr. Herbert Lloyd, president of the company, would be present, but he was unable to attend, a telegram read during the dinner explaining that he was compelled to remain in Philadelphia because of the death of an intimate friend. Mr. Charles Blizard, vice-president, was present and presided at the dinner, Mr. Godfrey H. Atkin, manager of the Chicago office, serving as his active lieutenant. There was no speechmaking, but after the cigars had been distributed a number of professional entertainers gave an excellent cabaret show. The menu, on gray paper, was margined in silver in honor of the anniversary. It contained some amusing "Exidiums," among them the following: "If you leave the club after 2 a. m., don't waste time in trying to crank your car; remember, it's an electric." "When meeting a car turn to the left. The approaching car will turn in the same direction. You can then determine which is the best-built car." "All the gasoline people to-day are shouting 'self-starters.' The electric vehicle was the first self-starter in the field." The dinner and the fun-making were greatly enjoyed by all who had the privilege of attending.

**Injunction Restrains Central Union Telephone Sale.**—Minority stockholders of the Central Union Telephone Company, the subsidiary Bell company operating in parts of Illinois, Indiana and Ohio, have obtained a temporary injunction in a state court in Chicago restraining the American Telephone & Telegraph Company and the Chicago Telephone Company from effecting the proposed change whereby the Illinois properties of the Central Union company will be consolidated with the Chicago Telephone Company. The proposed reorganization is a part of the plan of the parent company to have separate subsidiary companies within the boundaries of each state. The petitioners are William A. Read, a New York banker, and his associates, Charles J. Spencer and Charles G. Foster. Together they are said to own 829 shares of Central Union stock having a par value of \$82,900. The present par value of the outstanding stock is \$5,459,000, of which the American Telephone & Telegraph Company is said to own \$5,204,977. The petitioners assert that the proposed reorganization would violate the laws of Illinois relating to stock ownership by corporations; also that the rights of the minority stockholders have been disregarded. B. E. Sunny, president of the Chicago Telephone Company, says that the charges are absurd and that it is a matter of plain business economy to consolidate the properties in each state so as to facilitate reports to the various state commissions now in existence or which may be created hereafter.

**Notes from Byllesby Companies.**—The Consumers' Power Company has completed the tie line connecting the station at Cannon Falls with the Mankato distributing system. The Appalachian Power Company has completed its lines to serve the Vaughn and Flannagan coal-mining properties. If plans now under consideration for the construction of an interurban railway between Bluefield, Va., and Princeton, Va., a distance of 12 miles, are carried out, the Appalachian company will furnish the energy for operating this road and will also obtain rental for the use of its tracks in Bluefield. There are good prospects in Sioux Falls (S. D.) for the Sioux Falls Light & Power Company to secure additional motor-service load from the stone quarries in the western part of the city. Four new mills, each of which will require about 100 hp for its operation, will be constructed in the next few months in the Arkansas Valley, Col., for handling the alfalfa output and the Arkansas Valley Railway, Light & Power Company is looking for additional load from this source. Business conditions in all of the sections where the public utilities are operated by the Byllesby syndicate are said to be very flourishing and

the utility managers are very optimistic, therefore, as to the outlook for new business during the present year.

**United Public Service Company's Holdings.**—As was noted in these columns last week, the United Public Service Company has been incorporated under Delaware laws with a capital of \$10,000,000 and will take over electric-service properties, including several in Ohio and Kentucky. The properties which the new concern will take over are those of the Light & Development Company of St. Louis outside of the State of Missouri. They include the Oberlin (Ohio) Gas & Electric Company, the Paris (Tex.) Light & Power Company, the Fort Scott (Kan.) Gas & Electric Company, the Mitchell (S. D.) Power Company, the Tahlequah (Okla.) Light & Power Company, together with electric-service properties at Danville, Ky., and Ravenna, Ohio. The Light & Power Development Company of St. Louis was incorporated in 1908 under Missouri laws to manage and operate public service properties. It has an authorized capital stock of \$200,000, all of which is outstanding. The properties which it retains are isolated plants in St. Louis, the Cape Girardeau (Mo.) Water Works & Electric Light Company and the Poplar Bluffs (Mo.) Electric Light & Power Company.

**Vermont Hydroelectric Developments.**—The Consolidated Lighting Company, of Montpelier, Vt., one of the Tenney companies, has purchased the Molly Falls Light & Power Company, of Mansfield, Vt., together with water rights at Lambertson Mills and Peacham Pond. Plans for developing some 3000 hp at Molly Falls are being made by the Consolidated company. The proposed work includes the raising of the level of Peacham Pond about 8 ft., increasing its area by 100 acres, the erection of a power house on the site of the present station at Molly Falls and the installation of a pipe line  $1\frac{1}{2}$  miles long to Lambertson Mills, where the existing dam will be rebuilt. The energy will be utilized in the Barre and Montpelier districts in connection with that furnished by the company's other plants.

**Long Island Lighting Company's Board Re-elected.**—All of the directors of the Long Island Lighting Company, which supplies the towns of Northport, Centreport, Greenlawn, Smithtown, Kings Park, Sayville, West Sayville, Bayport, Oakdale, Great River, Islip, Amityville and several other communities on Long Island, N. Y., were re-elected at the annual meeting of the stockholders at the offices of the company, 50 Church Street, N. Y., last week and the report of the president covering the year ended Dec. 31, 1912, was presented. The officers were also re-elected as follows: President, E. L. Phillips; vice-president, G. W. Olmsted; treasurer, G. E. Lott, and secretary, H. R. Frost. The first three, with G. de B. Green and C. R. Dean, compose the board of directors.

**Sales Conference of Illinois Electric Company.**—The first sales conference of the Illinois Electric Company of Chicago was held at the Hotel La Salle in that city during the week ended Feb. 8. Meetings were held from 9 a. m. to 6 p. m., representatives of manufacturers giving instructive talks on devices and apparatus. The evening meetings were devoted to the affairs of the Illinois Electric Company. Much interest was taken in the conference, which will be made an annual event. N. G. Harvey, general manager of the company, planned the conference and supervised all its details.

**West Penn Traction & Water Power Earnings.**—The statement of the West Penn Traction & Water Power Company for the year ended Dec. 31, 1912, showed the largest earnings on record for the company. Gross earnings were \$3,408,586, an increase of \$1,148,299; expenses and taxes, \$1,829,459, an increase of \$717,178; net earnings, \$1,579,127, an increase of \$431,121, and fixed charges, \$794,748, an increase of \$266,472. The surplus remaining was \$549,379, an increase of \$164,649.

**McCrum-Howell Disbursement.**—Judge Buffington in the United States Circuit Court has authorized the receivers of the McCrum-Howell Company to pay a dividend of 21.2 per cent to non-assenting creditors. This will wipe out the remaining assets and after this payment the receivers will be discharged. The company has been reorganized as the Richmond Radiator Company.



**United Light & Railways Buys Iowa Companies.**—Announcement has been made of the purchase of the People's Gas & Electric Company, of Mason City, Ia., and the Mason City & Clear Lake Railway Company\* by the United Light & Railways Company, of Grand Rapids, Mich. The latter, it is said, has also made a contract to operate the system of the Iowa & Illinois Railway Company with an option to purchase it at the end of four years. This company operates a line from Davenport to Clinton, Ia., a distance of about 40 miles. Negotiations are also understood to be in progress for the purchase of the Iowa City Gas & Electric Company. The directors of the United Light & Railways Company have declared an initial dividend of 1 per cent on the common stock, payable April 1 to holders of record March 21. The directors declared a dividend of 4 per cent for 1913, to be payable during the year in quarterly instalments, beginning with April 1.

**Rubber-Covered Cable for New South Wales.**—The Armorduct Manufacturing Company of Farrington Avenue, London, has just received from the Postmaster-General of New South Wales an additional order for 1115 miles of its vulcanized rubber cable.

### January Statement of Copper Producers' Association

The January statement of the Copper Producers' Association, issued this week, showed an increase of 17,885,750 lb. in surplus stocks, and compared with the December statement as follows:

	January, Pounds	— December, Pounds—
Stocks on hand in the United States on first of month.....	108,312,582	\$6,164,059
Production.....	143,479,625	143,354,042
	248,792,207	229,518,101
Domestic deliveries.... 65,210,030	58,491,723	
Foreign deliveries.... 60,383,845	65,713,796	
	125,593,875	124,205,519
Stocks on hand at end of month..	123,198,332	105,312,582

### NEW YORK METAL MARKET PRICES

	Bid.	Feb. 4 Asked.	Bid.	Feb. 11 Asked.
Copper:				
Standard pot. ....	15.00		14.50	
	£ s d	£ s d	£ s d	£ s d
London, standard, spot.....	67 17 6	68 5 0	66 5 0	67 17 6
Prime lake.....	16.12½	15.75	15.87½	15.75
Electrolytic.....	16.00	15.50	15.50	15.75
Casting.....	15.87½	15.50	15.50	15.87½
Copper wire, base.....	17.50 to 18.00	17.50	17.50	18.00
Lead.....	4.35	4.35	4.35	4.35
Nickel.....	40.00 to 45.00	40.00 to 45.00	40.00 to 45.00	40.00 to 45.00
Sheet zinc, f.o.b. smelter.....	8.75	8.75	8.75	8.75
Spelter, spot.....	6.75	6.50	6.50	6.75
Tin, spot.....	49.15	49.12½	49.12½	49.15
Aluminum:				
Prompt delivery.....	26.00 to 26.50	25.50 to 26.00	25.50 to 26.00	26.00 to 26.50
Future.....	26.00 to 26.50	25.50 to 26.00	25.50 to 26.00	26.00 to 26.50

### OLD METALS

Heavy copper and wire.....	14.25	14.25
Brass, heavy.....	8.75	8.75
Brass, light.....	7.75	7.75
Lead, heavy.....	4.15	4.15
Zinc, scrap.....	5.75	5.75

### COPPER EXPORTS IN FEBRUARY

Total tons to Feb. 12.....	12,256
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### Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Feb. 5	Feb. 11
Allis-Chalmers, t. r., 3d pd. ....	\$15,501,800			4	4
Allis-Chalmers, pt., t. r., 3d pd. ....	1,110,500			4	4
Amalgamated Copper.....	153,887,900	1½		71½	71½
American Tel. & Tel.....	334,887,700	2		131	132
Electric Storage Battery, c.....	16,074,425	1		53½	53
General Electric.....	101,203,500	2		112	114
Mackay Cos., c.....	41,380,400	1½		84	84½
Mackay Cos., pt.....	50,000,000	1		67	67½
Western Union Tel.....	99,745,400	1		72½	72
Westinghouse, E. & M., c.....	33,798,520	1½		71	71½
Westinghouse, E. & M., pt.....	3,998,700	1½		119½	119½

\*Last price quoted.

## Personal

Mr. R. G. Parker has tendered his resignation as manager of the Faulkton (S. D.) light and power plant.

Mr. A. E. Cook has retired as manager of the Lake Mills (Wis.) Municipal Electric Light & Water Plant.

Mr. J. Cmylia has been appointed superintendent of the Kewaunee (Wis.) Municipal Electric Light Plant.

Mr. F. H. Andrus, superintendent of the municipal electric-lighting plant at Burlington, Vt., has tendered his resignation, effective Feb. 15.

Mr. W. C. Ross has resigned as president of the Aberdeen (S. D.) Light & Power Company. His successor is Mr. C. A. Grimmel, of Omaha, Neb.

Mr. Miles Bronson has been appointed general superintendent of the electric division of the New York Central & Hudson River Railroad Company.

Mr. Henry Koehber has been appointed chief engineer of the Auglaize Power Company, Defiance, Ohio, as successor to Mr. A. N. Libby, who has retired.

Mr. L. S. Keith, who for some time has been connected with the firm of McMeen & Miller, of Chicago, electrical engineers, has been made a member of the firm.

Mr. Garret H. Wilson has been appointed superintendent of the electric division and of the Grand Central Terminal of the New York Central & Hudson River Railroad Company.

Mr. A. S. Reed has severed his connection with the Rutland (Vt.) Railway, Light & Power Company and entered the employ of the Binghamton (N. Y.) Street Railway Company.

Mr. F. E. Watts, Jupiter of the Jovian Order, who is making a tour of the West in the interests of his organization, was tendered a dinner at Denver, Col., Feb. 12, by the Jovians of that city.

Mr. Reuben H. Barber, chief engineer of the municipal electric-light plant at Holyoke, Mass., has resigned his position and accepted a similar post with the New Bedford (Mass.) Gas & Edison Light Company.

Mr. Joseph H. Proctor, instructor in electrical engineering at the Agricultural & Mechanical College of Texas, has resigned from that institution and joined the patent department of the Westinghouse Electric & Manufacturing Company.

Mr. A. W. Hubbard, who as previously mentioned in these columns has concluded his services as manager with the Athol (Mass.) Gas & Electric Company, was presented with a Knights Templars charm by the employees of the company on Feb. 6.

Mr. Charles V. Seastone has been taken into partnership by Mr. Daniel W. Mead, consulting engineer, Madison, Wis. Mr. Seastone, who has been associated with Mr. Mead for several years, is an associate member of the American Society of Civil Engineers.

Mr. Wilbur M. Krise has been appointed general manager of the Jefferson Electric Light, Heat & Power Company of Punxsutawney, Pa. Mr. Krise, who is a graduate of Drexel Institute, was formerly connected with the commercial department of the lighting plant at Steubenville, Ohio.

Mr. S. W. Mower has become manager of the lighting companies allied with the Hartwick Power Company and the Otsego & Herkimer Railroad, succeeding Mr. Choate, resigned. The lighting companies in question are at Richfield Springs, Cooperstown and

Dr. Edward P. Hyde, director of the physical laboratory of the National Electric Lamp Association, Cleveland, Ohio, lectured at the Franklin Institute Jan. 30 on "The Activities of the Lamp Association in the Development of the Modern Science of Illumination."

Mr. R. J. Andrus has been appointed vice-president and general manager of the Northwest Electric & Water Works, with headquarters in Seattle, Wash. Mr. Andrus left the Pacific Power & Light Company, with which he had been associated for several years as manager of the Pasco and Kennewick branches, last spring to become new-business manager for the South Bend Electric Company and the

Montesano Light & Water Company. The Northwest Electric & Water Works is a consolidation of these properties and operates electric, gas and water utilities in western Washington.

**Mr. C. C. Custer**, for several years business manager and mechanical superintendent of the Miami (Ohio) Light, Heat & Power Company, which has been taken over by the Dayton Power & Light Company, has resigned, and Mr. Mason Lytle, formerly of Dayton, has been placed in charge of the local office.

**Mr. Lee Murray**, who recently retired from the position of general manager of Messrs. Bruce, Peebles & Co., Ltd., engineers, Edinburgh, has started business on his own account at 10 Norfolk Street, Strand, London, W. C., as engineering representative for firms and corporations in the colonies and abroad.

**Mr. F. F. P. Forrest**, who during the past sixteen years was connected with the Salem (Mass.) Electric Lighting Company, has severed his connection with the company to take up farming. Mr. Forrest on leaving the company was presented with a purse from his employers and fellow-employees as a token of esteem.

**Mr. H. U. Wallace**, well known in Iowa railroad circles and at present head of the Northern Colorado Power Company, Denver, Col., has been appointed receiver of the Denver, Laramie & Western Railroad. Mr. Wallace was at one time chief engineer of the Illinois Central Railroad and general manager of the Lake Shore Railroad.

**Mr. Samuel Insull**, president of the Commonwealth Edison Company of Chicago, was one of the speakers at the annual dinner of the British Electrical and Allied Manufacturers' Association at the Savoy Hotel, London, Jan. 24. He said that one of the great obstacles to the progress of electrical business in England is the lack of co-operation between electrical men in general and between the manufacturers of electrical apparatus and the suppliers of electrical energy in particular.

**Mr. Albert R. Whaley** has been elected vice-president of the New York, New Haven & Hartford Railroad in charge of operations. Mr. Whaley was formerly superintendent of the electric zone of the New York Central & Hudson River Railroad and was also in charge of the terminal construction. Prior to that he was superintendent of the Worcester division of the New York, New Haven & Hartford Railroad and came to have charge of the first heavy electric traction installation in this country, which was at Providence on the line between Providence and Fall River. All of the electric and terminal change-over at the Grand Central Station in New York has been done under his direction, and he had charge not only of the operation but also of the power houses, roadbed and equipment.

**Mr. Parker H. Kemble** has resigned the position of general sales manager of the Toronto (Ont.) Electric Light Company to accept that of manager of the commercial department of the Union Gas & Electric Company of Cincinnati, Ohio. Prior to going to Toronto Mr. Kemble was district manager of the Edison Electric Illuminating Company of Brooklyn, but his central-station experience has not been limited to these two companies. He was at one time connected with the engineering staff of the Boston Elevated Railroad Company and also rebuilt and operated the properties of the Northern Connecticut Light & Power Company of Windsor Locks, Conn. Mr. Kemble is a member of numerous engineering societies and was recently elected first vice-president of the Canadian Electrical Association and appointed Jovian Statesman for Ontario. He was educated at Harvard, at the Technology School in Dresden, Germany, and at the Massachusetts Institute of Technology.

**Mr. Frank K. Wade**, who as stated in the Feb. 1 issue of the *Electrical World* was appointed successor to Mr. G. H. Caffrey as superintendent of the Norwalk (Conn.) division of the United Electric Light & Water Company, entered upon his duties on Feb. 4. Mr. Wade spent four years in the mining section of the Transvaal, South Africa, installing electrical machinery for the development of both surface and deep-level mines, and also spent five years with the General Electric Company. He was formerly general superintendent of the Olean (N. Y.) Electric Light & Power Com-

pany and subsequently represented Mr. W. C. Johnson, consulting engineer, of Niagara Falls, in the installation of waterwheels, electric machinery and transmission lines for the Hannawa Falls Water Power Company at Potsdam, N. Y. During the past two years Mr. Wade was the district sales agent for the Cooper Hewitt Electric Company, Hoboken, N. J., having charge of the company's territory throughout northern New Jersey.

**Mr. James Bennett**, who was elected president of the Western Association of Electrical Inspectors at its St. Louis convention, Jan. 30, has for four years past served as chief electrical inspector for the Canadian Fire Underwriters' Association, with headquarters at Montreal, Canada. Mr. Bennett entered the electrical field after completing courses in a commercial college and at McGill University, joining in 1892 the forces of the Royal Electric Company, which at that time represented the Thomson-Houston Company in Canada. In 1897 he went to the Montreal Electric Company as superintendent and five years later embarked in the electrical contracting business for himself. Mr. Bennett has been a vice-president of the National Electrical Inspectors' Association since 1909 and served the Western Association of Electrical Inspectors as vice-president and chairman of the executive committee before his election as president. He is a member of the American Institute of Electrical Engineers, honorary member of the Electrical Association of the Province of Quebec, member of the electrical committee of the National Fire Protection Association and Quebec statesman for the Jovian Order. As recently announced in these columns, Mr. Bennett plans to retire from his position with the Canadian Fire Underwriters' Association on April 1, to become managing director of the Fire Prevention Company of Canada.

**Mr. George C. Keech**, the new president of the Electric Club of Chicago, has been a well-known figure in electrical circles in Chicago for several years. He took his

electrical engineering course with the class of 1895 at the University of Michigan, of which State he is a native. After graduation he was connected with the Sawyer-Man Electric Company (now the Westinghouse Lamp Company) for four years. After that, for a period of six years, he was manager of the Chicago office of the Bryan-Marsh Company. Since 1905 he has been illuminating engineer and general sales agent for the Cooper Hewitt Electric Company, with office in Chicago. He designed and

GEORGE C. KEECH

installed the first system of Cooper Hewitt lamps in Chicago and since then about 20,000 of the mercury-vapor lamps have been placed in position in Chicago and vicinity under his direction. He was one of the organizers of the Chicago Section of the Illuminating Engineering Society and was chairman of this section for the first two years of its existence. Afterward he was one of the national vice-presidents of the Illuminating Engineering Society. Mr. Keech has addressed various societies on topics connected with illumination and has prepared a number of papers on the same general subject. He designed the first street-lighting installation in the United States, using quartz-tube lamps, and his hobby is the high mounting of large units for street lighting. He was elected president of the Electric Club of Chicago on Feb. 6.

## Obituary

**Mr. John Fritz**, the noted steel-mill engineer, known the country over as "Uncle John," died at his home in Bethlehem, Pa., on Wednesday evening, Feb. 12, aged ninety years.



## Construction

**BESSEMER, ALA.**—The Republic Iron & Steel Co. is preparing to make extensive improvements at its mines on Red Mountain at Kalmind. It is understood that electrically driven machinery will be installed to replace steam in a number of places in the mines. Energy will be supplied from the power plant of the Birmingham Ry., Lt. & Pwr. Co. in Birmingham.

**PHOENIX, ARIZ.**—The Arizona Corporation Commission has instructed the Phoenix St. Ry. Co. to reconstruct and equip completely its street railway system here. The system will also be extended.

**WYNNE, ARK.**—Proposals will be received by the Board of Commissioners of Water and Light District No. 2 and Sanitary Sewer District No. 1 until Feb. 24 for construction of certain improvements as follows: One artesian well; electric motor and pump erected in pump pit; power house extension; 12,000 ft. 8-in., 11,400 ft. 6-in. and 8930 ft. 4-in. cast-iron pipe line; 41 standard fire hydrants, 25 valves, two high-speed engines, horizontal return tubular boiler, two generators, switchboards, street-lighting system, 5 miles pole-line construction, transformers and supplies; 5620 ft. 15-in., 3050 ft. 12-in., 2650 ft. 10-in., 16,000 ft. 8-in., 13,200 ft. 6-in. sewer pipe, 73 manholes, 2 special manholes, 40 lamp-holes and 24 flush tanks. Plans and specifications are on file at the office of the secretary of the Board of Commissioners, Wynne, and at the office of R. C. Huston & Co., consulting engineers, Exchange Building, Memphis, Tenn. C. B. Bailey is secretary of board.

**BARSTOW, CAL.**—The Barstow Utility Co. has applied to the State Railroad Commission for authority to sell its electric plant and distribution system to the Southern Sierras Pwr. Co., of San Bernardino, which has a 110,000-volt transmission line passing near Barstow.

**FRESNO, CAL.**—The Fresno, Hanford & Summit Lake Interurban Ry. Co. has applied to the State Railroad Commission for authority to issue \$1,250,000 in bonds, the proceeds to be used for the construction of an electric railway running from Fresno to Centerville, thence to Kingsburg, a distance of about 40 miles.

**LOS ANGELES, CAL.**—Bids will be received by the Board of Public Works for the installation of an ornamental street-lighting system on Seventh Street from Los Angeles River to Hoover Street, a distance of about 3 miles.

**LOS ANGELES, CAL.**—The State Railroad Commission has granted the Southern California Pwr. Co. authority to issue \$2,500,000 in bonds, of which more than \$1,000,000 will be used in completing the installation of a new unit at the Long Beach plant. The remainder will be devoted to new construction and improvements.

**LOS ANGELES, CAL.**—The municipal railway committee of Los Angeles has adopted the report of F. D. Howell, consulting engineer, recommending the construction of an electric belt railway line through the industrial district of the city in connection with the proposed municipal freight railway to the harbor at San Pedro. The city plans to begin this work at an early date.

**OROVILLE, CAL.**—The Oro Wtr., Lt. & Pwr. Co. is planning to build an electrically operated dredger, to cost about \$75,000.

**PASADENA, CAL.**—The officials of the Home Tel. & Tel. Co. have announced that improvements will be made to its system involving an expenditure of \$260,000.

**RANDESBURG, CAL.**—The Southern Sierras Power Co. contemplates extending its transmission lines into the Randesburg district and the construction of new power plants along the Owens River.

**SAN ANDREAS, CAL.**—The Oro El. Corp., of Oroville, has applied to the Board of Supervisors of Calaveras County for a franchise to erect and maintain transmission lines along certain roads and highways of the county. Bids for the above franchise will be received until March 3.

**SAN JACINTO, CAL.**—The city officials are planning to have a large number of street lamps installed in the near future.

**SIERRA CITY, CAL.**—Dennis Phelan, managing director of the Sierra Mercantile, Pwr. & Mining Co., is planning to erect an electric power plant to furnish electricity to operate the machinery in the Sacred Mound mine and mill.

**TULARE, CAL.**—The Big Four Railroad has applied to the State Railroad Commission for permission to issue \$300,000 in bonds, the proceeds to be used for the construction of an electric railway from Tulare to Visalia, a distance of 15 miles, and from Tulare to Porterville, a distance of about 20 miles.

**VISALIA, CAL.**—The Southern Pacific Co. is planning to extend the Visalia El. R. R. Co.'s lines through Dunnigan Gap to Fresno.

**NEW HARTFORD, CONN.**—Arrangements are being made by E. A. Perkins, of Torrington, for extending the electric-light system in New Hartford. Mr. Perkins proposes to install a larger engine and generator. Work has begun on the erection of lines through Pine Meadow to the Gilman Railroad crossing. It is proposed to furnish a 24-hour service.

**NEW HAVEN, CONN.**—Arrangements have been completed whereby the United Ilg. Co. of New Haven will extend its electric-lighting service to Woodbridge, a suburb of New Haven, in the near future.

**NEW HAVEN, CONN.**—Plans have been completed by C. E. Townsend, architect, for additions and alterations to the Grand Avenue power station of the United Ilg. Co. The building will be 58 ft. by 80 ft., one story high. Bids, it is understood, will be asked for at once.

**WASHINGTON, D. C.**—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 25, for furnishing at the various navy yards and naval stations supplies as follows: Boston, Mass., Schedule 5160—electric welding apparatus; Schedule 5161—one hydraulic pump, one foundry rotary blower, one steam-driven air compressor, one hydraulic pipe-bending press, one hydraulic steam forcing press; Schedule 5174—38,000 lb. galvanized crucible cast-steel wire; Schedule 5175—116" steel-to-steel single conductor cable; Schedule 5167—miscellaneous brass globe valves. Brooklyn, N. Y., Schedule 5159—eight radio sets; Schedule 5174—11 electric portable drills; Schedule 5175—3900 lb. seamless drawn brass pipe, 750 lb. seamless drawn brass tubing, 490 lb. seamless drawn copper tubing; Schedule 5170—10,400 lb. lead pipe; Schedule 5171—miscellaneous seamless drawn galvanized steel tubing. Schedules can be obtained upon application to the navy pay office nearest each navy yard. T. J. Cowie is paymaster general, U. S. N.

**WILLISTON, FLA.**—The Williston Mfg. Co. has been granted a franchise to install an electric-light plant here.

**ATLANTA, GA.**—Negotiations are pending for the transfer of the Georgia property of the Tennessee Pwr. Co., of Cleveland, Tenn., to the Georgia Pwr. Co. The transfer will include about 58 miles of transmission lines, the entire holdings of the Tennessee Pwr. Co. in Georgia. J. A. Cunningham, of Cleveland, is superintendent of the Tennessee Pwr. Co.

**ABINGDON, ILL.**—The Abingdon Lt. & Pwr. Co. is reported to have sold its electric-light plant here to the Illinois Trac. System for \$60,000. Franchises to supply energy to St. Augustine and Prairie City are also included in the transfer.

**ABINGDON, ILL.**—A new switchboard and underground cables are among the improvements contemplated by E. S. Cheadle, of Joliet, and E. S. Sterrett, of Henry, who have purchased the plant of the Union Mutual Tel. Co. from L. E. Cutler.

**ALTON, ILL.**—The city officials are contemplating the installation of a flashlight police signal system in Alton.

**ARCOLA, ILL.**—The Board of Highway Commissioners of Arcola Township has granted the Central Illinois Pub. Ser. Co., of Mattoon, a franchise to erect transmission lines on the highways of the town.

**BEARDSTOWN, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has purchased two 250-hp. Heine water-tube boilers for its local plant. A new 650-kw turbine engine, motor-generator set and generator will be installed. Contracts have been secured by the company for furnishing electricity to operate the pumping stations in the Big Swan and Hillview drainage districts near Winchester, and energy will be supplied to the local plant.

**CISSNA PARK, ILL.**—The Central Illinois Utilities Co., of Watseka, has applied to the Village Board for a 30-year franchise to operate an electric-light system here. The company offers to furnish a 24-hour service.

**DECATUR, ILL.**—An application has been filed with the city clerk by Frank L. Suffern for a franchise to construct and operate an electric-light plant here. A company has been incorporated with a capital stock of \$50,000 and the following officers: Frank L. Suffern, president; G. W. Mueller, vice-president, and E. L. Suffern, secretary.

**FREEPORT, ILL.**—The Freeport Ry. & Lt. Co. is placing in service the third waterwheel at its power plant on the Pecatonica River at Brown's Mill and contemplates adding another.

**MACOMB, ILL.**—A committee appointed by the City Council is making investigations with a view of installing an engine, generator and other electrical equipment at the city water pumping station to supply electricity for street lighting.

**NOKOMIS, ILL.**—The city officials are considering the question of establishing a municipal electric-light plant.

**PANA, ILL.**—The City Council has offered the Central Illinois Pub. Ser. Co. a contract for lighting the streets at \$60 per year for arc lamps of 2000 cp. The present rate is \$72 each per year.

**PERRY, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, is seeking a franchise to operate an electric-light plant in Perry.

**QUINCY, ILL.**—The Central Union Tel. Co. has announced that it will install a telephone and flashlight alarm system for the Police Department.

**QUINCY, ILL.**—Negotiations are pending for the transfer of the Ill. & Hte. Co. and the Mississippi River Power Co., of Keokuk, Ia., for the distribution of energy generated at this point in the company's big dam by the local company.

**ROCKFORD, ILL.**—Robert H. Coker has secured contracts for the supply of 1000 ft. of 12-in. cast-iron pipe for the wheels will be installed and extra work will be done. A two-story concrete building will be erected.

**ROOHBHOUSE, ILL.**—The Chicago & North Western Ry. Co. has entered a contract with the Central Illinois Pub. Ser. Co. whereby the latter will furnish electricity for lighting and power for the city hall, city buildings and other public buildings and for the use of the city and the railroad company.

**SPRINGFIELD, ILL.**—Resolutions have been passed by the Board of Street and Sanitation, State Park Commission, a distance of about 20 blocks, and residences on Monroe Street between Tenth Street and Amos Avenue (20 blocks) have been permitted with the City Commission asking that ornamental lamps be installed on these thoroughfares.



**SUMMIT, ILL.**—The Board of Trustees has awarded the contract for the construction and equipment of substation, complete, and installation of series tungsten street-lighting system for Summit and Argo, Ill., to the W. A. Jackson Co., Old Colony Building, Chicago, Ill.

**TOLONO, ILL.**—The Central Illinois Pub. Ser. Co., of Mattoon, has petitioned the Village Board for a 50-year franchise to furnish electricity in Tolono. It is proposed to change the street-lighting system.

**WASHINGTON, ILL.**—The Washington Home Tel. Co. contemplates the installation of a new switchboard. C. H. Cheadle, of Joliet, is secretary and treasurer.

**WATSEKA, ILL.**—The Central Utilities Co. has commenced work on the erection of a transmission line from Sheldon to Gilman.

**CAMANCHE, IA.**—The City Council has granted the Iowa & Illinois Ry. Co. a 25-year franchise to operate an electric-lighting system in Camanche. The company has also been given a ten-year contract for lighting the streets of the city.

**CEDAR FALLS, IA.**—A special election will be held Feb. 24 to submit the proposition to issue bonds to the amount of \$50,000 for the installation of a municipal electric-light plant to a vote.

**CEDAR RAPIDS, IA.**—The Cedar Rapids & Marion Tel. Co. will rebuild its West Side lines. The work will include the installation of new cables and building a half mile of conduits; the cost is estimated at about \$33,000.

**DAVENPORT, IA.**—An agreement has been entered into between the Iowa & Illinois Ry. Co. and the Davenport-Muscatine Interurban Ry. Co. whereby the former will be re-organized and operated as a part of the new interurban service between Clinton and Davenport and Davenport and Muscatine. Power will be furnished by the Tri-City Ry. & Lt. Co., which will install additional equipment. The company contemplates furnishing electricity for lamps and motors to towns along the route of the Iowa & Illinois Ry. Co. P. P. Crafts is general manager of both companies.

**EARLY, IA.**—Arrangements are being made for a survey of the town for the purpose of making an estimate of the cost of installing an electric-light plant.

**IOWA FALLS, IA.**—The property of the Iowa Falls Ht., Lt. & Pwr. Co., of Iowa Falls, will be sold at sheriff's sale at Eldora March 1. The company is successor to the Petersen El. Lt. & Htg. Co.

**KEOKUK, IA.**—The directors of the Mississippi River Pwr. Co. are contemplating issuing about \$6,500,000 additional capital stock to carry out plans for the completion of its large hydroelectric project at Keokuk, on the Mississippi River. Of this amount \$4,500,000 will be required because of changes made in construction designs and to carry out plans for further installation of generating units. Allowances for excess in construction cost and interest charges during construction will add about \$2,000,000 more.

**OELWEIN, IA.**—The Oelwein Lt., Ht. & Pwr. Co. has entered into a contract with the Chicago Great Western R. R. Co. whereby the local company will secure electricity for its system from the electric plant at the shops of the Chicago Great Western R. R. Co. For the present the single-phase and three-phase system will be used, but as soon as wires are erected the Oelwein company will use energy generated at the railway plant exclusively. William Walker is superintendent of the Oelwein company.

**ROCKWELL, IA.**—A special election will be called to vote on the proposition to grant a 20-year franchise to C. C. Carhart, of Sheffield, to furnish electricity here. The service will be supplied from Mr. Carhart's plant in Sheffield.

**SUTHERLAND, IA.**—At an election to be held Feb. 17 the proposition to grant the Peterson Pwr. & Milling Co., of Peterson City, a franchise to erect an electric distributing system in Sutherland will be submitted to a vote.

**VALLEY JUNCTION, IA.**—The City Council has decided to call a special election on March 14 to vote on the proposition to issue \$65,000 in bonds, the proceeds to be used to purchase or construct an electric-light plant and water-works system.

**CIMARRON, KAN.**—Bonds to the amount of \$15,000 have been voted for municipal improvements. An electric-light plant is among the improvements contemplated.

**KANOPOLIS, KAN.**—A committee has been appointed by the Council to make investigations relative to the installation of an electric-light plant in Kanopolis. A. E. Sturgis is a member of the committee.

**MOLINE, KAN.**—I. C. Bushong, of Ottawa, Kan., has been awarded a contract to install an electric-light plant in Moline, to cost about \$15,000. The plant will be equipped with two dynamos, one rated at 60 kva and the other at 10 kva.

**WAMEGO, KAN.**—The J. H. Bennett Barrel & Heading Works, of Wamego, has purchased a 30-hp, 60-cycle, 220-volt, single-phase motor with transformer and controlling apparatus for use in connection with their plant here. Energy for operating the works will be supplied by the municipal electric plant. D. A. Course is superintendent of Light and Water Department.

**ASHLAND, KY.**—The Ohio Valley El. Ry. Co., of Ashland, Ky., is negotiating with the Town Trustees for a franchise to supply electricity in Russell and for a contract for lighting the town.

**EMINENCE, KY.**—The property of the Eminence El. Lt. Co. has been

purchased by the Kentucky Utilities Co., of Lexington. The new company will immediately make improvements to the plant and furnish a 24-hour service. The company also contemplates extending its service to Pleasureville and New Castle.

**LEXINGTON, KY.**—The Lexington Utilities Co. has applied for a franchise to extend its transmission lines from Lexington into different parts of Fayette County.

**RICHMOND, KY.**—The property of the Richmond El. & Pwr. Co. has been purchased by the Middle West Utilities Co., of Lexington, controlled by the Insull interests of Chicago, Ill.

**RUSSELL, KY.**—The American Ry. Co., which owns the Ohio Valley El. Ry. Co., of Ashland, Ky., has opened negotiations with the city of Russell to furnish electricity for lamps and motors here. Russell is to be the terminal of the company's traction lines in this region.

**RUSSELL, KY.**—The Tygart Valley Wtr. Pwr. & El. Co., of Carter County, has practically completed its plans for extensive water-power developments in the neighborhood of Russell. The company was recently incorporated by D. H. Hall, W. F. Carter, George Snider and W. W. Carter and controls valuable power sites at the falls in the Tygart Creek.

**LINCOLN, MAINE.**—An act has been introduced in the State Legislature to incorporate the Lincoln Lt. & Pwr. Co. with George H. Haines and Austin G. Haines as incorporators. The company is to be capitalized at \$10,000 and to have the power to furnish electricity for lamps, heaters and motors in Lincoln.

**SOUTH BERWICK, MAINE.**—A bill has been introduced in the Legislature to authorize the town of South Berwick to own and operate an electric-light and power plant.

**ANNAPOLIS, MD.**—The City Council has granted a franchise to the Annapolis Public Utilities Co., a subsidiary of the Washington, Baltimore & Annapolis El. Rys. Co. The franchise is for a period of 50 years and gives the company the right to furnish both electricity and gas for lighting and power purposes. The Utility company will purchase the plant of the old company, which will be used only as a distributing station. It will be remodeled and new machinery installed. Energy for operating the local system will be secured from the Potomac power plant, which supplies the railway company.

**CHICOPEE, MASS.**—The Board of Aldermen has granted the Warren Pwr. Co. a franchise, together with locations for several hundred poles petitioned for, to furnish electricity in Chicopee. John T. MacDonnell is treasurer. The office of the Warren company is at 62 Stebbins Street, Springfield.

**NEWBURYPORT, MASS.**—The City Council has asked the Newburyport Gas & El. Co. to submit estimates of the most of maintaining the extra lamps required for the proposed ornamental street-lighting system.

**BLOOMINGDALE, MICH.**—A franchise has been granted to M. C. Hawk for the installation of an electric-light and power plant here. Work will begin immediately on construction of the proposed plant.

**CHEBOYGAN, MICH.**—The Cheboygan El. Lt. & Pwr. Co. will erect about 15 miles of three-phase, 12,000-volt transmission line and rebuild about 6 miles (this year) of old line. Other work has been planned by the company, but it has not yet decided upon the time of beginning construction.

**CHELSEA, MICH.**—The question of changing the system of the municipal electric-light plant from direct to alternating current is reported to be under consideration.

**DETROIT, MICH.**—The Public Lighting Commission has asked the city controller for an appropriation of \$119,500 for the installation of a 5000-kw turbo-generator unit in the municipal electric-light plant. An appropriation is also asked for the installation of 393 lamps, to be erected in different parts of the city, involving an expenditure of about \$130,000.

**ELKTON, MICH.**—The city has purchased an engine and a 30-kw Westinghouse generator for the municipal plant.

**HASTINGS, MICH.**—The City Council has passed a resolution calling an election in April to vote on the proposition to issue \$90,000 in bonds for a municipal lighting plant. Lighting service is now supplied by the Thornapple Gas & El. Lt. Co., of which Lewis Heath is local manager.

**KALAMAZOO, MICH.**—The contract for furnishing electrical equipment for the municipal electric-light plant was awarded to the Fort Wayne Electric Works, of Fort Wayne, Ind., for \$62,500. The equipment includes generators, rectifiers, switchboards, lamps, cut-outs, condensers and boilers. Work will start at once on improvements to the plant.

**MANISTEE, MICH.**—The State Railroad Commission has given its approval of the consolidation of the Manistee Lt. & Pwr. Co. and the Manistee Ry. Co. and has authorized the issuance of \$100,000 in bonds, the proceeds to be used for improvements.

**MARSHALL, MICH.**—The City Council has authorized an expenditure of \$1250 for improvements to the municipal electric plant and the installation of new lamps.

**MONTAGUE, MICH.**—Wernette & Bradfield, Housman Block, Grand Rapids, Mich., it is reported, are preparing plans for construction of a power plant for the White Lake Lt. & Pwr. Co. in Montague. The cost of the proposed plant is estimated at \$100,000.

**ST. CLAIR FLATS (P. O., DETROIT), MICH.**—Plans are being prepared for the installation of an electric-light plant in the Star Island

House, recently sold to Walter Lemke. It is understood that bids will soon be called for the proposed plant.

**FERGUS FALLS, MINN.**—The Otter Tail Pwr. Co. is planning to extend its transmission lines to Herman, Donnelly and Morris.

**GROVE CITY, MINN.**—The installation of an electric-light plant in Grove City is under consideration.

**JACKSON, MINN.**—The Commercial Club has petitioned the Council to submit the proposition to issue \$15,000 in bonds, the proceeds to be used to build a new dam to furnish power for the municipal electric-light plant, to the voters at the spring election.

**MINNEAPOLIS, MINN.**—The public lighting committee has recommended to the City Council the installation of 100 new arc lamps, to be distributed in different parts of the city.

**WAVERLY, MINN.**—The Central Minnesota Lt. & Pwr. Co. has submitted a proposition to the city to establish an electric-light plant here.

**ST. CHARLES, MO.**—A special election will be called to submit to the voters the proposition to grant Charles S. Ruffner, representing the Mississippi River Pwr. Co., of Keokuk, Ia., a franchise to distribute electricity for lamps and motors in St. Charles.

**ST. LOUIS, MO.**—The Lt. & Devel. Co., of St. Louis, which owns and operates electric-light and power plants in several small towns in Missouri and surrounding states, has filed notice of increase in capital stock from \$1,000,000 to \$1,500,000. Hugo Wurdack, of St. Louis, is president.

**ARLINGTON, NEB.**—An effort is being made to organize a stock company to take over the plant of the Arlington El. Lt. Co., which is operated by A. G. Ludwig. A steam-heating plant is operated in connection with the electric plant.

**BASSETT, NEB.**—Preparations are being made for the construction of an electric-light plant in Bassett, to cost about \$16,000, bids for which have been asked. The Alamo Engine Co., of Omaha, Neb., has charge of the work. W. E. Buckendorf is city clerk.

**OREANA, NEV.**—Plans are being prepared for the erection of a power plant at Oreana to supply electricity for lamps and motors to the mines at the head of Rochester Canyon and Lincoln Hill. Joseph Nenzel is interested in the project. Oreana has not a post office.

**RENO, NEV.**—The Nevada Pwr. Co., promoted by Oakland capitalists and associated with the Mono Valley Pwr. & Lt. Co., has filed a trust deed amounting to \$3,000,000 to secure a bond issue of like amount. The company proposes to furnish power in Reno and other places in Nevada.

**BOONTON, N. J.**—The Eastern Pennsylvania Pwr. Co., of Easton, Pa., contemplates utilizing the water-power at Boonton to generate electricity to meet the demand for electrical service in this part of the State.

**HOPE, N. J.**—Having been unable to induce the Hackettstown El. Lt. Co. to extend its service to the village of Hope, local business men have taken steps to organize a company to establish an independent plant to furnish electricity to light the town. It is proposed to utilize the water-power of the old Moravian mill to operate the plant.

**JERSEY CITY, N. J.**—Arrangements have been made for the installation of ornamental street lamps on Newark Avenue. The lamps will be installed by the Public Service El. Co. It is expected to have the lamps erected by March 15.

**JERSEY CITY, N. J.**—Plans are being considered by Supervisor O'Mealia and the Board of Freeholders for furnishing electricity for maintaining the lamps in the courts parks, roads and institutions from the court house power plant. It is proposed to install additional equipment in the power plant to provide for the additional service.

**MONTCLAIR, N. J.**—Bids will be received by Harry Trippett, town clerk, Montclair, until Feb. 24 for miscellaneous work in connection with the new municipal building, for the use of the Police and Fire Departments and other municipal purposes, as follows: (1) For furnishing and installing necessary equipment of the new council chamber, including desks, seats, etc.; (2) for furnishing and installing all lighting fixtures necessary for the building. Plans and specifications are on file at office of O. F. Semsch, Crane Building, Bloomfield Avenue, Montclair, and 109 Broad Street, New York, N. Y., copies of which can be obtained upon deposit of \$5, \$3 of which will be refunded upon return of plans.

**NORTH ARLINGTON, N. J.**—The Borough Council has entered into a contract with the Public Service El. Co. for lighting the streets of the borough. The contract provides for 62 lamps of 80 cp at \$1,833 per year. North Arlington has not a post office.

**PORT MURRAY, N. J.**—The National Fireproofing Co. will install an electric-light plant at its works in Port Murray. A large addition will be made to the factory.

**ALBUQUERQUE, N. M.**—Improvements are contemplated in the electric plant of the Albuquerque Gas, El. Lt. & Pwr. Co. The work will include replacing three old boilers with two 300-hp water-tube boilers especially designed to burn wood pulp, remodeling the air-pressure conveyor, etc. A. F. Van Diense is manager.

**TUCUMCARI, N. M.**—The Tucumcari Lt. & Pwr. Co. contemplates enlarging its light and power plant here.

**BAY SHORE, N. Y.**—The Suffolk Gas & El. Co., of Bay Shore, has received authority from the Public Service Commission, Second District, to issue bonds to the par value of \$134,000, to be sold at not less than 87, the proceeds to be used for the extension of its transmission line from Bay Shore to Babylon, from Bay Shore to Sayville and from Sayville to Bayport, and for distribution lines and necessary apparatus and

supplies. The company operates in the towns of Islip, East Islip and Bay Shore.

**BROOKLYN, N. Y.**—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, borough of Manhattan, New York, until Feb. 24, as follows: (1) For installing electric equipment in new Public School 172, on Fourth Avenue, between Twenty-ninth and Thirtieth Streets, borough of Brooklyn. (2)—Item 1—For installing heating and ventilating apparatus, with distribution temperature regulation in new Public School 175 on Blake Avenue, between Bristol Street and Hopkinson Avenue, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, borough of Manhattan, and also at branch office, 131 Livingston Street, Brooklyn.

**CANASERAGA, N. Y.**—Surveys are being made for the installation of an electric-light system in this village. Energy to operate the proposed system will be transmitted from Bennett Mill Falls.

**HEMPSTEAD, N. Y.**—Members of the Business Men's Association of Hempstead and other residents are considering the question of establishing a municipal electric-light plant in connection with the present pumping station. Electrical service is now supplied by the Nassau & Suffolk Ltg. Co. and the Nassau Lt. & Pwr. Co., of Mineola.

**MILFORD, N. Y.**—Negotiations are under way between the Village Board and the Clinton Mills Pwr. Co., of Cooperstown, for lighting the village with electricity. It is proposed to use incandescent lamps for street-lighting.

**POTSDAM, N. Y.**—The Public Service Commission, Second District, has authorized the Northern Pwr. Co., of Potsdam, to increase its capital stock from \$100,000 to \$500,000, the proceeds of \$143,000 to be used for payment of outstanding indebtedness; for general expenses in connection with the development of the property, \$15,000, and for new construction, \$158,000.

**STAMFORD, N. Y.**—The West Branch Lt. & Pwr. Co. is preparing to extend its transmission line from Wolcott down the north side of the river to the farm of Clarence Gould to supply electricity for lamps to farmers in that vicinity.

**CHARLOTTE, N. C.**—The Southern Pwr. Co. has closed a contract with the Georgia Ry. & Pwr. Co. whereby it will take over 14,000 hp of energy generated at the Tallulah Falls power station, beginning Sept. 1. The Southern Pwr. Co. will erect a transmission line from Easley, S. C., the present terminus, about 15 miles southwest of Greenville, through Liberty, Central and other South Carolina towns to Tallulah Falls. W. S. Lee is vice-president and chief engineer of the Southern Pwr. Co.

**CHERRYVILLE, N. C.**—The city is considering the question of calling an election to vote on the proposition to issue \$45,000 in bonds for municipal improvements. It is proposed to purchase the lighting plant owned by Kendrick Brothers and light the streets of the city, construct water-works, improve streets and erect schools.

**CLAYTON, N. C.**—Proposals will be received by the Mayor and Board of Commissioners of the town of Clayton until Feb. 25 for construction of water-works, electric-light plant and sewerage system as follows: The water-works system will include fireproof building, power pumps, clear-water basin and about 4 miles of 6-in., 8-in. and 10-in. water pipe to be laid with hydrants and valves, the electric-light plant will consist of 5 miles of pole lines and a 100-kw transformer station, the sewer system calls for about 3 miles of pipe sewers, 8 in. to 15 in. in diameter, and appurtenances. Plans and specifications are on file at the office of the Mayor at Clayton and at the office of Gilbert C. White, engineer, Charlotte, N. C.

**HICKORY, N. C.**—The Southern Pwr. Co., of Charlotte, has purchased the property of the Thornton Lt. & Pwr. Co. W. S. Lee is general manager and chief engineer of the Southern Pwr. Co.

**FARGO, N. D.**—A bill has been introduced into the State Legislature by Senator Porterfield providing for the installation of a 150-kw generator and engine to furnish electricity for lighting the campus and grounds at the North Dakota Agricultural College and for conduits and posts for lighting the campus. The cost is estimated at \$10,500.

**AKRON, OHIO.**—Plans have been prepared for the installation of an ornamental street-lighting system in the business district. The new lamps will be installed by the lighting company; the city will pay 20 per cent of the cost of maintenance and the merchants 80 per cent.

**CLEVELAND, OHIO.**—Service Director Kinnear will employ a consulting engineer to supervise the construction of the extension of the municipal light plant when bonds are issued for the purpose. The bonds issue, an ordinance for which has been introduced.

**COLUMBUS, OHIO.**—The city has approved a bond issue of \$30,000, the proceeds to be used for the construction of new street lamps in outlying districts of Columbus.

**NELSONVILLE, OHIO.**—The Nelsonville El. Co. has received authority from the Public Service Commission for authority to issue \$90,000 in capital stock, the proceeds to be used to take over the water-works and electric plant of the A. Stewart El. Co. at Nelsonville.

**PIQUA, OHIO.**—Estimates of costs of installing ornamental street lamps on Main and Wayne Streets, between Sycamore and Greene Street, and the cross-streets, Water, High and Ash, are being prepared by the Miami Lt. & Pwr. Co.



**ALBANY, ORE.**—The City Council has engaged Louis C. Kelsey, of Portland, civil engineer, to prepare preliminary estimates of the cost of installing a municipal electric-light plant (steam-driven) to provide electricity for lighting the business section of the city with 600 standards carrying cluster lamps.

**HOOD RIVER, ORE.**—The Hydro-Electric Co. has been granted permission to erect electric transmission lines on certain highways of Wasco County. Work will soon begin on construction of the lines.

**PORTLAND, ORE.**—Plans are being prepared by the Pacific Tel. & Teleg. Co. for the erection of a substation in the Lents district, Portland, to cost about \$30,000.

**BOILING SPRINGS, PA.**—The Boiling Springs El. Lt. Co. is planning to install a new low-speed generator at its plant.

**GREEN LANE, PA.**—The Green Lane Lt., Ht. & Pwr. Co., recently organized, will secure electricity to operate its system from the municipal electric plant in Pennsburg. J. B. Holden is interested in the company.

**HARRISBURG, PA.**—The special light committee of the Council is considering the question of installing a new type of arc lamps in the business district.

**HAWLEY, PA.**—The State Department has approved the merger of the Wallen-Paupack Pwr. Co. and the Paupack Pwr. Co., of Scranton, under the name of the New York, Pennsylvania and New Jersey Pwr. Co. The company is capitalized at \$450,000 and was formed by Scranton men. The merged companies hold land and water rights along the Paupack River near Hawley and propose to supply electricity for lamps and motors to towns and cities in the three states.

**JOHNSTOWN, PA.**—Mayor Cautell has given his approval of the franchise of the Dale Lt., Ht. & Pwr. Co. passed by the Common Council on Jan. 21 giving the company permission to extend its system into all districts of the city.

**LOCK HAVEN, PA.**—The City Council has adopted the recommendation of the light and sanitary committee of the City Council for the installation of an ornamental street-lighting system from Canal Park to Monument Place. Two propositions have been submitted by the Lock Haven El. Lt. & Pwr. Co. for installing the proposed system, as follows: The company offers to furnish electricity to maintain 43 standards (more or less) each carrying five 60-watt Mazda lamps at \$20 per standard per year, the city to furnish all mechanical work and material; (2) the company will furnish electricity for the above standards for \$25 each per year and will furnish all electrical material and electrical labor for installing same, provided the city will enter into a ten-year contract. The cost of the electrical material is estimated at \$2,000; the cost of conduit to be built by the city is estimated at \$1,500. The funds with which to purchase the lamp standards will be raised by the Board of Trade.

**PHILADELPHIA, PA.**—The capacity of the Philadelphia Hydro-Electric Co. is to be increased to 3500 kw. The company will also erect a 1500-kw hydroelectric plant at Norristown.

**POTTSVILLE, PA.**—The Pottsville Union Trac. Co. is planning to extend its electric railway from Pottsville to Shenandoah over the summit of Broad Mountain. The stockholders have authorized a loan of \$1,000,000 to provide funds for same.

**SHENANDOAH, PA.**—The Schuylkill Gas & El. Co., a subsidiary of the Harwood El. Co., of Hazleton, has closed negotiations whereby it will take over the Shenandoah light, heat and power plant and the property of the Mahanoy City Lt., Ht. & Pwr. Co. April 10. This gives the Harwood company complete control of lighting companies in this and the Hazleton regions.

**WAPWALOPEN, PA.**—The Heller Mining Co. has submitted a proposition to the town authorities offering to generate electricity for lighting the town provided the town will purchase and distribute same.

**SPARTANBURG, S. C.**—The Manufacturers' Pwr. Co. has been granted permission to supply electricity for lamps and motors in Spartanburg. All wires in this city will be placed underground. The company is interested in a hydroelectric development on Green River, near Saluda. N. C. W. S. Montgomery, of Spartanburg, is president of the company.

**ARTESIAN, S. D.**—The question of installing an electric-light system in Artesian is under consideration.

**GEDDES, S. D.**—The power company, which has leased the local electric-light plant, is contemplating establishing a central power plant from which to furnish electricity in Geddes, Platte, Armour, Scotland and other towns in this vicinity.

**HETLAND, S. D.**—The installation of an electric-lighting system in Hetland is under consideration.

**SELBY, S. D.**—Sealed bids will be received at the office of H. A. Taylor, county auditor, until March 4, for lighting fixtures for the court house and jail, the cost installed not to exceed \$750. Bids will also be received at the same time for equipment for electric-light plant for court house as follows: For one 10-hp gasoline engine, one 5-kw. non-flicker dynamo, 700 r.p.m.; one V-5 storage battery with charging panels, two for each cell, complete (rating of storage battery: 40 lamps three hours, 28 lamps five hours, 20 lamps eight hours, based on 16-cp tungsten lamps); one switchboard with battery charging connections. The plant is to have sufficient output to maintain 200 lamps of 16 cp.

**JOHNSON CITY, TENN.**—The City Council has instructed City Attorney George C. Sells to draft a bill to be presented to the State Legislature allowing the city to issue bonds to build and operate a lighting plant.

**AMARILLO, TEX.**—Henry L. Doherty & Co., of New York, N. Y., has purchased the property of the Amarillo St. Ry. Co. for \$200,000. The new owners will extend the lines and make other improvements to the system.

**CUERO, TEX.**—The Guadalupe Wtr. Pwr. Co. is seeking authority from the State Legislature to build five dams on the Guadalupe River for the purpose of providing water storage supply to operate hydroelectric plants which it proposes to install.

**DENTON, TEX.**—The City Council has granted J. T. Witt and associates a franchise to construct an interurban railway between Denton and the suburb of Cement City.

**FORT WORTH, TEX.**—Arrangements are being made by the Fort Worth Pwr. & Lt. Co. to enlarge its plant on Trinity River. Orders have been placed for a 10,000-hp turbine. The plant now has an output of 25,000 hp.

**MANOR, TEX.**—W. M. Allison is constructing an electric-light plant in Manor to furnish electricity for lighting the town. The equipment will consist of a 35-hp oil engine (Tifs & Co.), a 45-kw, 2300-volt, 133-cycle Westinghouse generator, with 2½-kw exciter and four 2½-kw transformers. Overhead line material will consist of 22,000 ft. of wire, red cedar poles and about 400 25-watt lamps.

**OGDEN, UTAH.**—Having provided an additional water supply by raising the dam in Ogden Canyon, the Utah Lt. & Ry. Co. is now preparing to install additional machinery at its hydroelectric plant on Twelfth Street which will double the output of the plant. O. H. Honnold is electrical engineer and C. A. Kohn superintendent of power stations, both of Salt Lake City.

**MARSHFIELD, VT.**—The Consol. Lig. Co., of Montpelier, in connection with the Charles Tenney Co., of Boston, Mass., has purchased the property of the Molly Falls Lt. & Pwr. Co., of Marshfield, which has a development at Molly Falls and furnishes electricity in Marshfield, Plainfield, Upper and Lower Cabot. The company has also purchased certain rights owned by Fred G. Lamberton, at Lamberton Mills, and by George May, around Peacham Pond, and others. An extensive hydroelectric development at Molly Falls is planned by the Consol. Lig. Co. The plans contemplate the construction of a new power house on the site of the present power station of the Molly Falls company and building a new penstock 7700 ft. long to the Lamberton mill, where the dam will be rebuilt and the storage capacity increased. Work may not be started on the project until next year. H. Larrabee, of Montpelier, is manager of the Consol. Lig. Co.

**ELIZABETH CITY, VA.**—Application will be made to the State Legislature asking for an amendment to the charter of the city of Elizabeth City providing for a bond issue not to exceed \$250,000 for the purchase of an electric-light plant and water-works system.

**SEATTLE, WASH.**—The City Council has rejected the proposition to submit for approval at the March election a \$2,000,000 bond issue to provide funds to build a municipal telephone system.

**BENWOOD, W. VA.**—The Wheeling Electrical Co., of Wheeling, has applied to the City Council for a franchise to supply electricity for lamps and motors in Benwood. John B. Garden, of Wheeling, is general manager of the company.

**MOOREFIELD, W. VA.**—At a special election held Feb. 1 the proposition to issue bonds for the installation of a municipal electric-light plant was carried.

**BARABOO, WIS.**—Steps have been taken by the Baraboo Commercial Club toward the installation of a new street-lighting system. The Baraboo Gas & El. Co. will soon begin work on rebuilding the street-lighting system.

**NEW RICHMOND, WIS.**—As soon as the weather permits the New Richmond Pwr. Co. will begin work on the construction of a new hydroelectric power plant, to be located on the John McClure farm, on Apple River, about a mile below its Huntington plant. The initial installation will provide for 300 hp. A transmission line will be erected from the Huntington plant to furnish electricity for use in connection with the construction of the new dam, which will be about 500 ft. long.

**FRASER MILLS, B. C. CAN.**—The Canadian Western Lumber Co., of New Westminster, will install a large power plant at Fraser Mills to supply electricity for its works. The equipment will include a General Electric low-pressure turbine and alternating-current generator.

**NELSON, B. C. CAN.**—The British Columbia Tel. Co. contemplates the erection of a telephone line to Kaslo from the terminus of its present line along the western arm, to equip an exchange at Kaslo and to provide service for the intermediate districts, provided sufficient subscribers can be secured to warrant the undertaking.

**NEW WESTMINSTER, B. C. CAN.**—The city authorities of New Westminster have entered into a contract with the British Columbia El. Ry. Co. for furnishing electricity to operate the municipal electric-light system, covering a period of 11 years from Jan. 1, 1913. The company is to deliver the energy at its local substation at 2300 volts for 1.25 cents per kw-hr. The company is also to furnish switchboards, regulators, transformers, etc., and also bear the operating expenses of the substation. The city agrees to take a minimum of 2,500,000 kw-hr.

**SWAN RIVER, MAN., CAN.**—The citizens of Swan River are considering the question of developing the water-power of Swan River near the town of Swan River, where it is estimated that about 1000 hp could be developed, at a cost of about \$49,000. The citizens have submitted a



proposition to Hon. C. H. Campbell, a Cabinet minister, asking that the government guarantee bonds to the amount of \$49,000 to finance the project.

**MONCTON, N. B., CAN.**—The Intercolonial Ry. Co. is planning to install a telephone system for dispatching trains. The first section is to be installed between St. John and Moncton.

**SYDNEY, N. S., CAN.**—The Cape Breton El. Co., Ltd., will construct during the coming summer a substation for distributing energy for street-railway use at a point on its Glace Bay division known as Reserve Junction. This substation will be equipped with two 250-kw step-down transformers furnishing energy at 2200-volt, two-phase, 60-cycle to a 300-kw motor generator set. A 10-mile 22,000-volt, three-phase transmission line will be erected from the Sydney power station to the above substation. To supply this line an additional bank, consisting of two 250-kw, 2200-volt two-phase to 22,000-volt three-phase transformers will be installed. The last-named transformers will operate in parallel with a bank now supplying 22,000-volt current for the present transmission line to Sydney. Included in the above work will be the necessary switching equipment in both the Sydney power station and the Reserve substation. E. L. Milliken is manager.

**COBALT, ONT., CAN.**—The Northern Ontario Lt. & Pwr. Co., Ltd., has formally taken over the entire property of the British Canadian Pwr. Co., Ltd., of Cobalt.

**FORT FRANCES, ONT., CAN.**—The date for receiving tenders for the construction of the Fort Frances municipal telephone system has been extended from Feb. 1 to March 1. J. W. Walker is clerk.

**ORANGEVILLE, ONT., CAN.**—The Pine River Lt. & Pwr. Co. is erecting a hydroelectric power plant on Pine River to develop 900 hp. The company owns and operates electric plants in Orangeville and Shelburne and expects to extend its service to Dundalk when the new plant is completed. Energy will be furnished for power purposes when the dam is completed. The equipment will consist of two Lombard water-wheels operating under a head of 138 ft., Canadian Westinghouse generators, switchboards, transformers, etc. Substations will be erected in Orangeville, Shelburne and probably Dundalk. Thomas R. Huxtable is engineer in charge. F. H. Kilbourne, of Owen Sound, is treasurer.

**TORONTO, ONT., CAN.**—Plans are being considered to extend the transmission lines of the Ontario Hydro-Electric Power Commission to Strathroy, Glencoe, Mount Brydges, Longwood and Melbourne to supply electricity in those places.

**AMQUI, QUE., CAN.**—Plans are being prepared for the installation of a municipal electric-light plant in Amqui. The proposed plant will be operated by water-power and about 500 hp developed at a cost of about \$70,000. J. A. Brilliant, of Amqui, is engineer in charge.

**GRAND-MERE, QUE., CAN.**—Announcement is made that the H. E. Talbot Co., of Sault Ste. Marie, Ont., has been awarded the contract for the construction of a 1500-ft. dam and complete hydroelectric power plant at Grand-Mere. The contract involves an expenditure of \$1,500,000. Interests financing the project are closely allied with the Laurentide Paper Co.

## New Industrial Companies

**THE ACME ELECTRIC AUTO WORKS, of Los Angeles, Cal.,** has been incorporated with a capital stock of \$10,000 by F. W. Jackman, E. E. Mason and F. C. Morgan.

**THE ALPHA DISPLAY COMPANY, of New York, N. Y.,** has been incorporated with a capital stock of \$25,000 by William Koebel, William G. Moir and George W. Schurer, 255 West 108th Street, New York, N. Y. The company proposes to do an electrical advertising business.

**THE GEORGE C. CARNWRIGHT COMPANY, of Grand Rapids, Mich.,** has been incorporated with a capital stock of \$8,000 to manufacture gas and electric-light fixtures. The officers are: George C. Carnwright, president; E. V. Carnwright, vice-president, and O. T. Rumsey, secretary and treasurer.

**THE CHESAPEAKE ENGINEERING & EQUIPMENT CORPORATION, of Baltimore, Md.,** has been chartered with a capital stock of \$25,000. The company proposes to promote central electric companies and to act as engineer and deal in electrical machinery and supplies. N. B. Hodskin is president and treasurer; E. D. Ford, of Chicago, Ill., vice-president, and L. W. Lake, secretary.

**THE CHICAGO INTERLOCKING RAILWAY & JOINT TRUSS COMPANY, of Chicago, Ill.,** has been incorporated with a capital stock of \$150,000 to manufacture railway supplies. The incorporators are: W. C. McDowell, O. Trenlich and A. Umenhofer, of Chicago, Ill.

**THE EAGLE GAS & ELECTRIC FIXTURE COMPANY, INC., of New York, N. Y.,** has been incorporated with a capital stock of \$10,000 by Emanuel Chanin, William Chepakoff and Adolph Warshaw, 1538 Minford Place, New York, N. Y.

**THE ELECTRIC BILLBOARD COMPANY, of Charleston, W. Va.,** has been incorporated with a capital stock of \$10,000 to manufacture electrical machinery, etc. The incorporators are: F. W. Hughes, B. Silman, C. E. Carney and others.

**THE ELECTRIC SCREEN COMPANY, of San Jose, Cal.,** has been incorporated with a capital stock of \$20,000 by C. H. Waterman, S. H. Shelly, G. D. Pratt, H. R. Fry and A. W. Johnson.

**THE ELECTRO STEEL CO. of New York, N. Y.,** has been incorporated with a capital stock of \$10,000 to do a commercial business. The incorporators are: Roy M. Thomas, William B. Goodspeed and James McEwan.

**THE ELECTRO-STATE COMPANY, of Los Angeles, Cal.,** has been incorporated with a capital stock of \$100,000 by R. H. Stone, C. J. Vance and F. C. Toney.

**THE FALLING ROCK MANUFACTURING COMPANY, of New York, N. Y.,** has been incorporated with a capital stock of \$30,000 to manufacture gas and electric-lighting fixtures. The incorporators are: E. Falkenbach, A. B. Traber and A. Traber, of New York, N. Y.

**THE IRON ROLLING COMPANY, of Providence, R. I.,** has been incorporated with a capital stock of \$100,000 by Charles M. Nichols, of Taunton; Oliver O. Goodwin, of and Samuel C. Cook, of Providence, R. I. The company proposes to manufacture and deal in and install transmission machinery and other devices, including power machinery.

## New Incorporations

**DOVER, DEL.**—The Kotelai Falls Pwr. Co. has been incorporated with a capital stock of \$11,000,000 by Herbert E. Latner, W. J. Maloney and Norman T. Coffman, of Wilmington. The company proposes to generate and distribute electricity.

**LEWISTOWN, ILL.**—The Lewistown El. Co. has been incorporated with a capital stock of \$5,000 to generate and distribute electricity and to manufacture and deal in electrical appliances. The incorporators are: H. C. Hall, William L. Hall and C. V. Smith.

**PARIS, KY.**—The United States Utilities Co. has been incorporated with a capital stock of \$10,000,000 for the purpose of taking over the electric-light plants at Paris and Danville, Ky., and gas plant at Paris. The main office of the company is in St. Louis, Mo.

**ROCHESTER, MINN.**—The Zumbro Pwr. Co. has been incorporated with a capital stock of \$500,000 by Henry O. Christensen and John M. Norton, both of Rochester, and Louis P. Wolff, of St. Paul. The company proposes to develop the water-power of Zumbro Falls and furnish electricity in Rochester and other towns and cities in Minnesota.

**TULSA, OKLA.**—The Tulsa City Lt. & Pwr. Co. has been incorporated with a capital stock of \$3,000 by A. A. Small, A. B. Davis and G. B. Small.

**PHILADELPHIA, PA.**—The Springfield El. Co. has been granted a charter with a capital stock of \$5,000. W. T. Robinson, 22 South Third Street, Philadelphia, is interested in the company.

**WALTERBORO, S. C.**—The Walterboro Ice & Lt. Co. has been chartered with a capital stock of \$12,000 to establish an ice plant with 10 to 20 tons capacity; also to install an electric light and power plant within two years. The machinery has been purchased. G. C. Brown will be secretary and treasurer and John D. Glover manager.

**BREMOND, TEX.**—The Bremond El. Lt. Co. has been incorporated with a capital stock of \$10,000 by S. M. Peters, J. K. Cayce and C. W. Brown.

**FREDERICKSBURG, TEX.**—The Fredericksburg El. Co. has been granted a charter with a capital stock of \$10,000. The incorporators are: Max H. Beckman, J. L. Nuetwig and Ferdinand Beckman.

**MARCUS, WASH.**—The Marcus & Kettle Valley Tel. Co. has been incorporated with a capital stock of \$15,000.

**VANCOUVER, B. C., CAN.**—The Bridge River Pwr. Co., Ltd., has been incorporated with a capital stock of \$2,000,000 to do a general lighting and power business.

## Trade Publications

**ELECTRIC SIGNS.**—The Federal Sign System (Electric), Chicago, Ill., in its Bulletin No. 172 makes brief reference to its new prismatic electric signs.

**ELECTRICAL SPECIALTIES.**—The McGill Manufacturing Company, Valparaiso, Ind., has issued its 1913 catalog, in which its complete line of lamp guards, portable and fixed electrical specialties are illustrated and described. The "Lamp Guard" lamp guard is especially referred to.

**BALL-BEARING HANGERS.**—A small pamphlet, "Ball-Bearing Hangers," issued by the Hesse-Light Manufacturing Company, Chicago, Ill., giving a brief description and showing the advantages of the Power Savings and Ball-Bearing Hangers for the use of electricians are briefly referred to.

**MOTORS.**—The Federal Sign System (Electric), Chicago, Ill., is the source of Bulletin No. 172, which contains a list of the Works of the Federal Sign System (Electric), Chicago, Ill., and the various types of electrical machinery and specialties that they offer. The Bulletin also contains a list of the various types of electrical machinery and specialties that they offer. The Bulletin also contains a list of the various types of electrical machinery and specialties that they offer.

**ELEVATORS.**—The Gurney Elevator Company, 62 West Forty-fifth Street, New York, has issued Bulletin No. 4, which relates to its traction elevators, designed for high-speed elevator service. A comprehensive, illustrated description of this type of elevator is given. Bulletin No. 5 is the engineering supplement to Bulletin No. 4.

**CONVEYING MACHINERY.**—The C. W. Hunt Company, West New Brighton, N. Y., is distributing Catalog No. 12-9, referring to its noiseless bucket conveyor. Within its sixty-four pages are described a number of prominent and interesting installations in which this type of apparatus is used for handling coal, ashes and other material.

**BOILER-ROOM ACCESSORIES.**—G. L. Simonds & Company, 64 East Van Buren Street, Chicago, Ill., in a sixteen-page catalog, size 4 in. by 9 in., describe and illustrate their testing apparatus for boilers, which includes gas analysis instruments, differential draft gages, soot cleaners for water-tube boilers, boiler-tube cleaners, check and pump valves, smoke indicators and a tube extractor. A list of some water-tube and return-tubular installations made by this company includes a number in electric-light and street-railway stations.

## Business Notes

**THE WILLIS ELECTRIC METER COMPANY**, of Chicago, Ill., has opened a downtown office at 19 South La Salle Street. Mr. W. W. Schwab is manager.

**THE ELECTRICAL MACHINERY SALES COMPANY** of Chicago is now located in its new quarters, 1536 Monadnock Building. This company represents in Chicago the Peerless Electric Company of Warren, Ohio, manufacturer of dynamos and motors. It also handles controllers, rheostats and fans.

**MR. R. S. MUELLER**, 423 High Avenue, S.E., Cleveland, Ohio, has recently secured the rights for the Anchor Webbing Company, Woonsocket, R. I., manufacturer of linen tapes and sleeveings and will represent that company in the State of Ohio and in the eastern parts of Indiana and Michigan.

**THE DIAMOND RUBBER COMPANY** OF NEW YORK, a subsidiary company of the B. F. Goodrich Company, Akron, Ohio, has appointed Mr. W. E. Hardy, formerly manager of the Diamond mechanical

branch at New York City, sales manager of the mechanical rubber-goods department, succeeding Mr. I. R. Bailey.

**TERRY STEAM TURBINE COMPANY.**—Mr. Norman L. Snow has been appointed general sales manager of the Terry Steam Turbine Company, with headquarters at the home office in Hartford, Conn. The New York district office, at 90 West Street, New York City, will continue under the management of Mr. Frederick D. Herbert.

**W. N. MATTHEWS & BROTHER**, St. Louis, Mo., announce the re-association with their organization of Mr. John L. Fay, who has been connected with The Milwaukee Railway & Light Company for almost a year past. Mr. Fay, as sales manager of the Matthews company, will have his headquarters at St. Louis. He is an expert on overhead distribution and is thoroughly familiar with the devices and apparatus used in such work. Mr. Louis E. Sperry, who represented the firm in San Francisco, will now have the entire State of California as his territory, owing to the resignation of Mr. Benjamin C. Chase, whose headquarters were formerly at Los Angeles.

**THE CARSTARPHEN ELECTRIC COMPANY**, of Denver, Col., recently suffered a serious loss through the caving in of its building at Colfax Street and Broadway, caused by partial dismantling of the structure to prepare the civic center site. The Carstarphen company was to have moved to its new building at 1330 Broadway within the week. Suits will probably be instituted against the city and the wrecking company responsible for the heavy damage which was sustained by the manufacturing plant and miscellaneous stock. Fortunately the settling of floors and walls was noted soon enough to enable all occupants of the building to escape.

**THE TERRY STEAM TURBINE COMPANY** in recent extensions of its organization has appointed Messrs. Robinson, Cary & Sands, of St. Paul, Northwestwestern agents, covering the territory of Minnesota and North and South Dakota. In addition to the agencies already established at Toronto and Montreal, the territory included in Manitoba, Alberta and Saskatchewan, Canada, will be represented by the Refrigerating & Engineering Company, Ltd., of Somerset Block, Winnipeg. After the middle of the month the general sales office of the Terry company will be removed to the works at Hartford, Conn., and will be under the direction of Mr. Norman L. Snow. Mr. Frederick D. Herbert will continue in charge of the New York office.

# Weekly Record of Electrical Patents

## UNITED STATES PATENTS ISSUED FEB. 4, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,051,894. **SPECIAL-CALL TELEPHONE SYSTEM**; A. E. Keith, Hinsdale, Ill. App. filed May 2, 1911. Semi-automatic with rotary calling devices.
- 1,051,929. **MECHANISM FOR OPERATING DISTANT CIRCUIT-BREAKERS**; C. S. Van Nuis and J. W. Achar, Philadelphia, Pa. App. filed Feb. 18, 1907. Motor-driven mechanism for storage-battery system.
- 1,051,940. **SYSTEM OF ELECTRICAL DISTRIBUTION**; J. L. Woodbridge, Philadelphia, Pa. App. filed April 19, 1904. Regulation by a "floating" battery.
- 1,051,941. **MEANS FOR RECTIFYING ALTERNATING CURRENTS**; J. L. Woodbridge, Philadelphia, Pa. App. filed Nov. 29, 1909. Variable-pressure resistance device synchronized.
- 1,051,942. **OUTLET BOX**; A. I. Appleton, Chicago, Ill. App. filed Aug. 21, 1909. Connections between sectional units.
- 1,051,944. **WOOL-WASHING AND DEGREASING MACHINE**; J. Baudot, Tourcoing, France. App. filed Feb. 6, 1911. The liquid is electrolyzed outside of the washing tank.
- 1,051,946. **FIRE-ALARM BOX**; C. F. Burroughs, East Orange, N. J. App. filed April 12, 1912. Protected self-winding mechanism.
- 1,051,949. **ELECTRICAL SYSTEM OF DISTRIBUTION**; L. H. Flanders, Jenkintown, Pa. App. filed Feb. 23, 1911. Storage-battery generator regulation.
- 1,051,967. **ELECTRIC HEATER**; A. W. Person, Harvard, Neb. App. filed March 11, 1912. Heater elements are arranged in grooves.
- 1,051,999. **AUTOMATIC CONTROL VALVE FOR WATER HEATERS**; J. M. Appleton, Lodi, Cal. App. filed April 16, 1912. Electric switch operated by the flow of water.
- 1,051,984. **PROCESS FOR EXTRACTING IODINE, CHLORINE, POTASSIUM HYDROXIDE AND OTHER USEFUL PRODUCTS FROM THE ASH OF SEAWEEDS OR OTHER MARINE FORMS OF ALGAE**; F. K. Cameron, Washington, D. C. App. filed Dec. 26, 1911. Electrolysis; dedicated to the public.
- 1,051,989. **HARMONIC PARTY-LINE TELEPHONE RINGER**; C. J. Erickson, Chicago, Ill. App. filed Aug. 11, 1906. Striker support.
- 1,051,991. **AUTOMATIC CUTOFF FOR ELECTRIC WATER HEATERS**; C. C. R. C. and J. W. Fine, Nanticoke, Pa. App. filed March 5, 1912. Thermostatic device carried by the cover.
- 1,052,001. **SELF-ACTING RESISTANCE FOR ELECTRIC MOTORS**; W. Kallmann (deceased), Berlin, Germany. App. filed Nov. 16, 1906. Plurality of independent parallel-connected sections.
- 1,052,030. **ELECTRIC WELDING SYSTEM**; J. Beckmann, Alameda, Cal. App. filed June 8, 1911. Automatic shut-off.
- 1,052,044. **ELECTRICAL APPLIANCE**; T. Deaderick, Nashville, Tenn. App. filed Feb. 27, 1912. Locking a lamp bulb in its socket.
- 1,052,056. **OPERATION OF TRANSLATING DEVICES WITH MULTIPLE ELECTRODES**; P. C. Hewitt, New York, N. Y. App. filed May 23, 1903. Balancing the emfs in two paths.
- 1,052,057. **VAPOR ELECTRIC DEVICE**; P. C. Hewitt, New York, N. Y. App. filed July 24, 1905. Starting by tilting the container.

- 1,052,065. **METHOD OF REGENERATING ELECTRIC GLOW LAMPS**; E. A. Kruger, Schussen, Germany. App. filed Aug. 30, 1911. Inserting a new filament and heating.
- 1,052,089. **IGNITER**; L. V. Raulet, Detroit, Mich. App. filed June 3, 1912. Spark ignition of gas stoves.
- 1,052,097. **ELECTRICALLY HEATED COMB**; E. Schwartz, Chicago, Ill. App. filed Aug. 15, 1912. Proportioned to prevent over-heating.
- 1,052,119. **UNIVERSAL ELECTRIC INDUCTION HEATING AND COOKING ELEMENT**; J. L. Anderson, Ogden, Utah. App. filed Oct. 30, 1911. Transformer for a grid or sardiron.
- 1,052,162. **SANITARY TELEPHONE MOUTHPIECE**; J. McCausland, Providence, R. I. App. filed May 8, 1912. Detachable paper cone.
- 1,052,184. **ELECTRIC ALARM AND SIGNAL FOR AIR BRAKES**; I. B. Snapp, Clifton Forge, Va. App. filed Dec. 4, 1911. The condition of the brakes is indicated in the cab.
- 1,052,202. **REFILLABLE FUSE CARTRIDGE**; G. W. Appler, Lyons, N. Y. App. filed Oct. 5, 1912. Removable end caps.
- 1,052,219. **AUTOMATIC TELEGRAPHY**; P. B. Delany, South Orange, N. J. App. filed Dec. 29, 1908. Chemical recorder.
- 1,052,232. **GAS-LIGHTING VALVE**; C. W. Francis, Omaha, Neb. App. filed April 11, 1912. Spark ignition for motor-vehicle lights.
- 1,052,256. **ELECTROLYSIS OF METAL SALT SOLUTIONS**; N. V. Hybinette, Christiansand, Norway. App. filed Jan. 5, 1912. Fibrous filtering material supported by lead.
- 1,052,263. **ELECTRICALLY PROPELLED MOTOR CARS**; F. G. Liljenrath, Vesterås, Sweden. App. filed April 8, 1912. Special winding of electric motor in a gas-engine motor-generator system.
- 1,052,268. **CURRENT-COLLECTING MEANS FOR SIGNAL APPARATUS OR THE LIKE**; E. L. Nicholson, Lakewood, Ohio. App. filed June 10, 1909. Third-rail shoe support.
- 1,052,285. **SIGNAL FOR ELEVATORS**; M. C. Schwab, Chicago, Ill. App. filed Dec. 8, 1910. Touch signal in the controller handle.
- 1,052,330. **PRIMARY BATTERY**; C. S. Engle, Providence, R. I. App. filed Dec. 4, 1908. Carbon, zinc and alkaline electrolyte.
- 1,052,354. **ELECTRIC BELL**; A. Lungen, New York, N. Y. App. filed Dec. 4, 1909. Sheet-metal frame; inclosed type.
- 1,052,389. **ANNUNCIATOR AND SIGNAL SYSTEM**; W. Tribble, Alton, Ill. App. filed Dec. 23, 1909. For setting a series of call numbers.
- 1,052,409. **SWITCH-OPERATING MECHANISM**; H. W. Cheney, Milwaukee, Wis. App. filed April 3, 1909. Separable connection for a circuit-breaker.
- 1,052,425. **ARC LAMP**; W. R. Ridings, Manchester, England. App. filed Oct. 5, 1912. Magazine type with inclined carbons; feed device.
- 1,052,427. **OPERATING CONTACT FOR AUTOMATIC PIANO-PLAYERS**; E. B. Sherman, Chicago, Ill. App. filed Jan. 10, 1910. "Tri-point" for coin-controlled instrument.
- 1,052,443. **TELEPHONE-RECEIVER HOLDER**; A. Orzechowski, Stamford, Conn. App. filed Jan. 24, 1912. For holding the receiver when off the hook.

# Electrical World

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## Conspiracy of a Trust

This week we report the result of the trial of the defendants in the well-known "bathtub" case on the conspiracy charge under the criminal section of the Sherman act, resulting in fines which totaled \$51,007. This outcome of the case, although not final in the event that the defendants take an appeal, will undoubtedly be effective in restraining attempts at circumvention of the anti-trust laws under the protection of an interpretation of the patent statutes at best doubtful and now dangerous. To the legal mind the case was settled by the action of the Supreme Court, but popular respect for the decision is vastly increased by a subsequent verdict of guilt from a jury which tried the defendants on the criminal charges. The outcome of this case, coupled with the agreed decree entered at Detroit on Feb. 7 dissolving the so-called boot and shoe last trust, tends to establish the principle that patents, while permitting numerous restrictions on patented articles themselves, cannot be extended to confer upon unpatented articles privileges which would normally or otherwise be unlawful. And yet, because no two cases are ever exactly alike, there must always be certain elements of doubt in almost every new case arising, which probably invite litigation that would not be thought of under statutes which adequately covered the situation.

## Display and Real Service

The central-station company which is endeavoring to hold the regard and good will of its customers and its public can make no more serious tactical mistake than that of installing a business office or building equipped to a degree of impressiveness or luxury that arouses local suspicion concerning the profitable character of utility service. With praiseworthy zeal and progressiveness of spirit, a number of the larger companies have lately erected monumental and beautiful structures—genuine ornaments to the community—which should be the cause for the greatest civic pride. In the same spirit, utilities in smaller places have vied with each other in installing mahogany fittings, marble counters and other evidences of material prosperity that would do credit to a city bank. These fine touches are not, of course, really extravagant when regarded as a percentage charge on the other heavy investments of the utility business. But to the customer who thinks he is being overcharged for his few kilowatt-hours per month, or to the disgruntled patron with a "kick," the effect of such grandeur can be only to arouse further enmity and to put off indefinitely the winning of a friend of whom the company stands in bad need. To the man with a grievance marble columns and onyx counters can have no other meaning than inflated rates and unjust charges. The discontent thus bred is sure to be disseminated

in the community and to hurt the corporation. Public sentiment is an asset more vitally material and priceless than any marble front. Whereas a bank gains prestige and confidence from impressive quarters, the utility which is endeavoring to serve the public at a reasonable return can expect only distrust and suspicion to result if it makes needless display. Seldom does popularity prevail where architecture and interior decoration have received more attention than is accorded to those intangible structures of public opinion on which final success really rests. Certain modern managers in close touch with the spirit of the times have been ready to admit that the splendid shells which house their offices are after all liabilities instead of assets when it comes to holding or recovering public sentiment. The central station is expected, as a matter of self-respect, of course, to occupy dignified and attractive quarters, but care must be taken, lest more vital interests be encroached upon, that the standard it adopts be not too far above the local scale prevailing among similar places of business of the rank and file of its friends and customers on whom it depends.

## Co-operation of Associations

To characterize it as an epochal event is merely to do justice to the meeting in New York this week of the public policy committees of the National Electric Light Association and the American Electric Railway Association, when subjects of mutual interest and importance to the two great electrical industries were taken up and discussed with every manifestation of good fellowship. The results of such a conference can hardly fail to be significant and far-reaching, for while the two industries have had very little clash and conflict during their period of wonderful parallel growth, they have more and more in common as the years go by in their dealings with the questions which affect their relations with the employee, the public and the investor, and more particularly the public service commissions, without which no modern commonwealth regards itself as complete. Our report of the meeting shows that the public policy committees and their colleagues whom they took into council with them on Tuesday night represent some of the most progressive in the electrical industry. It seems rather remarkable, now that the two associations have got together on questions of public utility, that the common good, that they did not find in the common ground they have done in many other useful lines, while there has been nothing definite, such as the plan of operation adopted this week, the very fact that the two industries are often interlaced and interlocked in one company or system has given the two organizations a commonality which is in reality often interchangeable, so that before the idea was put into formal expression or action a joint policy may



be said to have developed. Such evidences as this of solidarity in the great electrical field are to be welcomed, and we can only express the hope that the co-operative committee, which undoubtedly will be an active one, will devote its attention energetically to the many problems which lie within the relations of public utilities to the investor, the employee and the general public. Just now the legislatures of many states are giving consideration to public-utility measures, and at this psychological moment the work of the National Civic Federation can be made doubly effective if backed up by the weight of the combined public policy committees, it being presumed, of course, that the various interests involved agree on the model utility bill. There is also a tendency on the part of some railway companies possessing surplus energy to enter the lighting field, notwithstanding that the consensus of opinion among railway engineers and economists is that the generation of energy is the province of the central-station company and the transportation of passengers and freight that of the railway company. Here again the joint committee might do excellent work in conserving investments and enabling the two parties at interest to share in the joint economies resulting from a proper appreciation of the field of both. We believe that public utilities are being carried on with higher ideals and loftier principles and purposes than ever before in their history, inviting to their management the great administrative and constructive spirits of the country; but the corporations as such are still misunderstood in many ways by the public, for lack of real information about them. We cannot imagine any better task for a committee bearing the name of "public policy" than to do its best to bring about an era of good feeling between a public which deserves the very best service it can get and the utilities trying to give the very best service that is possible.

### Patent-Law License Restrictions

The agreed decree which was filed by Judge Tuttle at Detroit in the shoe-last case may be regarded as an echo of the recent bathtub case decided by the Supreme Court. Here apparently was a going trust under a highly perfected scheme of license agreements which could only be defended under a construction of the patent laws which the bathtub decision had set aside. There remained apparently no alternative, in a case of this kind where the protection of the patent was not in question, but to dissolve, and this was done under an agreed decree, instead of permitting the case to take its course. This victory for the standard bearers of patent reform, such as it is, does not add much to the record. Of course the foes of reform will rush to the front with renewed declarations that there is nothing the matter—that the present laws are entirely adequate to cope with such abuses as they reluctantly concede to exist. The answer to that, however, is contained in the fact that such relief as now emerges from the decisions of the federal courts from time to time in the anti-trust cases is judge-made law, built up piecemeal from decision to decision, and no one can positively tell in advance what the outcome in any specific case will be. What we need is revision of the fundamental law, with its scope and intent clearly worded. Public opinion against the form of monopoly typi-

fied in this particular case is undoubtedly strong, but the difficulty in relying upon such precedents as have already been created is found in the endless combinations of circumstances which make each case at least a little different from any other, and thus cloud the outcome with doubt.

### Compromises in Transformer Design

A brief paper by Messrs. George A. Thornton and George Goldman in the current issue gives an instructive view of the methods that can be used with transformers of approximately standard design in the way of adapting them to operating at the two usual frequencies of 25 cycles and 60 cycles per second. The paper details the results of some very practical experiments on the efficiency and heating of large transformers operated at both frequencies, both self-cooled and water-cooled. Of course, the general effects of changed frequency in transformer design are well known, and the question involved is one of facts rather than theory as to whether with suitable re-connection of the coils a transformer can be operated with reasonable success at either frequency.

The experiments recorded show that within limits a given structure can be operated at both 25 cycles and 60 cycles with a much greater degree of success than one would at first think. The copper loss is greater at the low-frequency than at the high, while the iron loss is less. The permissible output, other things being equal, is, of course, greatly changed with the frequency and also with the method of cooling adopted, so that the same piece of apparatus might be a 500-kw unit when self-cooled at 25 cycles and a 1500-kw unit when water-cooled at 60 cycles. In fact, one of the striking things demonstrated by the experiments is the great advantage of water cooling as regards both actually getting high output and improving the efficiency curve. The data on the whole are more instructive from the standpoint of methods of cooling employed than with respect to the change in frequency. Whether it would pay manufacturers to go deliberately into the interchangeable-frequency line of work is another matter. Good results can be attained, as the authors plainly show, yet it remains a somewhat dubious question as to whether a little specialization will not yield enough return in the way of lessened heating and better efficiency to pay for itself as against a standard construction capable of doing fairly well at both frequencies. As a rule, experiments in operating inductive apparatus under widely varying conditions have not turned out particularly well. We recall the time when an attempt was made to work at 60 cycles transformers designed for about double that frequency, all in behalf of an economical standardization, and we also recall the rapidity with which such transformers burned out. The present, of course, is an entirely different situation, and there is no reason why transformers, even if deliberately designed to do their best work at either 25 or 60 cycles, cannot be re-connected so as to do well at the other frequency; but the difference in frequency strikes one offhand as being a little too large to cover by a compromise in general service. The subject, however, is one worth following up experimentally and we hope to hear more of it later.

### The Resistance of Carbon Contacts

Carbon is employed in two electrical devices of widely extended use. One is the carbon-filament incandescent lamp and the other the carbon-microphone telephone transmitter. The carbon filament led to the solution of the problem of incandescent lighting; but the tungsten filament is so rapidly displacing its earlier prototype that we may expect, in a few years' time, to find carbon-filament lamps only in historical museums. The resistance of a carbon filament or prism falls with temperature, as is well known, instead of rising, as in the case of metals.

In the carbon microphone we find the application of another remarkable property of carbon, namely, the variability of resistance in its surface contact under variations of contact pressure, as discovered by Hughes and Edison. The full sensitiveness of the carbon microphone is, designedly, never displayed in the telephone transmitter, partly because the highest degrees of sensitiveness are associated with both electrical and mechanical instability. A sensitively adjusted carbon microphone, however, can occasionally be made to reproduce in the telephone the footfalls of a common house-fly over a soundboard so loudly as to suggest the running of a dog, and the tick of a watch can be made to sound like the throbbing of a small engine. Specially prepared carbon and delicately adjusted contacts are, however, needed for the development of such powerful sound magnifications, as the original publications on the behavior of the carbon microphone attest. Edison produced what he called a "micro-tasimeter," consisting of a carbon microphone placed in a Wheatstone bridge and delicately pressed upon by a strip of sensitive fiber. A very minute change in the length of the strip would thus give rise to a marked deflection of the bridge galvanometer. By this device a small change in the temperature or moisture of the air could easily be discovered, and even alcohol in the breath might sometimes be detected most shrewdly at a little distance.

The change in contact resistance under change of contact pressure received ample investigation in connection with the telephone transmitter. More recently, however, certain changes of contact resistance with time have been investigated by Mr. A. L. Clark and published in the *Physical Review*, as mentioned in this week's *Digest*. It seems that when a small voltage is applied steadily to a carbon-carbon contact, under light but uniform contact pressure, the resistance of the contact tends to fall in a regular manner for a little while. This diminution in contact resistance may possibly be explained by a sort of coherer welding action at the contact, under the stimulus of the impressed voltage. The phenomenon appears to repeat itself more or less definitely in new samples of carbon under the same conditions. There is, however, a critical value of the impressed emf in each case, beyond which the reverse action occurs. That is, above the critical impressed emf the apparent resistance of the carbon-carbon light contact tends to rise for a little while with time of application. This effect may also be explained, perhaps, by an oxidation or squeezing out of occluded gas into the contact, as soon as the current density over the contact surface is able to liberate a certain amount of heat. At all events, the effect is opposite to the supposed coherer action at low voltages.

The reversal of the direction effect in contact resistance indicates the complexity of the actions which are liable to occur in a carbon contact when analyzed with care. We have to recognize a microphonic variation with pressure, a variation with time in one direction or the other, changes of contact resistance with temperature, and finally variation with current strength. Probably these different actions interfere or are seldom able to introduce themselves singly. A change in one particular is apt to induce a change in another. And this state of affairs, of course, does not smooth the path of the investigator who is trying to determine the behavior of the carbon-microphone transmitter in a telephone circuit under the action of sound waves.

### Isolated Plant Economy

A somewhat typical plant for a large and important office building is described at some length in this issue. The design of equipment is in large measure a matter of rather intricate details of distribution service, but the key to the situation as regards economy must be looked for in the generating plant itself as influenced by the condition of its use. The economy of such an isolated plant, considering the conditions of its use in comparison with central-station service, has always been a moot point among engineers. A good deal of discussion has been spent on the matter in years past without reaching any very definite conclusion, and it seems to us that, considering the radical changes that have been made in central-station service in recent years, the problem should be again discussed from the standpoint of the present. We know of no thoroughly up-to-date examination of the load curves of office buildings or of the actual conditions of economy found in the plants. Such data are perhaps at hand, but have not been brought out into the light as they should be. There are available to those interested in the subject merely *ex parte* discussions by central-station men and occasional figures of a somewhat vague character from those who are operating isolated plants. It is difficult to determine offhand where the costs of energy from a plant operated by a single non-condensing engine without a battery to help over the peak meet those of central-station supply from a modern turbo-generator plant.

We seek for light on the above subject, and when it appears there will be a still further question of fact to settle. What would be the result of substituting for the equipment now common in this country in an isolated plant one of the "locomobile" units, with high pressure and high superheat, such as are being widely used in Germany for similar purposes? These units are very consistently reported as consuming less than 10 lb. of steam per brake-hp-hour, which means that in fuel consumption they can equal the record of even rather large turbo-generators. What would happen if such units were introduced generally into isolated plant practice in this country? For some reason or other the "locomobile" type of generating unit, extremely well known on the Continent and in use even in South America, has not yet penetrated American practice. When it does so valuable new data will soon become available for isolated plants.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### San Francisco Conventions in 1915

Arrangements are now being made for holding the annual conventions of various engineering societies in San Francisco during the exposition period in 1915. Included among these are the conventions of the International Electrotechnical Commission, during the week of Sept. 6; International Electrical Congress, week of Sept. 13; General Engineering Congress, week of Sept. 20, and International Gas Congress, week of Sept. 27. It is probable that the American Electric Railway Association will hold its convention during the week of Oct. 4.

It has been found undesirable, if not practically impossible, to hold the convention of the National Electric Light Association later than June, on account of certain constitutional provisions. It has been decided, therefore, to hold the 1915 N. E. L. A. convention during the week of June 14 at San Francisco.

### Conference of Public Policy Committees

Upon the initiative of the public policy committee of the National Electric Light Association and the invitation of its chairman, Mr. Arthur Williams, the members of the public policy committee of the American Electric Railway Association met the other committee at dinner at the Union League Club on the evening of Feb. 18. The event must be recorded as historical in many ways and cannot but bear useful fruit in shaping the future of the two great industries for which these national bodies speak authoritatively.

The dinner was attended by President George H. Harries of the American Electric Railway Association and President F. M. Tait of the National Electric Light Association. The two committees were very fully represented by their members as follows: N. E. L. A.—Arthur Williams, chairman; E. W. Burdett, H. L. Doherty, C. L. Edgar, W. W. Freeman, T. E. Murray, S. Scovil and C. A. Stone. A. E. R. A.—T. N. McCarter, chairman; Patrick Calhoun, O. T. Crosby, James H. McGraw and W. H. Heulings. In addition to these there were present as representing great public utility systems or groups Messrs. Frank Hedley, J. H. Pardee, H. G. Bradlee, E. A. Maher, C. C. Peirce, John W. Lieb, Jr., and C. Loomis Allen. Judge E. P. Matthews was also present. The societies were also represented by their respective secretaries, T. C. Martin and H. C. Donecker, while the dinner and other arrangements of the conference were in the hands of Mr. Walter Neumuller.

While for several years with increasing intimacy and relationship the two national bodies have been working together on matters of common technical interest, this was the first attempt to bring under joint consideration what may be termed the larger questions which affect the service of the public, the condition of employees and the attitude toward the new regulating element which has come into such active play in recent years in the shape of public service commissions. From time to time during the past six or seven years there have been tentative efforts toward co-operative consideration of these highly important matters, but this dinner is the first occasion upon which anything really definite has been accomplished, and before its close it was unanimously voted to form a joint committee

of five, each association to select two from the sister body and these four members to elect the fifth. It was felt in this way that a harmonious, cohesive and useful joint committee could act and speak for both bodies whenever necessary, with unquestioned influence and at short notice.

The meeting was addressed during the evening by Presidents Harries and Tait and by Messrs. McCarter, Williams, Edgar, Doherty, Hedley, Scovil, Maher and Burdett with an evident realization of the significance of the occasion. The speakers all manifested a high sense of personal and corporate responsibility in regard to the three relationships which have been mentioned above, and from time to time there were bursts of eloquence that made a strong appeal and deep impression.

Toward the close of the evening attention concentrated upon the proposed public utility bill which is being framed by the National Civic Federation embodying a model form of public service commission and regulation bill to be commended to states which have not yet placed their utilities under such a governing body, and the feeling was generally voiced and unanimously approved that, while such efforts should necessarily have the cordial support of the two great associations, it was the duty of their public policy committees, and indeed of every member, to assist in the shaping of such measures that the greatest good should be secured alike for the public, the employee and the investor.

The dinner, which began at 8 o'clock, lasted until 1:30 a. m., and even then the interest in the general subjects of discussion was so great that it was with reluctance the party broke up. It is understood that the joint committee will take form immediately and will at once assume the vital duties intrusted to it.

### A. I. E. E. Affairs

The next annual convention of the American Institute of Electrical Engineers will be held in Cooperstown, N. Y., during the week beginning Monday, June 23, 1913. A unanimous decision on this point was reached by the board of directors of the Institute at a meeting in New York on Feb. 14. The board authorized a two-day Institute meeting in Pittsburgh, Pa., during the latter part of April, under the auspices of the committee on the use of electricity in mines, in co-operation with the Pittsburgh Section, A. I. E. E. The exact date of the meeting, which was left to the discretion of the meetings and papers committee, will be announced later.

In view of the unusual activity incidental to the holding of the midwinter convention in New York, Feb. 26, 27 and 28, 1913, and the lectures on radio-activity to be given under the auspices of the Institute's electrophysics committee, it was decided to omit the New York meeting, scheduled for Friday, April 11. The lectures on radio-activity had previously been announced for Tuesday evenings during the latter part of March and April, but upon recommendation of the meetings and papers and electrophysics committees the dates were changed to Wednesday evenings, March 19, 26, and April 2 and 9.

Upon the recommendation of the sections committee, the organization of a section was authorized at Spokane, Wash., in response to a petition signed by twenty-five members and associates residing in that territory.



Letters were read from the Verband Deutscher Elektrotechniker of Germany and the Koninklijk Instituut van Ingenieurs of Holland concurring in the plan proposed by the Institute last year for the exchange of visiting member privileges.

### Convention of Engineering Societies in Spokane, Wash.

During the present week there is being held at Spokane, Wash., a convention of members of engineering and scientific societies of Spokane and vicinity. This meeting, while held under the auspices of local sections of certain societies and by members and associates of others, must not necessarily be understood as having official recognition of the societies whose members are participating. The object of the convention is to promote action, co-operation, better practice and a higher code of ethics, and to encourage the individual to become identified with that organization which will be most helpful to him. The officers of the committee in charge are Messrs. J. C. Ralston, chairman; C. S. MacCalla, vice-chairman, and L. K. Armstrong, secretary. Feb. 20 was electrical day, and the meeting was held under the auspices of local members and associates of the A. I. E. E., assisted by members of other societies. The chairman of the session was Mr. J. B. Fiske. The subjects of papers read on electrical day and on electrical subjects on other days were: "Long Lake Power Development," by Mr. C. S. MacCalla, general manager of the Washington Water Power Company, Spokane; "Electricity in Mining," by Mr. J. B. Fiske, superintendent of the Washington Water Power Company; "Illumination and Wiring of Large Buildings," by Messrs. W. K. Stacey and H. P. Peirce, Spokane; "Theory of Electric Transmission," by Prof. H. V. Carpenter, Washington State College, Pullman, Wash.; "Notes on System of Western Canada Power Company," by Mr. F. D. Nimms, electrical engineer, Vancouver, B. C.; "Conservation of Fruit and Other Food Products of the Northwest by Cold Storage and Mechanical Refrigeration," by Mr. H. G. Miller, mechanical engineer, Spokane. Among other papers the paper on "The Engineer and Engineering Education as Relating to Civic Responsibility," by Mr. J. C. Ralston, consulting engineer, Spokane, was of great general interest. On Thursday evening an informal reception was given and on Friday evening a banquet.

### San Francisco Exposition Building

Brilliant lighting effects are promised as a feature of the Panama-Pacific International Exposition at San Francisco in 1915. There will be three main groups of buildings on a site covering 625 acres and running for about a mile west from Fort Mason along the water front of San Francisco Bay. Machinery Hall will be the largest single structure at the exposition, having a length of 967 ft. and a width of 367 ft. This building will have more than 1½ miles of ornamental cornices. The dominating architectural feature of the exposition will be the imposing tower of the Administration Building at the south end of the Court of Sun and Stars. This tower will be about 400 ft. high. It is said that on June 25, 1914, every building will be finished and that the exposition will cost \$50,000,000. A number of foreign nations and thirty-four states of the Union have already decided to participate. White will form no part of the color scheme. Everywhere will be tints melting into others and forming beautiful effects in connection with the architectural design. The projectors style the exposition the "Dream City of 1915." On the large Ferry Building at the foot of Market Street in San Francisco there is now a large electric sign with the words "California Invites the World—1915—Panama-Pacific Exposition."

### International Electrotechnical Commission

The special committees of the International Electrotechnical Commission met in Zurich, Switzerland, on Jan. 13 and continued their deliberations until Jan. 19. The meetings were held in the town hall and were presided over by Prof. Dr. W. Wyssling (symbols), Mr. M. Huber-Stockar (rating) and Dr. H. Zoelly (prime movers). The special committees were as follows:

Country	Symbols	Rating	Prime Movers
Austria	Prof. E. Grosse	Prof. Pichelmayer	Dr. K. Kobes
Belgium	Prof. Paul Janet	Prof. H. Grosse	Mr. A. B. B. B.
France	Ged. Dr. K. Stockar	Mr. H. Grosse	Mr. A. B. B. B.
Germany	Dr. R. T. Glazebrook	Dr. G. Kapp	Mr. G. Kapp
Great Britain	Prof. Dr. de Haas	Dr. G. Kapp	Mr. G. Kapp
Holland	Mr. G. J. Van der Weij	Dr. G. Kapp	Mr. G. Kapp
Italy	Prof. M. A. L.	Dr. G. Kapp	Mr. G. Kapp
Norway	Mr. L. de la Pena	Dr. G. Kapp	Mr. G. Kapp
Spain	Dr. W. Wyssling	Dr. G. Kapp	Mr. G. Kapp
Sweden	Mr. C. O. Mailoux	Dr. G. Kapp	Mr. G. Kapp
Switzerland	Dr. W. Wyssling	Dr. G. Kapp	Mr. G. Kapp
United States	Mr. C. O. Mailoux	Dr. G. Kapp	Mr. G. Kapp

\*Mr. C. O. Mailoux represented Mr. Stoll.

Of the six publications issued by the commission during 1912 the most important related to standard symbols and the rating of electrical machinery. The discussion on symbols took two days, and there was considerable comment as to the relative importance of distinguishing between vector and scalar quantities as against electric and magnetic, some delegates regretting that for the sake of a comparatively small number of magnetic quantities the entire alphabet of script characters was unavailable for vector quantities, which, in their opinion, would to an increasing extent be bound to be employed by electricians in the practical solution of their many problems.

In German practice it is important to distinguish between vector and scalar quantities, and the special committee made certain modifications in its list of symbols so that should the German view find favor ultimately and script letters not be recommended for magnetic quantities, no confusion would occur by two identical letters being proposed for the same quantity whether magnetic or electric.

Three days were taken up in the discussion of rating of electrical machinery, most of the time of the delegates being naturally occupied in dealing with the numerous amendments to Report No. 17 of the International Electrotechnical Commission, issued in June, 1912, as the result of the work accomplished at Paris in May last, when after much preliminary discussion certain definite proposals were put forward. In view of expanding foreign trade the subject of international rating is undoubtedly of prime importance to the electrical industry of all countries. The British views were ably set forth by Drs. Gisbert Kapp and R. T. Glazebrook, the latter interesting himself particularly in the copper question and in the method of employing temperature correction, which until recently has not received adequate consideration. Dr. Kapp was assisted by the official representative of the British Electrical and Allied Manufacturers' Association. Modifications and new proposals had been received from many national committees and their consideration rendered the present proposals more complete and far more likely of acceptance than the proposals of the Paris proposals. The proposed international standard for copper was only briefly discussed, as Dr. Glazebrook and Prof. Paul Janet had been connected in general with the other national laboratories on the subject and transmit their final decision to the central office for submission to the Berlin meeting of the International Electrotechnical Commission.

The special committee on prime movers has after detailed discussion and modification adopted the report prepared by the Italian committee as the result of two years' work on

hydroelectric installations. The question of steam engines in connection with electrical plants will next engage the attention of the committee. An important proposal was unanimously adopted, "that the industrial unit of mechanical power be the kilowatt."

Detailed reports of the work of the special committees will be issued by the central office of the International Electrotechnical Commission without delay, and it should be noted that the proposals of these committees are to be submitted for the consideration of the various national committees with a view to their ratification at the next plenary meeting of the commission, which will be held in Berlin Sept. 2 to 6, 1913. The Italian Society of Electricians has decided to adopt the recommendations of the International Electrotechnical Commission as and when promulgated and to recommend their employment in all international specifications for electrical machinery. The Italian society has also decided to suggest that when the necessity arises in international contracts for an arbitrator he shall be chosen by the president of the international commission.

It is stated that the wisdom of the Turin meeting in appointing small international committees to discuss actual details and to formulate definite proposals has amply justified itself. The work of the Zurich meetings will undoubtedly be of real practical value to the industry, for when finally adopted at Berlin the Zurich proposals will be the foundation of international specifications for use by the electrical industry of all nations. Mr. C. Le Maistre, 28 Victoria Street, Westminster, London, S. W., is the general secretary of the International Electrotechnical Commission.

### Electrical Development Conference

The list of the acceptances received thus far by Mr. James M. Wakeman, general manager of the Society for Electrical Development, Inc., in response to the invitation which the society has extended to many well-known men to address those present at the conference which it is to hold at the Engineering Societies Building, New York, on March 4 and 5, promises that many valuable suggestions for increasing the use of electrical energy and apparatus will be presented upon the occasion.

As has been stated previously in these columns, all persons interested in any way in the manufacture, sale or utilization of electrical energy or equipment will be welcomed by the society at the conference, the purpose of which is to get the ideas of the entire electrical industry upon concrete methods for effecting the purposes for which the society has been formed.

The preliminary program is as follows: "Opening Address," by Mr. Henry L. Doherty, president the Society for Electrical Development, Inc.; "Aims of the Society," by Mr. J. M. Wakeman, general manager the Society for Electrical Development, Inc.; "Where the National Electric Light Association Comes In," by Mr. Thomas Commerford Martin, executive secretary National Electric Light Association; "The News Value of Electricity," by Mr. Frank G. Gale, advertising manager General Electric Company; "Electricity and the Architect," by Mr. Frank E. Wallis, of Wallis & Goodwillie; "The Dissemination of News," by Dr. Talcott Williams, director of the School of Journalism, Columbia University; "Co-operation in the Electrical Industry," by Mr. J. Robert Crouse, National Quality Lamp Division; "An Electrical Advertising Campaign," by Mr. William D. McJunkin; "Selling a Commodity," by Mr. E. St. Elmo Lewis; "Merchandising Co-operation," by Mr. W. E. Robertson, vice-president Robertson-Catacart Company; "Efficiency in Local Advertising," by Mr. J. C. McQuiston, Westinghouse Electric & Manufacturing Company; "Electrical Development and the Electrical Contractors," by Mr. Ernest Freeman, president the National Electrical Contractors' Association.

Papers are also being prepared by other prominent men. A number of ideas and suggestions are being received, and a digest which Mr. T. C. Martin is making of these will be read and discussed. A banquet will be held at Delmonico's on the evening of March 5.

### A. I. E. E. Lectures on Radioactivity

As noted elsewhere in this issue, it has been found necessary to change the dates for the series of lectures on "Radioactivity" to be given by Prof. Edwin P. Adams, of the Palmer Laboratory of Princeton University, under the auspices of the electrophysics committee of the American Institute of Electrical Engineers. The lectures will be given at 8:15 p. m. on Wednesday evenings, March 19 and 26 and April 2 and 9, in the auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York.

Lecture I, to be given on March 19, will cover the discovery of the property of radioactivity; radium and its preparation; ionization of gases; nature of the radiations from radioactive substances—alpha, beta and gamma rays.

Lecture II, to be given on March 26, will deal with the disintegration theory of radioactivity; the distribution of radioactive substance; radium and the age of the earth.

Lecture III, on April 2, will cover dependence of the mass of an electron on its velocity; the electron theory of matter; electrons in optical theory; Zeeman effect; emission and absorption of light.

Lecture IV, on April 9, will cover metallic conduction; indication afforded by the study of radioactivity regarding the structure of the atom; optical phenomena in moving bodies; the principle of relativity.

The lectures will be open to the membership of the Institute. The members of the American Society of Mechanical Engineers, the American Society of Civil Engineers, the Electrochemical Society and the Illuminating Engineering Society have also been invited.

### Revision of National Electrical Code

The electrical committee of the National Fire Protection Association has just issued its bulletin of committee reports and suggested changes in the National Electric Code to be acted on at the biennial meeting of the committee on March 26 and 27. The sessions, which are open to all interested, will be held in the rooms of the New York Board of Fire Underwriters, 123 William Street, New York. As is now very generally known, the policy of the electrical committee of the National Fire Protection Association is to recommend only such changes as are made necessary by progress in the art or such as have been found by field experience to be necessary to safeguard against hazards. Not less than seventeen committee and sub-committee reports will be presented, and the suggested changes submitted for consideration by others than the committees cover over six closely printed pages. The reports deal with the New York code, Rule 1-d, Rule 2-b, block distribution, Rule 15, Rule 23-d, theater and moving-picture-establishment wiring, sign and outlet wiring, rubber-covered wires and cables, outlet boxes, switches and cut-outs, cabinets, sockets, fixtures, auto-starters and rheostats, and transformers, in addition to the usual reports from the laboratories. The report of the committee on Rule 15 makes the grounding of transformer secondary circuits obligatory. If the report of the committee on block systems is adopted, isolated plants will be unable hereafter to supply more than one building except by permission of the department having jurisdiction. Fuses will no longer be accepted as suitable protection from excessive currents for three-wire compound or shunt-wound direct-current generators. Double-pole, double-coil or four-pole circuit-breakers will be required hereafter.

## The Electric Vehicle at Boston

At a meeting of the Electric Motor Car Club of Boston, Mass., at the Hotel Plaza, Boston, on Feb. 18, steps were taken to inaugurate a new advertising campaign in the Boston press, and Mr. O. G. Draper, formerly of the Boston Herald staff, was elected permanent secretary of the organization. Mr. Draper will give his entire time to the development of the electric vehicle, and is located at 39 Boylston Street, Boston. Closer co-operation of the club with the New England Section of the Electric Vehicle Association of America will probably follow.

## New York Electrical Society

At a meeting of the New York Electrical Society, held on Feb. 17 at the Engineering Societies Building, New York, Mr. William J. Hammer gave a short address on the history of the incandescent lamp, referring particularly to the "William J. Hammer historical collection of incandescent electric lamps," recently presented by the General Electric Company to the Association of Edison Electric Illuminating Companies, which is now in the rooms of the American Institute of Electrical Engineers. The speaker, who was associated with Mr. Thomas A. Edison in the earliest days of the incandescent lamp, traced the developments of the various kinds of incandescent lamps from the very first attempts to the present time. He referred to the efficiency of the various kinds of material used for filaments, no incandescent lamp made to-day having an efficiency of more than 1 per cent. Considerably better results have been obtained experimentally with cold-light sources, which the speaker referred to as the light of the future.

Following this address a demonstration and an informal talk were given on the Pollak-Virag telegraph system by Mr. V. C. Lovenc, an associate of Dr. Antoine Pollak, the inventor. Transmitting and receiving apparatus were shown in operation and sample messages were distributed among the audience.

The first operation in transmitting a message is performed by means of an apparatus resembling a typewriter. Instead of printing the message in ordinary type, the keys punch holes in a tape passing through the machine as needed. For each letter there is a characteristic arrangement of holes. This tape is placed on a transmitter and the message is delivered to the receiving station automatically and printed in ordinary script, as shown in Fig. 2.

The transmitter consists of a motor-driven drum  $R$  (Fig. 1), on which is unrolled the tape containing the message. The drum is made of six disks,  $a, b, c, d, e, f$ , insulated from each other. The disks are connected to a storage battery in such a manner as to give each one a different voltage.

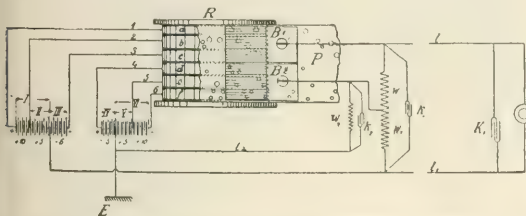


FIG. 1—DIAGRAM OF POLLAK-VIRAG TELEGRAPH SYSTEM

For each disk there is a contact brush, the brushes for disks  $a, b, c$  being connected at  $B_1$  and those of  $d, e, f$  at  $B_2$ . As the tape passes between the drum and the brushes contacts are made through the holes, the impulses being transmitted through the apparatus to the receiving station. In running the tape at full speed 400 contacts can be made per second.

In reaching the receiving apparatus the electrical impulses

act through magnetism upon the diaphragms of two telephone receivers,  $t_1$  and  $t_2$  (Fig. 3), which in turn act on a mirror, the latter reflecting the light from an electric lamp onto a strip of sensitized paper. The mirror is supported at a point  $u$ , the membrane  $S$  giving it a vertical motion and the membrane  $W$  a horizontal motion. The combination of the two motions, controlled by the punchings in the tape,

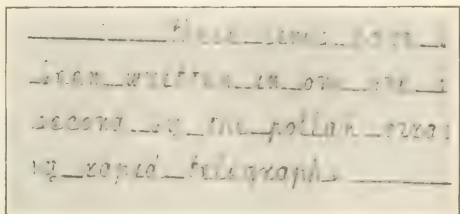


FIG. 2—MESSAGE RECEIVED DIRECTLY FROM APPARATUS

reflects the light in such a manner as to produce characters of the ordinary script type. The sensitized paper is automatically "developed and fixed" within the receiving apparatus and ready to be delivered. The light source referred to is an incandescent lamp  $l$  (Fig. 3) inclosed in a rotating cylinder  $k$ . In this cylinder there is a screw-shaped slot which, while rotating, moves the light across the sensitized paper strip, one line being written for each revolution of the cylinder.

As the horizontal and vertical components of the letters are of various lengths, the three disks,  $d$ ,  $e$ ,  $f$ , of the transmitter, acting on the horizontal membrane, and the disks  $a$ ,  $b$ ,  $c$ , acting on the vertical membrane, have different voltages. The disk  $f$  is connected to the battery so as to have a potential of  $+10$  volts and gives long horizontal lines, disk  $e$  corresponds to  $+5$  volts and gives short horizontal lines, and disk  $d$  corresponds to  $-5$  volts and gives lines in a reversed direction. In the same manner  $a$  has a potential of  $+10$  volts and produces a greater pressure on the membrane  $t_2$ ,  $b$  with  $+5$  volts produces a shorter line, and  $c$  a line in reversed directions.

Difficulties such as deformation of the writing due to vibrations of the membranes on account of heavy external disturbances have been overcome by an arrangement which automatically discontinues the operation until such vibrations are properly damped.

Other disturbances, such as induction from adjacent wires or earth currents, are avoided by arranging the diaphragms so as not to be sensitive.

It is claimed that the transmitting and receiving appa-

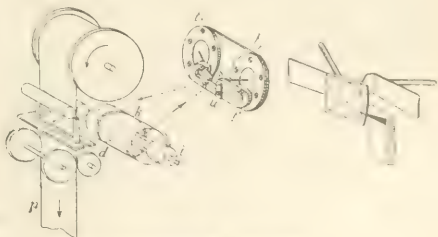


FIG. 3—RECEIVED AND PAID.

ratus can operate at a speed of 40,000 words per hour. This statement is indorsed by the Hungarian and French governments, which have submitted the system to tests on lines varying in length from 300 miles to about 700 miles.

After the technical part of the program a reception for President Henry L. Doherty was held in the rooms of the American Institute of Electrical Engineers.



## N. E. L. A. Booklet for Prospective Residence Customers

The publication committee of the Commercial Section of the National Electric Light Association, of which Mr. Douglass Burnett, of Baltimore, is chairman, met in New York on Feb. 15 to give attention to the final proofs of the new booklet to be issued on the subject of "Home Thoughts Electric" about March 1. The committee also considered the draft submitted for the booklet on "Store Service." These are two of a series of booklets prepared with the object of interesting prospective customers in electric service for residences. They are to be distributed by central-station companies and by electrical contractors in the course of "follow-up-by-mail" campaigns and at counters of sales-rooms and by salesmen. Publications of this kind are also distributed by some companies with packages of lamps and appliances which are sent to customers. Evidently, central-station companies find such publications of great use, because 175,000 of the booklets of the Commercial Section have been distributed within the past few months. The new booklet, "Home Thoughts Electric," is personally indorsed as to its purpose by Mr. Edison, and it is confidently predicted that owing to its attractive method of presenting the reasons for the use of central-station service in residences there will be a very large demand for the publication. The committee contemplates issuing 150,000 copies of the booklet at once.

## Dinner to Brooklyn Electrical Contractors

The annual dinner given by the Edison Electric Illuminating Company of Brooklyn to the electrical contractors of that borough was held at the Union League Club on Feb. 15. Some 250 contractors partook of the hospitality of the Edison company, which for some years has worked with the electrical contractors of the borough in a most loyal spirit of co-operation. Mr. T. I. Jones, general sales agent of the company, acted as toastmaster and addresses were made as follows: Mr. John P. Bonney, president of the Kilowatt Club, on "The Brooklyn Contractor"; Mr. Lewis H. Pounds, Commissioner of Public Works Borough of Brooklyn, on "The Borough of Brooklyn"; Mr. Charles L. Eidlitz, past-president National Electrical Contractors' Association, on "The Co-operative Movement"; Mr. Milo R. Maltbie, Public Service Commissioner of the First District, New York, on "The Public Service Commission"; Mr. Joseph C. Forsythe, chief inspector New York Board of Fire Underwriters, on "The Underwriters' Work"; Mr. Douglass Burnett, manager of the electric commercial department of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., on "The Central Station and the Contractor."

Mr. Bonney in his speech intimated that legislation will shortly be enacted calling for the licensing of electrical contractors in New York State. In describing the work of the Public Service Commission, Mr. Maltbie reiterated the policy of the State in making central-station service monopolistic where such service is adequate and reasonable and where the company meets the requirements of the Public Service Commission. According to Mr. Forsythe, there were 68,000 applications for inspection filed with the New York Board of Fire Underwriters last year, which resulted in the issuance of 55,000 permits and necessitated 161,000 inspections. These data were given in order that those present might have some comprehension of the work of the New York Board of Fire Underwriters. Of the 5000 or more fires attributed to defective electric wires, inspection revealed only forty-two due to that cause, and the total loss approximated \$40,000. Half of the forty-two fires caused by electricity were due to poor workmanship and one-quarter to defective material. Mr. Burnett wove his speech around the "slogan" "Service first," and showed

its application to the central station and the contractor. The only tinge of regret in the very happy speech of Mr. Eidlitz was that the electrical contractors of the city are not regulated by the Public Service Commission. Mr. Jones in the opening speech dwelt on the bonds of co-operative fellowship existing between the Brooklyn electrical contractors and the Edison company.

## High-Powered-Lamp Discussion at Boston

A symposium on high-powered lighting was held at Boston on Feb. 17 at a joint meeting of the New England Section of the Illuminating Engineering Society and the Boston branch of the American Institute of Electrical Engineers. The speakers were Mr. Percy H. Thomas, New York, on "Mercury-Vapor Lamps of the Quartz Type"; Mr. C. A. B. Halvorsen, Jr., Lynn, Mass., on "Ornamental Magnette Lamps," and Mr. W. H. Darrah, East Pittsburgh, Pa., on "Inclosed-Flame Lamps." In discussing the quartz type of mercury arc lamp Mr. Thomas pointed out that its efficiency is about twice that of an ordinary mercury-vapor lamp, but a disadvantage is its brilliancy as affecting the eye. It also casts shadows sharper than those cast by the mercury-vapor lamp with its longer tube. It is substantially a constant-current device and can best be adjusted by securing the proper voltage drop across its terminals as measured by a voltmeter. Current changes are effected by changing the natural cooling of the device. Quartz-tube mercury-vapor lamps designed for constant potential operation do not work well in series, as no opportunity exists for adjustment. At the next meeting Mr. Preston S. Millar, New York, will speak on "Various Types of Lighting."

## The Making of Investments

Mr. Charles G. Dawes, president of the Central Trust Company of Illinois and former Comptroller of the Currency, addressed the Electric Club of Chicago on Feb. 13 on "The Philosophy of Investment." The speaker discussed various forms of investments. He pointed out that investments in real estate may be regarded as made in a business which is competitive, except as to the monopoly of the ground used. A large office building, as a whole, is not to be regarded as a particularly profitable investment. The speaker warned against schemes where extraordinary profits were predicted and described operations on the Stock Exchange and the Board of Trade, telling about the formation of pools, the making of "wash" sales and the manipulation of prices. For the small investor seeking a better investment of his money than can be obtained in savings banks or high-class bonds, he suggested that he invest money with the man who has been successful and invest it in the business in which he has been successful. Electric-service and gas properties, properly operated, cannot lose money, said Mr. Dawes. These utilities take a little profit from a great many people; as the town grows their business grows, and they share what some people might call "unearned increment" in this way. They are, by nature, monopolies. Mr. Dawes referred briefly to the bonds of irrigation projects and told why he did not have a very high opinion of them. He answered several questions and among other things said that he thought state public utility commissions were all right if administered for the real interest of the public and not for political effect. The so-called "watering" of stock, he said, is not so bad as often represented. In nine cases out of ten it represents no hardship or unfairness or dishonesty; it may enable the man without capital to reap some reward from his initiative. The speaker also briefly described the principles on which holding companies operate.

## Accidents and Their Prevention

More than 750 employees of the Rochester (N. Y.) Railway & Light Company and invited guests attended the meeting of the company section of the N. E. L. A. in the banquet hall of the Powers Hotel on Feb. 11. The meeting was in charge of the general safety committee of the Rochester Railway & Light Company, and opened with an address on "Accidents and Their Prevention," by Mr. Victor T. Noonan. During the course of the evening motion pictures showing safety devices and guards on machines in operation at the Eastman Camera Works were shown, as well as lantern slides illustrating the work of the Rochester Railway & Light Company. The latter is said to be one of the first companies in the country to take up a systematic campaign against accidents, and it is understood that it is also the first electric light company to have pictures taken in its various plants and departments showing safe and unsafe ways of working. Lantern slides showed in addition careless habits, safety devices in the gas works and gas street department, and included almost everything from a lineman climbing a pole without his safety belt to a bookkeeper turning the ledger leaves the wrong way. Slides also were used to show safety devices of the New York Central Railroad, the National Association of Manufacturers and the United States Steel Corporation. Among the organizations represented at the meeting in addition to the Rochester Railway & Light Company were the Buffalo, Lockport & Rochester Railway, Buffalo; Rochester & Pittsburgh Railway, Rochester, Syracuse & Eastern Railway, New York State Railways, New York and Rochester telephone companies, Chamber of Commerce, Board of Education, police and fire departments and the Rochester Engineering Society.

## New England Power Company Expanding

Rapid growth of business on the new system of hydroelectric transmission service recently inaugurated by the New England Power Company of Shelburne Falls, Mass., has necessitated pushing ahead with plans for the construction of the so-called Hoosac development, by which 12,000 kva in generating machinery will be added to the resources of the organization. Press notices state that the company has applied to the county commissioners for authority to build a dam on the Deerfield River about three-quarters of a mile south of Monroe Bridge, in the town of Monroe, and that the hydraulic work will be pushed forward as soon as the conditions permit. According to the general plans of the company, which were outlined in the *Electrical World* of Dec. 28, 1912, page 1365, a concrete dam 235 ft. long will divert water from the river into a conduit and canal about 2.5 miles in length, from which it will be delivered to the wheels in the power house at Hoosac at a net head of about 200 ft. The waterwheels are to be directly connected to three 4000-kva generating units, each consisting of a 60-cycle and a 25-cycle generator mounted on a common shaft. These machines act as frequency changers between the New England company's system and that of the Boston & Maine Railroad, whose electrified train service through the Hoosac Tunnel is operated by 25-cycle, single-phase locomotives.

In a recent interview President George S. Smith stated that about 100 miles of transmission line are being built by the New England Power Company and allied interests to distribute power generated by the Connecticut and Deerfield River plants, and that these will be in complete operation during the coming spring. Contracts already closed will aggregate between \$400,000 and \$500,000 annually. The completion of the Hoosac station, known as the company's No. 5 plant, will add roughly 80 per cent to the capacity of the system, and although it had not been intended to equip this plant until 1914, the expansion of the business necessitated immediate steps toward the work.

Work on the large storage reservoir is progressing satisfactorily at Somerset, Vt., and of its total capacity of 2,700,000 cu. ft., there should be provided for the dry season of the coming summer about 700,000,000 cu. ft., the completion of the basin being expected in the fall of the present year. Rapid progress is being made on the tie transmission line which is being built between the Millbury plant of the Worcester Consolidated Street Railway and the Greendale lines of the Connecticut River Transmission Company, by which a complete loop is to be formed from the Deerfield River plants through the Worcester district and the Vernon plant of the Connecticut Company back to the Deerfield stations.

## Electrical Developments Near Pittsburgh, Pa.

The Kuhn interests of Pittsburgh, Pa., which control the West Penn Electric Company, are preparing to put in three dams on the Cheat River, Va., each of which will produce 50,000 hp, and, provided the necessary permission shall be obtained, the first will be in operation about Jan. 1, 1914. Certain dams will also be established on Sandy Creek, in West Virginia, which will provide additional power. The same interests also control the fall at Ohiopyle, Pa., where there is a drop of 110 ft., together with reservoir rights on the Youghiogheny River, so that ultimately about 250,000 hp will be available for commercial purposes around Pittsburgh. The West Penn Electric Company has at the present time a steam station at Connellsville, rated at 52,000 hp and operating with coal costing about \$1 a ton. The energy is transmitted as far as Butler, Pa., 120 miles away, and at the present time there are some 110 coal mines with connected loads ranging from 200 hp to 5000 hp being supplied from the company's system, not to mention the numerous municipalities centering around Connellsville. With the establishment of the hydroelectric plants referred to a tension of 110,000 volts will be adopted for transmitting the electricity.

## Report of Commonwealth Edison Company

Some interesting statistics are given in the annual report of the Commonwealth Edison Company of Chicago, just issued. The company's connected business (exclusive of electrical energy supplied to other public-service corporations) amounted to the equivalent of 8,293,523 standard 16-cp lamps on Dec. 31, 1912. The company has five generating stations and forty-one substations. The total number of customers is about 182,000, the average retail lighting rate is a little over 7 cents and the average number of lamps connected per customer is about twenty-eight. An analysis of the total operating revenue for 1912 of \$15,362,000 shows that the largest portion, \$7,261,000, or 47 per cent, came from the sales of electricity for lighting at retail; \$3,704,000, or 24 per cent, was for electricity supplied to railway companies; \$2,602,000, or 17 per cent, was for energy supplied for industrial purposes at retail, and \$1,788,000, or 12 per cent, was for wholesale energy for lamps and motors. The total earnings have doubled about every four and a half years. Of the \$1,444,000 paid in taxes and municipal compensation in 1911, a little less than \$700,000 was for personal and real-estate taxes, and nearly \$400,000 was for commercial corporation taxes, the latter being the federal corporation tax. For every dollar of earnings in 1911 over 8 cents was required for taxes. The constantly increasing demand for electric service has stimulated a large addition to the plant. Six new stations, which eventually will be doubled in output. A 35,000-hp Parsons turbine and generator unit is being installed and in addition the company has ordered from the General Electric Company a 27,000-hp Curtis turbine and generator. The annual meeting of the stockholders will be held on Feb. 24.



## Verdict of Criminal Conspiracy Returned Against Trust

The recent decision by the Supreme Court in the so-called bathtub case is still fresh in the minds of many who have followed the patent situation. In that decision it was held that the license agreements transcended what was necessary to protect the patented dredger for making enamel-ware and passed to the purpose and achieved the results of a monopoly. The case was then remanded to the lower court for the trial of the pending indictments under the criminal clauses of the Sherman act. Two indictments had been returned by the federal grand jury charging that by criminal conspiracy the defendants controlled 83 per cent of the output of enameled-ware and by means of patent license agreements restrained trade and dictated prices to the jobbers and retailers.

On Feb. 14 a jury sitting in the federal District Court at Detroit, Mich., returned a verdict of guilty on the conspiracy charge. The act is a misdemeanor, punishable by not more than one year's imprisonment or a fine not exceeding \$5,000, or both. Judge Sessions on Feb. 15 imposed fines on the fourteen individual and thirteen corporate defendants ranging from \$1 to \$10,000. The fines totaled \$51,007. The judge explained the differences in the fines on the ground of the financial circumstances of each defendant and the parts the various defendants played in the conspiracy. He furthermore overruled the Attorney-General's request that three of the individual defendants be imprisoned, on the ground that in the former trial they were dismissed, thus raising some doubt as to the propriety of an extreme punishment. The defense has made no statement as yet in reference to an appeal from the verdict.

## Good Will in Public Utilities

In an address before the New York Edison Commercial School on Feb. 13 Mr. T. C. Martin, secretary of the National Electric Light Association, speaking to the topic "Good Will in Public Utilities," intimated that the public service commissions have not yet discovered that with between thirty and forty in full operation they are rapidly drifting into chaos, confusion and contradiction, and that one thing above all others needed now is uniformity and standardization of verdict, ruling, regulation, requirement, phraseology and definition. The art being one, Mr. Martin maintained that its governing conditions must harmonize. The speaker pointed out that good will in utilities under the new conditions is taking on a novel aspect and suggested that one conception of good will may be said to be human effort imposed upon raw material. Expanding on this theme, Mr. Martin said there is not a public-utility system in this country that has not had built into it the labor, anxiety, energy, tears, self-sacrifice and lives of loyal and faithful workers, so that the physical-valuation idea by itself cannot hold. The intellectual value of a property was touched upon by the speaker, who maintained that in spite of all that has been said by the great authorities about the value of good will, the tendency has been to neglect entirely the intellectual value of a system or property, though without such value no property could be run.

In summing up his speech Mr. Martin formulated his ideas about good will in public utilities in the following series of propositions: (1) Good will is the intellectual value of a public utility as distinguished from and in addition to its physical value. (2) Intellectual value is cumulative, perpetual and eternal. Good will lives. The physical value is subject to constant depreciation, never renews itself, and ever demands new capital and new construction. (3) Intellectual value is based upon the human element and function. One man can renew a plant three, five or seven times in his career with growing knowledge,

experience and judgment. The value that goes into the plant is "he," not "it." (4) The personal responsibility now looms up because there can be no intellectual value or moral value without a human personality behind it. That narrows it down to each one, to foster good will where inherited, to create it where non-existent. (5) The earning power of a property does not lie in its physical elements. It lies in effective administration, efficient management, loyal devotion of every officer and employee to the ideal of satisfactory public service. Good will is "we" to the extent of our ability to do and give good service. (6) Intellectual value of a property carries with it the implication of a recognized value of the individual who contributes to its creation and of a value that may continue long after he has ceased to throw a switch, figure a balance sheet, bring in a new customer or open up a new line of consumption.

## Patent Office Employed to Harass Competitors

On Feb. 13 a jury verdict of guilty on three counts in the indictment charging conspiracy under the Sherman act was returned against President John H. Patterson and twenty-eight other officers of the National Cash Register Company at Cincinnati, Ohio. Besides charging that nearly all competitors had been driven out of business by illegal methods, and that a monopoly of the cash-register business had been created by these means, it was also charged that the company had applied for patents on the machines and improvements invented by competitors. The latter means was used to harass their business opponents, in addition to such tricks as selling bogus imitations of competitive machines, threatening lawsuits and organizing "fake" competitive companies.

The defendants were sentenced on Feb. 17 by Judge Hollister, who imposed both a fine and a jail sentence in each case except one, in which judgment was set aside. The fines were as high as \$5,000 and the maximum sentence was one year. The company's commercial practices were denounced by the judge, who said in part: "I have never heard of a legitimate concern having a competition department whose sole duties were not to sell goods but to prevent the sale of goods by competitors." Notice of appeal was given by the attorneys for the defendants.

This is the second case in which jail sentences have been imposed under the Sherman law. The first instance was that of the "turpentine trust," when three men were sentenced to serve three months. Their case is now on appeal in the Supreme Court.

## Senate Defeats Federal Tax on Water-Powers

The proposal of President Taft and Secretary of War Stimson that the federal government have control over water-power sites to the extent of imposing a "reasonable annual charge" was defeated in the Senate on Feb. 17. The issue was fought out on the Connecticut River dam bill, in which was included a provision for an annual federal tax. On the motion of Senator Bankhead, of Alabama, the provision was stricken from the bill. With that out the bill passed by a vote of seventy-four to twelve.

An amendment was made to the bill, at the suggestion of Senator Borah, making hydroelectric transmission companies having transmission lines passing from one state to another subject to the control of the Interstate Commerce Commission and to the interstate commerce laws. Another amendment, added, by Senator Jones, gives the Secretary of War the right to cancel the privileges on the Connecticut River granted by the measure to the Connecticut River Power Company if the company ever becomes part of an unlawful monopoly or corporation or ever enters into any contracts in restraint of trade.



Notwithstanding the passage of the bill by the Senate, the Secretary of War does not yield to the Senate in his belief in a federal tax on water-powers. He issued a statement, following the passage of the bill, voicing the opinion of the administration and the advocates of the tax, which is in part as follows: "A dam is to be built by the Connecticut River Company at the Enfield Rapids, on the Connecticut River. This dam will promote navigation and it will also create valuable water-power for that company. I insisted that the company, as one of the conditions under which it was to obtain the government's consent for the construction of the dam, should pay into the national treasury a share of its net profits above 8 per cent, this money to be applied by the government toward the improvement of the navigation of the Connecticut River. The company was quite ready to do this, and the arrangement was carefully drawn up and agreed upon. The majority of the United States Senate, comprising almost all of the Democratic members, are unwilling to permit this contribution to be made to the national treasury. They insist that this valuable privilege shall be granted to the Connecticut River Company without any such return, and they insist upon this in face of the fact that the company is ready to pay it. I do not believe that such a position is good law or good business or good politics, and I venture the prediction that in spite of this apparent rebuff the day when these valuable water-powers will be given away for nothing is over."

It is stated in Washington that the fight for the principle involved will be resumed at the extraordinary session of the Senate which was called by President Taft on Feb. 18 to convene on March 4. It is the intention of the advocates of a federal tax on water-power sites to renew the fight at every opportunity, and as bills granting the privilege of constructing dams are constantly being introduced in Congress, there will be no lack of opportunities for the advocates of the principle.

### Chicopee (Mass.) Power Issue Settled

By a unanimous vote the Board of Aldermen of Chicopee, Mass., has granted over the veto of Mayor Rivers a franchise to the Amherst Power Company which authorizes the erection of 400 poles in the municipality and the consequent distribution of electrical energy from the hydro-electric and steam auxiliary stations of the company to power consumers in the community. Representatives of the company have announced their willingness to enter into reasonable business arrangements with the competing Warren Power Company for the joint use of poles. In the event of a disagreement the joint use of poles may be ordered by the State.

### Patentee Held to Have No Right to Fix Resale Price

Those who have held that a patentee has the right to fix the resale price on his patented article or device, on the ground that the statute gives him the unlimited right to exclude all others from making or vending his device during the term of the patent grant, were undoubtedly dumfounded at the decision rendered this week by Judge Ray in the United States District Court at New York. The Waltham Watch Company, of Waltham, Mass., asked the court to enjoin Mr. Charles A. Keene, a New York jeweler, from selling at less than its fixed price one of the watch movements patented, manufactured and sold by it.

Mr. Keene contended that after purchasing the watches they became his exclusive property and that he could sell them for whatever he wished. He also alleged that the Waltham company, although it charged \$28.50 for the movement in this country, sold it to exporters for \$10. Every watch sold by the manufacturer, it is said, contained

a notice that the jobber or retailer thereby bound himself to regard the price agreement.

Judge Ray, in sustaining Mr. Keene's contention and dismissing the application for injunction, held that it was contrary to public policy to permit a patentee to prescribe the terms of resale. The court said further that the case had no parallel in *Henry versus Dick*, where the restrictions related to the use of the patented machine rather than its sale. In the latter case the patentee, said the court, was to receive his reward in part from the use of the machine.

### Burton Act to Be Extended

At a conference between Secretary of War Stimson and the House foreign affairs committee this week it was decided to postpone all legislation for the control of the power companies operating at Niagara Falls. The Cline bill, indorsed by the committee on foreign affairs, also received the indorsement of Secretary Stimson, but owing to the congested condition of business in the House the committee decided it would be unwise to press the bill at this session. Secretary Stimson advised that the Burton law, which will expire on March 4, be extended and this extension will probably be granted.

### Jovians and Society for Electrical Development, Inc.

Mr. James M. Wakeman, general manager of the Society for Electrical Development, Inc., spoke on "The Latest Expression of Jovianism" at the semi-monthly luncheon of the New York Jovian luncheon club on Feb. 19. Mr. Wakeman, who was the Apollo of the fifth Jovian congress and was prominent in the early history of the order, recalled the days when the membership numbered only about 500 and also told of the work done by Mr. J. Robert Crouse in fostering a spirit of co-operation among electrical men.

He said that the purpose of the Society for Electrical Development, Inc., to increase public demand for electrical energy and appliances, is one of co-operation, and that, as the purpose of the Jovian Order, representative of fraternalism in the electrical industry, is also one of co-operation, these bodies have a common purpose and can accomplish much of mutual advantage by acting together. He extended to the entire order an invitation to attend the conference which the society is to hold in New York on March 4 and 5, as noted elsewhere in this issue, and to send suggestions of methods for carrying on the society's work to Mr. T. C. Martin, who is making a digest of the many ideas along this line that have already been forwarded. He also invited the order to take part in the discussion at the conference and to attend the banquet which the society is to hold at Delmonico's on the evening of March 5.

Mr. Wakeman instanced as an example of the things which Jovians could do along the lines of practical co-operation that a lamp salesman might complain of the absence of an electric fan in a barber shop on a hot day, thus helping the fan salesman toward securing an order, or that a fan salesman might complain when he found inadequate lighting service in a hotel room and thus help to pave the way for the lamp salesman. Each by such methods will help to increase the use of electrical energy.

Mr. Charles L. Eidlitz, electrical engineer and contractor, of New York, of long connection with the Jovian Order, being called upon, said that too many Jovians are content merely to belong to the order, remain inactive and let someone else do the actual work. Mr. W. C. Andrews, of the membership committee, reported that he had received the names of 123 prospective members for the next rejuvenation, which is to take place in March, and that an excellent program had been arranged for the occasion.

## New Public Utilities Board for Massachusetts Proposed

A bill is being drafted in the Legislature providing for a new public utilities board to be known as the transportation commission, with supervision of railroads, electric railways, steamships, express companies, telephone and telegraph service. The bill is a redraft of the Washburn bill to give more power to the Railroad Commission, and resembles the public utilities measures advocated by Governor Foss for the past three years. The proposed board would have five members, the chairman's salary being \$10,500 and the other commissioners' \$10,000 each. If the present bill is enacted the Gas and Electric Light Commission will be retained as at present, with regulatory powers over central stations, gas companies and municipal plants.

## Public Service Commission News

### MASSACHUSETTS COMMISSION

The Gas and Electric Light Commission gave a hearing at Westfield upon the petition of the municipal light board for authority to reduce the price of gas from \$1.10 to \$1 per 1000 cu. ft. and of electricity for lighting purposes from 10 cents to 7 cents per kw-hr. The town also desires to lower the electric energy rates for motors, establishing a sliding scale of from 4 cents to 2 cents per kw-hr., depending upon the quantity used. Manager T. T. Logie of the lighting department testified that by establishing a lower energy rate for motors than already obtains larger consumers could be induced to sign contracts for service, and that the additional business would enable the plant to be more economically operated per unit of output. At present about 2800 hp is required to operate the factories in the town, which is the largest center of whip manufacturing in the world. The town electric plant furnishes about 500 hp in this service at present. Representatives of the Westfield Power Company, a concern supplying about seventeen tenants with a total of about 175 hp, objected to the reduction in energy rates for motors on the ground that the municipality had no right to offer service at prices below its actual cost of production. Chairman Barker called attention to the disadvantages of the law requiring depreciation to be figured at 5 per cent by municipal plants and said that a thorough investigation would have to be made before the board would decide the issue. Commissioner Schaff criticized the proposed sliding scale for motor service, suggesting that the municipal plant should offer both large and small manufacturers equally favorable rates. The proposed entry of the Amherst Power Company into the town was mentioned, and the commissioner voiced the opinion that a five-year contract between the company and the town should not be exceeded, in view of the possible future of water-power development in the Connecticut and Westfield Valleys. General Schaff also said that the municipal lighting department should be run at a profit and according to business principles generally. The case was taken under advisement.

### OHIO COMMISSION

The Public Service Commission has ordered the Cleveland, Painesville & Eastern Railroad to install side arms, supported by brackets, on its lines between Painesville and Willoughby Township, the side arms to be of sufficient length and so placed as to afford a clearance of not less than 6 ft. between any one and all of its high-tension lines and the nearest wire of the Western Union Telegraph Company. The company is also ordered to insert a suitable strain insulator in every case where a strain guy is used on the south side of any pole north of the lines of the Western Union Telegraph Company between the eastern limits of Painesville, Ohio, and the point of crossing at the east line of

Willoughby Township, and to insert a similar insulator in the guy close to the point where said guy is attached to the anchor bolt. It is required in every case where a strain guy is installed on the south side of any pole to install a strain guy upon the north side of the pole, or, if the installation of a strain guy on the north side of the pole is found to be impracticable, then a push guy shall be installed on the south side of the pole in such manner as to prevent the pole leaning south under the combined influence of the strain guy and the prevailing north winds. It was further ordered that the company be required to maintain a clearance distance of not less than 6 ft. between any and all of its high-tension transmission lines or wires and any and all of the wires of the Western Union Telegraph Company. The changes and improvements are required to be fully completed on or before March 1, 1913, and the company must cause an inspection to be made, by competent linemen, at regular intervals of not to exceed ten days, of all and every part of its high-tension line between its generating station in Painesville, Ohio, and its substation in Willoughby, Ohio; and this inspection shall be made to include and cover insulators, tie wires, pins, cross wires, ground wires and their support and the wire connecting the ground wire with the earth. The company is required to keep on file, subject to inspection by the Public Service Commission of Ohio, all reports of inspections made hereunder and all reports of trouble on this line.

## Current News and Notes

**REJUVENATION OF MINNESOTA JOVIANS.**—A rejuvenation of the Sons of Jove is announced to take place in Duluth, Minn., Feb. 22. The affair falling on a holiday, prospects for a large attendance are promising. Many prominent men in civic and sectional circles have been invited to attend.

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**HYDROELECTRIC POWER FOR NASHVILLE.**—The long transmission line from the Ocoee River hydroelectric development of the Tennessee Power Company to Nashville, Tenn., will be completed early in May, it is expected. This transmission is operated at 66,000 volts, and the wires are carried on steel towers. The energy will be supplied to the Nashville Railway & Light Company for distribution.

\* \* \*

**DENVER TELEPHONE COMPANY OUTLAWED.**—At a special election held on Feb. 14 an ordinance initiated by petition was passed declaring the Mountain States Telephone & Telegraph Company an outlaw on Denver streets and alleys. Rates were established for unlimited, measured service and residence telephones, and the telephone company is required to apply within a limited time for a franchise.

\* \* \*

**CENTRAL STATION COMPELLED TO USE ICE FOR MAKING STEAM.**—With the Arkansas River frozen solid and the city water supply shut off, the municipal electric light plant at Tulsa, Okla., was compelled to melt more than 1000 cakes of artificial ice for water to keep its boilers running last month. When the ice supply was exhausted the plant was compelled to shut down, leaving the city in total darkness and the street cars tied up.

\* \* \*

**MUNICIPAL PLANT WANTS A 13.5-CENT RATE.**—According to the St. Louis newspapers, the Board of Aldermen of Kirkwood, a suburb of that city, is considering the reported need for an increase in the municipal electric-service rates from 12.5 cents to 13.5 cents per kw-hr. This will put the price above that of the Suburban Electric Light & Power Company of St. Louis, which is delivering electrical energy there at a gross rate of 12.5 cents.

**PROPOSED MUNICIPALIZATION OF ALL NEW PUBLIC UTILITIES IN INDIANA.**—A bill has been introduced in the Indiana Legislature providing that no municipality shall grant a franchise to a gas, electric light or power company until the question of buying the public utility has been voted on by the people. The proposed bill will give a city authority to issue bonds for the purchase or lease of such a plant.

\* \* \*

**NOVEL USE FOR CLAY CONDUIT.**—That more than one kind of "juice" may be run through a conduit is illustrated by the novel use which a wealthy wool merchant of Philadelphia is said recently to have made of some 600 12-in. lengths of vitrified-clay conduit. These tile ducts are being built into the wall of a wine cellar to serve as receptacles for wine bottles. Each piece of conduit being about 4 in. in diameter and a foot in length, is just the right size to hold a quart bottle comfortably.

\* \* \*

**SAFETY TRAINING IN PUBLIC SCHOOLS.**—The committee on welfare and sanitation of the United States Steel Corporation has induced the Board of Education of Pittsburgh to place in the curriculum of all the minor schools a course of training for the purpose of enabling children of workmen to absorb, in the course of their regular classroom duties, principles of caution and self-protection. The committee also intimates that technical colleges will soon begin a course of systematic instruction of engineers in the matter of foresighted protection of the men to come under their direction.

\* \* \*

**BILL TO PROHIBIT EXPORTATION OF ENERGY FROM WASHINGTON.**—The Senate and House irrigation and arid-land committees of Washington State have before them a bill which provides that waters or streams in the State necessary for irrigation cannot be used for the generation of electricity to be sold in other states. The primary object of the measure is said to be to prevent the Northwestern Electric Company from proceeding with its extensive operations on the Klickitat River. The company is damming the stream, erecting power houses and spending several millions of dollars on a hydroelectric system, the greater part of the energy from which is to be disposed of in Portland, Ore. The water is all that is available for the irrigation of some 500,000 acres of arid land in Klickitat, Yakima and Benton Counties.

\* \* \*

**CIVIL SERVICE EXAMINATIONS FOR FIRST AND SECOND CLASS STEAM ENGINEERS.**—On March 5 the United States Civil Service Commission will hold an open competitive examination for first-class steam engineer. Practical knowledge of mechanical and electrical engineering and operation of heating and lighting plants and elevator machinery will be necessary. The salary is \$1,200 a year. Form 1312, to be had from the United States Civil Service Commission, Washington, D. C., outlines the requirements for those who desire to take the examination. An examination for assistant steam engineer takes place on March 6. This is for the position of engineer in the Quartermaster Corps of the army at San Juan, Porto Rico, at \$100 per month, the usual entrance salary being \$1,000 per annum. The subjects will be the same as in the examination for first-class engineer. Form 1800 gives detailed information regarding this examination and the places where it is to be held.

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**ELECTRO-STIMULATION OF WINTER EGG OUTPUT.**—Until recently Mr. Oscar L. Hallack, a poultry producer of Ossining, N. Y., viewed with alarm the decreasing egg output of his flock of hens as the hours of daylight shortened with the coming of winter. Learning, however, of the advantages of central-station service in other industries, Mr. Hallack conceived the idea of installing electric lamps

in his chicken house, and these he now switches on each day at the early hour when he goes about his matutinal milking. With the advent of this false dawn the henhouse is immediately astir, the cocks begin to crow, and the hens promptly set about their day's work of scratching. By again turning on the illumination at the approach of dusk, the electrical hengeineer is, in all, able to prolong barnyard activity and production to the span of a July day. Of course with the shortening winter days there comes a corresponding increase in the electric-light bills, but the increased industry and output of his feathered helpers leaves for the astute poultterer a handsome margin of profit.

**EMPLOYMENT EXCHANGE FOR TECHNICAL MEN.** Mr. H. C. Spaulding, an 1887 graduate of the Massachusetts Institute of Technology, who has been connected with various electrical and mechanical organizations, including the Thomson-Houston Electric Company, the Siemens & Halske Electric Company, the Blake & Knowles Pump Company, the Yale & Towne Manufacturing Company, etc., has been placed in charge of the new technical employment department recently established by the National Employment Exchange. The exchange, whose offices are located at 30 Church Street, New York, has now completed its third year, having been founded by a group of well-known business men who realized the need for a reliable and substantial clearing house between employees and employers. Although not yet on a self-sustaining basis, the cost of operation has steadily decreased. The growing number of requests for and applications from men of technical training has demonstrated the advisability of establishing the present new technical department devoted solely to this class of employees, and the recognition already accorded it by engineering and business concerns seems to indicate the wisdom of the step.

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**THE COMPLETE ELECTRIC VEHICLE.**—A Long Island woman recently addressed to the Electric Vehicle Association of America the following request for assistance in obtaining fulfillment of her ideals concerning electric-automobile construction: "Could you build an electric car, on the small van design, and equip same with living accommodations for three adults; have the electric motor power to be used on electric cooking appliances—say, for instance, making use of my own ideas, of papier-mâché washbasin and drain pipes, the same to be thrown away each day; collapsible rubber bathtub, fastened in a compartment under a trap door in floor of car; walls lined with quilted satin sectional flaps, hiding compartments and shelves for clothing; also cot beds to be folded back against the wall—space for tables and campstools; mirror panels, electric light and flat wicker hamper on roof of car—same surrounded with guard railings; extension porch folding under exit door; chauffeur's seat convertible into a cot on the Davenport bed plan? What would be total cost of such a car? Walls to be satin-floor stained cork mat or solid rubber floor like that used on the new ferry boats; long narrow windows swinging outward and shutter ventilators high above and in the roof; all fixtures aluminum rims—storage space for sliding table and aluminum cooking ware somewhere near the motor. Could same be built and sold on terms of a few hundred down and balance at stated intervals, or same as a house mortgage at 4% per year interest? The wife abhors the stationary house, and wants a home on wheels for self, husband and two children, and has no money and have had to resort to her own resources. How please help me out with this. I am a mother, a person and want substantial returns for what I am doing. I don't like gasoline. You are a good engineer and I am sure you have been suggested that if the car the house should have a radiator, it would make an excellent vehicle for an electric light sales manager."



**EFFICIENCY STUDIES WITH MOVING-PICTURE CAMERA.**—At its Providence (R. I.) factory the New England Butt Company makes use of a moving-picture camera to analyze individual efficiency and eliminate waste motions from its workmen's routine tasks. With this camera photographic records are taken of the men at their work. Close by each laborer is a large clock, the hands of which revolve at the rate of one revolution in six seconds. The subdivisions of time intervals on the face of this clock are so minute that it is possible by a microscopic examination of the films to tell to within 0.0005 minute the time required for each motion or part of a motion. As a result, unnecessary effort has been eliminated by putting the worker's tools or materials within more convenient reach, enabling him to make more rhythmical motions and arranging his motions in more economic sequence. From practical experience with the moving-picture analysis, the company has found the time required for the manufacture of its goods cut by two-thirds, and even more; in one example from thirty to seven seconds.

\* \* \*

**INVESTIGATION OF EXPLOSION-PROOF MOTORS.**—The Bureau of Mines has been conducting an extensive investigation of explosion-proof motors, having reference to a type of motor inclosed by a casing so constructed that an explosion of mine gas—or methane—and air within the casing will not ignite a mixture of the same gas surrounding the motor. The results of this investigation have been published in Bulletin No. 46, prepared by Mr. H. H. Clark. There are two classes of explosion-proof motors, the first being totally inclosed and built strong enough to withstand high internal pressures, and the second a class provided with relief openings or valves designed to relieve the pressure of an internal explosion and to cool any products of combustion discharged through the valves. A satisfactory motor of the first class is more expensive than an equally safe motor of the second class, and therefore attempts to build explosion-proof motors have been largely confined to the latter type. Of the five protective devices submitted, one was rejected without test, one failed completely in test, and each of the others failed under one or more of the test conditions. One of the three devices last mentioned discharged flames in almost every test, another discharged only when the motor was running, while the third discharged no flames in any condition. Some weak point was found in each type of protection. Explosion-proof protective devices should be so designed that flames cannot be driven through them by an explosion of gas within the casing, and also so that coal dust cannot enter them or, if allowed to enter, cannot be discharged while ignited. Such devices should be very rugged in mechanical design or should be completely protected from injury. They should also be so constructed and applied to the motor that they cannot be detached from it without rendering the motor inoperative. The bureau states that it is prepared to make tests of explosion-proof motors for the purpose of establishing a "permissible list" of such machines, the schedule of charges for which may be obtained by applying to the director of the Bureau of Mines, Washington, D. C.

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#### SOCIETY MEETINGS

**CONVENTION OF THE CANADIAN ELECTRICAL ASSOCIATION.**—At a meeting in Toronto of the executive committee of the Canadian Electrical Association it was decided to hold the next annual convention in the twin cities of Port Arthur and Fort William on June 23, 24 and 25.

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**ELECTRIC VEHICLE ASSOCIATION OF AMERICA.**—At the regular meeting of the Electric Vehicle Association of America to be held in New York on Feb. 25 Mr. James M. Skinner, of the Philadelphia Storage Battery Company, will give an illustrated talk on the Philadelphia thin-plate storage battery.

**COLUMBIA ELECTRICAL SOCIETY.**—At a meeting of the Electrical Engineering Society of Columbia University to be held on Feb. 27 at 8.15 p. m. in the Engineering Building, 117th Street and Broadway, Mr. S. H. Blake, of the General Electric Company, will give an illustrated talk on "Arc and Theater Lighting."

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**NEW YORK SECTION, I. E. S.**—A meeting of the New York Section of the Illuminating Engineering Society will be held in the Engineering Societies Building on March 13, in co-operation with the American Museum of Safety, the Society for the Conservation of Vision and the American Society of Mechanical Engineers.

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**LADIES' DAY AT COLORADO ELECTRIC CLUB.**—"Ladies' Day" was celebrated by the Colorado Electric Club on Feb. 13, with an attendance of 210 members and ladies. Hon. Helen Ring Robinson, Colorado State Senator from Denver, addressed the meeting on the subject of "American Democracy," and Mr. F. E. Watts, eleventh Jupiter of the Jovian Order, spoke of the growth and aims of his organization.

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**AMERICAN INSTITUTE OF CONSULTING ENGINEERS.**—At a dinner meeting of the American Institute of Consulting Engineers, to be held at the Engineers' Club, New York, on Tuesday evening, March 11, the general subject for discussion will be "Professional Relations." Outlines by Messrs. L. B. Stillwell and S. Whinery will form the basis of the discussion. Mr. Eugene W. Stern, 103 Park Avenue, New York, is secretary of the Institute.

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**PHILADELPHIA SECTION, N. E. L. A., ACTIVITIES.**—At a meeting of the commercial branch of the Philadelphia Electric Company Section, National Electric Light Association, Jan. 27, Mr. William Foster, of the company's overhead department, presented a paper on "Service Estimates and Construction." The main section meeting for the month was held on Jan. 20 at the Franklin Institute, when Mr. Clarence Renshaw, Pittsburgh, Pa., spoke on "Modern Electric Railway Operation." As usual, a dinner at the New Bingham Hotel preceded the session. On Jan. 14 Mr. Arnold F. Meyers, of the local meter department, read a paper on the billing of customers, reading of meters, etc., before the accounting department branch. Steps have been recently taken toward forming another section branch to include the technical and engineering departments of the company. Mr. Thomas Sproule, past section chairman, was chosen temporary chairman, and Mr. A. L. Atmore secretary.

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**NEW YORK COMPANIES' SECTION, N. E. L. A., MEETING.**—About 400 were present at the meeting of the New York Companies' Section on Feb. 17 to hear Mr. J. W. Lieb, Jr., of the New York Edison Company, discuss the question of "Rates." The meeting was opened by Dr. W. H. Tolman, who presented an illustrated lecture on "How to Prevent 50 Per Cent of Industrial Accidents." After Dr. Tolman's talk Mr. Joseph Becker, chairman of the section, presented Mr. Lieb. Several charts and graphics had been prepared and were used during the course of Mr. Lieb's lecture to point out the rather interesting analogies between electric-lighting plant costs and railroad costs when put into comparable terms. The fact was clearly brought out that the law does not prohibit and never has prohibited discriminatory rates. It is only when these discriminatory rates become unjust, unreasonable and disproportionate to the consumers that the law prohibits them. Mr. Lieb then explained in detail the system of rates now used by the New York Edison Company. Previous to the meeting a dinner was given to Mr. Lieb at Louis Martin's restaurant.

## Electrical Equipment of a Modern Building

**Isolated 500-kw generating plant for the Aeolian Hall,  
New York—Wiring for feeder and distribution system—  
Illumination of concert hall, exhibition rooms and offices**

ONE of the latest additions to the rapidly increasing number of high-class office buildings in New York is the Aeolian Hall, located on Forty-second and Forty-third Streets, between Fifth and Sixth Avenues and facing Bryant Park. This building has seventeen floors above the street level and extends two below the street. The first four floors and the basement are used by the Aeolian Company as sales and exhibition rooms, while the executive offices of the company occupy the fifth floor. The upper floors are public offices and lofts.

The greater part of the first and second floors is occupied by an auditorium or exhibition hall, with a seating capacity of 1380 and provided with a large and handsomely decorated stage. The entrance to this hall is from Forty-third Street. On the main floor at Forty-second Street is the Aeolian Company's reception room, which is connected with the floor above by a broad marble staircase and has three elevators running to the fifth floor for the exclusive service of the Aeolian Company and its patrons.

### POWER PLANT

Energy for lighting and motor service in the building is produced in a private generating plant installed in the sub-basement on the Forty-third Street side of the building. The boiler-room equipment consists of three Babcock & Wilcox boilers, each rated at 300 boiler-hp, which are separated by 5-ft. aisles. Coal is stored in a large vault beneath the sidewalk, whence it is carried on a small railroad

to the boiler room. The ashes are removed in cans and raised by an electrically operated lift to the sidewalk.

In the boiler room there are also a storage tank, filter and pumps for the oiling system of the engines and generators. This oiling system is the "Richardson central system" and was installed by the Peterson Engineering Company. The sump pit is below the boiler room and is provided with two pumps and auxiliary apparatus.

The generating equipment consists of three units—one 160-hp simple horizontal Corliss engine, directly connected to a 100-kw Crocker-Wheeler three-wire, 120-240-volt generator, and two 310-hp simple horizontal Corliss engines, directly connected to 200-kw Crocker-Wheeler three-wire generators. The engines were built by the C. & G. Cooper Company of Mount Vernon, Ohio, and are equipped with separate eccentrics for steam and exhaust valves and releasing valve gear. The speed of all units is 120 r.p.m. The engines operate non-condensing, the back pressure being very small. The steam pressure at the throttle is approximately 120 lb.

Each unit is equipped with an electric engine stop and speed-limit device. The latter device is mounted on an iron pedestal near the generator and connected to the engine shaft by a small belt. There are two push-button boards for stopping the engines. One is located in the office of the chief engineer and the other is mounted on a column in the center of the engine room conveniently in reach in case of danger. These safety devices are made

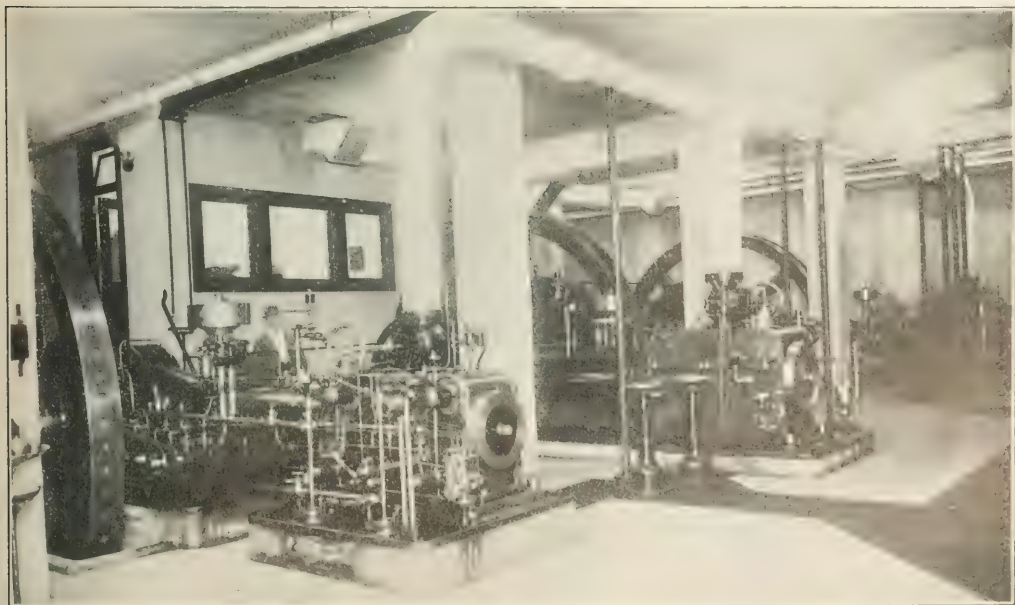


FIG 1—GENERATING ROOM OF AEOLIAN HALL POWER PLANT

and installed by the Locke Manufacturing Company, of Salem, Mass.

The cables from the generators to the switchboard are run in galvanized-iron conduits placed under the engine-room floor. The conduits terminate in brick-lined pits at the generator and switchboard. The cables have special rubber insulation and are lead-covered.

The switchboard consists of three generator panels, two motor panels and three lighting panels. The board proper is of 3-in. gray Tennessee marble. On the panels for the 200-kw generators are mounted a 1200-amp I-T-E circuit-breaker, a 1000-amp four-pole knife switch for motor service, a 1000-amp four-pole knife switch for lighting, a 1000-amp single-pole switch for the neutral, and two 1200-amp Weston ammeters, one in each outside conductor. The panel for the 100-kw generator has the same equipment of switches and meters but of one-half the rating of those of the other panels. Each panel is also equipped with ground

a 14-hp Diehl motor, supplies fresh filtered air to certain offices in the building and also for the engine room. A vacuum-cleaning plant, made by the Connersville Manufacturing Company, of Connersville, Ind., operated by a General Electric 15-hp interpole motor, is installed on the mezzanine floor. There are also two water filters and accessories made by the Roberts Manufacturing Company, of Philadelphia, Pa., and two Worthington steam-driven pumps for circulating the water. A high-pressure house pump and an interconnected high-pressure fire pump, made by the Worthington Pump Works, complete the equipment.

#### DISTRIBUTION SYSTEM

The system of distribution of energy for lighting and motor service consists of thirty-four feeders from the switchboard in the engine room terminating at the distribution panels on the floors above. There are three rising points for these feeders shown on the feeder sheet and

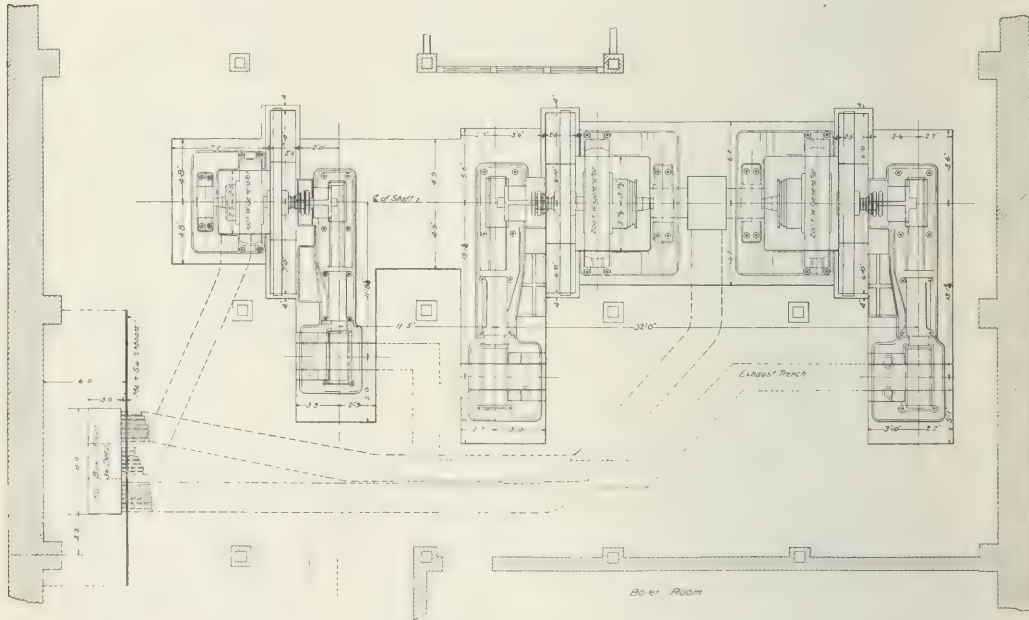


FIG. 2—PLAN OF GENERATING ROOM

detector, rheostat, pilot lamp and Weston watt-hour meters.

On the motor panels are mounted double-pole feeder switches, a Weston ammeter and a Columbia watt-hour meter. On the lighting panels are mounted three-pole feeder switches, two Weston ammeters, one in each leg, and a Columbia three-wire watt-hour meter.

Over the switchboard are mounted two iron pull boxes in which the feeder conduits terminate. From the pull boxes the feeder cables pass through bushed holes down to the lugs on the switchboard extension bars. The sides and top of the switchboard are inclosed with an iron grill. In front of the switchboard, supported from brackets, is a Frink reflector running the length of the board. The main switchboard and all the cut-out panels are manufactured by the Metropolitan Electric Manufacturing Company of Brooklyn.

The engine room is lighted by fourteen 100-watt tungsten fixtures, in addition to the switchboard reflector. For the ventilation of the boiler and engine room there are two fans operated by an 8-hp and a 2.5-hp Diehl motor respectively. A large Sturtevant ventilating fan, driven by

designed as *A*, *B* and *C*. The feeders marked *A* terminate in the panels on the Forty-second Street side of the building on the floors from the basement to the sixth floor. The feeders marked *C* terminate in the panels on the seventh, tenth, thirteenth and sixteenth floors. Each of the panels on these floors is provided with two sub-main switches which control sub-feeders to panels on the floors below and above. These panels control the branch circuits for the office lighting on the south end of the building. Feeders rising at point *C* also terminate in panels on the eighth, thirteenth and sixteenth floors with sub-feeders to panels on the two floors below and to two floors above. These panels control the branch circuits for stair, corridor and toilet lighting, and are located in the same boxes as the panels for the office lighting. The same general scheme is followed for the feeders rising at point *B*, for panels at the north side of building.

The distribution panels consist of 220-volt feeder buses and 110-volt branch buses, all of 98 per cent conductivity copper. In each branch circuit is a 10-amp fused "baby" knife switch. The fuses are of the inclosed type held in



spring clips. Each panel has a compartment for push-button switches which control the circuits for the corridor lighting. All copper is highly polished and mounted on a  $\frac{7}{8}$ -in. slate base, the latter being inclosed by slabs of  $\frac{3}{4}$ -in. marbleized slate. The panels are inclosed in sheet-steel cabinets, with an inner metal door and trimming and an outer door and trim of steel, the finish of the latter con-

fore lowering the fixture, a receptacle and insertion plug have been provided for each circuit and placed within easy reach beneath the trap-door. Six other lighting fixtures are recessed into the ceiling, three on each side of the center fixtures. For each one a cylindrical metal box 30 in. in diameter is set into the ceiling, the lower edge of which is about 6 in. above the surface of the ceiling, the opening



FIG. 3—FORTY-SECOND STREET ENTRANCE

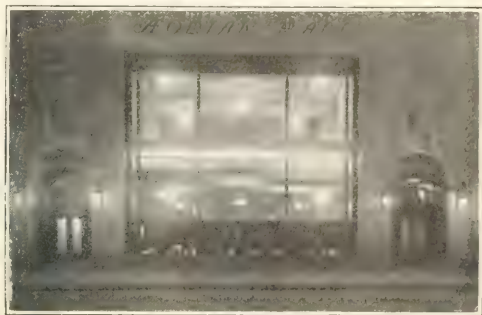


FIG. 5—ILLUMINATION AT ENTRANCE

forming in color and design to the interior finish of each floor. Each panel is provided with a testing lamp, a fuse box and a directory that indicates the circuits that the "baby" knife switches and push-button switches control. On the office floors there is an average of thirty-six circuits, each one supplying from three to six outlets. Two of the feeders terminate in panels on the roof, one at each end of the building. These panels contain twenty branch circuits each and are intended for special illumination on the roof to be installed at a future date.

#### ILLUMINATION

Of particular interest is the illumination of the auditorium. The general lighting of this hall is obtained from nine sources in the arched ceiling. Along the center of the ceiling there are three cone-shaped fixtures, each one

providing a passage for air to the ventilating ducts, which are also located above the ceiling.

In each of these boxes are installed thirteen 100-watt tungsten lamps spaced about 8 in. apart. The interior of the box is painted white. Below the lights there is a heavily etched "silver ripple" glass diffuser. By this arrangement is obtained a large surface of evenly distributed light of high intensity providing good general illumination in the auditorium. Above the balcony on each side of the auditorium are horizontal cove reflectors so placed and designed as to throw the light up to the ceiling, from which it is reflected to the balcony and main floor. These reflectors are the "Linolite" type, made by the H. W. Johns-Manville Company, and contain 25-watt tungsten lamps connected four in series. An unusual lighting effect has been secured in this auditorium by installing "Linolite"



FIG. 4—EXHIBITION ROOM ON SECOND FLOOR



FIG. 6—EXHIBITION ROOM ON SECOND FLOOR

containing forty 40-watt tungsten lamps, behind sectors of heavily etched "silver ripple" glass. These fixtures are supported by angle-iron frames and are raised and lowered by means of windlasses fastened to the angle-iron support. A trap-door in the floor above each fixture gives access to the windlass.

To provide for disconnecting of the fixture circuits be-

reflectors along the edge of the balcony below the railing in a small cove especially designed for this purpose. This cove is covered with an etched glass of deep pink color. The reflector is so designed as to throw the soft pink-colored light directly upward into the recessed a person leaning over the balcony. These reflectors also contain 25-watt tungsten lamps connected four in series.



## OUTLETS AND SYMBOLS

LOCATIONS	OUTLETS	CEILING CHANDE- LIER	REFLECTOR LIGHT	RECEPTACLE UNIT	DROP CORD	WALL BRACKET	ROCKERS BRT	INSERTION PLUG	FLOOR PLUG	STEREOTYPION PLUG	AUTO DOOR SW	P.B. SWITCH	EXIT LIGHT	JUNCTION BOX	POWER PLUG	CEILING EXTENSION	CALL BELL	TEL. WALL TYPE	TEL. DESK TYPE	RECEIVE BOX	FLOOR TELE	WATCHMAN FIRE	ALARM SATION
Roof	3																						
17th Floor	30/14	3	6	59																			
16th "	31/14	1	6	58																			
15th "	31/15	1	6	58																			
14th "	31/14	1	6	58																			
13th "	31/14	1	6	58																			
12th "	31/15	1	6	58																			
11th "	31/14	1	6	58																			
10th "	31/14	1	6	58																			
9th "	31/15	1	6	58																			
8th "	36/14	1	6	58																			
7th "	31/14	1	6	58																			
6th "	30/14	1	6	58																			
5th "	44/7	1	12	13																			
Basement	25/9	1	12	13																			
3rd Floor	27/38	2	15/14	13/1																			
2nd "	27/38	2	15/14	13/1																			
Ground Floor	13/4	62/4	2																				
Basement	27/37	32/2	22	2	10																		
Sub-Bas. Mezza	28/15	9																					
Sub-Basement	28/15	9																					
Total	552/348	56	151	3	1756	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

## MOTOR CIRCUITS

NUMBER	SERVICES FOR SUPPLYING CURRENT TO	HP SUPPLIED	ESTIMATED LENGTH IN FT. (ONE WAY)	SIZE OF WIRE (CONDUCTOR DIAMETER ALLOWED)
1	Exhaust Fan	4	250	No. 3
2	Air Supply Fan	11/2	35	No. 4
3	Exhaust Fan	11/2	40	No. 4
4	Vent. Motor	32	100	No. 4
5	"	1/2	40	No. 4
6	Organ Motor	7	120	No. 4
7	Vent. Motor	35	125	No. 4
8	"	1/2	125	No. 4
9	"	1/2	110	No. 4
10	"	1/2	110	No. 4
11	Organ Motor	2	80	No. 4
12	Vent. Motor	1	80	No. 4
13	Fan Motor	12 1/2	24	No. 4
14	"	1	110	No. 4
15	Housepump M.	10	30	No. 4
16	"	10	35	No. 4
17	Fire Pump Motor	10	34	No. 4
18	"	10	34	No. 4
19	Elevator Motor	40	25	No. 4
20	"	35	25	No. 4
21	"	35	25	No. 4
22	"	35	25	No. 4
23	"	35	25	No. 4
24	"	35	25	No. 4
25	"	35	25	No. 4

## LIGHTING MAINS

NUMBER	SUPPLIED BY	FLOOR	ESTIMATED LENGTH IN FT. (ONE WAY)	SIZE OF WIRE (CONDUCTOR DIAMETER ALLOWED)
A5	6	4	250	No. 4
A6	1	12	16	No. 6
A7	1	12	16	No. 6
A8	1	12	16	No. 6
A9	1	12	16	No. 6
A10	1	12	16	No. 6
A11	1	12	16	No. 6
A12	1	12	16	No. 6
A13	1	12	16	No. 6
A14	1	12	16	No. 6
A15	1	12	16	No. 6
A16	1	12	16	No. 6
A17	1	12	16	No. 6
A18	1	12	16	No. 6
A19	1	12	16	No. 6
A20	1	12	16	No. 6
A21	1	12	16	No. 6
A22	1	12	16	No. 6
A23	1	12	16	No. 6
A24	1	12	16	No. 6
A25	1	12	16	No. 6
A26	1	12	16	No. 6
A27	1	12	16	No. 6
A28	1	12	16	No. 6
A29	1	12	16	No. 6
A30	1	12	16	No. 6
A31	1	12	16	No. 6
A32	1	12	16	No. 6
A33	1	12	16	No. 6
A34	1	12	16	No. 6
A35	1	12	16	No. 6
A36	1	12	16	No. 6
A37	1	12	16	No. 6
A38	1	12	16	No. 6
A39	1	12	16	No. 6
A40	1	12	16	No. 6
A41	1	12	16	No. 6
A42	1	12	16	No. 6
A43	1	12	16	No. 6
A44	1	12	16	No. 6
A45	1	12	16	No. 6
A46	1	12	16	No. 6
A47	1	12	16	No. 6
A48	1	12	16	No. 6
A49	1	12	16	No. 6
A50	1	12	16	No. 6
A51	1	12	16	No. 6
A52	1	12	16	No. 6
A53	1	12	16	No. 6
A54	1	12	16	No. 6
A55	1	12	16	No. 6
A56	1	12	16	No. 6
A57	1	12	16	No. 6
A58	1	12	16	No. 6
A59	1	12	16	No. 6
A60	1	12	16	No. 6
A61	1	12	16	No. 6
A62	1	12	16	No. 6
A63	1	12	16	No. 6
A64	1	12	16	No. 6
A65	1	12	16	No. 6
A66	1	12	16	No. 6
A67	1	12	16	No. 6
A68	1	12	16	No. 6
A69	1	12	16	No. 6
A70	1	12	16	No. 6
A71	1	12	16	No. 6
A72	1	12	16	No. 6
A73	1	12	16	No. 6
A74	1	12	16	No. 6
A75	1	12	16	No. 6
A76	1	12	16	No. 6
A77	1	12	16	No. 6
A78	1	12	16	No. 6
A79	1	12	16	No. 6
A80	1	12	16	No. 6
A81	1	12	16	No. 6
A82	1	12	16	No. 6
A83	1	12	16	No. 6
A84	1	12	16	No. 6
A85	1	12	16	No. 6
A86	1	12	16	No. 6
A87	1	12	16	No. 6
A88	1	12	16	No. 6
A89	1	12	16	No. 6
A90	1	12	16	No. 6
A91	1	12	16	No. 6
A92	1	12	16	No. 6
A93	1	12	16	No. 6
A94	1	12	16	No. 6
A95	1	12	16	No. 6
A96	1	12	16	No. 6
A97	1	12	16	No. 6
A98	1	12	16	No. 6
A99	1	12	16	No. 6
A100	1	12	16	No. 6

## LIGHTING FEEDERS

NUMBER	TERMINATES AT		BRANCH CIRCS	ESTIMATED LENGTH IN FT. (ONE WAY)	LOSS IN VOLTS (CONDUCTOR DIAMETER ALLOWED)	SIZE OF WIRE			
	FLOOR	CUT-OUT				MIDDLE CONDUCTOR		OUTSIDE CONDUCTOR	
						No.	6	No.	6
1	S-B	A	14	35	80	2 1/2			1"
2	B	A	24	60	140	3 5/8		3	1 1/2"
3	B	A	40	120	155	2 1/2	000	000	2 1/2"
4	D	A	72	180	60	2 8/16	250 000	250 000	2 1/2"
5	F	A	36	90	100	2 1/2	000	000	2 1/2"
6	F	A	42	105	210	2 1/2	000	000	2 1/2"
7	G	A	50	125	260	3 5/8	000	000	2 1/2"
8	H	A	34	85	280	2 5/8	000	000	2 1/2"
9	I	A	48	120	305	3 1/2	060	000	2 1/2"
10	J	A	48	120	350	3 1/2	000	000	2 1/2"
11	K	A	38	95	350	2 5/8	000	000	2 1/2"
12	L	A	50	125	350	3 1/2	000	000	2 1/2"
13	M	A	12	30	395	2 1/2	000	000	2 1/2"
14	R	A	20	50	440	3 1/2	000	000	2 1/2"
15	R	A	20	50	500	4	000	000	2 1/2"
16	B	B	34	85	120	3 1/2	2	2	2"
17	A	B	42	105	200	3 1/2	000	000	2 1/2"
18	A	B	42	105	250	1	000	000	2 1/2"
19	A	B	44	110	395	3 1/2	000	000	2 1/2"
20	A	B	42	105	395	3 1/2	000	000	2 1/2"
21	A	B	42	105	390	3 1/2	000	000	2 1/2"
22	A	B	42	105	415	3 1/2	000	000	2 1/2"



A long graceful arch, divided up into a number of square open panels, spans the entire stage. Over each panel is placed a square metal frame that is divided into four smaller squares, into which etched "silver ripple" glass is inserted. Between the metal frames and the arch proper a 1-in. air space is provided for ventilation and as an exit for the sound waves from the organ echo chambers above.

Above the center of each four panels is placed a Norbitt receptacle in a conduit outlet box. Each receptacle is fitted with a 100-watt tungsten lamp and a 12-in. Frink corrugated reflector. The tip of the lamp is 36 in. above the surface of the glass. The conduit and outlet boxes are all supported on angle-iron framework secured to the floor beams above. This method of illumination provides a well-distributed and even lighting effect on the stage.

At times a very strong light on the stage is desirable, and for this purpose three silk canopy fixtures have been suspended from the arched ceiling at a height of 10 ft. above the stage. Each one of these fixtures consists of a Benjamin cluster of eight 100-watt tungsten lamps. To increase further the stage illumination a 16-ft. vertical Frink reflector has been provided each side of the stage.

The rear of the balcony is lighted from a number of three-arm brackets, each arm being equipped with a 60-watt lamp with a round frosted bulb. Under the balcony there are eight hemisphere ceiling fixtures, each containing five 20-watt lamps.

The entrance lobby is lighted from three shallow hemisphere ceiling fixtures, each containing two 40-watt tungsten lamps. Over the entrance to the hall is a massive marquee extending along the full width of the building and out to the edge of the sidewalk. Along the outer edge of the marquee there are ninety-six 15-watt tungsten lamps spaced 9 in. apart. Each lamp is supported from a Russell & Stoll heavy-brass waterproof outlet box and receptacle and inclosed in an "Opalux" bowl. Over each door in the auditorium is an exit lamp in a regulation box. The circuits for these exit lamps are run directly to the switchboard in the sub-basement.

The lighting of the auditorium and stage is controlled from a special panel placed in a small passage to the east of the stage. This panel is divided into seven sections, as follows: Section 1, controlling lighting behind the stage,



FIG. 10—STAGE IN CONCERT HALL.

in addition to the "baby" knife switches controlling the individual circuits, with the exception of section 1, which is connected below the main switch. The opening of this switch extinguishes all lamps in the auditorium except the exit lamps, the lamps behind the stage and those for the stereopticon. For dimming effects the baby knife switches in the various sections are opened.



FIG. 11—RECEPTION ROOM ON MAIN FLOOR

The basement floor is used for demonstration of talking machines and pianolas and is divided into a main reception room and a number of individual music rooms. The lighting of the main portion of this floor is from three ceiling chandeliers, each containing four 60-watt lamps with "Opalux" shades and six ceiling hemisphere fixtures with frosted glass globes. The individual music rooms are lighted by a single hemisphere ceiling fixture similar to those in the main room. Each music room has a wall plug for additional lighting or for operating the organ motors.

The large reception room on the main floor facing Forty-second Street is lighted by means of four semi-indirect ceiling fixtures of white alabaster suspended by three heavy chains. The lighting of the second floor showroom is practically the same as that of the reception room. The third floor is decorated entirely in light blue and gold, and the fourth floor in a dark red and gold. The lighting on both floors is semi-indirect from hemisphere alabaster bowls suspended from the ceilings by chains. The lighting of the ordinary office is by ceiling fixtures with two and three arms, each arm supporting a 40-watt or 60-watt tungsten lamp and an "Opalux" shade. Pendent switches are used.

The lighting of the corridors is by straight-stem fixtures, each equipped with a 40-watt tungsten lamp and an "Opalux" shade. Each office is provided with one or two insertion plugs located in the wall 18 in. above the floor.

#### ELEVATORS AND MISCELLANEOUS ELECTRICAL DEVICES

The building is provided with three sets of elevators, of which one set of three cars on the east side of the building at Forty-second Street runs only to the fifth floor. On the West Forty-second Street side a set of four elevators serves all floors. At the Forty-third Street side one passenger car and one freight car travel from the basement to the top floor. All the passenger elevators are of the Otis one-to-one direct-traction type and the freight elevator is of the worm-gear type.

The ventilation of the building is well provided for by forced draft from the ventilating fans in the sub-basement and is supplemented by electric ozonators on each floor.

An interesting feature is the control of the organ in the auditorium. The organ bellows, which are operated by

on the organ loft and for the stereopticon; section 2, controlling ceiling lamps in auditorium; section 3, controlling cove reflector lamps; section 4, controlling balcony reflector lamps; section 5, controlling stage lighting; section 6, controlling lamps under the balcony; section 7, controlling vestibule lamps.

Each of the above sections is controlled by knife switches

two 5-hp motors, are located on the mezzanine floor of the engine room. These motors can be started or stopped from the auditorium stage by means of two push-button switches. These switches are so connected that either may be used to start or stop the motors. When the upper button is pressed a circuit is established that operates a relay in the organ motor rooms. This relay closes the motor circuits



FIG. 12—INTERIOR OF ENGINE ROOM

and at the same time a small pilot lamp in the passageway at the east side of the stage is switched on which indicates that the motors are running.

Over the marquise at the Forty-third Street entrance is placed on a heavy iron bracket a carriage-call device manufactured by the Woodruff Carriage Call Company. This carriage call is electrically operated from a small push-button board inserted in the wall at the middle entrance.

The entire electrical equipment was designed by C. O.

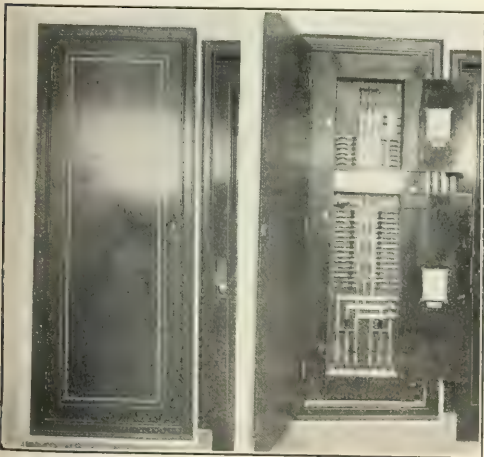


FIG. 13—TYPICAL FLOOR DISTRIBUTION BOX

Mailloux and C. E. Knox, consulting electrical engineers, 90 West Street, New York City. The architects for the building are Warren & Wetmore, 16 East Forty-seventh Street, New York City. Most of the electrical installations were made by the Lord Electric Company. Mr. R. A. Foster is superintendent and Mr. J. W. Roberts chief engineer of the building.

## Precipitation of Smoke and Suspended Dust by Electrostatic Methods

By H. N. HOLMES

The public is beginning to demand a rigid control of the dust issuing from the rotary kilns of Portland-cement plants, of smoke from factories and of acid fumes from smelters. In England it is even interested in removing the excessive fog from the atmosphere.

All this may be done with excellent success in some cases by the magic of the electric discharge. The principle of this process is easily illustrated. Suppose a metallic point be placed near a smooth sheet of metal and a silent electric discharge be passed across the gap. The air particles will have the same charge as the point and will be repelled from it in a miniature wind. If the air be laden with floating dust, the charged or ionized gas particles will strike these dust motes and give them their own charge, causing the dust to be deposited on the opposite electrodes and thus clearing the gas. Of course, a direct-current charge of high potential is understood in the above experiment.

In England Sir Oliver Lodge worked for some time experimenting with the effect of Hertzian waves on fog. His idea was that the minute particles of moisture upon

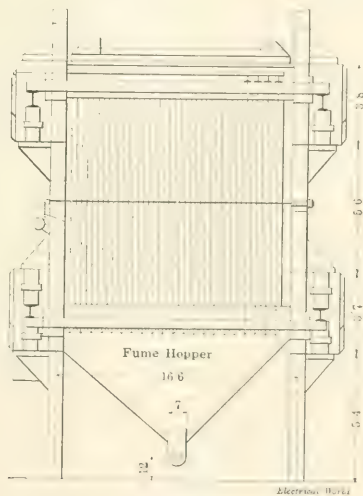


FIG. 1—SECTION THROUGH PRECIPITATING UNIT

becoming electrically charged would collect in drops large enough to fall to the earth. There is some hope that success may ultimately be achieved in these experiments.

In America Dr. F. G. Cottrell, of the United States Bureau of Mines, has advanced this principle largely in catching the Portland-cement dust from rotary kilns, and in removing dust and acid fumes from smelter gases. In the average kiln of this type, 100 ft. long and 7 ft. 10 in. diameter, there is a volume of stack gas pulling 1,000 cu. ft. per minute and carrying four or five tons of dust per day of twenty-four hours. The Cottrell method uses two forms of electrodes in the stack: the "striking" electrodes, between which leaps a heavy discharge to ionize the gases and ultimately the dust particles, and the collecting electrodes, so arranged that when a discharge takes place, a powerful electrostatic field is formed in which the ionized particles migrate and are deposited on the electrodes. The two forms of electrodes are alternated across the apparatus with an electrode spacing of 2 in. to 6 in. In the plant of the Riverside Portland Cement Company the "treater" has a cross-section 12 ft. by 16 ft., with



a length of 20 ft. The dust is removed from the electrodes every three or four hours by mechanical shaking. Such a treater consumes 7 kw-hr. per day, including energy for the motors. A 5000-barrel mill would use about 75 kw-hr. per day.

The Raritan Copper Works, of Perth Amboy, N. J., have used this process in the treatment of their slimes from

the removal of tar from gas made by the distillation of soft coal, and gratifying success has been achieved by the electrical precipitation process. In San Francisco Mr. W. A. Schmidt has done as well in purifying gas made by heating crude petroleum. The tar is collected on the electrodes and run off into containers.

The tremendous volume of gas issuing from the top of a blast furnace is between 20 and 30 per cent carbon monoxide, a poisonous gas of great fuel value. A great quantity of dust is, however, also carried out with this gas and must be separated before the carbon monoxide can be used in explosion gas engines. Right here, again, is a splendid field for the application of electric precipitation of suspended dust particles as above outlined, and this work is being tried at present.

Of course, the general public is particularly interested in the problem of removing smoke particles from flue gases. In most cases it is probable that better combustion of the coal by means of uniform firing and proper draft must be relied upon, but still a measure of success is possible with the electric method. The New York Edison Company's power plant, Waterside No. 2, is giving the new process a thorough trial. Here one hundred boilers connected to four smokestacks 300 ft. high and 22 ft. in diameter will surely be sufficient for a conclusive test. The velocity of the flue gases is 38 linear ft. per second. In the evening the load is doubled. The potential of the discharge used is from 15,000 volts to 50,000 volts, and the trial is being watched with great interest.

### Methods of Obtaining Greater Flexibility of Operation in Standard Transformers

By GEORGE A. THORNTON AND GEORGE GOLDMAN

the electrolytic baths. These slimes contain gold, silver, arsenic, antimony, selenium and other elements. Generally this slime is roasted in a furnace and the volatile elements are driven off and condensed in the flue. However, this separation is not satisfactory when gravity alone is depended upon as the settling agent. Some of the fumes have even been collected after passing through water scrubbers and been found to contain large amounts of precious metals. By electrical precipitation of these particles practically all the valuable dust has been recovered. The Garfield (Utah) smelter of the American Smelting & Refining Company is about to use this electrical precipitation process in treating the fumes from its copper converters. This dust consists of much lead and some silver and other elements.

The Ohio & Colorado Smelting & Refining Company, of Salida, Col., is installing the process on its roaster stack. In this flue the velocity of the gases is 500 ft. per minute, and this improvement will make it possible to push the plant harder without loss of dust.

In the accompanying sketches is shown the arrangement of the precipitating plant and units installed at the Balaklala Consolidated Copper Company's smelter, at Coram, Col. Fig. 2 shows the general plan, and Fig. 1 is a cross-section through one of the precipitating units. In the former sketch the rows of vertical lines represent the collecting electrodes—sheets of No. 10 iron each measuring 10 ft. by 6 in. The dotted lines show the discharge electrodes formed of pairs of iron-wire strands between which is twisted the discharge material, asbestos or mica. Each precipitating unit contains twenty-four rows of twenty-four electrodes of each type. The collecting electrodes are carried by bars connected directly to the frame of the chambers, while the discharge electrodes are connected by springs to busbars supported by insulators. A cam actuates a shaker rod across the middle of the unit, agitating the electrodes to keep them free from dust. It is declared that 80 to 90 per cent of the suspended matter in the gas is precipitated by these units.

A great deal of sulphuric-acid mist is commonly lost from the parting kettles in silver refineries, but some plants now collect this mist by electrical methods. In fact, stills for concentrating sulphuric acid lose a good deal of mist which can be collected as described.

Illuminating gas often carries considerable fine carbon and tar particles in suspension. It is an important problem to remove them completely, for they clog pipes and burners. The Michigan Gas Association has carried on a series of experiments under the direction of Mr. A. H. White for

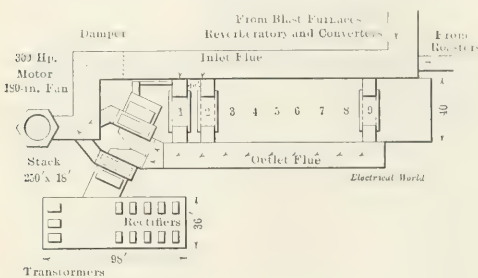


FIG. 2—GENERAL ARRANGEMENT OF PRECIPITATING PLANT

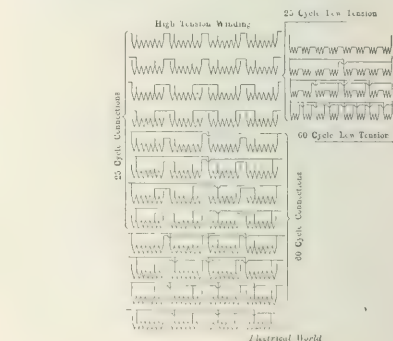


FIG. 1—TRANSFORMER CONNECTIONS FOR 25 CYCLES AND 60 CYCLES

proved methods of cooling transformers, have also reduced the weight per kilowatt and the cost of production. While improvements affecting efficiencies are to be looked for in the future, they will probably be of minor interest to the users of electrical apparatus because of the larger wastes in other directions which will occupy their attention. To the manufacturer, nevertheless, they may still be of great



importance, for when all other things are about equal this factor would be the determining one in securing business.

Little attention, however, seems to have been given to making transformers which will be adaptable to circuits of different frequencies. Almost every order for sizes above 50 kw received by a manufacturer of this kind of apparatus calls for special designs and drawings, special parts and

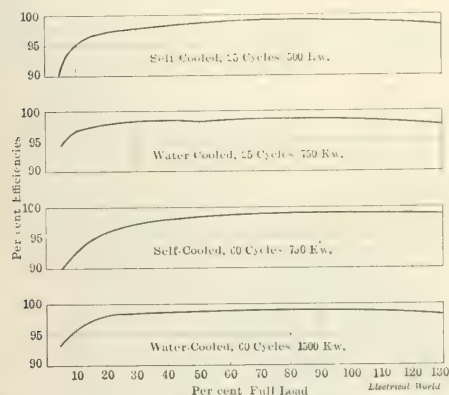


FIG. 2—EFFICIENCIES OF SELF-COOLED AND WATER-COOLED TRANSFORMERS

consequent delays and increased cost. Much of this business is based, to a large extent, on quick deliveries. Manufacturers, especially the larger ones with greater momentum, must and do try to anticipate the future demand by keeping on hand a stock of apparatus which experience has shown them will most likely be required. Owing to the lack of interchangeability with circuits of different frequencies, attempts to provide for the future call for a heavy investment in stock apparatus. The equipment then, when sold, must leave the factory burdened with heavy interest, storage and obsolescence charges.

By producing more flexible transformers these charges will be greatly reduced. The obsolescence charge, aside from reducing the stock apparatus to a scrap value, has frequently been the cause of delaying or even stifling improvements. Voltage ratings generally obtainable for such

TABLE 1—RESULTS OF COMMERCIAL TESTS ON TRANSFORMERS INTERCHANGEABLE ON 25-CYCLE AND 60-CYCLE CIRCUITS (13,200/4480 VOLTS)

	SELF-COOLED		WATER-COOLED	
	25-Cycle, 500-Kw.	60-Cycle, 750-Kw.	25-Cycle, 750-Kw.	60-Cycle, 150-Kw.
Core loss at normal voltage...	3100 watts	6200 watts	3150 watts	6200 watts
Exciting current at normal voltage...	10 per cent	1 per cent	5 per cent	2 per cent
Copper loss at full load	4690 watts	2415 watts	9670 watts	9670 watts
Impedance drop at full load	4.15 per cent	4 per cent	...	...
Regulation	1.1 per cent	...	...	...
Gallons water per minute	...	...	3.5	6.5

apparatus in circuits of the same frequency are: High tension, 2200/1100; low-tension, 440/220/110. This range of voltage covers fairly well present-day lighting and motor-circuit needs, but with transformers designed for multi-frequency operation, as the following explanation and tests show might easily be done, the flexibility would be greatly increased.

Since the standard frequencies in use are 25 and 60 cycles, a number of transformers, both self-cooled and water-cooled, were changed to make them operative on either one of these frequencies. The self-cooled trans-

TABLE 11—RESULTS OF HEAVY RUN TESTS ON WATER-COOLED TRANSFORMERS INTER-CHANGED ON 25-CYCLE AND 60-CYCLE CIRCUITS

Temperature	25-CYCLE, 750-KW.			
	100 per Cent Load, Deg. C.	100 per Cent Load, Temp. Rise, °F.	200 per Cent Load, Deg. C.	200 per Cent Load, Deg. C.
Tank top	12.5	20	16	22
Tank bottom	...	12	6.5	21
Oil surface	15	23.5	18	27
Water, entering	13.5	17.5	12.5	12
Water, leaving	20.5	23	19	18
Primary coils*	34.5	4	40	...
Secondary coils*	44	42	35	40
Room temperature	18	16	14	13.5
Gallons water per minute	3.5	3.5	6.5	6.5
Time of heat run, hours...	12	2	12	2

\*Temperature determined by resistance measurements.

formers had been built primarily for a rating of 500 kw, with a ratio of 13,200/4480 volts, at 25 cycles. The water-cooled transformers were rated at 750 kw, with a ratio of 13,200/4480 volts, at 25 cycles.

The changes of connection necessary when reverting from 25-cycle to 60-cycle operation are shown in Fig. 1 and are readily made on the connection boards of the transformers. It will be noticed that owing to the multiple connections of the coils the range of voltage obtainable in the secondary for 60-cycle operation is one less than that which can be had at 25 cycles. Fig. 2 shows the connection board for the secondary. The high-tension board is similar to this. For operation at 60 cycles a rating for the transformer was predetermined from a study of its design, and tests were made at this rating.

In changing from the series connection at 25 cycles to a



FIG. 3—TRANSFORMER SECONDARY CONNECTION

multiple connection at 60 cycles, the ratio of turns in series is as 2:1.

Therefore, since (flux at 25 cycles)  $\propto \frac{1}{\sqrt{f}}$  = (flux at 60 cycles)  $\propto \frac{1}{\sqrt{f}}$  =  $\frac{1}{\sqrt{2}}$ , the flux density has

decreased in this ratio. The eddy-current loss in the core varies as the square of the frequency and the flux density; the hysteresis loss varies directly as the frequency and as the 1.6th power of the flux density. Therefore, since the

frequency is increased in the ratio of 25:60, while the decrease in flux is only 5:6, there will be a greater core loss at 60 cycles than at 25 cycles. The limitations with respect to saturation are at 60 cycles rather than at 25 cycles, in so far as heating and efficiency of the transformer are affected. However, in the new alloy steels the magnetizing current sets the limit, and as this depends primarily on saturation, the flux density at 25 cycles is still generally the governing feature. The increased core loss at 60 cycles might possibly at times conflict with the efficiency guarantees and must be guarded against. In regard to the effect of the increased heating of the iron it may be said that heated iron offers greater resistance to current flow and hence would tend to reduce the core loss. It is not thought, however, that enough heat would reach the coils from this source to harm them since the iron is in good contact with the oil.

In consideration of the difference in copper losses due to changed connections it must be noted that the resistance of the circuits, with the coils connected for 60-cycle operation, is one-fourth that for 25-cycle operation. This makes possible a twofold increase in load with no increase in *I*<sup>2</sup>*R* loss. In the self-cooled transformers we are limited in the total losses of the iron and copper by the ability of the

TABLE III—RESULTS OF HEAT-RUN TESTS ON SELF-COOLED TRANSFORMERS INTERCHANGED ON 25-CYCLE AND 60-CYCLE CIRCUITS

Temperature	25-CYCLE, 500-KW.		60-CYCLE, 750-KW.	
	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.	100 per Cent Load, Deg. C.	150 per Cent Load, Deg. C.
Tank top	24	32	25	28
Tank bottom	12	18	10	11
Oil surface	30	39.5	31	32
Primary coils*	41	56	40	45.5
Secondary coils*	40	56	40	45
Room temperature	18	14.6	15	16.5
Time of heat run, hours	24	2	24	2

\*Temperature determined by resistance measurements.

tank to radiate the heat generated without exceeding a safe value of temperature rise. Since the core loss is increased at 60 cycles, the copper loss must be decreased; that is, the sum of the core and copper losses at both frequencies must be approximately the same. Such was the case when the 25-cycle, 500-kw transformers were rated at 750 kw at 60 cycles. One would expect the windings in the shell-type transformers to run cooler at the latter rating than at the former, and this is borne out by test. At 500 kw and 750 volts both transformers operated with about the same temperature rise. At 50 per cent overload on the 750-kw rating the transformers would be expected to be warmer than at 50 per cent overload at 500 kw, because the losses vary as the square of the current. All this is fairly well borne out by results of tests. The efficiencies of the transformer at both ratings are shown by curves in Fig. 2.

In the water-cooled transformers dependence is placed on both the tank radiation and the amount of water circulating in the cooling coils to keep down the temperature. Tests were made at a rating of 1500 kw at 60 cycles, the results showing that doubling the water circulation at 60 cycles over that at 25 cycles would give about the same temperature rises. Increasing the load and water still further would produce a steep temperature gradient and hot windings, shortening the life of the apparatus. Efficiencies at these ratings are also shown in Fig. 2.

Changing connections from 25-cycle to 60-cycle operation doubles the voltage between turns. This is the only objection to this method. As transformers are usually designed, the breakdown voltage between turns under tests is over 2000 volts. It would seem, therefore, that doubling the voltage between turns would still leave an ample factor of safety. As a matter of fact, however, transformers persist in breaking down between turns in spite of the apparently ample margin. Whether this tendency would be increased with the increased voltage between turns is problematical, although it may be presumed it would be increased somewhat. However, even in this design it is not necessary to exceed the higher value of volts per turn in the standard designs. Insulation between turns is the weakest point in transformers to-day, and improvements in this respect are now being attempted.

Adding more insulation or substituting a little more mica in place of paper would add to the insulation strength. Having thus strengthened the insulation between turns

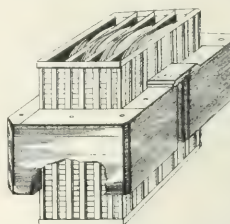


FIG. 4—ASSEMBLY OF CORE, COILS AND INSULATING CASING

at 25 cycles, not only might the transformer then be operated at 13,200 volts on the high-tension side and at 4480 volts on the low-tension side, but also even up to twice these voltages; namely, 26,400/8960 volts. The core loss, while low at 25 cycles and 13,200 volts, would now be rather high, but a halt would be called because of high magnetizing current. At any rate, if necessary, the transformer could be operated at pressures above 13,200/4480 volts, the magnetizing current at higher loads not being so objectionable.

The above discussion shows the increased flexibility due to multi-frequency operation. Still further advances in this direction are obtainable by converting a self-cooled into a water-cooled transformer. This was actually done, the self-cooled transformers being made to operate as water-cooled with the necessary changes in rating. Hence, one piece of apparatus may have all the following ratings:

Self-cooled, 25-cycle, 500-kw, 13,200/4480 volts.  
 Self-cooled, 60-cycle, 750-kw, 13,200/4480 volts.  
 Water-cooled, 25-cycle, 750-kw, 13,200/4480 volts.  
 Water-cooled, 60-cycle, 1500-kw, 13,200/4480 volts.  
 Water-cooled, 25-cycle, 750-kw, voltages not above 26,400/8960.  
 Self-cooled, 25-cycle, 500-kw, voltages not above 26,400/8960.

The feasibility of one transformer having all the above ratings was first carefully worked out from the design and then checked by actual commercial tests which bore out the calculation.

Two methods are therefore suggested for increasing the economies of transformer manufacture. First, the adaptation of apparatus to multi-frequency operation and, secondly, conversion of the self-cooled types to water-cooling, or vice versa. Fig. 4 shows the assembly of core and insulating casing.

### Electricity for Leper Colonies

The announcement has been made that the advisory committee of five physicians which assists the Massachusetts State Board of Charity in doing what is possible for the lepers has recommended the installation of electricity and an X-ray outfit for the leper colony. Electricity for lighting is urged for the reason that the majority of lepers have lost the sense of touch or feeling and are extremely apt to burn themselves seriously as long as lamps other than electric are used. The X-ray outfit is intended for curative experiments.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Central-Station Service in a Powder Mill

An unusual installation of equipment for electric lighting and motor service has just been completed by the engineers of the Louisville Lighting Company, of Louisville, Ky., in the new plant of the Wedgerite Chemical Company, 1 mile south of that city. When the newly organized powder manufacturers contracted for the central-station company's service it was necessary for the utility to extend its southernmost line a distance of a mile or more to the plant. Special provisions were made for strictly modern wiring and motor installation, the motors being located outside the mixing shed because of the dangerous nature of the high explosives handled.

## Uniform Prices to Encourage Use of Larger Tungsten Lamps

Under a new reduced-price schedule for tungsten lamps recently put into effect by the Edison Electric Illuminating Company of Brooklyn, the company is now offering to sell to customers whose contracts call for free carbon-lamp renewals all tungsten lamps, from the 10-watt to the 60-watt sizes inclusive, at the same price. Such customers can now obtain 10-watt, 15-watt, 25-watt, 40-watt or 60-watt tungsten lamps at 30 cents each, whereas under the former schedule the 15-watt, 25-watt and 40-watt sizes sold for 33 cents apiece and the 60-watt size for 45 cents. By making the same price for the small 10-watt lamps as for the 60-watt size the company has been able to encourage the use of the larger units, for, according to the laws of human nature, a customer will select the largest lamp he can buy for the price.

## Partial and Summer Service to Isolated Plants

Established isolated plants offer a considerable field for central-station service in summer, even where heating requirements in winter make isolated-plant operation preferable. Running non-condensing in the summer, the cost of fuel, firemen's wages, oil expense and various minor items can be saved by purchasing energy. The cost of fuel, firemen, waste, oil, packing, etc., would amount to at least 0.75 cent per kilowatt-hour, and in most cases from 1 cent to 2 cents per kilowatt-hour. It would not be policy to lay off a good operating engineer, and his time could be very profitably spent in overhauling the equipment, making necessary alterations, and, in general, preparing the plant to handle its winter load most economically.

The central station equipped for the December peak has ample idle capacity in summer, and such a taste of central station service might make a customer for all or a large part of his year-round load.

Another possibility is that of supplementing the isolated plant with power for part of its load, especially where the factory has been enlarged or the power plant is outgrown. Already this is being done to some extent, but there is room for a great deal more work along these lines. Here the salesmen can figure depreciation, investment and expense, as well as labor and fuel, against the steam cost, and can often get a year-round load at a rate which will well compensate for being carried through the winter peak.

## An Electric Sign per 250 Inhabitants

At Lexington, Ky., 134 electric signs have been installed by local merchants, business houses, theaters, etc., making a total of nearly 10,000 sign lamps supplied from the circuits of the Lexington Utilities Company, which furnishes the local central-station service. As Lexington has



FIG. 1—NEW ELECTRIC SIGN, LOUISVILLE

a population of about 34,000, the little Blue Grass city can show an average of about one sign per 250 inhabitants, according to the records of the Federal Sign System, which has a local office.

The Lexington Utilities Company recently erected a strik-



FIG. 2—DISPLAY ROOMS

ing electric sign, measuring 8 ft. by 14 ft., on the façade of its own eight-story building at the corner of Main Street and Cheapside. Two flaming torches on this sign burn continuously. The word "Light" is first flashed on in 16-in. letters and is then extinguished as the representation of an electric iron appears. Green lamps outline the cord, and



the socket is shown in white and amber globes. As the iron disappears, the word "Power" comes on, and then the entire sign flashes into view, the picture being held for one minute.

### Electric Appliances as Standard Household Furnishings

In the belief that electrical appliances for household service have reached the point where they may be classed as standard furnishings, a leading Boston store has inaugurated the direct sale of such apparatus and has equipped its model six-room "apartment" with a complete line of electrical devices illustrating the latest possibilities in heating, lighting and motor service. The apartment contains a reception hall, library, bedchamber, bathroom, kitchen and laundry, the total floor area covered being about 2000 sq. ft., and it is equipped with a varied assortment of the latest appliances, mainly of Simplex, General Electric and Landers, Frary & Clark manufacture. Three demonstrators are connected with the department, which is in charge of Mr. E. W. Bates, formerly manager of the Cohasset Electric Company and well known in the New England central-station field. The six rooms were re-wired in conduit prior to the opening of the electrical display, and, in accordance with recent requirements, a red pilot lamp is included in the circuit of every heating appliance.

### Central-Station High-Pressure Fire Service for Boston

The city of Boston is preparing to install a high-pressure water supply system for fire protection throughout the district north of Berkeley and Dover Streets. An underground station for the motor-driven high-pressure pumps will be constructed on Charles Street, between Beacon and Boylston Streets, care being taken to conceal the plant so as not to mar the appearance of the Public Garden and Common.

Six multi-stage 3000-gal. centrifugal pumps, delivering their output at 300 lb. pressure per sq. in., will comprise the initial equipment. Each pump will be direct-connected to two 800-hp induction motors—one for 6600-volt, 60-cycle operation and the other utilizing 13,000-volt, 25-cycle energy. In this way provision is made for emergency operation from the local elevated-railway 25-cycle system in the remote possibility of interruption to the 60-cycle service of the Boston Edison Company. The design of the station includes space for two additional pumping equipments, and, in addition, service will be required for heating and lighting purposes, as well as for the operation of a small amount of auxiliary apparatus.

The contract with the Edison company calls for a maximum supply of 4800 hp, or 3580 kw, of 6600-volt, 60-cycle energy. The city's engineers in charge of the high-pressure undertaking at the outset recommended central-station service as affording the maximum conditions of reliability, convenience and economy in the operation of the system. The contract with the Boston Elevated Railway Company for auxiliary service is made by the central-station company itself and will be taken advantage of only in case of interruption to its own system.

Fire-pump connections will be tapped from the central-station system at three points, the Head Place, Jordan-Marsh and Houghton & Dutton stations, each line being of 2500-kw capacity. Different groups of transmission lines supply these stations over divergent routes, thus providing every possible insurance against accident, in addition to the storage-battery equipment in the city substations. The city water-works mains will be used as the source of supply, although in case of emergency salt-water connections will be available with the bay.

### Central-Station Service in a Great Newspaper Plant

The New York Times recently moved its mechanical plant from its famous Broadway tower building to its new eleven-story annex on Forty-fourth Street, where are installed four double sextuple Hoe presses and one octuple press, whose combined double-page web output is produced at the rate of 12.5 miles a minute, or 750 miles an hour.

New York Edison service is used throughout the new plant. As declared editorially by the paper itself: "The adoption of central-station service saved considerable money in first cost of installation. It saved valuable space. It avoided fires in the boilers in the warm months of the year, thereby keeping down the temperature of the press room. It minimized the handling of coal and ashes to the winter season and to the smaller quantities incidental only to heating the structure. It saved the extra cost of a 'breakdown' connection for emergencies."

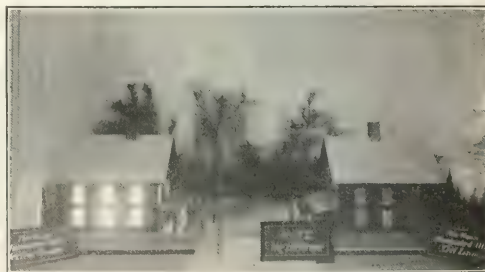
The Times Annex has 17 miles of electric conduits with 49 miles of wire, excluding telegraph and telephone service. The service connections have a carrying capacity of 2200 amp for lighting and 2000 amp for motors. There are supply lines taken from both Forty-third and Forty-fourth Streets, each of full combined rating, while a 2700-amp circuit is led from the Times Building.

Each double sextuple press is driven by two 60-hp main motors and two 5-hp auxiliaries. A complete system of push-button control is provided, with twenty-six stations, from any of which the presses can be stopped, locked or started.

Not only the press room but every department of the entire business has been planned for measuring the supply used for different purposes. Practically every function of the newspaper and its building has been metered so that the work of each press, each elevator, each pump and each auto-plate may be closely watched. Each line set by each linotype is charted by electricity. Every movement of every press is charted. Every automatic start and stop of a pump is recorded. The supply of light to each department is measured. Recording thermometers and a hygrometer will record temperature and humidity at all hours of the day and night.

### Which House Is Yours?

During its recent house-wiring campaign the Meridian (Miss.) Light & Railway Company displayed an attractive window exhibit showing two miniature dwellings, one duly lighted by an old-fashioned illuminant and the other ren-



WINDOW DISPLAY, MERIDIAN, MISS.

dered brilliant with modern tungsten lamps. Placards in the window called attention to the difference, and the display attracted a measure of local attention that was quite out of proportion to its small cost.

The houses were made from ordinary lamp boxes, with the aid of a jar of paste and a pair of scissors. The windows were covered with tracing paper, giving the appear-

ance of frosted panes. The entire show window was lined with a sky-blue cloth, the ground being represented by green paper, and the background was an ordinary wallpaper border, with a forest design. The fences were made from small strips of wood, and the road was formed of ordinary sand. The trees seen in the picture were the top-cut from small pines.

## Waste in Compiling Unnecessary Reports

By D. C. BONN.

In going through the work of various departments of large central-station electric companies it is often evident that of the great number of monthly reports regularly submitted for the information of officials and department heads some may be of little real usefulness. Recognizing this tendency, one executive of a large company asked to have sent him a complete set of the forms used regularly by certain offices and to have stated thereon full particulars concerning their use. In consequence of this special investigation many reports were discontinued, while others were condensed or changed so as to be of more real value. The time consumed in going over this mass of data was well spent.

How many reports have been started and are continued at the request of the department head?

How many of such reports have long since served their purpose?

Of what real value are those he initials and files each month?

Could he not instead have test reports made for his information when needed?

Does he know the number and character of the reports being made and sent him each month?

Has he thought of any changes to make them less burdensome?

After all, is the information worth what it costs to compile it?

The truth of this growing burden and expense is that reports are inaugurated from time to time by the men at the head of departments, while preceding statements are seldom discontinued.

More attention should also be given to the drawing up of forms and reports. For example, in the plant mentioned, for many years separate forms were used for material recovered and that returned to the storeroom. After a little consideration, however, a form was adopted to serve both purposes.

A vast amount of report work is often executed at the beginning of each month which hinders every department of the organization in keeping up its routine work at the end of the thirty-day period. Every head of a department and company chief clerk should realize the tax, effort, time and expense involved in the compilation of this great amount of data, which is so often allowed to pass through various departments from month to month and year to year without its being given earnest and proper consideration.

## The Value of the Lighting Engineer to the Central Station

By F. H. M. RILEY

The true illuminating engineer should be not only familiar with physical laws pertaining to the use of light but also alive to the importance of the hygienic and esthetic phases of his subject. To the central station the lighting engineer can be valuable in two ways—first, in securing new business, and, second, in rendering satisfaction to the company's present lighting customers, for a satisfied customer is now recognized to be among the most valuable assets that a corporation, public utility or small business can possess.

One of the greatest central-station problems is that of closing down isolated plants in large stores, factories, hotels, etc., for it is from these places that bulk business is often to be obtained. Here the lighting specialist can be especially useful, showing the private-plant owner how his connected load could be lessened or rearranged, thus contributing to the economy of central-station service. While



FIG. 1. WINDOW ILLUMINATION WITH ORIGINAL INSTALLATION

there are many other reasons which may be advanced to secure the business, such as reduced insurance rates, elimination of dangerous boilers, smoke and dirt, cost of up-keep, depreciation, etc., the point of lessening the connected load is pertinent.

An example will show the effectiveness of the lighting specialist in this respect. The Kansas City Electric Light Company recently undertook to re-design the lighting system of a large local store, the George B. Peck Dry Goods Company, which operated an isolated plant, the object being to cut the existing energy consumption in half without reducing the effective illumination, in this way rendering easier the task of securing the business for the central station. The problem was rather difficult, since the new lighting units had to be placed on outlets already installed, for the wiring was antiquated, and, while it would stand if no extensions were made, any changes would have necessitated the complete rewiring of the building. Such a course would have entailed an expenditure of about \$10,000, which was out of the question.

Approximately fifty-five 650-watt arc lamps were in operation throughout the store. Although there were a number of tungsten and tantalum lamps in use, the majority of incandescent lamps were 50-watt and 60-watt carbon fila-



FIG. 2. SAME WINDOW ILLUMINATION, FOREGROUND REMOVED

ment units. In making the substitution for the incandescent illuminants arc lamps were replaced by 250-watt bowl-frosted tungsten lamps equipped with translucent glass shields. Tungsten lamps of proper wattage were employed to supersede the carbon and tantalum units. All lamps used were bowl frosted and properly shielded, an important feature of the plan not been hitherto observed, the result being im-



creased efficiency and freedom from glare. Clear lamps were used, of course, in the showcases and windows.

Particular attention was paid to the lighting of the rug racks. Although the consumption here was not diminished, the intensity and distribution were vastly increased and improved. Scoop-shape, silver-plated glass reflectors, con-

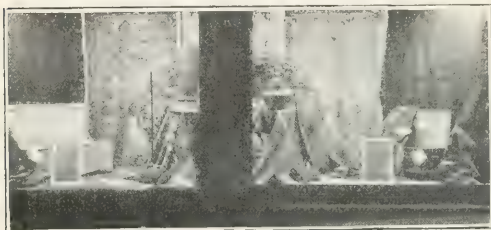


FIG. 3—EXHIBITING HOUSE FURNISHING UNDER IMPROVED ILLUMINATION

taining 25-watt clear-globe tungsten lamps, were placed at intervals of 2 ft., being mounted about 12 in. below the top of the rugs displayed. While this method does not give an even distribution over the entire surface of the rug, it serves to distribute the light on that portion which is studied by the purchaser. The ordinary method of rug-rack lighting is much less effective, since it tends to place the highest intensity at the top of the rugs, despite the fact that the purchaser studies the lower portion.

The improvement in window illumination is revealed by the accompanying illustrations. Fig. 1 shows one of the Peck windows before the lighting was changed, and Figs. 2 and 3 windows after the installation was completed. The decrease in wattage in the windows was practically one-half, after the carbon and tantalum lamps had been replaced by tungsten units with reflectors. The photographs were made with identical exposures, although the new installation had been in operation about five months before the latter pictures were taken.

The alteration-room lighting is shown in Fig. 4. Tin troughs containing carbon lamps, placed 20 in. above the tables, formerly supplied the illumination of these rooms. The result was inefficiency and headaches among the women employed in this department. The new system is general in type, employing 250-watt bowl-frosted tungsten lamps fitted with glass shades and resulting in an even, diffused light, free from shadows. The health and the condition of the eyes of the women employed here have since improved, with a corresponding increase in efficiency.



FIG. 4—ILLUMINATION OF ALTERATION ROOM

The great saving in wattage thus effected in the lighting of the building enabled the owners of the store to change four hydraulic elevators to electric cars, each driven by a 30-hp, direct-current, 110-volt motor, and also to install a 25-hp motor to operate the pumps on the automatic sprinkler system. Prior to these changes the maximum

demand, for lighting alone, was 123 kw; after the new lighting system was installed and the elevators and pump motors had been added the total maximum demand dropped to 105 kw. The elevators, meanwhile, have increased their average daily travel by 150 trips since the change, and the general illumination has been improved 10 to 15 per cent. Aside from the foregoing the entire building is being heated by steam taken from the mains of the lighting company. Space occupied by the plant is now utilized for the sale of merchandise.

The cost of the entire change approximated \$12,000. To operate the former private plant the cost was approximately \$16,000 per year, and since the bill for the central-station's service, including the steam for heating, will not exceed \$10,000 per year, the saving effected will pay for the changes in less than two years.

The lighting specialist can be of assistance also in giving satisfaction to the lighting customers of the company, advising them of best methods of illumination and designing installations of commercial or residence lighting, where the object is to reduce energy consumption or to increase the advertising value of a commercial interior by efficient and different lighting. On the satisfaction of the customer depend the growth and development of every business.



FIG. 5—ILLUMINATION OF DISPLAY OF JEWELRY AND SILVERWARE

People are likely to become vexed at a public utility upon the least provocation. Lighting companies operated by large corporations easily incur the ill will of the public. The elimination of such prejudice should be the aim of every utility, and in this direction the work of the lighting specialist can be particularly efficient.

Again, the lighting specialist can be effective in combating unscrupulous manufacturers and jobbers of glassware and accessories in the disposal of their inefficient lighting appliances, practices which have caused the management of central stations no little worry and trouble. These manufacturers and merchants have maintained a policy of selling direct to the consumer or fixture dealer, who in many cases knows very little of correct illumination. Later, it is difficult to convince the customer that his poor or incorrect illumination is not the fault of the lighting company but is due to the fixture installation. This alone is one of the strongest reasons for the employment of a lighting specialist by the central station.

There are other ways in which this newest of professions may be of use to the public utility, but the preceding paragraphs contain the most important. The lighting specialist, although new in the engineering field, is rapidly coming into his own, and making the world a better place to live in, by spreading the gospel of the correct, hygienic, artistic and efficient use of artificial light.



## Electrically Operated Excavators on Calumet-Sag Channel of Chicago Drainage Canal

Practically all construction operations on the Palos Park section of the Calumet-Sag Channel of the Chicago Drainage Canal are being accomplished by the use of electricity. This new channel is being excavated to connect the Calumet River with the main channel of the Drainage Canal, thus draining off sewage from the lower end of Lake Michigan. The Green & Sons Company is the contractor for Section No. 5 of the new channel, which is near Palos Park, a suburban town a few miles west of the southern end of Chicago. This section is about 8000 ft. long, and the channel is 150 ft. wide across the top and 50 ft. wide at the bottom, the excavation being about 37 ft. deep. Nearly 1,000,000 cu. yd. of earth is to be removed from this section.

Two electrically operated Lidgerwood-Crawford drag-line excavators are used on the work. Fig. 1 shows one of them. The buckets used are each capable of lifting 2.5 cu. yd. The excavator is carried on a turntable mounted on trucks which run on two sets of parallel tracks. These tracks are placed on both sides of the channel, so that both of them can be worked at the same time from opposite sides. The tracks are built on platforms and laid in sections, which are bolted together.

The method of propelling the machines is rather novel. When it is desired to move the excavator along the track, the boom is pointed in the direction of travel and the

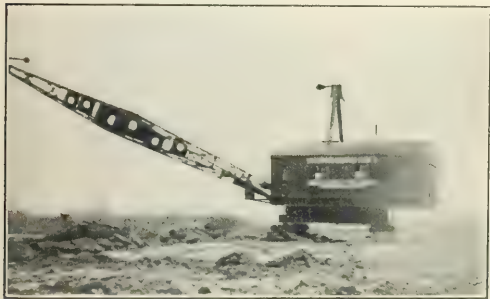


FIG. 1—ELECTRICALLY OPERATED DRAG-LINE EXCAVATOR

scoop let down until it bites into the earth. The drag-line is then drawn in, pulling the entire mechanism in the direction desired.

All of the maneuvers of the scoop are accomplished through the boom hoist-line and drag-line. The hoist and drag lines are wound on drums, which are rotated through gearing and friction clutches by two wound-rotor induction motors, which operate continuously. These motors are both 112-hp machines, and run at 720 r.p.m. at no load and 600 r.p.m. at full load.

Compressed air is used to operate the friction clutches and band brakes on the drums. It is provided by a pump driven by a 5-hp induction motor of the squirrel-cage type. A 52-hp wound-rotor induction motor operates the turntable. All of these motors are controlled from a single switchboard and are of the 440-volt, three-phase, 60-cycle type built by the General Electric Company.

Electricity is supplied by the Public Service Company of Northern Illinois. A three-phase, 33,000-volt transmission line, consisting of three No. 6 copper conductors supported on single cross-arms, connects the Hodgkins substation with the Blue Island generating stations. Cedar poles 35 ft. long are used and spaced 120 ft. apart, with a 0.375-in. stranded, galvanized-iron ground wire running along the top of the poles about 4 ft. above the center line of the cross-arms.

A branch line taps the 33,000-volt line about half way between the Hodgkins substation and the Blue Island station.

Disconnecting switches and 10-amp S. & C. fuses are used. The branch line runs to a temporary substation located on McLaughrey Road in the vicinity of Palos Park. The building is a frame structure covered with corrugated sheet iron. The branch line consists of three No. 6 copper-clad conductors carried on 30-ft. cedar poles and spaced 140 ft.

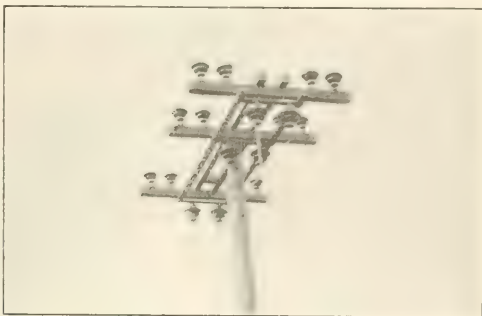


FIG. 2—HIGH-POTENTIAL FUSES AND DISCONNECTING SWITCHES

apart. Possible interruption of service is lessened by the fact that the branch line is fed from two directions.

Located in the McLaughrey Road substation are three delta-connected 100-kw, 33,000-2300-volt step-down Westinghouse transformers. The 2300-volt line is carried from the substation along both sides of the proposed drainage canal on 30-ft. poles spaced 140 ft. apart and just outside the right-of-way so as to clear the spoil banks.

In order to avoid tapping the 2300-volt lines which run along the sides of the channel in a different place every time the excavator is moved, a transformer truck, shown in Fig. 3, is used. This truck carries three 50-kw, 2200-440-volt transformers. The high-tension taps from these transformers are secured to a cross-arm on a 20-ft. mast carried on the truck. From this cross-arm short lines connect with the distribution line running parallel to the channel. A steel-armored cable, containing three No. 6 stranded conductors, connects the 440-volt taps of the transformers with slip-rings on the lower side of the turntable. These slip-rings are connected, through conduit, with the switchboard on the excavator. The cable permits the machine to be moved about 800 ft. without moving the transformers.

During the cold weather which has prevailed in Chicago



FIG. 3—TRANSFORMER TRUCK

this winter the contractors on this section of the canal have had none of the troubles that usually attend the use of a steam-operated excavator at this season of the year. Work has been carried on during twenty hours out of the twenty-four, and, with both excavators working, about 4200 cu. yd. of earth have been removed each day.

# Illumination and Wiring

## Influence of Colored Surroundings on the Color of the Useful Light

Much attention has heretofore been given to the color value of illuminants, although, after all, the color value of the useful light is perhaps of greater interest to the user.

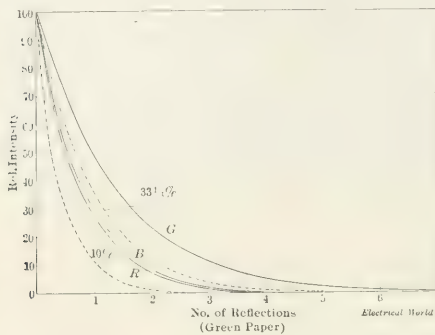


FIG. 1—PERCENTAGE OF ORIGINAL LIGHT REMAINING AFTER VARIOUS REFLECTIONS

It has been suspected that, especially in indirect lighting, the colored walls and ceiling, even though nearly white, would effect appreciable color changes in the incident light. In the course of the investigation reported by Mr. M. Luckiesh, physicist for the National Quality Division of the General Electric Company, Cleveland, Ohio, for the meeting of the Chicago Section, Illuminating Engineering Society, at Milwaukee, Wis., Feb. 22, theoretical calculations and colorimeter measurements were made to determine the magnitude of the influence of colored surroundings on the color of the useful light. For example, it was shown that only a moderate yellow paper is required to change the color of tungsten light to that of a carbon-filament lamp.

Based on theoretical calculations involving the summation of various series representing the total reflected and re-reflected light falling on the walls of a diffusing sphere,

TABLE I—COLORIMETER MEASUREMENTS IN A MINIATURE ROOM UNDER VARIOUS CONDITIONS

No.	Condition	R	G	B
1	Tungsten lamp	33.3	33.3	33.3
2	Carbon lamp, 3.1 watts per candle	38.9	34.7	26.6
3	Carbon lamp, 4 watts per candle	43.0	35.7	23.3
4	Yellow walls and ceiling, indirect	53.1	37.0	9.9
5	Yellow walls and ceiling, direct	47.6	35.7	16.7
6	Yellow walls and white ceiling, indirect	43.2	35.8	21.3
7	Yellow walls and white ceiling, direct	42.1	35.3	27.6
8	Yellow paper	43.6	38.1	18.0
9	Green paper	31.5	39.8	25.7
10	Green ceiling and green walls, indirect	35.9	43.6	17.5
11	Green ceiling and green walls, direct	36.3	47.8	25.9
12	Green walls and yellow ceiling, indirect	48.2	42.6	9.2
13	Green walls and yellow ceiling, direct	39.8	59.6	20.6
14	Green walls and white ceiling, indirect	36.6	34.1	29.5
15	Green walls and white ceiling, direct	35.2	34.6	36.2

the author obtained figures showing the actual luminosity values of the red, green and blue components of the light after undergoing several reflections. These results are represented in Fig. 1 accompanying, where the dotted lines show the rapid decrease in the light values for a paper of 10 per cent reflective coefficient, compared with one of 33.3 per cent coefficient. In Fig. 2 are plotted the relative amounts of the red, green and blue components in the light

after it has suffered various reflections. The sum of the ordinates at any particular reflection equals 100 per cent. Here the rapid approach toward a pure green is shown after the light has undergone several reflections.

### EXPERIMENTS IN MINIATURE ROOM

After purely theoretical computations it becomes of interest to make observations with an Ives colorimeter and in a room papered with various colored wall-papers. With

TABLE II—RELATIVE BRIGHTNESS OF VARIOUS PAPERS ILLUMINATED FROM DIFFERENT SOURCES

Illuminant	COLOR OF PAPER				
	White	Red	Yellow	Green	Blue
Tungsten (Ruby) lamp, per cent	100	84	96	23	9
Mercury - vapor lamp, per cent	100	11	95	33	14
Tungsten lamp, per cent	100	36	91	26	11
Carbon, 4 watts per candle lamp, per cent	100	41	94	27	11

actual wall-papers there is more or less specular reflection. The light specularly reflected does not necessarily undergo the same change in its color as in the case of diffuse reflection. If the paper is placed at such an angle as regularly to reflect the light from the illuminant into the colorimeter, obviously the true color of the paper will not be obtained, the readings instead more nearly representing the color of the illuminant.

It is impracticable to use an actual room in these experiments owing to the great amount of light required for the colorimeter readings and also the large surfaces which must be re-papered. A cubical box, 4 ft. on a side, was therefore arranged with a single fixture in the center of the ceiling, the light source being a 500-watt tungsten lamp used both directly and indirectly. With the direct system no reflector was used, of course permitting considerably more than the usual percentage of light flux to reach the walls and ceiling. Green, yellow and white papers were used. The green and yellow papers were selected from regular wall-paper

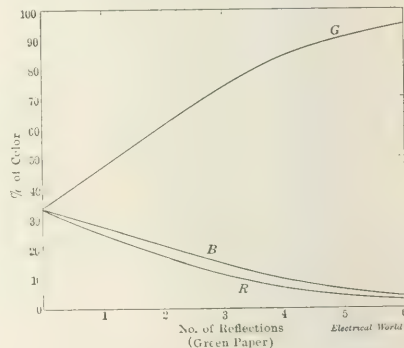


FIG. 2—PERCENTAGE OF THREE COMPONENTS AFTER REFLECTION FROM GREEN PAPER

stock and were quite unsaturated colors. The white used was blotting paper. All colorimeter readings were made with the photometric field of constant brightness. From Table I, it will be noted that the readings for the tungsten are shown as being equal for the red, green and blue. This of course is legitimate, for the readings are merely

relative. It is also more convenient. The readings are not reduced to sensation values for the same reason, and further because only the magnitude of the change in color due to reflection from colored surroundings is desired. The results are also plotted in trilinear co-ordinates in Fig. 3. It is interesting to note that 4, 5, 6, 7 show a gradual change from yellow toward white, as would be expected. These results are consistent with the theoretical computations. The color values of the carbon lamps are given relatively to the tungsten lamp, in order to illustrate the change in color of the tungsten light due to colored surroundings. The color values of the yellow and green papers show the color of the tungsten light after being once reflected.

#### INSTRUMENT FOR OBSERVING COLOR CHANGES

An instrument for observing the change in color of light due to colored surroundings is easily made. A box 16 in. long and 4 in. square, coated white inside, contains a lamp of the same type and voltage as used in the room in question. This lamp illuminates a piece of opal glass. Variation in the brightness of the glass is obtained by means of a diaphragm. In an adjacent compartment is a mirror inclined at 45 deg. to the vertical. Above this is a ground opal glass which receives the light just as it is received on the working plane. By means of the mirror this glass is seen adjacent to the glass illuminated by the electric lamp. When a brightness match is made the change in the color of the illuminant is observable. Such a box was used in the present experiments, changes in the color of the illuminant due to colored surroundings being noted even in extreme cases of direct lighting.

The coefficient of reflection of a surface is not the same for all illuminants unless that surface is white. With the ever-increasing diversity of light sources and refinement of illuminating engineering procedure it may soon become desirable when giving reflection

### Comparison of Arc and Incandescent Lighting in a Shop Building

The accompanying illustrations and curves show the arrangement and distribution secured by lighting a shop building with inclosed arc lamps and with tungsten units.

#### DATA ON LIGHTING OF A SHOP BUILDING.

	24 Arc Lamps	14 Tungsten Lamps
Total number of lamps	24	14
Height of lamps above floor	12	12
Height of test plates	12	12
Lamps per bay	12	7
Watts per lamp	750	100
Rated specific consumption, watts per candle		1.12
Area of bay, 12 ft. by 48 ft., sq. ft.	576	576
Watts per sq. ft.	4.17	1.73
Average intensity, ft.-candles	1.15	2.2
Effective lumens, per watt	1.18	1.18
Annual operating cost per lamp (4000 hours)	\$ 8.00	\$ 1.40
Annual operating cost of installation	\$ 2.00	\$ 1.00
Annual cost for equal illumination	\$ 10.00	\$ 2.40

the wattage totaling the same in each case. Mr. Ward Harrison, of the National Quality Lamp Division, General

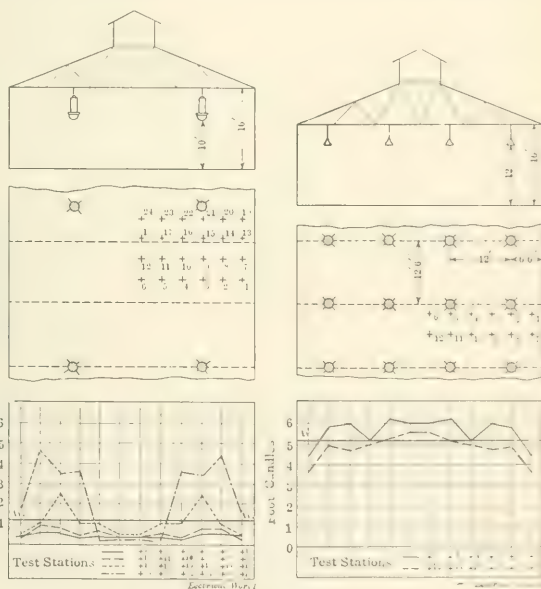


FIG. 3—RESULTS OBTAINED IN A SMALL ROOM

coefficients to include also in the statement the light source for which the coefficient was determined. To illustrate this point some relative reflection coefficients of various colored papers of high saturation are given in Table II. These were determined only relatively, by measuring the relative brightnesses in a fixed direction while the specimen was illuminated successively by various illuminants at hand. The brightness measurements were made by means of a flicker photometer, the comparison standard being a white matte surface (magnesia) illuminated by a tungsten lamp. The papers were all viewed at the same angle and likewise illuminated from the same direction. Specular reflection was carefully avoided. The results for the carbon and tungsten lamps are the averages of a great many determinations.

#### COMPARISON OF ARC AND TUNGSTEN LIGHTING

Electric Company, Cleveland, Ohio, submitted these figures in a paper on the lighting of mill structures before the Association of Iron and Steel Electrical Engineers at its Milwaukee meeting. In addition to the arc lamps, the original installation was supplemented by about fifty indirect drop-lamps over the individual machines. These were found unnecessary when the tungsten units were installed. It should also be noted, as pointed out by Mr. Harrison, that in addition to producing a much higher average intensity of light, the installation using the tungsten units is far more uniform. The intensity from the arc installation, on the other hand, varied between one and a half foot-candles at points which required only a foot-candle in the accompanying table of data the carbon drop lamps are omitted.



## Effect of Sleet Storm on Distributing Lines at Rochester, N. Y.

The accompanying illustrations show in rather marked degree the effect of a sleet storm which swept over Rochester, N. Y., early last month. There was nothing unusual about the storm so far as record-breaking performances are concerned; but a combination of snow and wind was sufficient to play such havoc with the overhead lines of the



FIG. 1—BROKEN POLE AT ROAD CROSSING

lighting, telegraph and telephone companies as has not been known in a long time in the Flower City. Rain, which had been falling in the afternoon of Jan. 3, changed to heavy, wet snow, which clung to the wires and poles and quickly froze with falling temperature into a solid mass. As the evening approached, the wind began to increase in velocity, reaching at length a maximum of 36 miles an hour. Added to this, limbs of trees weighted down with an accumulation of snow and ice began to snap off and fall across the already heavily loaded wires, and here and there entire trees were blown against the poles and lines. Fig. 1 shows how the branches of trees on Murray Street bore down on the pole in front of them. The wires on the lower arms were caught, demonstrating the desirability of getting poles and wires off streets where shade trees are encountered. Many poles throughout the city were found in like condition.



FIG. 2—WIRES HANGING ACROSS RAILROAD TRACKS, CAUSING DELAY TO TRAINS

The Niagara, Lockport & Ontario Power Company shut down its transmission lines very early during the storm so that every available machine in the stations of the Rochester Railway & Light Company had to be started in order not only to maintain good local service but also to afford some relief to the Syracuse and the Buffalo, Lockport & Rochester railways, which were suffering from the Niagara shut-down.

No attempt was made during the night of the storm to make repairs, the linemen devoting their efforts to clearing the lines and eliminating dangers. Whenever indications in the stations showed a circuit grounded or crossed that circuit was shut down entirely. In the early part of the evening a telephone wire dropped across an arc circuit with fatal results to a pedestrian, and the Mayor of the city gave permission to shut down every arc circuit having aerial lines.

Fig. 2 shows a pole which fell over the tracks of the Buffalo, Rochester & Pittsburgh crossing at Hague Street, delaying traffic about one hour until propped up as shown. The two double cross-arms on top of the pole carry lines of the Rochester Railway & Light Company, and it will be noted that every wire is intact. One of five poles near the canal on South Avenue which collapsed during the storm is shown in Fig. 3. This pole was double-guyed, and the point of breakage occurred between the points of guy attachment, giving mute evidence of the tremendous crushing strain imposed by the ice and snow load. This canal pole line carries two three-phase circuits and twelve arc



FIGS. 3 AND 4—POLES BROKEN AND STRIPPED OF WIRES NEAR CANAL BRIDGE

circuits. A force of linemen had five new 60-ft. poles in place and all circuits cleared the day after the storm. Fig. 4 shows a pole stripped of every wire except the guy wires.

It is estimated that 40 per cent of the damage to the lighting company's circuits was due to wires of other companies falling across and short-circuiting the high-tension lines; 40 per cent was due to falling trees or branches bearing down on poles and wires, and 20 per cent was due to direct failure of poles and wires under stresses imposed by wind and snow. The N. E. L. A. specifications call for construction to withstand an ice load on the conductors of 0.5 in. with wind pressure of 8 lb. per sq. ft. on the projected area of the wires so loaded. Wires were found coated with 1.5 in. of ice, and during short periods the wind pressure imposed a strain much greater than that specified.

As a result of the storm the company proposes to push its rear-lot-line method of distribution with high-potential wires, transformers, etc., underground and the low-potential and service wires on short poles on private property as free from trees as possible and with the telephone wires strung below the light wires.

# Letter to the Editors

## Electric Fuse Testing

To the Editors of the *Electrical World*:

SIRS:—The article on "Electric Fuse Testing" by Dr. A. A. Somerville in your issue dated Jan. 18, 1913, conveys a very incorrect impression to those of your readers who have had no opportunity of investigating this subject carefully and, further, contains several contradictions and erroneous conclusions.

The author claims that his investigations have disclosed several new features. After reading the paper most carefully, it does not appear that there is a single statement contained therein that has not already been touched upon by earlier investigators, and these features are in no sense new. His claim of having made an "exhaustive series of tests" is hardly borne out by the brief description given or by the conclusions he draws from his very limited number of observations. The art of fuse construction is by no means so simple. Various investigators have spent practically their entire time for many years in covering this field. Is it possible, then, for an observer to reach definite conclusions from any such set of experiments as is referred to? Many of the conclusions are so contrary to accepted laws that they disclose at once the superficial nature of the investigations.

The author states that "the capacity of fuses increases with time because repeated annealing renders the fuse metal a better conductor." This statement is not borne out by the facts, and if there is any variation whatsoever in the fuse capacity, it is a slight lowering of the current-carrying power due to the tendency to crystallization of the fuse metal under repeated heating and cooling, which renders it more readily separable. This tendency, however, is so slight that except in cases where the link is absolutely broken by the expansion of the tube it is almost indeterminable. The possibility of annealing lead tin alloys, or alloys in that classification, is certainly a most remarkable suggestion.

The author's description of the cartridge fuse would indicate a most profound lack of familiarity with that device, since the description is quite different from the almost universal standard of inclosed fuses. The article says: "This tube is fitted with metal caps to slip into terminal receptacles of the holder. The fuse wire is soldered or riveted to these metal caps." This is quite incorrect, as it is the prevailing practice of standard approved fuse manufacturers to attach the fuse wire to copper terminals which are then soldered to the cap, and in no single instance have I ever seen one in which the fuse wire was riveted to the cap.

His next conclusion that "almost any kind of wire can be used as a fuse" (and from the context this conclusion must be taken to apply to inclosed fuses) is contrary to the universally accepted laws of fuse design by the best known engineers who have given this subject a study.

The practically verbatim copy of the Underwriters' rules which the article contains can certainly not be looked upon as embodying new and important discoveries, since these rules have been in public print in their present form since 1905 and have undoubtedly been read by the great mass of the readers of your paper.

The author states that he has examined the action of zinc, tin, copper, aluminum and magnesium, and three insulating materials, manganese dioxide, slaked lime and borax, and from these very limited investigations draws the following conclusions: "Any metal may be used as a fuse strip, and if conditions are properly adjusted, the fuse will blow at a fairly definite overload." These conclusions are quite incorrect according to the general accepted practice. The fact is that no metal of high melting point such as copper can be used in inclosed fuses, except possibly in those of very low ampere capacity, since the temperature

rise will go far beyond that permitted by the Underwriters or permissible in inclosed-fuse design.

The author states that "the controlling features are relative values of length, width and thickness of the strip, together with the amount and kind of insulating powder surrounding it." In this conclusion he has entirely overlooked what is unquestionably one of the most important features of all fuse design particularly applicable to fuses of large capacity, which has been so carefully investigated and so repeatedly proved that it has now become a recognized law of fuse design by all engineers, and that is the volume and distribution of the metal and extension of its surface within the filling.

Contrary to the author's conclusions that all metals give equally clear breaks, there is a marked difference in the character of breaks of permissible fuse metals. Some alloys can be produced which at temperatures below the melting point break owing to crystallization. Other metals or alloys are wholly unsuitable for fuse use although of low melting point, owing to the fact that they will remain in a molten condition within the filling without rupturing the circuit unless special precautions are taken to guard against such a contingency.

A further conclusion in regard to what is termed "the insulating powders," or what is commonly known as filling, is erroneous in that it conveys the idea that practically any filling can be employed provided it is a good thermal conductor. This is contrary to the accepted laws. Certain materials which have a very high thermal conductivity are known to be wholly unsuitable for filling owing to the fact that their physical form or chemical composition unsuits them for this purpose.

The conclusion reached regarding the load that a fuse will carry apparently entirely ignores the subject of the area of the fuse and the radiation factor which has so important a bearing on this subject.

The author's final conclusions "that fuses at their best are very unreliable, and no two fuses except by chance will operate in the same way," is certainly quite contrary to the conclusions he has already reached in the earlier portion of his article, viz., "that fuses will blow at a fairly definite overload." The deviation in blowing time the author states "will usually be 25 per cent of the average." While not admitting this to be the fact, since I know it is perfectly possible to construct fuses with a degree of accuracy which is considerably greater than the Underwriters require, the important consideration from the user's standpoint is what possible difference it could make if a fuse did vary two or three seconds in its blowing time at, say, 100 per cent overload. The author has apparently overlooked the fact that the Underwriters have very carefully specified the blowing time at specific overloads of 50 per cent. In the 0-to-30-amp class one minute is the maximum time allowable. Suppose a fuse does blow with fifteen seconds variation in time as compared with another, and still within the one-minute limit, it is difficult to see how that in any way affects its value as a protective device, as the variation is far too small.

It is the practice of the Underwriters' Laboratories to test frequently the product of fuses made by the manufacturers on their approved list. At frequent intervals they go out into the open market and purchase fuses from dealers, and these frequent tests check in a most effective way the product of all of the factories. For this reason the absolutely unreliable devices Dr. Somerville would condemn are constructed on accurate and definitely agreed rules. As in every other class of apparatus, failures occur, but the total number is such a positively small percentage of the total number of fuses produced, and is so small, that bringing the standard of fuse construction into the class of high-quality material.

L. W. DOWNES,

Manager D & W Fuse Company

Providence, R. I.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Electro-Mechanical Waterwheel Governor

The accompanying photograph and sketch show an original electro-mechanical waterwheel governor which is in successful operation, giving very close speed regulation, at the hydroelectric plant of the St. Croix Power Company, Somerset, Wis. This station supplies energy to the St. Paul (Minn.) Gas Light Company's electrical system.

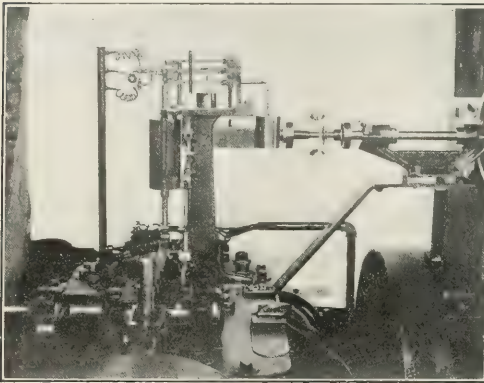


FIG. 1—ELECTRIC GOVERNOR, ST. CROIX POWER COMPANY PLANT, SOMERSET, WIS.

The governor was devised and built by Mr. John Pearson, superintendent at Somerset, and is the subject of patents recently granted him.

In this governor centrifugal fly-balls actuate electrical contacts which, through a clutch, control a differential gearing device operating the gate motion. The fly-balls as shown are very light, since they are required to do no work except operate the floating contacts through the crank-arm. To reduce the current strength required here and to eliminate arcing, the fly-ball contacts simply control relay contactors which are also energized from the machine exciter circuit. The current carried by these secondary contactors approximates 4 amp at 110 volts for each of the clutch-actuating magnets, and to reduce such arcing as might occur condensers are bridged across the latter gaps. Depending on which operating solenoid is energized, the corresponding wheel and worm are engaged by the armature, thus deriving mechanical power from the main turbine shaft to work the gate shaft, and opening or closing the gate as required.

The sketch makes clear the mechanical arrangement. The main generator shaft, running at 300 r.p.m., is geared to the worm shaft through an intermediate pinion. The worm shaft serves as the spindle for free-running sleeves carrying right-hand and left-hand worm gears and leather-covered friction disks. Through these friction disks either worm can be driven by the shaft, depending on which direction the armature lever applies pressure. Each worm drives its corresponding differential gear (with both of which the gate-actuating shaft is meshed), so that the gate shaft can be driven in either direction as determined by the movement of the armature lever and the engagement of the friction clutches. Provision is also made, with the

aid of springs, for effecting the centering of the armature arm. This centering arrangement keeps the armature in position when not operated upon by the magnet coils. Outside of the centering mechanism are friction brakes which interrupt the friction drives when disengaged by the armature movement.

It was to insure the noiseless operation of the governor that worm gears were used, while to render the apparatus sensitive to rapid starting and stopping friction drives were employed. The epicyclic or differential gears at the reverse motion were selected in order to secure positive action, free from pawls, ratchets, springs, etc.

To start the waterwheel controlled by this governor, the gate need be opened by hand only enough to cause the waterwheel to turn; this is accomplished through a hand-shaft and gear, not shown. After the machine is moving, the remaining starting governing action can be secured by power through pushing on the friction disks with the aid of a special handle. Excellent lubrication of all parts is secured by inclosing the worm gears and other fast-running pinions in tight housings filled with oil.

Inserted in the primary control circuits will be noted limit contacts which are actuated by the gate movement. One contact cuts out the opening-magnet circuit as soon as the gate has reached its full aperture. The other prevents further operation of the closing magnet when the generator is running without load at full speed. This stop is essential; for in case of sudden interruption to the load, caused by operation of circuit-breakers, fuses or other accident, the governor will hold the machine down to normal speed until the operator can reach it. Again, in case several wheels are in service pulling synchronous alternators paralleled, the gate will be promptly closed so that no machine will be operated as a motor.

The compensatory or anti-racing device is also of special interest. The feature of this is an ingenious dash-pot

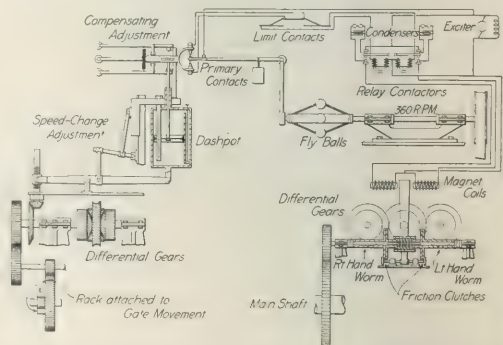


FIG. 2—DIAGRAMMATIC ARRANGEMENT OF GOVERNOR PARTS

mechanism with a slotted piston and valve partition which by-passes oil when the piston is removed from its center position. A system of springs, rollers, arms, etc., acts to return the dash-pot to its central position when diverted from normal. As this compensating dash-pot is mounted in a vertical position, no stuffing box is needed for the piston. The compensating mechanism thus operates to



interrupt the fly-ball control contact as soon as the required speed change has been accomplished, at once opening the actuating contact and preventing over-travel of the gate motion. But if a very large load change has taken place suddenly, the piston, in its effort to stop the gate movement, will pass considerably above the partition in the pipe valve, thus allowing the oil to by-pass and reducing the action of the piston. In other words, the anti-racing device opposes the action of the fly-balls, but as the speed varies more and more this opposition is less and less.

In the system of levers connecting the dash-pot with the gate motion is a speed-changing or equalizing device, by means of which through lengthening or shortening the rod by the double thumbscrew, the load on the wheel may be increased or decreased at will when running in parallel with other machines.

### Home-Made Commutator Truing Rig

In a great many stations the usual practice in turning down commutators is to remove the armature entirely from the machine and place it in a lathe, if one be available, or else send it to some nearby machine shop. In either case the machine is useless until the armature is reset, and ignoring entirely the annoyance of taking the machine apart and the bother of replacing the armature in its exact position again, the time lost plus the actual cost of turning down the commutator every once in a while is no mean item of expense. In the station of the Renovo Edison Light, Heat & Power Company at Renovo, Pa., recourse is had to home-made rigs which serve the purpose excellently and have moreover the added advantage that the work of turning down the commutator can be done without removing the armature from the machine at all. Nor is the rig intricate or expensive; it merely represents the ideas of a practical man desirous of avoiding the necessity of dismantling a machine every time a commutator has to be turned down. For this

rest are shown applied to the armature frame and ready for use, except that the rest is not secured to the terminal of the commutator as in operation; otherwise a full view of the device could not be obtained. Just enough brush-holders need be removed to allow room for the brace and rest.

The same lathe rest applied to a different type of machine in the station at Renovo is shown in Fig. 2. Here the rest



FIG. 2—LATHE REST BLOCKED UP FOR OPERATION

iron tees were taken from the scrap heap and bolted together with a hard-wood block between them to get the proper height. A brace of wood extending from the top flange of the tee to the opposite side of the base frame of the machine is used to stiffen the tees or tool post. Holes were drilled in the base frame of the machine and the tees bolted to it. This rig was got up in an emergency eight years ago, and it worked so well that the wooden brace is now replaced by an iron brace and the emergency truing device made a permanent affair.

The time required to set up the lathe rest, turn off the commutator and take down the tools varies from two to four hours, depending on the size and condition of the commutator. The tool may be used right-handed or left-handed, and the entire cost of the lathe rest, tools, brace and post was about \$40. The cost of removing one 110-hp motor armature and putting it back ready for use would be at least \$30, besides the inconvenience and risk of damaging the armature. This cost means the dismantling of the machine without the aid of a crane. Mr. F. M. Noecker is the general manager of the Renovo station, which, although small in size and output, has many features of interest and possesses by much larger stations.



FIG. 1—APPLICATION OF LATHE REST

purpose use is made of a lathe rest having a sufficient range to turn down any commutator up to one 22 in. wide, without readjustment or realignment.

Fig. 1 shows the lathe rest fastened to an iron brace for use in turning down the commutator of a 110-hp motor. The illustration shows how the frame of the machine can be used as a support for the rig. The brace and

### Converting a Motor from a 60-Cycle to a 133-Cycle Machine

What changes are necessary to convert a 60-cycle, 440-volt, 10-hp motor into a 133-cycle, 440-volt, 10-hp motor?

N. H.

When rearranged for sixteen poles the speed will be about 1000 r.p.m., which should be satisfactory. Make the coil throw one-half the present value, thus giving a pole surface one-half of the present area. With all coils in series per phase, star-connected, the voltage per turn will be the same as before and the core flux density about 90 per cent of the former value, which should prove fairly satisfactory.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**High Angular Speeds.**—MAURICE LE BLANC.—A long illustrated paper on the realization of very high angular speeds. In the first part of his paper the author points out the importance of high speeds of about 30,000 r.p.m. for the construction of steam turbines of low capacity with a single wheel, or of alternators driven by such turbines, or of rotary compressors. In the second part the author shows how these enormous angular speeds can be realized without causing trouble if the rotor is permitted to choose at will its axle of rotation. In the third part the author studies the devices which permit the equilibrium of the rotor to be re-established automatically when this equilibrium is being disturbed by centrifugal forces.—*Bull. de l'Assoc. Techn. Maritime*, No. 23, 1912; abstracted in *La Revue Elec.*, Jan. 17, 1913.

**Heavy Electric Engineering.**—F. NIETHAMMER.—A continuation of his long lecture before the Electrical Society of Vienna on comparisons of heavy electrical engineering in the United States and in Europe. In the present instalment the author deals with oil switches and protective devices on overhead lines and passes over to a discussion of electric lighting and heating.—*Elek. und Masch.* (Vienna), Feb. 2, 1913.

**Return-Energy Testing of Direct-Current Traction Motors.**—With reference to the recent article of W. E. French, F. M. Denton writes that the return-energy, or "pump-back," method of testing as applied to direct-current railway motors is by no means new and gives diagrams of the arrangement of the test as it is usually carried out by the General Electric Company at Schenectady, N. Y. G. W. O'Howe writes that the application of the Hopkinson test to series motors is looked upon as a standard in many works.—*London Electrician*, Jan. 31, 1913.

**Armature Construction.**—R. LIVINGSTONE.—The conclusion of his article on some mechanical points in armature construction. In the present instalment the author deals especially with the unbalanced magnetic pull on rotors.—*London Electrician*, Jan. 31, 1913.

**Transformers.**—J. REYVAL.—An illustrated article on the construction of single-phase transformers with special reference to the losses. He shows that for certain cases transformers with as small no-load losses as possible must be used while in other cases the no-load losses are of small practical importance as the design must be adapted to the conditions according to the requirements of the case.—*La Lumière Elec.*, Feb. 1, 1913.

### Lamps and Lighting

**Metallic-Filament Lamps Versus Arc Lamps.**—PAUL STAHL.—An article on the present strong competition between metallic-filament lamps and arc lamps. The metallic-filament lamp has already captured a considerable part of the field formerly held by the arc lamp, but the arc lamp maintains its strength for exterior lighting, street lighting, lighting of railroad depots, etc., though even in these fields the large metallic-filament lamp will in time become popular. For interior lighting and for show-window lighting the metallic-filament lamp has practically replaced the arc lamp and many of its advantages shown there will also count in exterior lighting.—*Elek. Anz.*, Jan. 26, 1913.

**Intrinsic Brilliance of the Glowworm.**—H. E. IVES AND C. W. JORDAN.—An abstract of an American Physical

Society paper. Even more important than the luminous efficiency of the glowworm is the intrinsic brightness of the light emitted. A species of glowworm was studied for this purpose on account of giving a steady glow from its luminous abdominal areas. The brightness of these spots was compared directly with that of a white blotting paper illuminated by a 10-cp standard incandescent lamp. By proper manipulation of the glowworms their bright areas were visible directly against the white surface, with no dividing line, making possible a very close match by moving the incandescent lamp to and fro. It was found that the luminous spots were as bright as the blotting paper under an illumination of 190 meter-candles, or considerably brighter than white surfaces are ordinarily when illuminated by artificial light (about 25 meter-candles). Taking the albedo of blotting paper as 0.76, it follows that the candle-power per square centimeter of the glowworm is 0.0046. In order, therefore, to obtain 25 meter-candles on a plane 2 m below a light source, the latter would have to be about 2 sq. m in area. The source would give 100 cp, which should be sufficient to illuminate a room having five times the area just stated. A peculiarity of most instances of chemi-luminescence is their excessively low specific brightness. On the other hand, most artificial illuminants are of such excessive brightness that the light must be spread over a greater area by the use of diffusing glass or reflecting surfaces. The intrinsic brilliancy of the glowworm lies between these extremes. It appears, therefore, that the solution not only of the problem of light efficiency but also of that of light intensity may follow from copying the process exhibited by the firefly.—*Phys. Review*, January, 1913.

### Generation, Transmission and Distribution

**Blackburn.**—An illustrated article on the electricity supply of Blackburn, England. A sketch of the history and gradual development of the station is given. There are installed fifteen generators of various types and makes, all driven by reciprocating engines. These generators deliver either direct-current or alternating-current energy directly to the mains for meeting the lighting demands. In connection with a motor-generator which raises the voltage from 440 to 500, they also supply energy for traction, a battery and booster which are connected across this motor generator preventing the lighting voltage from being unduly disturbed. To satisfy the recent considerable increase in the motor load, extensions have been provided, consisting of two 2000-kw high-pressure, impulse-type turbo-alternators which, when running at 3000 r.p.m., generate three-phase currents at a pressure of 6000 volts and a frequency of 50 cycles.—*London Electrician*, Jan. 31, 1913.

**Pump.**—The difficulties attending the pumping of liquids holding solids in suspension are mentioned, and a description is given of a new pump, designed by R. C. Parsons, which by means of a knife blade cuts up solids which are passed into it. Its applicability for drainage work is pointed out, and a description is given of some tests which it has undergone.—*London Electrician*, Jan. 31, 1913.

**Electricity in Tin Mines.**—H. THIEME.—The conclusion of his descriptive article on the hydraulic and hydroelectric plant of a tin mine in Ulu Guroh, Tekkah, India, with notes on the advantages of electricity in tin mining.—*Elek. Zeit.*, Jan. 30, 1913.

### Traction

**Single-Phase Locomotive.**—VAN CAUWENBERGHE.—An illustrated translation of his recent German paper on the 1500-hp, single-phase Jeumont locomotive used on a French line.—*London Electrician*, Jan. 31, 1913.

### Installations, Systems and Appliances

**Association of Austrian and Hungarian Central Stations.**—An account of the ninth annual convention of the Association of Austrian and Hungarian Central Stations held last year in Salzburg. The association has ninety-two ordinary members, representing 105 stations, and five extraordinary members. Lederer read a paper on the tungsten lamp, Beron one on fuses, Hartmann one on the competition which has arisen to central stations from coal mines, and Kvetensky one on the position which the Austrian post and telegraph department is taking with respect to high-tension overhead lines. A report was presented by the committee on first aid in case of electric accidents. Dr. Jelinek emphasized the importance of practical resuscitation and reported on the good results he had obtained with the pulmotor. Methods of propaganda to further the use of electricity and various problems of bookkeeping in central stations, especially depreciation, were discussed.—*Elek. Zeit.*, Jan. 13, 1913.

**Lighting Battery for Central Stations.**—An account of the discussion which followed the recent paper of F. H. Whysall in London on the use of a large lighting battery in connection with central stations. J. S. Highfield emphasized that of first importance is the greater security insured by the battery. The advantage of the battery from the point of view of taking the peak load is rather in the opposite direction to its advantage from the point of view of security, because if an accident happened at the time of peak load the battery would be partly run down, and therefore the battery can really be only partly used for both purposes. Nevertheless, he is quite satisfied about the value of large batteries. The method of control is of the greatest importance and would permit of much discussion, but for a general lighting and motor load he thinks that the best solution is the use of a hand-controlled booster for charging and discharging, and he would also like to have a short-circuiting switch, so that in the case of a very bad accident it could be rapidly closed and the booster saved from destruction. A. M. Taylor said that the practical results given by the author confirm his theoretical results as to the saving in coal. He disagreed with the opinions recently expressed that the battery is of no use because of the large extension of alternating-current plant, and he considers that the battery is really valuable in a station that combined alternating-current distribution with continuous-current supply. Considering all the saving to be effected by the battery, it would pay to introduce rotary converters capable of operating reversely, using them to take the enormous discharge from the battery and to send it to the alternating-current mains, using it as an alternating-current standby. R. T. Smith gave figures on the battery of the Great Western supply station at Port Royal for traction or lighting. The maximum load on the generating station with batteries is 2720 kw, while without the batteries it is 3870 kw. The station load with batteries is actually taken by three steam sets, whereas without them five steam sets would have been required. The daily load-factor on the steam plant with the batteries, corresponding to the figures given by the author, is 58 per cent, and without the batteries 41 per cent, showing an improvement in load-factor of 17 per cent. Of course, the percentage gain in load-factor due to a battery simply depends on the percentage of the total output passing through the battery. He would suggest that the most economical amount of the total output to go through the batteries is between 15 per cent and 20 per cent. C. P. Sparks said with regard to the position of the battery that, so far as a general supply is concerned, he is of opin-

ion that it should be placed in the substation instead of in the generating station.—*London Electrician*, Jan. 31, 1913.

**Electricity Supply.**—G. W. MEYER.—The first part of a review of the present status of electric energy supply and prospects of further developments. The author sketches the development from the pure direct-current system to the three-phase system and the combined three-phase and direct-current system, the introduction of turbo-generators into central stations, and the evolution of the very large central station.—*Elek. Anz.*, Jan. 13, 1913.

**Propaganda for Electricity.**—E. WIKANDER.—A lecture given before the Electrical Society of Vienna on new tendencies in the propaganda for electricity and on other means to encourage greater sale of electrical energy and electric apparatus.—*Elek. und Masch.* (Vienna), Feb. 2, 1913.

### Wires, Wiring and Conduits

**Aluminum Cables.**—An abstract of a report of E. d'Hoop, presented at the Christiania convention of the International Tramway and Light Railway Association. The use of aluminum cables seems to be developing and merits special attention. Eight undertakings report that they have them in use, namely, Copenhagen Municipal Tramways, Geneva Tramways Company, Lausanne Tramways, Lyons Tramways & Omnibus Company, Nuremberg Municipal Tramways, Nogentais (Paris) Company, the Paris General Omnibus Company and the Société Nationale des Chemins de Fer Vicinaux de Belgique, Brussels. The last-named company uses only aluminum cables for high-tension alternating current. On the other hand, the cable manufacturers who have replied mention numerous examples of the adoption of these cables for both high tension and low tension. The proportion admitted between the useful section of aluminum cables in comparison with copper cables of the same conductivity oscillates around 1.65. The useful section of cables used for low tension frequently exceeds 1000 sq. mm, the maximum mentioned reaching 1700 sq. mm. The Siemens-Schuckert Company gives a description of the installation of a cable with a single aluminum conductor for single-phase current at 60,000 volts on the Muldenstein-Bitterfeld section of the Prussian State Railways. The first application of these cables was at Rennes in 1901, but the extended use of them dates back three to five years only. All who have adopted these cables state that they are satisfied with them, and no practical drawbacks have been experienced. The making of the joints and connections, however, necessitates the exercise of special care, owing to the low conductivity of the oxide of aluminum, which may form on the surfaces of the pieces to be connected. The ends to be joined should be cleaned most carefully, branch sleeves of large contact surface used, and the joint made as rapidly as possible so as to limit the effects of the air. The fear has been expressed that, owing to the considerable capacity of aluminum cables, the increased effects of resonance may cause piercing of the insulation in case of a sharp break in the circuit; but so far nothing of the kind appears to have occurred with those companies which have these cables in use. The desirability of using aluminum cables, in comparison with copper, depends principally on pecuniary considerations and the relative market prices of the two metals. However, there is an advantage in using aluminum for cables of large section for continuous current. In some instances the economy thus secured exceeds 14 per cent. According to a formula worked out by the Copenhagen Tramways, the use of aluminum is more economical than that of copper in pounds per ton is lower by  $2.08 \times$  price of copper — 30. This formula evidently assumes the parity of the price of lead, iron hooping and the other materials used in the manufacture of cables. Independently of the question of price, aluminum cables have the advantage, in the case of very high tension, when it is necessary to augment the section of the conductors in order to increase the dielectric rigidity.—*London Electrician*, Jan. 31, 1913.



### Electrophysics and Magnetism

*Elementary Electric Charge.*—R. A. MILLIKAN.—An American Physical Society paper giving a summary of the results obtained in the work of the past two years in the determination of all of the factors entering into the oil-drop method for the evaluation of the elementary electric charge. The final result is that this elementary electric charge equals  $4.774 \times 10^{-10} \times 10^{-19}$  electrostatic units.—*Phys. Review*, January, 1913.

*Resistance of Carbon Contacts.*—A. L. CLARK.—The author has found that the resistance of carbon contacts varies to a remarkable extent, not only with pressure and current, but also with the time and in a very regular manner. This regular variation with time after eliminating the effect of change due to a rise of temperature seems to have escaped notice formerly. The author has investigated the time relations of changes in resistance in carbon contacts, such as are commonly used in telephone transmitters. Experiments were made on carbon in the form of grains, balls and plates, always with the same results. The experiments were made both for loose and for tight contacts, and the results are given in tables and diagrams.—*Phys. Review*, January, 1913.

*Emission of Electrons from Hot Bodies.*—H. L. COOKE AND O. W. RICHARDSON.—An abstract of an American Physical Society paper giving an account of experiments made with osmium filaments in order to establish the existence of the cooling effect which accompanies the emission of electrons from hot bodies. The experiments appear conclusively to demonstrate the existence of the effect under investigation.—*Phys. Review*, January, 1913.

*Resolving Periodic Curves.*—FRIEDRICH MEURER.—A mathematical article, illustrated by diagrams, in which the author describes a new method for resolving a periodic curve into its fundamental wave and higher harmonics, according to the Fourier series, by means of drawing parallel lines to the time axis. An analytical method or a graphical method may be employed for completing the process. Symmetric half-waves are best resolved by means of the graphical method, non-symmetric half-waves by the analytical method.—*Elek. Zeit.*, Jan. 30, 1913.

*Electric Conductivity of Glass and Quartz Crystals.*—R. AMBRON.—An account of careful measurements within a large temperature interval of the resistance of glasses of simple chemical composition as a function of the composition and as a function of the temperature. The electric resistance of quartz crystals was also measured to determine how it depends on the angle of the plane of the sample under test with respect to the crystallographic axis.—*Phys. Zeit.*, Feb. 1, 1913.

*Physical Review.*—This journal, founded in 1893, was transferred by its editors (E. L. Nichols, E. Merritt and F. Bedell) and by Cornell University, which had assumed the financial responsibility for the publication, to the American Physical Society with the beginning of this year. F. Bedell is to be the managing editor.—*Phys. Review*, January, 1913.

### Units, Measurements and Instruments

*Myriawatt.*—An editorial criticising the proposal by H. G. Scott and H. O'Neill to recognize a new unit, the myriawatt. "We fail to see any substantial ground for the introduction of the proposed new unit. The idea is that it will facilitate the expression of over-all efficiency; that the input of heat at one end of a transforming system consisting, for example, of boilers and turbo-generators will be expressed in myriawatts and the output in kilowatts, and consequently the over-all efficiency will be found very easily. But it is surely much more rational to use the kilowatt all through for such a purpose. The sole ground with a shadow of reasonableness in it for the introduction of this new unit is that the myriawatt is very nearly equal to a 'boiler-horse-power,' one of those illogical units which have no true connection with any other quantity. The 'horse-power' is bad

enough in this respect, but it has the respectability of age about it, and it may be treated with some regard on that account. The boiler-horse-power is an American unit based on 30 lb. of steam per hour raised from water at 100 deg. Fahr. to a pressure of 70 lb. per sq. in. It is entirely illogical to have more than one horse-power. . . . Thermally 1 hp is equal to 2547 b.t.u. per hour, but a boiler-horse-power is 33,479 b.t.u. per hour. Obviously there is no sort of relation between the two, though it may be supposed that under certain conditions one boiler-horse-power is capable of producing one mechanical horse-power by means of a steam engine used in conjunction with it. . . . In due time the term 'boiler-horse-power' should disappear like other irrational units. . . . We trust that the Electrotechnical Commission will see the advantages of simplicity and of adopting only those units which are useful rather than ornamental. There is nothing to prevent anybody from rating his boilers in kilowatts, tens of kilowatts or hundreds of kilowatts as he may think fit, but there is no need to complicate literature by unnecessary terms."—*London Electrician*, Jan. 31, 1913.

*Myriawatt.*—An editorial discussion of the proposal of this new standard. "We cannot refrain from pointing out that to 'standardize' the myriawatt, which is simply a recognized decimal multiple of the standard watt, is as superfluous as to standardize the number ten or ten thousand. It is not standardization at all. What the conference really did was to agree to abolish the 'boiler-horse-power,' a term which has been disused and obsolete in this country [England] for years and years. . . . We are sure that American engineers will be well rid of this clumsy unit. What we cannot understand, however, is why, in the name of common sense, they want to measure the input by a unit ten times that used for the output. Surely the kilowatt is good enough for both ends of the machine. Have our cousins lost their traditional sense of humor?"—*London Elec. Review*, Jan. 31, 1913.

*Iron in Electric Measuring Instruments.*—M. DOLIVODOBROWOLSKY.—The author emphasizes the disadvantages of delicate instruments and the great advantage which robustness of construction has for the average use. Robustness of construction requires especially robustness of the bearings, and the present tendency to make the revolving part of the instrument as light as possible does not permit this. The author thinks that it is time now to follow the opposite tendency by putting as much iron into instruments as possible. This is done in the "ferrodynamic" instruments of the Allgemeine Elektrizitäts Gesellschaft, especially in the wattmeter. They are of the dynamometer type, but contain iron. Fig. 1 shows the arrangement of the iron with respect to the fixed and movable coil of the dynamometer.

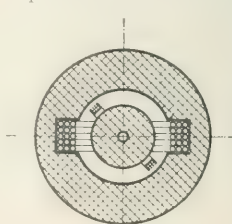
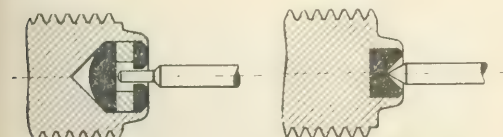


FIG. 1—SECTIONAL VIEW OF DYNAMOMETER

With the use of much iron it is possible to increase the torque very considerably so that a much heavier weight of the movable part can be employed. The only disadvantages of the iron are remanences and hysteresis. The author shows that in order to make the error due to remanence negligible it is necessary only to make the number of ampere turns for the magnetization of the iron sufficiently small in comparison to the total ampere turns.

In order to make the error due to hysteresis negligible it is necessary only to make the watts lost in the iron small in comparison with the wattless inductive volt-ampere of the coil. In the instruments of the Allgemeine Elektrizitäts Gesellschaft the total number of turns is about 200, while less than one ampere turn is needed for the magnetization of

the iron. The remanence is less than 0.5 per cent while the weight of the iron employed is about 300 grams. If this is compared with delicate electromagnetic instruments in which the remanence is also 0.5 per cent while the iron weighs only about 1 gram, it will be found that much iron does not necessarily mean much remanence. The author thinks that this kind of construction is suitable particularly



FIGS. 2 AND 3—INSTRUMENT BEARINGS

for wattmeters rather than for voltmeters or ammeters. The torque is 0.8 gram-centimeters; that is, double the usual torque. In cases where the instruments may be subjected to vibrations, etc., this greater torque permits using journal bearings (Fig. 2) instead of pivot bearings (Fig. 3). The two illustrations show these two types of bearings for two instruments otherwise identical. The journal-bearing construction is far more robust, and there are no errors due to adjustment or friction. The high torque is also of great advantage in recording instruments. Since these instruments are completely incased in iron, they are not affected at all by external electromagnetic fields.—*Elek. Zeit.*, Jan. 30, 1913.

**Measuring the Degree of Irregularity of Speed of Alternators During One Revolution.**—P. BOUCHEROT.—For parallel operation of alternators the degree of irregularity of speed during one revolution is important. It is defined as  $e = (S_{max} - S_{min}) / 2 S_{mean}$ , where  $S_{max}$  is the maximum instantaneous angular speed during one revolution,  $S_{min}$  the minimum instantaneous angular speed, and  $S_{mean}$  the mean instantaneous angular speed. To measure the degree of irregularity  $e$  the author uses a galvanometer which has a period of oscillation very nearly equal the period of the alternating current produced by the alternator under test, the period of oscillation being adjustable by very small degrees at will. A flat coil  $A$  is mounted on the center of a U-formed elastic ribbon  $B$  (Fig. 4), in a magnetic field normal to its plane. The coil  $A$  is connected to the alternator through the intermediary of a large resistance, the current being of the order of magnitude of one-tenth of an ampere. The ends of the ribbon  $B$ , which is bent into U-form, are mounted in the blocks  $CC$ , and the distance between them may be varied by means of the screw  $D$  so as to enable one to vary the period of oscillation within the

desired limits. A concave mirror  $E$ , an incandescent lamp which serves as source of light for the mirror, and an ordinary transparent scale complete the apparatus. During one revolution of the alternator, the frequency varies between the limits  $F(1+e)$  and  $F(1-e)$ . If now the natural frequency  $Fp$  of the galvanometer is adjusted so that it is equal to  $F$ , the light spot on the scale has a constant length which

### Telegraphy, Telephony and Signals

**Telegraphy and Telephony.**—DEAN CHANDLER.—A review of developments during 1912 with special reference to the effect of single-phase traction lines on telephony.—*La Lumière Elec.*, Feb. 1, 1913.

**Disturbances of Telephone Lines from Three Phase Lines.**—O. BRAUNS.—The first part of a mathematical article illustrated by diagrams on disturbances of telephone lines caused by star-connected three-phase systems when the neutral point of the generator is earthed or not earthed.—*Elek. Zeit.*, Jan. 30, 1913.

**Wave Detector.**—An illustrated description of the Helsby detector, which belongs to the general type of crystal detectors.—*Elek. Zeit.*, Jan. 20, 1913.

**Wireless Telegraphy.**—C. G. CRAWLEY.—An account of observations of wireless "atmospherics" in the Mediterranean. The chief results are as follows: The number of times strong "atmospherics" were observed during night watches was very great compared with that during day watches; that is, from 70 per cent to 90 per cent. The percentage of watches when strong atmospheric were prevalent was almost exactly the same as that for slight atmospheric.—*London Electrician*, Jan. 31, 1913.

**Wireless Receivers.**—A note on a recent British patent (86, 1912) of G. Marconi and C. S. Franklin. A series characteristic generator, with its magnetic parts, unsaturated, is connected in series with a battery and a Fleming valve, carborundum or other crystal detector. The generator at a certain speed causes the increase of current which always takes place at a certain potential difference to become much more rapid. The strength of signals in the receiver is thereby greatly augmented, owing to the increase in pressure produced by the incidence of a wave. The increase in current is limited only by the saturation current of the detector, but it does not decrease again on the removal of the extra applied potential difference and hence a second relay is inserted in the indicating circuit to break the generator and detector circuit as soon as the current in it is sufficient to work the first relay.—*London Elec. Eng'g.*, Jan. 30, 1913.

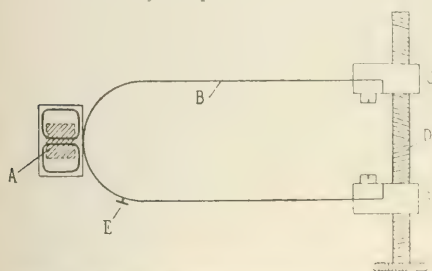


FIG. 4—DEVICE FOR MEASURING SPEED VARIATION

desired limits. A concave mirror  $E$ , an incandescent lamp which serves as source of light for the mirror, and an ordinary transparent scale complete the apparatus. During one revolution of the alternator, the frequency varies between the limits  $F(1+e)$  and  $F(1-e)$ . If now the natural frequency  $Fp$  of the galvanometer is adjusted so that it is equal to  $F$ , the light spot on the scale has a constant length which

## Book Review

**METAL STATISTICS.** Published by the American Metal and Daily Iron and Steel Report, 8, Madison Street, New York. 254 (1912).

The sixth annual edition of this little book, containing 1912 statistics of all the metals, was issued recently. In addition to giving the 1912 production, consumption, etc., it contains a vast quantity of statistical data, which should make it of great value for reference purposes. The present edition has many improvements over its predecessors as regards completeness and arrangement of the information presented.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Double-Blade Disconnecting Switch

A new type of disconnecting switch, which is claimed to make better contacts between the switch blade and the studs, has recently been placed on the market by the Electrical Engineers' Equipment Company, 10 North Desplaines

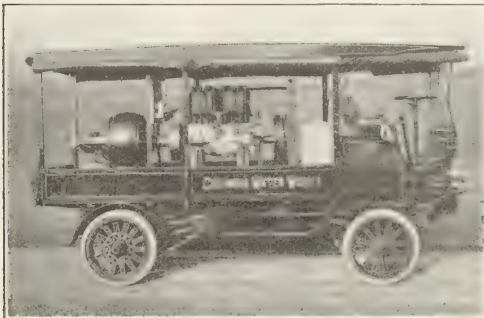


DISCONNECTING SWITCH

Street, Chicago. The usual pair of clips and single blade have been supplanted by a solid copper tongue, cast integral with the base, and a double blade, the two parts of which are separated so as to close firmly over the tongues. The blades are adjustable so as to allow for wear on both tongues and blade. The construction is clearly shown in the illustration. The line of standard switches includes sizes from 300 amp to 2000 amp and from 2000 volts to 33,000 volts for either pipe or flat steel-base mountings.

### Self-Contained Electric Pipe-Thawing Outfit

For thawing frozen water pipes at distances from the central-station supply lines where the carrying of long taps becomes cumbersome or difficult the Columbus (Ohio) city water department has developed and had built a special self-contained pipe-thawing outfit comprising a 30-kw gaso-line-engine-driven generator set which is carried on a 2.5-ton motor truck. At the close of the winter season the engine set can be demounted from the truck body by remov-



PORTABLE PIPE-THAWING OUTFIT

ing the channel bolts and the truck utilized for other purposes.

The four-cylinder four-cycle engine is rated at 50 hp at 800 r.p.m. and drives the 30-kw generator through a flexible coupling. The latter unit has a current output of 300 amp at 100 volts or 400 amp at 75 volts. A special

governor permits engine-speed control within the range from 250 to 850 r.p.m. The radiator is designed for continuous operation at full load, natural dissipation of heat being supplemented by a 24-in. fan mounted on an extension of the engine shaft. Cooling water is circulated by a pump.

The switchboard, mounted between the engine and generator, carries a voltmeter and an ammeter, field rheostat, main switch and overload circuit-breaker. All elements of control are thus brought within easy reach of the operator without moving from his position.

Suspended from hangers beneath the right-hand side of the truck body is the conductor reel, which carries two 210-ft. lengths of 300,000-circ. mil cable. Collector rings and brushes convey the current to these pivoted reel conductors. Special bronze clamps have been constructed to make proper electrical contact on any size of pipe between 0.375 in. and 2.5 in. in diameter by means of hand-nut adjustments. Other contacts are provided for making connection to hydrants, bib-cocks, etc. All parts can be assembled by hand-nuts without the use of tools.

The equipment was completed only this season and has not yet been used in service, owing to the mildness of the present winter, but according to Mr. C. P. Hoover, chemist for the local water-purification works, it is expected the outfit will be able to thaw as many as forty services a day if necessary. Mr. Jerry O'Shaughnessy is superintendent of the Columbus water-works division.

### Electrically Operated Ice-Cream Plant

The factory of the Lifter Ice Cream Company, Philadelphia, Pa., which has the remarkable output of 10,000 quarts of ice cream per day, is equipped throughout with electric drive, a total of seventeen motors with an aggregate rating of 139 hp having been installed. Most of these motors are utilized for refrigerating purposes. No ice is used except for the preservation of the ice cream in its frozen state during its transportation from the factory to its destination.

The refrigeration is produced by a 30-ton York refrigerating machine connected by means of chain drive to a 60-hp, three-bearing, adjustable-speed induction motor, as shown in the illustration.

The mixing machine, belted to a shaft driven by a 10-hp motor, which also drives the cooling apparatus, prepares the cream and forces it through a series of cooling coils into six 40-quart individual freezing machines, each driven by a 3-hp induction motor. The cylindrical freezer is surrounded by a brine jacket, the brine being kept in constant circulation by the brine-pump, which is driven by a 10-hp motor. When the cream reaches a consistency which will just permit of its being poured it is drawn out of the freezers into the ice-cream cans.

An interesting feature of this installation is the method of determining when this consistency has been reached. This is accomplished by the installation in each freezer-motor circuit of an ammeter which shows the current taken by the motor driving that particular freezer. Of course, as the cream hardens the motor performs more work, which is indicated by the ammeter needle. The ammeter scale is graduated to show the consistency of the cream.



The cans containing the frozen cream are placed in a large refrigerating room with a temperature of about 6 deg., where they are kept over night and dry-hardened. Every morning the cans are transferred from the cold room and packed in ice and salt for delivery to the consumer or dealer.

Electric motors are also used to drive can washers, sterilizers, ice crushers, pumps, elevators and fans.



ELECTRICALLY OPERATED ICE-CREAM FACTORY

The company has eighty-five employees, twenty-nine wagons and one automobile truck. Nine 2.5-ton motor trucks have been ordered and will soon be placed in service. The motors are all of the induction type, designed for operation on a two-phase, 60-cycle, 220-volt alternating-current circuit, and were furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Energy is obtained from the circuits of the Philadelphia Electric Company.

### Vertical-Handle Drum-Type Controller

The location of drum-type controllers sometimes makes operation by a straight backward and forward motion of the operating handle more convenient than the usual rotary motion in a horizontal plane. The Cutler-Hammer Manufacturing Company, Milwaukee, has, therefore, included in its standard line of apparatus a vertical-handle drum-type controller.

The lever has a centering latch, which is released by the button at the end of the handle, as in the case of the horizontal rotating-type lever. The operation of the controller is accomplished by means of a bevel-gear drive, the construction otherwise being identical with that of the standard line of controllers made by this company.

### General-Utility Dry Battery

The Western Electric Company has recently placed upon the market a new dry battery, known as the "Red Label Blue Bell battery." It is of the high initial amperage and low internal-resistance type, having an initial amperage of 25 amp on short-circuit.

A few of the most important uses to which it is said to be well adapted are for the operation of call bells, annunciators and electrical toys, for operating telephone pole changers, for railway telephones in furnishing transmitter current on train-dispatching circuits, as selective signaling battery or in operating certain types of interrupters. It is also well fitted for ignition service in general, in conjunction with industrial gas engines, as starting battery for automobiles and with low-speed gas engines, such as are used in motor boats and automobile trucks.

### Test of Large High-Vacuum Condenser

A condenser of the dry-tube-base design, manufactured by the Wheeler Condenser & Engineering Company, Carteret, N. J., was recently installed at the South Works of the Illinois Steel Company, South Chicago, Ill., in con-

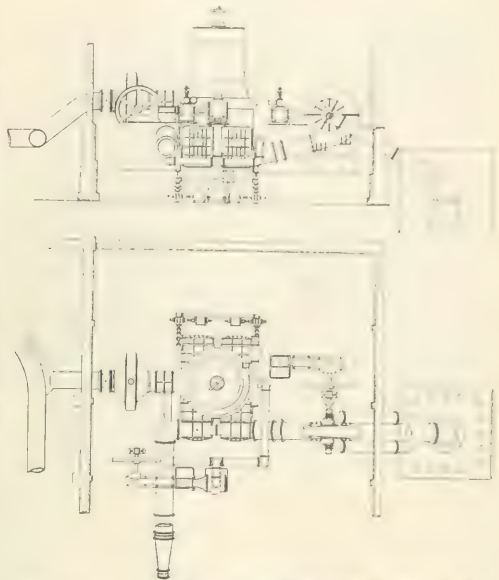


FIG. 1—ARRANGEMENT OF CONDENSER AND AUXILIARIES

nection with a 7000-kw Curtis mixed-pressure turbo-generator.

Low-pressure steam is supplied by three 2000-kw compound reciprocating engines, which discharge into a header about 100 ft. long. In addition to this supply of steam, the exhaust from blast-furnace blowing engines and auxiliaries is used up to the extent of 200,000 to 250,000 lb. per hour. In case of a deficiency in the supply of exhaust steam high-pressure steam is used to carry the load on the turbo-generators.

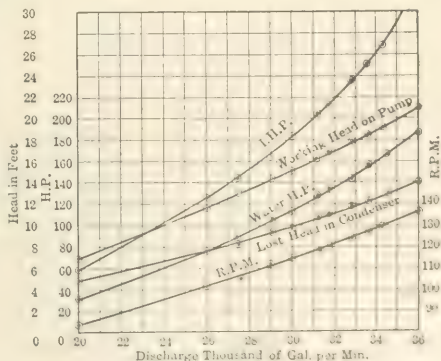


FIG. 2—RESULTS OF TEST ON CENTRIFUGAL CIRCULATING PUMP

The arrangement of condenser and auxiliaries is shown in Fig. 1. The condenser-tube surface is arranged in two sets of banks on either side of the center line with dry plates at several elevations on each side draining outward toward the shell. They divide the tube surface into a number of compartments designed to give the most efficient

and even distribution of the steam to all of the surface of the condenser.

There are about 6000 1-in. tubes, making in all about 25,000 sq. ft. of surface. The circulating water makes two passes through the tubes, entering at one end and passing

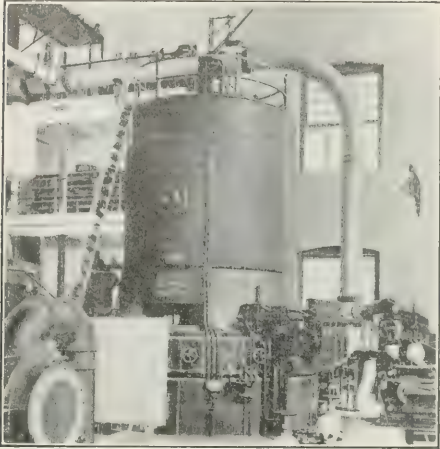


FIG. 3—LARGE HIGH-VACUUM CONDENSER

through the lower bank of tubes on both sides of the center, returning through the top bank to the discharge.

TESTS OF DRY-VACUUM PUMP

Speed in r.p.m. ....	93.00
Steam cylinder:	
Mean effective pressure, lb. ....	33.76
Indicated horse-power ....	73.10
Air cylinder:	
Mean effective pressure, lb. ....	5.37
Indicated horse-power ....	61.20
Mechanical efficiency, per cent. ....	83.89

The circulating water is drawn from Lake Michigan through an intake tunnel 150 ft. long and discharged to a

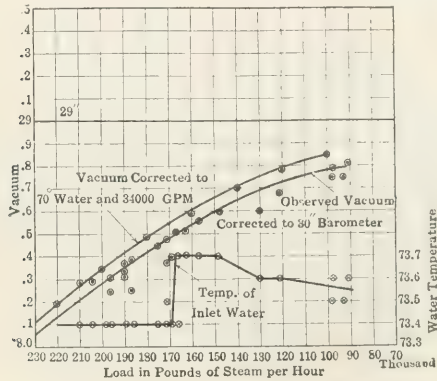


FIG. 4—RESULTS OF TEST ON CONDENSER

sewer. The circulating pump is a Wheeler 36-in. double-suction volute pump, operating at a speed of from 100 r.p.m. to 135 r.p.m., driven by a 20-in. by 24-in. Cooper Corliss engine. The performance of this pump is shown by curves in Fig. 2. The dry-air pump is a 14-in. by 36-in. by

24-in. Wheeler tandem rotative dry-vacuum pump. The efficiency of this pump is given in accompanying table, the figures being the average of twenty-four readings. It is to be noted that the mechanical efficiency of this pump is 89.89 per cent. Two 5-in. centrifugal hot-well pumps are installed, driven by 24-hp steam turbines.

The coefficients of heat transmission are calculated on the basis of 980 lb. Fahr. thermal units per pound of condensate and by the logarithmic formula for heat transmission.

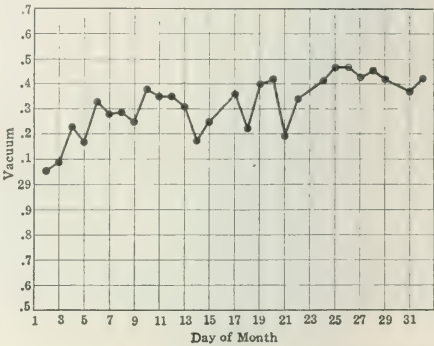
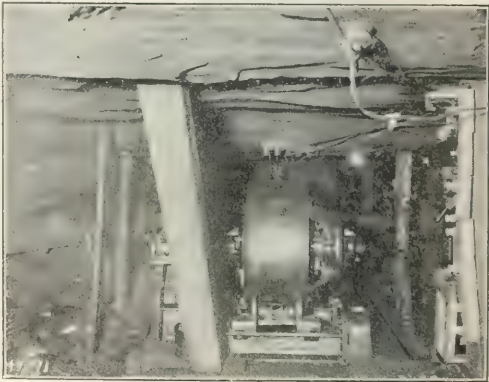


FIG. 5—ONE MONTH'S PERFORMANCE OF CONDENSER EQUIPMENT

A log of a month's performance of this condensing outfit is shown graphically in Fig. 5. This log covers performance in the month of January with inlet cooling water down to about 34 deg. Fahr. and shows a remarkable consistency in the operation of the condenser.

Self-Starting Direct-Current Motors

A new self-starting direct-current motor especially designed for driving mine pumps and fans has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The only difference in construction between this motor and the type of motor



SELF-STARTING MOTOR INSTALLED IN A MINE

usually employed for these purposes is the heavier compounding winding, which reduces the starting current. This feature eliminates the necessity of starting boxes. It is claimed that the motors have been found highly satisfactory in service.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Washington Water Power's Year.**—The report of the Washington Water Power Company, of Spokane, Wash., for the year ended Dec. 31, 1912, showed gross earnings of \$3,170,245, as compared with \$3,294,138 in 1911. Net earnings available for dividends were \$1,075,545, as compared with \$1,054,008. Dividends at the rate of 8 per cent per annum, amounting to \$1,125,120, were paid, leaving a deficit for the year of \$49,575. The surplus as of Dec. 31, 1912, was \$1,130,466. The balance sheet as of Dec. 31, 1912, showed total assets and liabilities of \$21,461,374. The electric light and power properties are placed at \$12,309,232, the street-railway property, both city and interurban, at \$4,357,410, and the real estate, buildings and water-power property at \$3,675,568. There is \$15,000,000 authorized capital stock, of which \$14,081,900 is outstanding and \$5,385,000 first-mortgage 5 per cent refunding bonds, due July 1, 1930. Up to Dec. 31 the company had spent \$2,968,608 toward construction of its Long Lake development, from which no income has been received as yet. Excluding this unproductive amount from the outstanding capital stock of \$14,081,900, the \$11,113,291 capital representing the property actually in operation earned net \$959,493, or 8.6 per cent. The receipts from the railway system in 1912 were less than in 1911, and a considerable part of the decrease is attributed to the increasing use of automobiles. The installed capacity of the company's power stations is as follows: Spokane, 12,000 hp; Post Falls, 15,000 hp; Little Falls, 27,000 hp, and the Spokane steam plant, 19,000 hp, making a total of 73,000 hp. The Long Lake development will have an initial installation of 33,000 hp and an ultimate installation of twice this figure, upon completion of which the total rating of the company's generating system will be 139,000 hp. The company also owns 25,000 undeveloped horse-power in Spokane. The work contemplated for 1913 includes continuation of construction of the Long Lake station, placing wires underground in Spokane, the erection of a warehouse in Spokane for the storage of materials, and extensions of the light and power system. The total output for 1912 was 140,216,201 kw-hr., an increase of 4.6 per cent over 1911. The connected load in motors in Spokane at the end of the year was 17,970 hp, comparing with 16,224 hp at the close of 1911, and the connected load in motors on the transmission lines for these two periods was 20,992 hp and 18,735 hp respectively. The number of accounts at the end of 1912 was 20,222, comparing with 19,105 in 1911, and the number of meters in use was 19,095, against 18,850 on Dec. 31, 1911. The company has under consideration the advisability of constructing a transmission line from Little Falls and Long Lake to Republic, Wash., about 110 miles in length, to serve the Republic and Chewelah mining districts and the towns of Chewelah, Colville and Republic and other smaller towns. The work at the Long Lake power development has proceeded most satisfactorily. The rock excavation for the main dam and power house was completed about Oct. 1, 1912, and shortly afterward the placing of concrete was begun. On Dec. 31 60,000 cu. yd. had been placed in the dam, bringing it up to an elevation 64 ft. above the lowest point of the bedrock; 163 ft. is still to be added, requiring about 215,000 cu. yd. more. The power-house foundation, containing 6800 cu. yd., has been finished and is now ready for the brick walls. The work of concreting will be continued during the winter, when the weather permits, and until the spring freshets overflow the dam; thereafter work should be resumed by July 10. The dam will probably be finished in time to fill the lake during the high water in the spring of 1914. Steps have been taken to acquire an additional right-of-way for the transmission lines from Long Lake to Spokane and a substation site adjoining the east city limits of Spokane, from which the Long Lake energy

will be distributed when the generating plant is erected. Four separate transmission circuits, suspended from steel towers, will ultimately be erected on this right-of-way.

**New Jersey's New Corporation Laws Considered Too Drastic.**—What may be regarded as the first sign of the possible withdrawal of holding corporations from New Jersey as a result of the enactment of Governor Wilson's anti-trust bills by the Legislature of that State this week, occurred on Feb. 17, when the American Railways Company of Philadelphia, a New Jersey corporation which operates many street railway, electric lighting and steam-heating properties in various parts of the country, took out a charter in Delaware, with a capital of \$25,000,000, to operate steam and electric railways wholly outside of Delaware. Since its incorporation in New Jersey in 1889, the American Railways Company has paid \$54,522 to that State in taxes. Jeremiah J. Sullivan, president of the company, was quoted as saying that the New Jersey charter would probably be surrendered and that the company would transact its business hereafter under the laws of Delaware. In explanation of the company's move he is quoted as saying: "Under the new legislation it is made illegal for a holding corporation to loan money to a corporation outside the State or to buy additional properties. The American Railways Company operates numerous street railway properties in various states, and it is necessary to advance money to the companies from time to time and to finance their needs. We are constantly buying new properties. I do not think we could do business under the proposed laws. I think there is little doubt that many corporations will take similar action, and if so it will mean a considerable loss to the State of New Jersey." Whether or not an effect of the new laws will be to hasten the passage of a national incorporation act remains to be seen. Among the subsidiaries of the American Railways Company are the Altoona & Logan Valley Electric Railway Company; the Ashland (Ky.) Electric Light, Heat & Power Company; the Bridgeton (N. J.) Electric Company; the Bridgeton & Millville Traction Company; the Chicago & Desplaines Valley Electric Railway Company, Joliet, Ill.; Chicago & Joliet Railway Company; the Consolidated Light & Railway Company, Huntington, W. Va.; Home Electric Light & Steam Heating Company, Tyrone, Pa.; Ironton (Ohio) Electric Company; Johnstown (Pa.) Passenger Railway Company; Lynchburg (Va.) Traction & Light Company; Ohio Valley Electric Company, Huntington, W. Va.; People's Railway Company, Dayton, Ohio; Roanoke (Va.) Traction & Light Company; the Scranton (Pa.) Railway Company, and the Springfield (Ohio) Railway Company.

**The Expansion of Central-Station Electric Service in Chicago.**—In his annual report to the stockholders of the Commonwealth Edison Company of Chicago, made public on Feb. 14, President Samuel Insull made official statement of some interesting facts relating to the remarkable expansion of the company's business. In relation to the additions now under way at the Fisk Street generating station, he said: "The constantly increasing demand for the company's electric service has necessitated a large addition to the Fisk Street station, and this is now under construction. Eventually the capacity of that station will be doubled. With a view of installing in the additional building a turbo-generator of the highest efficiency, the lowest operating cost and the largest capacity, your directors, upon advice of Mr. Frederick Sargent, of Chicago, the company's consulting engineer, and Mr. Charles H. Merz, of London, England, consulting engineer, have contracted with Messrs. Charles A. Parsons & Company, of Newcastle, England, for a Parsons turbine and generator having a



maximum capacity of 35,000 electrical hp, the largest yet constructed. It is hoped that this will be in operation during the coming spring. Your directors have also contracted with the General Electric Company for a turbo-generator with a capacity of 27,000 electrical hp, and this will likewise be installed in the addition to the Fisk Street station. Upon the installation of these two units the company will have a total generating capacity of 400,000 electrical hp." During the year the company put into operation its new Northwest station, at Roscoe Street and California Avenue. Here there have been installed two turbo-generators, each having a rating of 27,000 electrical horse-power. In pursuance of its established policy of making such voluntary reductions in rates as found practicable, the company, by a series of reductions, was able to bring its net primary charge to 10 cents per kw-hr. on April 1, 1912, and its net secondary charge to 5 cents per kw-hr. on Oct. 1, 1912. To meet the company's growing requirements for office space it is expected that possession will be taken of the building now occupied by the Continental and Commercial National Bank, on the corner of West Adams Street and South Clark Street, after the removal of the bank to its new building in course of construction. The operating revenue of the company for the calendar year 1912 was \$15,361,649. This compares with \$13,902,266 for the year 1911. The operating expenses in 1912, including depreciation, were \$8,855,572. Deducting also taxes and municipal compensation, which amounted to the sum of \$1,127,194 for the year, the operating income was \$5,378,882. Adding \$203,347 of other income, the total net income was \$5,582,229. From this was deducted \$1,600,000 for interest on bonds and \$544,000 as depreciation reserve under the requirements of the company's general mortgage. This left \$3,438,229 as available for dividends. The sum of \$2,516,784 was paid in dividends (at 7 per cent), leaving \$921,445 as the balance carried to surplus. While there has been a large increase in the operating revenue, the amount carried to surplus has not increased in the same proportion. This is due to the rate reductions mentioned and to the increasing cost of labor and fuel. The total amount of capital stock outstanding at the close of 1912 was \$37,764,140, and the total amount of outstanding bonds was \$32,000,000. The balance sheet shows total assets of \$80,908,052 on Dec. 31 last. The greater part of this, of course, is in plants, real estate, etc., but there is an item of \$3,965,576 in cash. The total surplus on Dec. 31, 1912, was \$5,252,146, and the depreciation reserve was \$3,977,839.

**Annual Report of the Public Service Company of Northern Illinois.**—The annual report of President Samuel Insull of the Public Service Company of Northern Illinois covers a period of fourteen months ended Dec. 31, 1912. The territory served by this company is in the northeastern part of Illinois, surrounding Chicago. The company has acquired a number of public-utility properties, and its territory is divided into three general operating systems. The field served covers approximately 4300 sq. miles. The company has electric generating stations in Waukegan, Evanston, Maywood, Blue Island, Oak Park, Wilmington and Streator. In Joliet there are two generating stations, one steam and one hydroelectric, and in Kankakee similarly there are two generating stations. The company has thirty-two substations for the distribution of electricity and four gas generating plants. During the period covered by the report the company has effected a large reduction in the underlying obligations of the companies which it has acquired, the total of such retirement of debentures, bonds and water-fund certificates amounting to \$6,729,000. The gross earnings for the fourteen months were \$4,230,021, the net earnings being \$1,861,567. Out of this were paid, or set aside, the following items: Bond interest, \$745,734; depreciation reserve, \$137,773; preferred-stock dividends (at 6 per cent), \$311,349; common-stock dividends, \$362,370. The balance carried to surplus was \$304,530. The balance sheet shows that the liabilities include about \$7,660,000 of preferred stock outstanding, about \$9,065,500 of common stock outstanding, \$8,800,000 of the Public Service Company's bonds in the hands of the public, and about \$6,250,000 of underlying bonds and depreciation reserve. Reserves and surplus on Dec. 31, 1912, amounted to \$543,056. The company's connected business (exclusive of railway power

business) amounted to the equivalent of 1,468,606 standard 16-cp lamps on Dec. 31, 1912, being an increase of 262,332 during the fourteen-month period covered by the report. The annual meeting of the company will be held on Feb. 24, at 2:30 p. m. At that time the proposed consolidation with the Northwestern Gas Light & Coke Company will be voted upon.

**Philadelphia Electric Company Declines Lease Offer.**—Attention was called in these columns on Feb. 1, 1913, to the revival of the rumor that some form of consolidation would take place between the Philadelphia Electric Company and the United Gas Improvement Company, and that the latter would shortly make a proposal along these lines. Such a proposal was made last week by the United company. In general, the proposition was to lease the Philadelphia Electric Company for a term of ninety-nine years, on terms which would yield 8 per cent upon its paid-up capital stock of \$17,500,000, provide for the refunding of the 4s and 5s and furnish funds for the extension and improvement of the property, without calling upon the stockholders of the electric company to make further payments upon the uncalled balance of subscription to its capital stock. The proposition was considered by the board of the Philadelphia Electric Company and after various conferences was declined.

**Ohio Manufacturer Thinks Outlook Is Uncertain.**—One of the best known manufacturers of power-station equipment in the State of Ohio, discussing trade conditions, said recently: "Our 1912 business was about the same in volume as that in 1911, and with a little better prices we made slightly better profits. These, however, are not satisfactory. While circumstances seem to point to more stability in prices, we regard the outlook for 1913 as dubious and uncertain. We think that the greatest drawback in our field is socialistic and labor agitation and unjust legislation against employers. Radical constitutional amendments in Ohio now threaten us with a commission government of almost unlimited power, such as the right to establish a minimum wage or the hours of labor per day, and various other enactments unjust to the employer. We can suggest no remedy, as our State is practically in the hands of socialism at the present time."

**Mackay Companies Had Good Year.**—At the annual meeting of the Mackay Companies in Boston on Feb. 15 it was voted to elect eight trustees to serve during the present year, as follows: Clarence H. Mackay, William W. Cook, George G. Ward, Edward C. Platt, Milton W. Blackmar, Henry V. Meredith, George Clapperton and Sir Edmund B. Osler. The last named three are additions to the board. In his report for the year ended Jan. 31, 1913, President Mackay says that the past year was one of constant progress with the Mackay Companies and with its land line and ocean systems. The income account shows income from investments in other companies of \$4,136,009, as compared with \$4,128,490 in 1911, and a balance, after operating expenses and preferred and common dividends, of \$35,665, as compared with \$27,379 in the year ended Jan. 31, 1912.

**Crude-Oil Engine Manufacture.**—In connection with the article on this subject in our issue of Feb. 8, our attention has been called to the extent of the pioneer work in this field carried out by the Busch-Sulzer Brothers-Diesel Engine Company of St. Louis. At the time of the expiration of the original Diesel patent last July, when oil-engine manufacture was in a degree thrown open to all, the Busch company had placed Diesel engines in operation in 117 individual plants. That number has now grown to 150, with a dozen more in various stages of installation. The aggregate horse-power of these plants is considerably more than 60,000.

**Finds Dealers Optimistic on Washing-Machine Prospects.**—Mr. R. C. Knopke, who was recently appointed sales manager for Ohio, Indiana and West Virginia by the Hurley Machine Company, manufacturers of the Thor electric home laundry machine, has returned from a trip through his territory, where he called upon the various dealers. All of them, he states, are very enthusiastic and look for a larger business in electric washing machines during the present year than ever before.

**Automatic Telephone Service in Chicago.**—Receivers for the Illinois Tunnel Company of Chicago, operating the un-

derground freight tunnels and the automatic telephone system in that city, made their final report to the United States District Court on Feb. 7. The property is now under the management of a reorganization committee. The receivers report that the number of automatic telephones in connection with the system is now in excess of 25,000. Attention is also called to the growth and popularity of the tunnel method of transporting freight by means of narrow-gauge electric railways forming a network beneath the streets in the central portion of Chicago.

**H. W. Johns-Manville Salesmen's Annual Conventions.**—Following a long-established custom, over 600 of the salesmen, together with the district managers, of the H. W. Johns-Manville Company assembled in annual conventions on various dates from Jan. 2 to Feb. 8 at Milwaukee, Boston, New York, Philadelphia, Pittsburgh, Cleveland, Chicago, St. Louis, New Orleans, San Francisco and Toronto to learn more concerning the products sold by them. Each of the 300 or so of these products was discussed in detail and its merits were pointed out. A week's time was devoted to each of these conventions, with a banquet at the close.

**To Merge Columbus Railway & Light Subsidiaries.**—An application has been made to the Ohio Public Service Commission for authority to merge all the subsidiaries of the Columbus Railway & Light Company. The merger would include the Columbus Railway & Light Company, the Columbus Light, Heat & Power Company, the Columbus Edison Company and several underlying companies.

**Will Supply Energy to Maryland Steel Company.**—The Consolidated Gas, Electric Light & Power Company has entered into a contract with the Maryland Steel Company, Sparrow's Point, Md., to supply the latter with 6500 hp of electrical energy. It is stated that the central-station company is to supply 20,000 hp eventually to this concern.

**Control of Ohio Company Changes Hands.**—The Cleveland, Painesville & Eastern Railroad Company, Willoughby, Ohio, has purchased the United Light & Power Company, which furnishes electric service in a number of towns and rural sections in Lake and Ashtabula Counties, Ohio.

## NEW YORK METAL MARKET PRICES

	Feb. 11—			Feb. 13—		
	Bid.	Asked.		Bid.	Asked.	
Copper:						
Standard, spot	14.50			14.00		
	£	s	d	£	s	d
London, standard, spot	60	15	8	60	0	0
Promt. Lake	15.75	15.87		15.00	15.12	15.12
Electrolytic	15.50	15.75		14.75		
Casting	15.50			14.75		
Copper wire, base	17.50			16.25		
	£	s	d	£	s	d
Lead	10 10	14 60		40.00	45.00	
Sheet zinc, f.o.b. smelter	8.75			8.50		
Spelter, spot	48 12			48.50		
Tin, spot	6.50			6.50		
Aluminum:						
Prompt delivery	29.50 1/2	29.60		29.50	29.60	
Future	29.50 1/2	29.60		29.50 1/2	29.60	

## OLD METALS

Heavy copper and wire.....	14.35	13.87 1/2
Brass, heavy .....	8.75	8.75
Brass, light .....	4.15	4.15
Lead, heavy .....	2.25	2.25
Zinc, scrap .....	2.25	2.25

## COPPER EXPORTS IN FEBRUARY

$[t_1, t_2]$  times  $t = 1, 2, \dots, \dots$  . . . . .

## Industrial Securities

Security	Current Price	Low	High	Per Cent	Period	Feb. 11	Feb. 19
Allis-Chalmers, t.r., 3d pd...	\$15 1/4	14 1/2	15 1/4	100			
Allis-Chalmers, com.	14 1/2	14 1/2	15 1/4	100			
Amalgamated, com.	14 1/2	14 1/2	15 1/4	100			
American Tel. & Tel., com.	14 1/2	14 1/2	15 1/4	100			
Electric Storage Battery, com.	14 1/2	14 1/2	15 1/4	100			
General Electric, com.	14 1/2	14 1/2	15 1/4	100			
Mackay, com.	14 1/2	14 1/2	15 1/4	100			
Maryland, com.	14 1/2	14 1/2	15 1/4	100			
Western Union, com.	14 1/2	14 1/2	15 1/4	100			
Western Union, 1st & 2d pd.	14 1/2	14 1/2	15 1/4	100			
Western Union, 1st & 2d pd.	14 1/2	14 1/2	15 1/4	100			

\*Last price quoted.



## Personal

**Mr. G. H. Smart** has succeeded **Mr. J. H. Drake** as superintendent of the electrical department of the Knoxville (Tenn.) Railway & Light Company.

**Mr. H. C. Gamage** has been appointed superintendent of the Ware County Light & Power Company, Waycross, Ga., succeeding **Mr. J. W. Reeve**, resigned.

**Mr. M. Metz** has resigned his position as manager for the Harlan & Avoca Telephone Company at Oakland, Ia., to accept a position with the Oakland Electric Company.

**Mr. J. W. Kirkland**, vice-president of the South African General Electric Company, has been elected president of the South African Institute of Electrical Engineers for the current year.

**Mr. George N. Rooker**, general manager of the Northern Idaho & Montana Power Company, Sandpoint, Idaho, has been appointed a member of the public improvement committee of the Sandpoint Commercial Club.

**Mr. P. C. Kaercher**, who has been purchasing agent of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, has been promoted to the power sales department as assistant to **Mr. T. L. Sturgeon**.

**Mr. J. Wright Reeve** has resigned from the position of superintendent of the Ware County Light & Power Company's properties, at Waycross, Ga., and will enter into the sales department of one of the leading electric manufacturers.

**Mr. A. A. Dion**, manager of the Ottawa Electric Company, Ottawa, Ont., delivered an interesting lecture on "Electrical Underground Conduit Construction" before the Ottawa branch of the Canadian Society of Civil Engineers on Feb. 7.

**Dr. Edward P. Hyde**, director of the research laboratory of the National Electric Lamp Association, delivered a lecture Feb. 10 before the engineering students of the University of Virginia, the subject being "Illuminating Engineering, Its Evolution and Its Goal."

**Mr. W. H. Atkins**, general manager, and **Mr. W. P. Hancock**, superintendent of generation of the Edison Electric Illuminating Company of Boston, sailed from New York on the Cunard Line steamship *Laconia* on Feb. 15 for a three months' trip to Egypt and Mediterranean ports.

**Mr. J. E. Aldred**, president of the Shawinigan Water & Power Company of Shawinigan Falls, Quebec, has presented the town of Shawinigan Falls with a technical school built at a cost of \$50,000. The structure is of brick and has a good equipment of electrical and other technical apparatus.

**Mr. William McClellan**, chief engineer of the Public Service Commission, Second District, New York, gave a talk at the Technology Union, Boston, on Feb. 12, before the Electrical Engineering Society of the Massachusetts Institute of Technology, his subject being "Public Service Corporations and the Public."

**Mr. Alexander D. Dubois**, assistant professor of electrical engineering at Purdue University, has resigned because of ill health. **Mr. Dubois** went to Purdue from Cornell University two years ago. He is a graduate of Illinois University. For nine years previous to entering Cornell he was employed by the Western Electric Company.

**Messrs. Frank E. Shepard**, of the Denver Engineering Works, and **A. B. Kennedy**, of the Stearns-Rogers Machinery & Supply Company, both of Denver, have been elected directors of the Colorado Electric Club, succeeding **Messrs. J. F. Dostal** and **J. W. Greenawalt**, who recently resigned on account of removal from Denver.

**Mr. A. A. Laughton** has been appointed local manager of the Athol (Mass.) Gas & Electric Company. **Mr. Laughton** is now employed as local manager of the Gardner (Mass.) Gas, Fuel & Light Company, which position he will continue to fill in addition to his new duties at Athol. He will make his headquarters, however, in Athol.

**Dr. Ernst J. Berg**, for the last four years head of the electrical department of the University of Illinois, has been appointed professor in charge of the electrical department of

Union College, Schenectady, N. Y. **Dr. Berg** is a native of Sweden and was educated in the Royal University of Stockholm. For many years he was connected with the General Electric Company, where he worked as assistant to **Dr. Steinmetz**.

**Mr. Charles B. Scott** has been made manager of the new Bureau of Safety operated in conjunction with the Middle West Utilities Company of Chicago. This bureau advises subsidiary companies on questions relating to safe operation, claims and indemnities. For several years **Mr. Scott** has been associated with **Mr. Martin J. Insull**, vice-president of the Middle West Utilities Company, in the operation of public utilities in Indiana and elsewhere.

**Mr. Alfred Still** has resigned his position as chief electrical engineer to the Algoma Steel Corporation of Sault Ste. Marie, Ont., to take charge of the courses in electrical design at Purdue University, Lafayette, Ind. **Mr. Still** is a member of both the American Institute and British Institution of Electrical Engineers. He has made a special study of hydroelectric developments and long-distance transmission of electrical energy, and has only lately returned from a trip to Colorado and the Pacific Coast, where he visited many of the important systems of power transmission and distribution.

**Mr. Robert M. Searle**, the well-known vice-president of the Rochester (N. Y.) Railway & Light Company, whose election as president of the Rochester Chamber of Commerce

was announced in these columns a short time ago, was born March 3, 1869, at Peekskill, N. Y. He received a common-school education in the public schools of the city of New York and in 1884 began in the lighting business as office boy with **Thomas A. Edison**. **Mr. Searle** acquired his engineering knowledge by night study, and he has had twenty-six years of experience in the lighting business in all of its varied branches—from office boy to vice-president. He was awarded the honor medal by the English Institute of Gas Engineers in 1907. At present **Mr. Searle** is actively engaged on committees in about forty-four institutions within and without the State of New York. He is vice-president and a director of the Rochester Railway & Light Company, a director of the New York State Railways, and, as previously announced, was elected to the presidency of the Rochester Chamber of Commerce in January.



ROBERT M. SEARLE

of the Rochester Chamber of Commerce in January.

## Obituary

**Gustaf de Laval**, the well-known engineer and inventor of the steam turbine bearing his name, died at his home in Stockholm, Sweden, on Feb. 7 at the age of sixty-seven. **Dr. de Laval** after devoting much time to the design of dairy machinery, turned his attention to the construction of a high-speed rotary engine in 1883. He patented his divergent-nozzle steam turbine in 1889.

**Edward L. Clark**, for many years auditor of the General Electric Company, died at his home in Schenectady, N. Y., Feb. 15. **Mr. Clark** was born in Edinburgh, Scotland, in 1849 and came to America and was employed by **Mr. Edison** as auditor of the Edison Electric Light Company in New York City. In December, 1891, he became auditor of the Edison General Electric Company, and he had full charge of the arduous work of consolidation of accounts when the General Electric Company was organized in 1892. Two years later **Mr. Clark** was made assistant to the comptroller, the late **J. P. Ord**, and soon thereafter was made general auditor of the company and continued in that capacity until his death. He is survived by a widow and two sons.



## Construction

ALABAMA CITY, ALA.—The City Council has granted the Alabama Pwr. Co., of Gadsden, a franchise to erect transmission lines in Alabama City.

BESSEMER, ALA.—The J. B. McNary Co., of Atlanta, Ga., has been engaged by the City Council to make surveys and estimates for construction of the proposed municipal electric light plant, for which bonds to the amount of \$35,000 have been authorized.

FOREMAN, ARK. An electric light franchise has been granted to W. B. and J. M. Madden.

BAY CITY, CAL.—The Pacific El. Ry. Co. has applied to the County Supervisors for a franchise to build and operate an electric railway on Main Street and Ocean Avenue in Bay City.

CHICO, CAL.—Plans are being considered by the management of Richardson Springs for the establishment of an electric light and power plant, to cost about \$10,000. The water-power of Mud Creek will be utilized to operate the proposed plant.

FRESNO, CAL.—The San Joaquin L. & Pwr. Co. will soon begin work on construction of its power plant No. 4, to be located on the east side of Crane Valley Lake, where a fall of 2000 ft. will be secured. Two tunnels will be driven to divert the water, one of which will be about a mile long. Water will be secured from Sand Creek and the South Fork. Two reservoirs will be constructed to supply Plant No. 4, one of which will be located on Sand Creek and the other on the South Fork.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Works until March 7 for furnishing miscellaneous electrical material, consisting of lead-covered cable and terminals, copper tubing and fittings, bus supports and disconnecting switches.

MONROVIA, CAL.—The city authorities are contemplating the installation of a new police and fire-alarm system.

OWENSMOUTH, CAL.—Plans are being prepared for lighting the streets of Owensmouth and the 18-mile speedway to Lankersham also. The Southern California Edison Co. is planning to erect a new substation to supply electricity for lamps in this district. Owensmouth has not a post office.

REDWOOD CITY, CAL.—Bonds to the amount of \$6,000 have been voted, the proceeds to be used for extension to street-lighting system.

SAN FRANCISCO, CAL.—The Marconi Wireless Co. has officially announced that one of the five large wireless stations which the company has been planning will be erected at Tanalas Bay and Bolinas. It is proposed to install a 1000-hp plant at each of the stations.

SAN FRANCISCO, CAL.—Property owners on Ninth Street have secured authority from the lighting committee to erect a tungsten lamp street-lighting system, using six standards to the block. Arrangements have been made for the installation of cluster lamps on Mason Street. The property owners will erect the electroliters, carrying five-lamp clusters; the city will supply electricity to maintain them.

NORWICH, CONN.—The Connecticut Co. proposes to furnish energy for the New London electric railways from the Thamesville station, using the station at Winthrop's Cove for a transforming station. If necessary to carry the New London load, additional equipment will be installed at Thamesville. The company has petitioned the Public Service Commissioners for permission to connect the Thamesville and New London stations.

WINDSOR LOCKS, CONN.—Plans have been nearly completed by the Northern Connecticut Lt. & Pwr. Co., of Windsor Locks, for the erection of the new transmission line and substation to supply the towns formerly served by the Housatonic Pwr. Co., Suffield, Agawam and Feeding Hills, and work will probably be started in the spring. Walter P. Schwabe is general manager.

WASHINGTON, D. C. Proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 1 for the following supplies: (1) 560 telephone head sets; (2) 100 ear caps for Dean hand receivers; (3) 200 retardation coils; (4) 22 porous cups; (5) 125 diaphragms; (6) 100 condensers; (7) 36 rubber gaskets for door of B. C. telephones; (8) 36 rubber gaskets for door of gun telephones; (9) 12 iron handles, complete, for B. C. telephones; C. A. T. L.; (10) 12 iron handles, complete, for gun telephones; (11) 75 universal joints for C. A. T. head sets; (12) 12 transmitters, suspended type, complete, consisting of transmitter bar, brackets for same, two h. r. bushings, C. B. transmitter, cords and weights; (13) 100 shells for Dean hand receivers without caps; (14) 200 rings for Dean hand receiver. Captain W. L. Clarke is disbursing officer.

GAINESVILLE, FLA.—Proposals will be received by the Board of Public Works, Gainesville, Fla., at the offices of H. E. Taylor, chairman, until March 17, for furnishing all material, machinery, equipment and labor for the construction of an electric-lighting system and improvements to the water-works system. The work will embrace a complete water-works and lighting station erected in the town on the railroad, approximately 20 miles of pole line, 4300 ft. of 14-in. cast-iron pipe, one 150,000-gal. tank on 75-ft. tower. Station equipment will consist of three 150-hp return-tubular boilers, one 600-hp steel or reinforced-concrete stack, one 600-hp feed-water heater and purifier, one 1,500,000-gal. high-duty Meyer gear or triple-expansion pump, one cross-compound condensing compressor, 750 cu. ft. capacity, or one motor-driven deep-well

[illegible]

ST. CLOUT, IL. The second P. system has been routed to transfer to the existing P. system at the west system here.

ST. PETERSBURG, FLA.—Plans are being prepared by the St. Petersburg Electric Co. for a new power plant with a capacity of 1,200 kw. The estimated cost of the plant is \$125,000. The proposed plant will be equipped with two 1200-kw generating units. Definite plans have not yet been decided upon.

[illegible]

GRiffin, GA—An appropriation of \$150,000 has been allocated for the City Council for extension of the electric light and waterworks systems.

MALAD, IDAHO - The Idaho Power Co. has announced the sale of the Idaho Lt. & Pwr. Co. for \$27.660. The new owner contemplates making improvements to the plant.

CERRO GORDO, ILL.—The Central Illinois Pub. Ser. Co. has submitted a proposition to the Village Board to supply electricity to operate the municipal water-works pumping station.

DECATUR, ILL.—The People's Co-operative Lt. Co., of Decatur, which recently applied for a franchise to construct an electric light and power plant here, expects to increase its capital stock from \$50,000 to \$100,000 in the near future. If granted a franchise the company will erect a plant in Decatur. Frank L. Saffern is president and treasurer.

DEER CREEK, ILL. The Peoria Gas & El. Co. is seeking a contract to light the streets of the village. If successful, it will supply electricity for lamps and motors for commercial purposes.

HIGHLAND, ILL.—The Illinois Trac. System, of Champaign, is seeking a franchise to turn electricity for lamps and motors, and a contract to light the streets at the village.

**JACKSONVILLE, FLA.** The City Council is considering an ordinance providing for an issue of \$50,000 in bonds for the rehabilitation of the municipal electric power plant.

[illegible]

OAK PARK, Ill. (U.S.A.)—Banks in America maintain the traditional street-front facade in the business district, and the Business Men's Association will not pay the cost of remodeling the corner. It is indicated that banks may finally begin meeting the New standards.

PITTSBURGH, PA.—The expenses of the 1964-65 Journal of the Pub. Ser. Co., at \$1000.00, have been approved by the editorial board. The board has also approved the election of the editorial board for the 1965-66 year.

BATTLE Grounds, N.Y.: The Battle Grounds Foundation is sponsoring the "March of the Living" to the Battle Grounds, N.Y. The energy from the "Ten Wings" & "Newborn" Journal of the "March of the Living" will disperse the love and peace of the "March of the Living" and Calmness and also to the "March of the Living" from the "March of the Living" mission line.

**BROAD RIPPLE, IND.**—The Broad Ripple has signed a contract with the Merchants' Ht. & Lt. Co., of Indianapolis, for lighting the streets at 10 c. per ft. The board canceled the contract with the Indianapolis Lt. & Ht. Co. recently.

**CENTERVILLE, IND.**—The Town Council has awarded the Terre Haute, Indianapolis & Eastern Trac. Co. a contract to furnish electricity for lighting the streets of the town and for commercial purposes.

**EVANSVILLE, IND.**—The West Side Business Men's Association is leading a movement to organize a public service company, to be capitalized at \$100,000, to erect and operate an electric light and power plant in Evansville.

**INDIANAPOLIS, IND.**—The plant of the People's Lt. & Ht. Co., of Indianapolis, is to be consolidated with that of the Merchants' Ht. & Lt. Co., of this city. Energy and heat will be supplied from the station of the Merchants' Ht. & Lt. Co., which is to be rebuilt. Tentative plans provide for a 10,000-kw generator.

**KENDALLVILLE, IND.**—Bids will be received for the construction of a new power house for the municipal electric-light plant until March 11. The cost of the building is estimated at about \$10,000. Contracts for equipment have already been placed.

**MCCORDSVILLE, IND.**—The Indiana Union Trac. Co. has entered into a contract with the town board of McCordsville Kennard, Sharpsville and Hobbs to supply electricity for lamps and motors.

**ROCHESTER, IND.**—The Rochester Lt., Ht. & Pwr. Co. has increased its capital stock from \$150,000 to \$200,000.

**AMES, IA.**—At a special election held Feb. 10 the proposition to issue bonds to establish a municipal electric-light plant was carried.

**BAYARD, IA.**—The citizens are considering the question of establishing an electric-light plant here.

**DENISON, IA.**—The Denison El. Lt. & Pwr. Co. contemplates improvements to its plant which will involve an expenditure of about \$20,000 in the next two years.

**FONTANELLE, IA.**—The City Council is considering the question of installing an electric-light plant. It is estimated that a plant can be installed at a cost of about \$7,500.

**GREENFIELD, IA.**—Preparations are being made to change the municipal electric-light plant from direct-current to alternating-current system and to establish a 24-hour service. The equipment will include one engine and two alternating-current generators and switchboard equipment complete, transformers, overhead-line materials, meters, etc. J. B. Hill, of Iowa City, is consulting engineer.

**LEON, IA.**—The city of Leon is not contemplating the construction of a municipal electric-light plant as reported in these columns some time ago. The railroad company will build a new freight depot on the site said to have been purchased by the city. The Leon El. Co. furnishes electrical service in Leon and the city does not contemplate taking over the plant.

**PERRY, IA.**—The question of submitting a proposition to raise funds for rebuilding the electric-light system at the spring election is under consideration.

**REDFIELD, IA.**—The town of Redfield, it is reported, will receive bids about March 1 for construction of combined electric-light and water works systems; also for each system separate.

**RUSSELL, IA.**—A proposition has been submitted to the town of Russell for the installation of an electric-light plant by J. D. Elder, of Albia.

**TOPEKA, KAN.**—The purchase of a new generator, to cost about \$3,000, to be installed in the municipal electric-light plant before next fall is under consideration.

**BURNSIDE, KY.**—The Kentucky Utilities Co., of Lexington, has been granted a 20-year franchise to supply electricity in Burnside. Harry Reed, of Lexington, is general manager.

**EMINENCE, KY.**—The Kentucky Utilities Co., of Lexington, has purchased several franchises recently, allowing the company to enter Eminence, Pleasureville and New Castle, Ky., as well as in the counties in which those cities are located. Work will soon begin on extensions to the company's present lines.

**HENDERSON, KY.**—The Kentucky Southwestern El. Ry., Lt. & Pwr. Co. contemplates the construction of three substations. W. A. Calhoun, of Paducah, is chief engineer.

**HOPKINSVILLE, KY.**—The Kentucky Pub. Ser. Co., of Hopkinsville, is contemplating extensions and improvements to its plant and will install one 500-kw, three-phase, 60-cycle generator directly connected to steam turbine, new switchboard, etc. All lines are to be changed from two-phase to three-phase and present generators are to be wound for three-phase and held as a reserve. J. G. White & Co., 43 Exchange Place, New York, N. Y., are engineers in charge.

**LEXINGTON, KY.**—The installation of an ornamental street-lighting system along the principal business thoroughfares is contemplated. It is proposed to erect ornamental lamp standards carrying five-lamp standards. Eugene Creed, business manager of the Lexington Utilities Co., has charge of the work.

**OWINGSVILLE, KY.**—The Kentucky Utilities Co., of Lexington, is negotiating for the purchase of the plant of the Owingsville El. Lt. Co. If acquired the plant will be remodeled.

**PADUCAH, KY.**—The Paducah Lt. & Pwr. Co. is negotiating with the City Council for furnishing energy at a cost of \$2,100 per year, for a new street-lighting system in the retail business district.

**WINFIELD, IA.**—George W. Newman, of Rochester, N. Y., has

purchased the controlling interest in the Winfield Ice & Lt. Co. It is proposed to rebuild both the ice and electric plants and install new machinery. Mr. Newman will be president and manager of the company.

**PORTLAND, MAINE.**—The Cumberland County Pwr. & Lt. Co., of Portland, contemplates the erection of a new transmission line from Bonny Eagle to North Gorham, for which the right-of-way has already been purchased. The cost of the line is estimated at about \$100,000.

**ELLERSLIE, MD.**—The Cooks Mills El. Lt. & Pwr. Co., controlled by Deal Brothers, of Cumberland, represented by J. W. S. Cochrane, attorney, has applied to the Road Commissioners of Allegany County for a franchise to erect transmission lines from the state line to Corrigansville for the purpose of supplying electricity for lamps, heat and motors in Corrigansville and Ellerslie.

**ELLERSLIE, MD.**—Application has been made to the Road Commissioners of Allegany County for a franchise to erect transmission lines along the county road for the purpose of supplying electricity by Andrew Ramsay, representing the Ramsay Corporation, which has large brick plants at Mount Savage and Ellerslie. The company proposes to erect a water and light plant, at a cost of \$250,000, to supply the two plants with water and electricity, and to furnish electricity for lamps in Ellerslie.

**BOSTON, MASS.**—The Massachusetts El. Cos. will spend \$1,500,000 for new construction and betterments to its properties during the current year. Of this amount \$1,000,000 will be for new work.

**FALL RIVER, MASS.**—The Merchants' Association has submitted a proposition to the City Council offering to pay \$2,000 per year for a period of five years toward maintaining the proposed ornamental street-lighting system in the business district.

**MARLBORO, MASS.**—The Marlboro El. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue 1300 additional shares of capital stock at \$160, the proceeds to be used in financing additions to and improvements in the company's plant.

**MONROE BRIDGE, MASS.**—The New England Pwr. Co. which is building a series of hydroelectric plants on the Deerfield River, has filed a petition with the County Commissioners asking for approval of plans for the construction of a dam on the Deerfield River about  $\frac{3}{4}$  mile below Monroe Bridge in the town of Monroe. The proposed dam is to be 253 ft. long.

**NEW BEDFORD, MASS.**—Extensive improvements and additions are contemplated by the New Bedford Gas & Edison Lt. Co. to its plant. The plans provide for new buildings and reconstruction of present buildings and installation of new machinery, including two 4000-kw turbines, orders for which have already been placed. Oliver Prescott is president.

**WEST BROOKFIELD, MASS.**—The question of lighting the streets of West Brookfield is under consideration. A proposition has been submitted by the Central Massachusetts El. Co., of Palmer, which has a franchise here. One plan provides for 56 lamps to burn until 1 o'clock every night at \$17.50 each per year, the other for lamps to burn until 12 o'clock at \$15.50 per lamp per year.

**WORCESTER, MASS.**—Plans are being prepared by the Worcester El. Lt. Co. for the installation of another 5000-kw turbine, additional boilers and machinery at the Webster Street station, and for extension of coal-storage bins and other improvements, involving an expenditure of about \$250,000. The company, it is said, is now receiving bids for the turbine, condensers, etc., and two additional boilers, which will provide for 1500 hp. Extension of cables, etc., will also be made.

**BATTLE CREEK, MICH.**—Two centrifugal pumps will be installed at the pumping station which is to be erected at a cost of \$40,000, to be driven by electric motors, one of 100 hp and the other of 200 hp.

**BELDING, MICH.**—The Spencer El. Lt. & Pwr. Co., of Belding, Mich., expects to purchase a 250-hp engine and boilers and necessary accessories for steam plant and one waterwheel governor within the next ten months. J. E. Stanton is manager.

**BUCHANAN, MICH.**—The Buchanan El. Steel Co. is preparing to install a new 5-ton electric furnace. W. N. Broderick has been appointed assistant superintendent.

**DETROIT, MICH.**—The State Railroad Commission has authorized the Eastern Michigan Edison Co., of Detroit, to sell \$865,000 in bonds, the proceeds to be used for the purpose of making extensions and improvements.

**DETROIT, MICH.**—The annual report of the Detroit Edison Co. announces that a fourth turbo-generator has been purchased for the Delray power plant, to be delivered during the coming summer. The new generator will be installed in the No. 2 power house. Announcement is also made that a new power plant is to be constructed on the east side of the city, 8 miles up the stream from the Delray plant, a site for which has already been purchased at a cost of \$50,000. Alexander Dow is vice-president and general manager.

**ELFTON, MICH.**—A proposition to install a municipal electric-light plant at a cost of \$25,000 and to issue bonds for same will be submitted to the taxpayers at the next regular corporation election, which takes place next March. Electrical service is now furnished by the Independent Lt. & Pwr. Co.

**GLADSTONE, MICH.**—Negotiations are pending for the installation of electric motors in the Soo Line elevator and warehouses to operate the machinery, to replace the steam plants. If the change is made, energy



would be furnished from the power station of the Escanaba Traction Co., on the Escanaba River. C. H. Bayliss is chief engineer of the Soo Line.

**GRAND RAPIDS, MICH.**—The City Council has approved the recommendation presented by the ways and means committee advising the purchase of a 550-kw turbo-generator set for the municipal electric-light plant, at a cost of \$30,000.

**PINCKNEY, MICH.**—The local electric-light plant, owned by Floyd Jackson, has been sold to Richard Clinton.

**ELYSIAN, MINN.**—The Consumers' Pwr. Co. contemplates extending its lines throughout the city, for which a franchise will soon be asked.

**MINNEAPOLIS, MINN.**—The Franklin Avenue Business Men's Association is considering the installation of ornamental street lamps on Franklin Avenue from Tenth Avenue south to Cedar Avenue.

**MORRIS, MINN.**—The Otter Tail Pwr. Co., of Fergus Falls, has been granted a franchise to supply electricity here. The company proposes to erect a transmission line from Dayton Hollow to Morris, via Wendell, Donnelly and Herman. The steam plant at Morris will be rebuilt and held for use in emergencies. An option has already been secured on the Morris plant. Both the Morris and Wahpeton transmission lines will be connected with the Dayton Hollow and Hoot Lake power plants.

**WARROAD, MINN.**—At an election held Feb. 7 the proposition to issue \$20,000 for electric-light plant, town hall and jail and \$8,000 for water-works was carried. The Oscar Claussen Engineering Co., of St. Paul, Minn., has charge of the work. E. M. Heimach is village clerk.

**WYOMING, MINN.**—The village of Wyoming is considering the question of installing an electric-light system.

**FRANKFORD, MO.**—The L. T. Tucker Co. has been granted a franchise to supply electricity here. An electric plant will be installed in connection with its flour mill. The company would like to receive estimates on a 40-kw or 50-kw three-phase, 2300-volt alternator.

**HANNIBAL, MO.**—The North Missouri Pwr. Co. is planning to erect 65 miles of 33,000-volt transmission line. Plans have not yet been definitely decided upon. The company is associated with the municipal Public Ser. Co., 1105 Chemical Building, St. Louis, Mo. Morrison & McCall, 1105 Chemical Building, St. Louis, engineers, have charge of the work.

**POPLAR, MONT.**—An effort is being made to organize a stock company to construct and operate an electric-light plant in Poplar. The cost of the proposed plant is estimated at \$3,000.

**LINCOLN, NEB.**—The city clerk has been instructed to advertise for a car unloader, elevator and motor for the water and light plant.

**PORTSMOUTH, N. H.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 8, for one 20-ton, four-motor electric traveling crane, delivered at the navy yard, Portsmouth, N. H. The cost of the work is estimated at \$5,000. Specifications can be obtained on application to the bureau or the commandant of the navy yard named. H. R. Stanford is chief of bureau.

**BORDENTOWN, N. J.**—The Board of Public Utility Commissioners has granted the Bordentown El. Co. permission to issue \$50,000 in additional stock, the proceeds to be used for extensions and improvements to its plant.

**HIGHTSTOWN, N. J.**—The Borough Council has made arrangements with the Electric Lt. & Pwr. Co. of Hightstown for the installation of a new tungsten street-lighting system to replace the arc lamps now in use.

**JERSEY CITY, N. J.**—Prof. A. F. Zan, Stevens Institute of Technology, Hoboken, has been engaged to make investigations of the electric-light plants in the court house and at Snake Hill and prepare estimates of cost of equipping the plants to furnish electricity for lighting the county parks, roads and institutions.

**JERSEY CITY, N. J.**—Owing to the refusal of the Public Service Electric Co. to bid upon the lighting specifications advertised by the Street and Water Board, the commissioners are considering the project of establishing a municipal electric-light plant at the City Hospital grounds, where three large dynamos are installed although only one is being used. Another generator could be installed with the present engines, which would enable the plant to furnish electricity to light a large portion of the city. It is suggested that the electric plant at the high-service station could also be utilized to light a large section of the city.

**KEYPORT, N. J.**—The Board of Public Utility Commissioners has granted the Middlesex & Monmouth El. Lt. & Pwr. Co. permission to erect new transmission lines on the turnpike between Freehold and Matawan.

**PENNS GROVE, N. J.**—The Penns Grove El. Lt. & Pwr. Co. has awarded the contract for erection of buildings and also for an ice plant, work on which will begin at once. The borough will be lighted by the new company. The officers are: Matthew Mitchell, president; Harry A. Dulbow, treasurer, and S. Rushing Leap, secretary.

**ALBANY, N. Y.**—Contracts have been awarded for erecting power stations and installing electrical machinery for operating and lighting locks along the Erie and Champlain Canals to McArthur Brothers Co. and the Lord Electric Co., of New York, N. Y., for \$1,612,356.

**BAYSHORE, N. Y.**—The United States Wave Pwr. Co. has decided to establish a large power plant at Saltair. The proposed plant will furnish electricity for Saltair and adjacent developments.

**BINGHAMTON, N. Y.**—The proposition to issue \$43,000 in bonds for the purpose of acquiring transmission conductors and installing lines in Court Street from Exchange to Carroll, and in Chenango from Court Street to the Binghamton Hotel, has been approved by the city council. An election will probably be held March 21.

**COHOES, N. Y.**—Sanderson & Porter, 52 William Street, New York, N. Y., consulting engineers, have been engaged by the Cohoes Pwr. Co. to take charge of construction of its proposed hydroelectric power plant. W. P. Parsons, of Cohoes, is superintendent.

**NEW YORK, N. Y.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 17, for an eight-story concrete and brick building on the United States government warehouse, New York, N. Y., in accordance with specifications, copies of which may be obtained from the supervising chief engineer, New York, N. Y., or at the above office. O. Wenderoth is supervising architect.

**POTSDAM, N. Y.**—The Northern Pwr. Co. of Potsdam has applied to the Public Service Commission, Second District, for permission to exercise its franchises to erect transmission lines and supply electricity in the village and town of Antwerp, in the town of Rome.

**BURLINGTON, N. C.**—The City Council has decided to call an election to vote on the proposition to sell the municipal electric-light plant submitted by E. S. Parker, Jr., representing the company which proposes to purchase the plant. The company offers to purchase the plant at \$50,000, the city to retain all real estate and machinery now owned by it, the city to pay \$50 per year for each acre land.

**DURHAM, N. C.**—Z. V. Taylor, representing the Southern Pwr. Co., of Charlotte, has asked the City Council to delay the awarding of the street-lighting contract for two weeks to allow his company to submit a proposition for street lighting. The service is now supplied by the Durham Traction Co.

**JAMESTOWN, N. D.**—The City Council is considering a proposition to install an electric-light plant.

**MOHALL, N. D.**—The installation of an electric-light plant in Mohall is under consideration.

**MOTT, N. D.**—Propositions for the installation of an electric-light plant in Mott have been submitted by outside parties.

**PEMBINA, N. D.**—The city of Pembina is considering the question of purchasing the plant in the Pembina Traction Co.

**DAYTON, OHIO.**—Proposals will be received at the office of the supervising chief, Treasury Department, Washington, D. C., until March 19 for mechanical equipment, except elevators and lifts, for the United States post office and court house, Dayton, Ohio, in accordance with plans and specifications, copies of which may be obtained at the office of construction, Dayton, Ohio, or at the above office. O. Wenderoth is supervising architect.

**PAULDING, OHIO.**—Owing to the town council not being able to make satisfactory arrangements with the Anglaise Pwr. Co., of Defiance, to transmit energy to the town of Paulding, the Council has decided to rebuild the municipal electric-light plant. The plans provide for the installation of new generating machinery and a new transmission throughout. Alternating-current system will be installed. Smith & Gray, of Toledo, are engineers.

**RAVSTON, OKLA.**—The project of a pipeline system to connect its gasoline engine on the station of a transmission line to a power city, a distance of 18 miles, to secure electricity from the municipal electric plant in that city, is being considered by the Ravston El. Lt. & Pwr. Wks.

**TAHOMA, OKLA.**—The city of Tahoma has engaged W. M. Magruder, engineer, of Liberal, Kan., to take charge of the construction of the proposed municipal electric-light plant, bids for which will be opened Feb. 28.

**GRANT'S PASS, ORE.**—The Rogue River Pub. Ser. Corp., recently organized to take over the property of the Columbia & Rogue River Pub. Ser. Corp., the Oregon Wtr. & Pwr. Co. and the Grants Pass El. Co., will build two additional power plants on the Rogue River, the president of the Rogue River Pub. Ser. Corp.

**MILTON, ORE.**—The City Council has decided to build a new street-lighting system, the work to be done under contract.

**PORTLAND, ORE.**—The City Council has decided to build a new street-lighting system, the work to be done under contract.

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**PRairie City, ORE.**—The City Council has decided to build a new street-lighting system, the work to be done under contract.



**TOLEDO, ORE.**—The local electric-light plant has been purchased by Lewis Montgomery, of Portland. A new power station will be erected and new machinery installed. The machinery which has been used heretofore will be removed from the sawmill to the new building.

**PANAMA.**—Sealed proposals will be received at the office of the general purchasing officer, Indian Land Commission, Washington, D. C., until April 14, for furnishing and erecting coal-handling machinery and accessories for two coaling plants. Blanks and general information relating to this circular (No. 763) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

**ELLWOOD CITY, PA.**—The Pennsylvania Pwr. Co., a subsidiary of the Mahoning & Shenango Valley Lt. Co., is making a survey for a dam on the Shenango River near Hazel Dell.

**HARRISBURG, PA.**—The Harrisburg Lt. & Pwr. Co. has submitted a proposition to the City Council offering to install 52 single standard arcs, similar to those now temporarily located on Market Square, and 54 standards, carrying five-lamp clusters, similar to those temporarily placed on the Courthouse Plaza. The arc lamps will cost \$98.60 each per year and the cluster lamps \$91 per standard per year, making a total of \$10,041. George E. Lupp is vice president of the company.

**JOHNSTOWN, PA.**—Notices have been filed at the State Department at Harrisburg of the merging of 38 electric companies chartered for Blair, Indiana and Cambria Counties into the Penn. Pub. Ser. Co., of Johnstown; 11 into the Central Lt., Ht. & Pwr. Co., and three into the Penn. Pub. Ser. Co. All companies will operate in the vicinity of Johnstown.

**PHILADELPHIA, PA.**—The Philadelphia Hydro-Electric Co. is planning to increase the output of its power station at Manayunk and will install four 700-hp Morgan Smith Co. waterwheels, Lombard water-wheel governors, four 400-hp Westinghouse alternating-current generators with switchboard and six Westinghouse transformers. The company will also erect one substation to be equipped with three 50-kw rotaries, etc. S. Leonard Kent, Jr., is general manager.

**GREER, S. C.**—Bonds to the amount of \$15,000 have been voted for the construction of an electric-light plant. John D. Wood is mayor.

**PORT ROYAL, S. C.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 15 for an ice-making and refrigerating plant at the United States Naval Discharge Barracks, Port Royal. The cost of the work is estimated at \$6,000. H. R. Stanford is chief of bureau.

**WATERTOWN, S. D.**—Work will begin early in March on construction of the new service building to be erected by the Dakota Central Tel. Co. at a cost of about \$20,000.

**WINNER, S. D.**—C. O. Cobb, of Funk, Neb., has applied to the City Council for a franchise to install and operate an electric-light system in Winner.

**ARLINGTON, TENN.**—The city of Arlington will award contracts on March 7 for construction of an electric-light plant and water-works system. R. C. Huston & Co., Exchange Building, Memphis, Tenn., are engineers in charge.

**CHATTANOOGA, TENN.**—The Chattanooga & Tennessee River Pwr. Co. will begin work at once on the construction of a steam power plant, to cost about \$1,000,000. This will be operated in connection with the plant now being erected at Hale's Bar, 15 miles from Chattanooga, where a lock and dam is being built across the Tennessee River. The auxiliary plant will have an output of from 20,000 hp. to 25,000 hp. The Hale's Bar plant will develop 56,000 hp.

**COLUMBIA, TENN.**—A committee has been appointed to make investigations with a view of installing an ornamental street-lighting system in the business district.

**KENTON, TENN.**—Bids will be received by the city of Kenton until March 11 for the construction of an electric-light plant and water-works system. R. C. Huston & Co., Exchange Building, Memphis, Tenn., are engineers.

**ANGLETON, TEX.**—The Angleton Gin & Pwr. Co. has been granted a franchise to install an electric-light plant and ice plant. The capital stock of the company will be increased from \$8,000 to \$25,000.

**DE LEON, TEX.**—The De Leon-Gorman Lt. & Pwr. Co., recently organized, will install electric light and power plants at De Leon and Gorman. W. L. Lowe, J. T. Collie and W. M. Collie are incorporators.

**FRANKSTON, TEX.**—An electric light and water company has been organized by local residents for the purpose of installing an electric-light plant and water-works system in Frankston.

**HEARNE, TEX.**—The contract for installing a new electric light and power plant in Hearne has been awarded to Randall, Lovegrove & Wyman, of Houston.

**MOULTON, TEX.**—A company has been organized by residents of Moulton for the purpose of installing an electric-light and water-works plant.

**YOAKUM, TEX.**—The property of the Yoakum Improvement Co. has been purchased by L. L. Stephenson, of Sweetwater, including water-works system and electric-light plant, for a consideration of \$100,000. Improvements will be made to the property by the new owner, involving an expenditure of more than \$30,000.

**COVINGTON, VA.**—The Town Council has adopted a resolution authorizing the committee on street lighting to prepare in conjunction with W. E. Allen, attorney for the town, an ordinance providing for soliciting bids upon a franchise for electric lighting and power purposes, and to report the same to the Council for action thereupon. This action was taken at the request of the Covington Lt. & Pwr. Co. The franchise of the company expires May 20, 1918, and in order to finance proposed extensions and improvements it finds it necessary to extend the life of its franchise.

**RICHMOND, VA.**—Plans have been filed in the office of the building inspector for an annex to the present power house of the Richmond & Henrico Ry. Co., on Lester Street, near James River. The annex will be 106 ft. by 85 ft., built of concrete and brick, and will provide room for additional generating units to be used in connection with the proposed light and power service. The cost of the structure is placed at \$35,000.

**BELLINGHAM, WASH.**—The Stone & Webster Corp., of Boston, Mass., has taken over the property of the Skagit Pwr. Co. The power locations of the Skagit Pwr. Co. include two sites, one capable of developing 50,000 hp. and the other 20,000 hp.

**CASHIER, WASH.**—The Council has passed a resolution creating an improvement district for the lighting of Division, River and Maple Streets and Cottage, Mission and Woodruff Avenues; also along the west side of Park and Long Streets.

**CATLAMET, WASH.**—The Council is considering the question of establishing a municipal electric-light plant.

**COLVILLE, WASH.**—The Arden Tel. Co. has petitioned the County Commissioners for a franchise to erect telephone lines throughout Stevens County.

**COLVILLE, WASH.**—The Stevens County Pwr. & Lt. Co. is planning to extend its transmission lines to the Republic district, where, it is said, the company has closed contracts with Republic operators. Orders have been placed for equipment to increase the output of the plant near Meyer Falls and for erection of transmission lines, to cost about \$200,000. The company recently closed a contract with the United Copper & Aurora Copper Companies, of Chewelah.

**ELENSBURG, WASH.**—The City Council has authorized the Municipal Light Department to sell electricity to the Menashash El. Co., recently organized by 30 West Side ranchers, for the purpose of supplying farmers in that district with energy for lamps and motors. E. L. Butler is superintendent of the municipal electric plant.

**ELMA, WASH.**—The Elma Lt. & Pwr. Co. has been granted a 40-year franchise to construct an electric-light plant in this city.

**NORTH YAKIMA, WASH.**—The County Commissioners have granted the Pacific Pwr. & Lt. Co., of North Yakima, a franchise to erect a transmission line from its power house in the Naches Valley to Naches City. The cost of the Naches Valley project is estimated at about \$500,000.

**SPOKANE, WASH.**—The Washington Wtr. Pwr. Co., of Spokane, contemplates extending its transmission line from Spokane to Chewelah and Republic this year. D. L. Huntington is president.

**TACOMA, WASH.**—A petition has been filed with Homer H. Edwards, city clerk, asking the City Council to erect standards carrying three-lamp clusters in the North End district.

**BELOIT, WIS.**—A movement is on foot to install an ornamental street-lighting system in the business district. It is proposed to use cluster lamps.

**EAU CLAIRE, WIS.**—The committee appointed by the business men has adopted the trolley-pole scheme for the ornamental street-lighting system. It is proposed to suspend arms from the trolley poles of the Chippewa Valley Ry., Lt. & Pwr. Co., each carrying four 100-cp lamps.

**LA CROSSE, WIS.**—The two electric plants of the La Crosse Gas & El. Co. in La Crosse are to be consolidated and one of the power stations practically rebuilt. The plans provide for the installation of two 1500-kw generators.

**HOPE, B. C., CAN.**—The Hope & District Pwr., Lt. & General Development Co., Ltd., has applied for a license to take 1000 cu. ft. per second of water from the Coquahalla River, to be used for power purposes.

**VANCOUVER, B. C., CAN.**—The Western Canada Pwr. Co. will install two additional electric generating units at its plant at Stave Falls, increasing the output to 50,000 hp. William McNeill, of Vancouver, is assistant general manager.

**VICTORIA, B. C., CAN.**—The city electrician has recommended an expenditure of \$7,351 for equipment for the fire-alarm system.

**VICTORIA, B. C., CAN.**—The Hinton El. Co., of Vancouver, B. C., has secured the contract for electrical equipment for the additions to the Parliament Buildings.

**VICTORIA, B. C., CAN.**—The British Columbia El. Co. has asked for permission to erect transmission lines on Tenth Avenue to University. The company may construct a car line in same district. C. F. Bolischweiler is general superintendent.

**WALKERVILLE, ONT., CAN.**—The contract for elevators for the power plant building, owned by Walker & Sons, has been awarded to the Otis-Fenson Elevator Co., of Toronto, Can.

**WATERLOO, ONT., CAN.**—The Kintz Brewery Co., of Waterloo, it is reported, will soon award contracts for additions to its power plant. Milder & Eschen, of Detroit, Mich., are architects.

**WINDSOR, ONT., CAN.**—The Remington Arms-Union Metallic Cartridge Co., with main offices in New York, N. Y., has closed a deal for 100 acres in Windsor. Work will begin at once on construction of buildings, for which contracts have already been awarded to the Canadian Frost-Winchester Co. of Windsor. A power house equipped with boilers, pumping machinery, etc., will also be installed.

**GUANTANAMO, CUBA.**—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 1, for three buildings for radio station to be erected at the naval station at Guantanamo, Cuba. The cost is estimated \$11,000. Plans and specifications can be obtained on application to the above bureau. H. R. Stanford is chief of bureau.

## New Industrial Companies

**THE AMERICAN GENERATOR COMPANY**, of Shelbyville, Ill., has been incorporated with a capital stock of \$150,000 in manufacturing machinery. The incorporators are: Clarence P. Wood, William P. Wilson and William L. Wood.

**THE ELECTRIC CONSTRUCTION COMPANY**, of Wheeling, W. Va., has been incorporated by Edward S. Godwin, R. L. McKelvey, E. B. Hunter, H. E. Holman and William J. Burns. The company is capitalized at \$100,000 and proposes to do general electric and construction work. The works and office of the company are at 42 Ely and Street, Wheeling.

**THE ELECTRIC FIRE ALARM & SIGNAL SYSTEM**, of New York, N. Y., has been incorporated by Joseph Nooden, Matthew Nooden and Jacob Hanover, 1993 Amsterdam Avenue, New York, N. Y. The company is capitalized at \$10,000, and proposes to install and operate electric signaling systems.

**THE KLIMAN ELECTRIC SYSTEMS COMPANY**, of Chicago, Ill., has been incorporated by M. J. Isaacs, James D. Woley and John D. Silber. The company is capitalized at \$25,000 and proposes to do a general manufacturing and merchandising business.

**THE NEW YORK TELEPHONOGRAPH CORPORATION**, of New York, N. Y., has been incorporated with a capital stock of \$10,000 for the purpose of manufacturing dictating talking machines and telephonographs. The incorporators are: Edward L. Langley, William M. Moore and Vere B. Reed, 34 Pine Street, New York, N. Y.

**THE PERFECTION STORAGE BATTERY COMPANY**, of Chicago, Ill., has been incorporated by Edward O. Briggs, Roscoe B. Higgins and William R. Feizer. The company is capitalized at \$2,500 and proposes to manufacture and deal in electrical storage batteries and electrical accessories.

**THE RAPID DISPLAY MACHINE COMPANY**, of Jersey City, N. J., has been incorporated by J. Lutz, C. J. Leyas and W. Gallwey, of Jersey City. The company is capitalized at \$100,000 and proposes to manufacture appliances for advertising and display purposes.

**THE JOHN SPLITDORF CORPORATION**, of New York, N. Y., has been incorporated by John Splitdorf, P. J. W. Kelly and A. L. Kull, 42 West Castle Place, New Rochelle, N. Y. The company is capitalized at \$350,000 and proposes to do a general electrical and mechanical engineering business.

## New Incorporations

**ERVING, MASS.**—The Miller's River Pwr. Co. has been incorporated with a capital stock of \$1,000,000 by Fred T. Ley, Leo L. Ley and Joseph W. Johnston. The company will take over land and various water rights and easements on Miller's River in Erving, owned by F. T. Ley, and proposes to build a system of dams which will give a total fall of 400 ft. and generate from 35,000 kw to 10,000 kw. The company was organized primarily to supply power to the Yankee Pwr. Co.

**TOMS RIVER, N. J.**—The Central Jersey Pwr. Co. has been incorporated with a capital stock of \$125,000 to operate power and light plants. The incorporators are: G. C. Van Hise, S. F. Applegate and E. R. Yoder, of Toms River.

**WESTFIELD, N. Y.**—The Lake Shore E. L. & Pwr. Co. has been incorporated with a capital stock of \$25,000 by Eugene L. Falk, W. Miller Scott and Lee L. Ottaway, of Westfield.

**TOLEDO, OHIO.**—The Toledo Trac., Lt. & Pwr. Co. has filed articles of incorporation under the laws of the State of Maine and reorganization of the Toledo Rys. & Lt. Co. The new company is capitalized at \$17,200,000. F. J. C. Little, of Augusta, Maine, is president, and J. N. Miller, of New York, N. Y., treasurer.

**SPOKANE, WASH.**—The Des Chutes Pwr. Co. has been incorporated under the laws of the State of Washington. The company is capitalized at \$300,000 and proposes to develop one or two water ones in central Oregon, one on the Des Chutes River and the other on the Crooked River. The plans include the erection of 80 miles of transmission lines to furnish electricity in the towns of Pomeroy, Richland, Colfax, Metolius and Madras, Ore. The officers are: Samuel Galland, president; W. C. Siver, vice-president; B. L. Siver, secretary and treasurer; and L. M. Simpson, general manager.

## Trade Publications

**GUY, C. H.**—The Guy Electric Co. has been incorporated in New York, N. Y., with a capital stock of \$100,000. The company is organized for the purpose of manufacturing and selling electrical appliances.

**BLOWTORCHES.**—Folder No. 4245 of the Westinghouse Electric & Manufacturing Co. contains a list of blowtorches and their uses.

**STEAM ENGINE.**—The Westinghouse Electric & Manufacturing Co. has issued a folder containing a list of steam engines and their uses.

**DISINFECTANTS.**—The Westinghouse Electric & Manufacturing Co. has issued a folder containing a list of disinfectants and their uses.

**ELECTRIC MOTOR.**—The Westinghouse Electric & Manufacturing Co. has issued a folder containing a list of electric motors and their uses.

**CONTROL.**—The Westinghouse Electric & Manufacturing Co. has issued a folder containing a list of control devices and their uses.

**RESISTANCE UNITS.**—The Westinghouse Electric & Manufacturing Co. has issued a folder containing a list of resistance units and their uses.

**WATER METERS.**—Bulletin No. 100 of the Alberger Pump & Condenser Co. contains a list of water meters and their uses.

**FANS.**—The F. L. Galt & Brother Co. has issued a folder containing a list of fans and their uses.

**ALUMINUM.**—The British Aluminium Co., Ltd., of 100 Queen Victoria Street, London, has prepared a booklet setting forth the leading properties of aluminum and the various firms in which the company supplies it. The booklet is a valuable pocket reference and is particularly use to electricians, engineers, architects, draftsmen, etc., as they will find full information regarding aluminum in all its forms as rods, wire, bars and strips, sheets, strands, cables, tubes and aluminum alloys. It also contains details of the working of aluminum.

**CENTRAL ILLUMINATION.**—The National Electric Lamp Association, Chicago, Ill., has issued a folder containing a list of central illumination systems and their uses.

**"FLEXITRON."**—The Central Electric Company, of New York, N. Y., has issued a folder containing a list of "Flexitron" fixtures and their uses.

## Business Notes

**FORBES & MCKENNA.**—The Forbes & McKenna Co. has been incorporated in New York, N. Y., with a capital stock of \$100,000.

**W. N. MEYERHANS & BROTH.**—The W. N. Meyerhans & Broth. Co. has been incorporated in New York, N. Y., with a capital stock of \$100,000.

**LEUNG ENGINEERING COMPANY.**—The Leung Engineering Co. has been incorporated in New York, N. Y., with a capital stock of \$100,000.

**WAGNER ELECTRIC MANUFACTURING COMPANY.**—The Wagner Electric Manufacturing Company, of St. Louis, has moved its Buffalo office to 802 Electric Building, where Mr. Lewis G. Bassett continues in charge, as at the former location.

**Hemming Manufacturing Company.**—A branch office has been opened in Suite 1654, Monadnock Block, Chicago, by the Hemming Manufacturing Company, Garfield, N. J. Mr. B. A. Appleton, a graduate of Stevens Institute, will be the company's sales engineer for the Western territory.

**LOCKWOOD, GREENE & COMPANY,** of Boston, have appointed Mr. Leonard Goodwin, until recently in the home office, manager of the Chicago branch, with headquarters in the First National Bank Building. Mr. Harold V. Coes, formerly of the latter office, has been transferred to Boston to take charge of special work.

**W. N. MATTHEWS & BROTHER.**—The New York office of W. N. Matthews & Brother has been moved from 227 Fulton Street to 50

Church Street. The office will continue to be under the charge of Mr. Warren M. Heim, whose territory extends from Maine to North Carolina, and from the Atlantic to Harrisburg and Syracuse on the west.

**THE PACIFIC STATES ELECTRICAL COMPANY** has recently completed its six-story electrical supply house between First and Second Streets on Mission and Minna Streets, San Francisco, Cal. The building contains offices, stock rooms and display rooms, and is provided throughout with elevators, lifts, automatic tubes, private telephones, etc., to facilitate the rapid and economical handling of electrical appliances.

**THE CLEVELAND ICE MACHINE & MANUFACTURING COMPANY** has increased its capital stock to \$100,000, changed its name from the Cleveland Ice Machine Company, purchased the plant of the Brown-Cochran Company, at Lorain, Ohio, and has moved its factory to that city. The company owns a well-equipped building and is manufacturing refrigerating plants, oil, gas and gasoline engines and doing other machine work and business of that character.

## Weekly Record of Electrical Patents

### UNITED STATES PATENTS ISSUED FEB. 11, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,052,449. **BATTERY BOX;** C. W. Beck, Rockville Center, N. Y. App. filed April 27, 1908. For automobile footboards, etc.
- 1,052,478. **VARIABLE-SPEED ALTERNATING-CURRENT MOTOR.** M. M. Goldberg, Ithaca, N. Y. App. filed March 4, 1912. Torqueless frequency transformer and induction motor.
- 1,052,488. **ELECTRIC LOCK;** C. Legrand and A. Armel, Paris, France. App. filed July 26, 1911. For railway cars, etc.
- 1,052,490. **ELECTRIC WELDING TOOL;** C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed Oct. 6, 1911. Hand tool with spaced wheel electrodes.
- 1,052,491. **ELECTRIC WELDING MACHINE;** C. A. Linden and C. A. Carlson, Jamestown, N. Y. App. filed March 19, 1912. Stationary wheel and electrodes for welding tubes, etc.
- 1,052,513. **TELEGRAPH SYSTEM;** E. Pope, Quebec, Canada. App. filed June 25, 1910. Continuous stream of automatic alternations operating polar relays.
- 1,052,522. **ELECTRIC HAIRBRUSH;** V. Sence, New York, N. Y. App. filed May 14, 1912. Maeneto attachment.
- 1,052,528. **INDUCTIVE CONTROLLING APPARATUS;** A. Sundh, Yonkers, N. Y. App. filed March 1, 1910. Manually operated master switch system for elevators, etc.
- 1,052,535. **FIELD MAGNET;** E. Volkers, Berlin, Germany. App. filed March 27, 1911. Interconnected pole pieces.
- 1,052,538. **ELECTRIC ALARM SYSTEM;** A. U. and S. E. Weaver, Santa Anna, Tex. App. filed Feb. 3, 1912. Selenium cell circuit-closer.
- 1,052,548. **TELEGRAPH TRANSMITTER;** J. E. Wright, New York, N. Y. App. filed Feb. 28, 1911. Page-printing machine. (Improvement on patent No. 954,489.)
- 1,052,550. **ELECTRICAL SWITCH;** M. F. Young, Pueblo, Col. App. filed April 19, 1911. Controlled by the motorman.
- 1,052,555. **METER-SERVICE LEAD CONNECTION FOR THREE-WIRE SYSTEMS;** P. H. Bacon, New York, N. Y. App. filed Nov. 10, 1911. To prevent the theft of electricity.
- 1,052,583. **PROTECTING DEVICE FOR VAPOR APPARATUS;** P. C. Hewitt, New York, N. Y. App. filed Jan. 11, 1906. X-shaped container.
- 1,052,584. **COOLING DEVICE FOR VAPOR ELECTRIC APPARATUS;** P. C. Hewitt, Ringwood Manor, N. J. App. filed July 7, 1904. Liquid circulation through the container.
- 1,052,586. **TROLLEY STAND;** H. Holland, Cleveland, Ohio. App. filed Dec. 19, 1910. Low-setting spring type.
- 1,052,587. **SYSTEM OF ELECTRICAL CONTROL;** J. D. Ihlder, New York, N. Y. App. filed June 12, 1908. Ammunition hoist for gun service, etc.
- 1,052,595. **CIRCUIT-BREAKER;** R. C. Lanphier, Springfield, Ill. App. filed March 22, 1911. Solenoid type.
- 1,052,608. **METER TESTING CUT-OUT;** A. V. A. McHarg, New York, N. Y. App. filed May 31, 1912. Switch-gang and operating lever.
- 1,052,642. **ELECTRIC OUTLET BOX;** A. J. Appleton, Chicago, Ill. App. filed June 11, 1909. Detachable outlet cover.
- 1,052,674. **THERMOSTAT;** A. A. Lindsey, Armuchee, Ga. App. filed Dec. 14, 1911. Operates on quick or excessive change of temperature only.
- 1,052,717. **ROTARY TRANSFORMER;** E. M. Fraser, Yonkers, N. Y. App. filed April 28, 1911. Controlled by a rotation without the introduction of ohmic resistance.
- 1,052,724. **ELECTRIC BURGLAR-ALARM DEVICE;** R. C. Jones, Brooklyn, N. Y. App. filed May 13, 1912. Window switch.
- 1,052,727. **PROCESS OF EXTRACTING ALUMINUM FROM ITS ORES;** A. Kiasock, Golden, Col. App. filed June 6, 1911. The ore is heated with carbon and sulphur compound.
- 1,052,730. **ELECTRIC HEATING UNIT;** F. Kuhn and F. E. Shailor, Detroit, Mich. App. filed Oct. 16, 1909. Flat-plate construction for sardions, etc.
- 1,052,753. **TRANSFORMER FOR ELECTRIC METAL-WORKING APPARATUS;** A. F. Rietzel, Charlestown, R. I. App. filed Jan. 12, 1910. Single transformer for multiple welding.
- 1,052,787. **CLAMP FOR ELECTRIC METAL-WORKING APPARATUS;** G. E. Barstow, Lynn, Mass. App. filed June 10, 1911. Variable pressure for welding.
- 1,052,816. **THERMOSTAT;** W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Automatic regulator for electric heating device.
- 1,052,820. **PROCESS OF BRAZING TUBING;** H. Higgin, Newport, Ky. App. filed March 14, 1910. Passed between pressure and heating rolls.
- 1,052,834. **AIR HEATER;** J. Lawrence, New York, N. Y. App. filed Dec. 16, 1909. Accumulator system for house heating, etc.
- 1,052,843. **ELECTRICAL-RESISTANCE DEVICE;** E. J. Ovington, Los Angeles, Cal. App. filed April 26, 1910. Immersion heating device.
- 1,052,849. **SYSTEM OF RADIOTELEPHONY;** W. Schlemmich and P. E. Pichon, Berlin, Germany. App. filed Nov. 29, 1907. Continuous oscillations of constant amplitude.
- 1,052,851. **PROCESS OF TREATING WOOD SEPARATORS FOR STORAGE BATTERIES;** J. M. Skinner, Philadelphia, Pa. App. filed March 13, 1912. Immersion in sodium sulphate.
- 1,052,891. **CURRENT-CONTROLLING DEVICE;** L. O. Corell, Kalamazoo, Mich. App. filed April 17, 1911. Foot-operated switch for electric lights, etc.
- 1,052,894. **ELECTRICALLY HEATED STOVE;** A. S. Cubitt, Rugby, England. App. filed Oct. 21, 1911. Closing the door opens the controlling switch.
- 1,052,903. **ELECTRIC SWITCH OR CUT-OUT;** P. Druessdt, Remscheid, Germany. App. filed April 28, 1910. Push-button type.
- 1,052,920. **SWITCH;** H. D. Hincley, Hartford, Conn. App. filed Oct. 14, 1911. Quick-break straight-line movement.
- 1,052,932. **ELECTRIC AUTOMATIC ALARM;** W. Maginot, Hammond, Ind. App. filed May 8, 1912. Temperature alarm for incubators.
- 1,052,950. **FUSE;** J. H. Palmer, Chicago, Ill. App. filed May 24, 1912. Cartridge type with replaceable fuse.
- 1,052,975. **SWITCH-JAW;** C. B. Shoeman, Wilkensburg, Pa. App. filed Sept. 25, 1912. Knife switch jaw anchor.
- 1,052,987. **THERMOSTATIC SWITCH;** A. E. Weed, Berkeley, Cal. App. filed March 7, 1911. For controlling current through a resistance.
- 1,052,997. **ELECTRIC HEATER;** W. Barstow, San Francisco, Cal. App. filed May 21, 1912. Tubular air heater.
- 1,052,998. **AUTOMATIC ELECTRIC HEATER;** L. S. Besley, Salt Lake City, Utah. App. filed Sept. 26, 1911. Tubular bed heater, etc.
- 1,053,006. **TROLLEY-HEAD;** C. H. Buck, Cleveland, Tenn. App. filed Jan. 13, 1912. Joint and pressure device.
- 1,053,022. **ELECTRIC SWITCH;** J. M. S. Fontecha, Mexico, Mexico. App. filed Feb. 26, 1912. Rheostat type.
- 1,053,038. **SIGNALING SYSTEM;** J. M. Johnson, Ishpeming, Mich. App. filed Feb. 23, 1908. Mine hoist, etc.
- 1,053,042. **HIGH-SPEED TELEGRAPH SYSTEM;** C. Kinsley, Chicago, Ill. App. filed Aug. 30, 1909. Segmental letter printing.
- 1,053,048. **SELECTIVE TELEPHONE-CALL SYSTEM;** O. N. Lindsey, Senatobia, Tenn. App. filed Aug. 20, 1909. Successive action of cut-outs.
- 1,053,062. **MOTOR CAR;** A. Palmros, Columbus, Ohio. App. filed Nov. 22, 1900. Two separate motor-driven trucks pivotally connected with the body.
- 1,053,076. **ELECTRICAL WATER HEATER;** F. Walker, Los Angeles, Cal. App. filed Sept. 10, 1906. Construction to prevent electrolysis.
- 1,053,096. **ELECTRIC FUSE AND CUT-OUT;** I. S. Johnston, Utica, N. Y. App. filed Feb. 28, 1910. Manual and automatic renewal.
- 1,053,098. **SYSTEM FOR THE TRANSMISSION OF ELECTRICAL ENERGY;** G. D. Laning, Boston, Mass. App. filed Dec. 26, 1905. The reinforcing of telephonic alternating currents by super-position.
- 1,053,107. **APPARATUS FOR GENERATING ALTERNATING CURRENTS;** J. L. Milton, Chicago, Ill. App. filed Jan. 30, 1909. For gas-engine spark ignition.
- 1,053,110. **APPARATUS FOR REGULATING THE PRESSURE IN STEP TRANSFORMERS;** R. Richter, Grunau, Germany. App. filed Sept. 21, 1911. Induction regulator.
- 1,053,111. **ELECTRIC BELL;** W. E. Russell, Danbury, Conn. App. filed April 28, 1909. Inclosed type of mechanism.
- 1,352,526 (reissue). **INSULATOR;** W. H. Kempton, Mansfield, Ohio. App. filed Sept. 22, 1909. Strain insulator. (Original patent No. 904,069, Nov. 17, 1908.)
- 1,352,529 (reissue). **INSULATING BUSHING;** C. H. Thordarson, Chicago, Ill. App. filed Nov. 1, 1911. For electric wiring. (Original patent No. 962,726, June 28, 1910.)
- 1,353,000 (reissue). **ELECTRIC WELDING MACHINE;** F. Warren, Cincinnati, Ohio. App. filed Jan. 9, 1913. Adjustable and movable dies. (Original patent No. 1,046,240, Dec. 3, 1912.)



# Electrical World

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No. 9

## Ice Making for Central Stations

Already the decreasing daily station output and diminished peak load—infallible harbingers of spring—are serving notice to the central-station man that in a few months more he will have a lot of expensive machinery lying idle in his plant—machinery which during the summer months might be earning its highest rate of return had foresight only been exercised in preparing to have a part in the profits of ice manufacture. As pointed out many times in these columns, the combination ice-electric plant utilizes the waste products and hours of light load of the electric plant for the manufacture of a very profitable by-product. The ice business shares the burden of operating, labor, office, real-estate, plant investment and insurance costs, lowering the cost of electricity and making cheap ice. One set of employees and office help can handle both businesses, keeping themselves useful all the year round so that there need be no lay-offs. An ice plant often makes it possible to perform without loss an otherwise unproductive twenty-four-hour service during the first season or two of all-day operation, while the electric-fan, flatiron and cooking loads are being built up. Moreover, pure, clean, sanitary ice is a product for which the demand grows as the commodity becomes available at a reasonable price. Once the supply is established the demand grows rapidly, and in point of economy no mere ice plant can ever begin to compete with the central station which is turning out ice and electricity with a single set of plant costs.

## New Use for Anti-Trust Law

If the government is successful in the suit filed this week against two Chicago locals of the Brotherhood of Electrical

Workers, a new field of usefulness will be opened up for the Sherman law. The Attorney-General's bill in this suit charges officers and members of the union with combining and conspiring, through acts of violence and depredation, to damage telegraph wires and interfere with the transmission of government and commercial messages in interstate commerce. It has already been decided by the courts that telegraph messages are interstate commerce, and if the position of the government is sustained in this case, it would apparently apply as well to interstate telephone and transmission lines. The Attorney-General's suit comes just at the moment when an attempt is being made in Congress to pass a law providing that no part of the appropriation for enforcement of the anti-trust laws shall be used in the prosecution of workingmen's organizations. It is to be hoped that this attempt will fail, as many similar attempts have failed in the past, to set up a privileged class—the members of labor unions—who need not obey the laws made for all. In this event, and should the government

win the Chicago case, a new and effective means will be available for dealing with labor conspiracies, and one that is of particular interest to telephone, telegraph and transmission companies.

## All Employees as Business Aids

Upon the accomplishments of the commercial department, no less than on the character of service which the central station renders, depends the success of the company. Every employee, then, whose personal fortunes are cast with those of the corporation should be vitally interested in the work of new-business getting, lending the specialists of that department all possible aid. The commercial agent will welcome tips from every source, and the getting of such tips depends largely upon the number of points of contact with the community served. Each employee has his own little circle of friends, acquaintances and friends' friends, and even the humblest of these groups offers a rich field for obtaining suggestions, criticisms, house-wiring prospects, possible appliance sales, etc. A progressive Western company recently went to the extent of preparing a detailed schedule of remuneration for non-commercial employees who aid the new-business department, and the plan has already proved very profitable to both the utility and members of the operating and maintaining forces. Passing over the practical expediency of such a plan (which certain sensitive central-station moralists insist is "bribing the employee to do his plain duty"), we can only insist that such commercial co-operation is indeed the employee's duty, and that the performance of such duty invariably brings its own reward. Even if the employee is to be denied a direct reward, he will just as surely reap his profit in increased company activity and greater chance for his own advancement.

## The Economics of Culm Burning

The disposal of the waste of a coal mine has been a standing problem for many years. Mountains of culm accumulate alongside every active mine. Some small portions were often burned for incidental uses, but no real progress was made until the rise of the electric lighting and motor-service business. This filled the necessary condition of being a business in which the point at which energy might be generated was in a measure independent of the place where it might be sold and used. An ordinary factory might find itself greatly incommoded by being next to the culm pile, but electric stations have found this location advantageous for at least twenty years past. One of the recent and very interesting examples of the burning of culm to great advantage is found in the electric plant of the Acadia Coal Company, described elsewhere in our columns.

It represents a deliberate and highly successful attempt to utilize this waste fuel not only for the service of the mine from which it is derived but for the distribution of energy to other points, including another large mine. The generating plant is out of the ordinary in several particulars. In the first place, the generators are of German make, although coupled to horizontal turbines of the familiar Curtis type, and the frequency is the standard Continental frequency of 50 cycles instead of the 60 cycles usual here.

The boiler room contains the usual bank of water-tube boilers with superheaters and is equipped with mechanical stokers, as every plant burning low-grade fuel ought to be. There is, however, special provision for averting the waste of fuel likely to be troublesome in burning culm. Below the front of each furnace provision is made for catching unburned coal which falls from or through the stokers, and a conveyor is provided to return this still useful fuel to the feeding system. The device appears to work well in facilitating efficient burning of the very heterogeneous material found in the culm coal, although the percentage of ash in this case rises as high as 40. The ashes from the furnaces are discharged into an open flume which runs down onto flats below the station, and the ashes are swept away and dumped on the flats by the discharge from the condensers and some waste water from the mines.

Most of the energy from the plant is utilized for motor service in the mining work, largely for pumping. The three-phase motors for the main pumps are built with squirrel-cage rotors, a rather unusual construction for such large units, but admirably applicable in this case, owing to the steady load which is upon them and the infrequency of stopping and starting. Another unusual bit of engineering is the transmission of energy from the switchboard to a group of mines a mile and a half distant by underground cables worked at 3000 volts. These cables are of ordinary leaded construction laid in dry sand at the bottom of a trench 3 ft. deep and protected with a layer of tiles. This simple underground system seems to work admirably. The plant is a capital example of the useful disposition of waste material.

### The Electron Theory of Magnetism

Ampère demonstrated that all the ordinary phenomena of ferromagnetism could be simulated by the actions of steady electric currents. That is to say, if we assume, for example, the simple case of two short horizontal bar-magnets, with their like poles presented to each other, we know that the magnets will be mutually repelled. Now, if we should replace the permanent magnets by properly selected helices of insulated copper wire, carrying currents, the same repulsion could be manifested.

The modern electron theory regards the atoms of all substances as active aggregations of positive and negative corpuscles, the negative corpuscles being the smaller, more numerous and more rapidly revolving constituents. An atom of hydrogen, on this theory, comprises a large number of negative corpuscles, each similar and similarly charged with electricity, and perhaps describing rapid revolutions in orbits around a central positive corpuscle or

positive corpuscular nucleus, like a microcosmic solar system with the central sun as the positive nucleus and the negative electrons as equal planets, the size of each planet being small in comparison with the size of the orbit in which it revolves. If, for instance, we imagine the atom of hydrogen enlarged to the size of a house, the planets or negative electrons might be each as large as a gnat or small fly.

The electron theory seeks to give a physical basis to Ampère's hypothesis by pointing out that everyone admits a moving electric charge to be the equivalent of an electric current. Hence each and every molecule of iron in a permanent magnet, since it is built up of atomic aggregations of charged and moving electrons, is a congeries of little electric currents in closed loops of extremely small dimensions. It is reasonable to suppose that when iron or steel is magnetized all the little current loops of planetary orbits become oriented in the same sense, or are brought into parallel planes. Here are Ampère's equivalent electric currents all ready made, and permanently inherent in the structure of iron atoms.

A fresh contribution to the mathematical literature of this subject by Dr. Elmer H. Williams is referred to in this week's *Digest*. It is shown that certain experimental results favor the theory, while other experimental results are not at present in accordance with it. For example, in order to account for the observed magnetic moment of oxygen molecules, the velocity of rotation in the atomic orbit of a single active electron should be 2000 km per second, or once around our world in twenty seconds. If, now, we consider what should be the velocity of such a negative electron in the same orbit, in order that its centrifugal force should just balance its attractive pull toward the central nucleus, considered as a single positive electron, the result is 1200 km per second. In this case the agreement is not very close; nevertheless, the velocity which satisfies the crude electric problem is of the same order as that which satisfies the magnetic state of the case, so that there is hope of bringing the agreement closer when the facts of electric attraction may be more definitely known. Incidentally, we may notice that on the estimate of an orbital radius of  $1.5 \times 10^{-8}$  cm, and the velocity of 1200 km per second, the periodic time or duration of one revolution comes out as about  $8 \times 10^{-16}$  second; or one second of time would include more than a thousand million million rotations, or "years," of the planetary electron.

Again, Curie deduced from the electron theory the simple law that in paramagnetic substances—that is, substances which are magnetic like iron, but only in very feeble degree—the coefficient of magnetization should be inversely proportional to the absolute temperature. This rule seems to be borne out in a number of substances, but not in all. Again, the self-induction of the electric currents due to the orbital revolutions of charged electrons appears to be of just the right amount to account for the inertia of the electrons considered as moving masses. The electronic theory thus accounts for the inertia of matter as the sum total of all the inertia of the electrons, which appears to be the precise mechanical equivalent of the self-inductions, pertaining to electric currents of closed loops in space.

This is, however, aside from the phenomena of magnetism. Although the evidence in favor of the electron theory of magnetism is far from being convincing, yet there is sufficient experimental evidence of its probability to invest the critical investigation of the theory with great interest.

### Iron in Electrical Instruments

In a recent paper read before the German Electro-Technical Society Dr. Dolivo Dobrowolsky takes up the question of the use of iron in electrical measuring instruments, a subject to which he has given much attention. He assumes a position which, as he frankly intimates, sounds altogether radical to the ordinary engineer in advocating the liberal use of iron in measuring instruments, on the general ground that the great increase of available torque quite overweighs, in a properly designed instrument, the variations of remnant magnetism which have been generally feared. He points out that the remnant magnetism on percentage as a basis depends on the ratio of the ampere-turns effective in magnetizing it to the total ampere-turns concerned, so that if to the iron parts only 1 per cent or so of the total ampere-turns are applied in such instruments, for example, as commercial wattmeters, then the possible remaining magnetic error reduces to a similar proportion and practically drops out of sight. He finds, for example, that it is quite practicable to design instruments of this class with errors due to phase difference of only a small fraction of 1 per cent and yet with many times the torque available in instruments of which the iron has been reduced to a minimum. The gain in robustness in such instruments of powerful torque is too obvious to need comment, a gain peculiarly important in the case of curve-drawing instruments, in which lack of sufficient torque tends to be a constant and irritating source of error.

Dr. Dobrowolsky describes in detail the construction of commercial wattmeters made according to his principles, and they seem indeed to be extraordinarily powerful and substantial, while yet showing very small phase errors and a precision quite sufficient for all the ordinary work of the technical alternating-current measurements. After all, the practical desideratum in the everyday commercial instrument is that its total errors must be within very moderate limits, preferably within a small fraction of 1 per cent. It makes little difference what the nature of the errors may be if their sum be always small.

Dr. Dobrowolsky's line of operation involves cheerfully facing the small remnant errors due to the use of liberal quantities of iron, for the sake of wiping out the irregularities of performance which may be traced to insufficient torque. The results as he reports them seem fully to justify the means taken to secure them. For instruments designed strictly for laboratory use, in which the casual errors can be reduced to the minimum possible amount, the free use of iron may add more difficulties than it obviates, but certainly if Dr. Dobrowolsky's figures are at all typical of the general practice he has introduced, his plan of construction is working out with a degree of precision very gratifying for ordinary technical measurements.

### Hyperbolic Functions

In his notable course of lectures on the application of hyperbolic functions to electrical engineering problems, abstracts of the last two of which are published elsewhere in this issue, Dr. A. E. Kennelly has practically covered again the ground of his first series of lectures on the subject before the University of London nearly two years ago. In demonstrating the peculiar fitness of hyperbolic functions for solving quantitative problems in circuits possessing linear resistance, reactance, capacitance and leakage, he has also done a service in emphasizing the ever-growing importance of a sound training in applied mathematics as a preparation for constructive engineering performance. Probably nine out of ten electrical engineering graduates fall back instinctively upon the methods taught them in college when confronted in practical experience with a problem which requires a theoretical solution as a basis of procedure. Comparatively few engineers, however, are called upon to accomplish results which make it necessary to increase their equipment or knowledge of mathematical methods. Yet when the need arises it is very essential to choose an effective and efficient method of mathematical analysis. When looked upon as a tool or machine which only grinds the grist that comes to the mill, mathematics ought to lose some of its terrors for the average mind. Devoid of real mystery, and turning out conclusions which can never transcend the limits of the assumptions or hypotheses that, so to speak, were dumped into the hopper at the outset, it becomes a most useful tool and very essential in many problems met in modern engineering.

When a teacher of electrical science commences to discuss mathematical functions which have a strange or unfamiliar name, the average engineer readily assumes that the subject is passing beyond his grasp. But the term function means merely a mathematical operation, and every technical graduate is familiar with the more common functions, such as logarithms, the circular or trigonometric functions, etc. Other and less familiar functions become very useful in the solution of some of the more complex phenomena, such as the determination of the skin effect in conductors with very rapidly changing currents. It was first discovered many years ago that the so-called hyperbolic functions, definable in terms of the simple exponential quantities  $e^x$  and  $e^{-x}$ , are also of use in several electrical problems. The foremost of these is the case of linear circuits with distributed properties, as in the case of all transmission lines, whether for transporting energy or intelligence. The differential equations which express the fundamental relations in such circuits lead at once to solutions involving  $e^{ax}$  and  $e^{-ax}$ . But for the purpose of practical calculation it becomes very convenient to write this form of expression and substitute hyperbolic functions. Facility in their use is therefore an advantage in dealing with concrete problems in energy transmission, in power transmission and telegraph transmission. They also become useful in calculating the exact capacitance of linear circuits, as Dr. Kennelly has previously shown in our columns. The engineering profession is indebted to him for elucidating the uses of another tool which has numerous applications in electrical engineering.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### International Congress of Refrigeration

The first International Congress of Refrigeration was held at Paris in 1908, the second at Vienna in 1910, and the third will be held in Washington, D. C., and Chicago, Ill., during September, 1913. The opening meeting will take place in Washington, D. C., on Sept. 15, while the other meetings, business and scientific, will commence in Chicago on Sept. 17. More than forty countries will be represented by official government delegates as well as by delegates from industrial associations, technical societies and institutions of learning and experts and practical men interested in the subject.

An exposition of perishable foods under refrigeration and of ice-making and refrigerating machinery will be held at the Coliseum for two weeks, in conjunction with the congress. Public lectures will also be given on the proper care and conservation under refrigeration of perishable foods. A cold-storage banquet will also be one of the unique features. The general purpose of the congress is to stimulate harmonious and concerted efforts for the development of the science and the art of refrigeration, to encourage educational and general progress in the industry, to determine correct basic data and standards, to promote scientific study and discussion, to stimulate investigation and research, to determine the best methods of refrigeration, to encourage trade in cold-storage products and to study existing laws and the need of laws regulating the industry.

Any person, firm, corporation, society or association interested in the objects of the congress is eligible to membership. The official languages will be English, French, German and Spanish. There will be six sections, each in charge of a committee responsible to the general executive committee. According to the present plans for the program, it is proposed to leave New York on Sept. 14 for Washington, where the formal opening will take place on Sept. 15, after which the delegates will be received by the President of the United States. On Sept. 16 the delegates will leave for Chicago. It is planned to have half-day sessions of each section from Sept. 18 to 23 inclusive. The secretary-general is Mr. J. F. Nickerson, 431 South Dearborn Street, Chicago, Ill.

### Electrical Development Society Conference

The morning sessions of the conference which the Society for Electrical Development, Inc., is to hold in New York on March 4 and 5 will begin at 10 a.m. The afternoon sessions will begin at 2 p.m. There will be an evening session on March 4, beginning at 8 p.m., and on the evening of March 5 there will be a banquet at Delmonico's, as previously noted. The hour for the banquet will be 7 p.m. The guests will be Mr. Frank E. Wallis, of Wallis & Goodwille, architects; Dr. Talcott Williams, director of the School of Journalism, Columbia University, and Mr. James H. Collins, the well-known writer on business topics. The price of the banquet to the electrical industry will be \$5 per cover. On March 6 the board of directors and the executive committee of the Society for Electrical Development, Inc., will hold a meeting and review the proceedings of the conference. Mr. James M. Wakeman, general man-

ager of the society, in discussing its aims, said in part, this week: "No one manufacturer, central station, contractor or dealer can carry out, single-handed, efficient educational work as well as it can be carried out by co-operative effort. It is believed that the conference will constitute a starting point in electrical development and that it will produce a co-operative result eclipsing any heretofore known, with individual benefit to all engaged in the industry, and to the industry at large."

### Pacific Coast A. I. E. E. Convention

At the request of the American Institute of Electrical Engineers' members in Vancouver and vicinity, the board of directors has authorized the holding of the annual Pacific Coast convention of the Institute at Vancouver, British Columbia, on Sept. 9, 10 and 11, 1913. The Vancouver section has been working for some time in preparation for this convention and has already arranged for a number of papers, and plans are maturing for interesting trips to some of the large hydroelectric installations in the vicinity of Vancouver.

### Awards of Medals by Franklin Institute

The Franklin Institute, Philadelphia, has awarded Elliott Cresson gold medals, the highest honor in the gift of the institute, to six men for notable work done for the betterment of living conditions or improvement in art, science or mechanics. Winners of the medals and the work for which they won recognition are as follows:

Dr. Charles Proteus Steinmetz, Schenectady, N. Y., for successful application of the analytical method to the solution of numerous problems of first practical importance in the field of electrical engineering.

Mr. Emile Berliner, Washington, D. C., for important contributions to telephony and to the science and art of sound reproduction.

Dr. Isham Randolph, Chicago, for distinguished achievement in the field of civil engineering.

Lord Rayleigh (Dr. John William Strutt), Witham, Essex, England, for extended researches of signal importance in physical science.

Sir William Ramsay, London, for numerous discoveries in the science of chemistry.

Dr. Emil Fischer, Berlin, Germany, for numerous contributions of fundamental importance to the science of organic and biological chemistry.

### American Museum of Safety

At a special meeting of the officers of the American Museum of Safety called by its president, Mr. Arthur Williams, of the New York Edison Company, at Delmonico's, New York, Feb. 21, the views of Mrs. E. H. Harriman concerning the Harriman railway medals in memory of her husband were outlined by Dr. George F. Kunz. The three medals, of gold, silver and bronze, will be designed by Mr. J. B. Frazer, the noted sculptor and designer of the new 5-cent piece. The awards are to be

made annually in January, beginning with 1914, to the railroad, operative head and individual employee contributing most to progress and safety in railroad travel. President Williams has appointed as the medal committee Dr. Arthur T. Hadley, president of Yale, chairman; the United States Commissioner of Labor; Mr. W. F. Allen, secretary of the American Railway Association; Samuel O. Dunn, editor of the *Railway Age Gazette*, and Mr. Franklin K. Lane, chairman of the Interstate Commerce Commission. A committee on arrangements for a new building to house the American Safety Museum, which is now rather cramped in its quarters in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, has also been appointed and consists of Messrs. Arthur Williams, chairman; James Speyer, Henry D. Whitefield and L. B. Gawtry, Dr. George F. Kunz and Dr. Charles A. Doremus.

### Disastrous Sleet Storm in the Middle West

Extensive areas of Illinois and Wisconsin were visited on Feb. 21 by a storm of wind, snow and rain, which became an infliction of sleet in Chicago and its vicinity. Damage amounting to hundreds of thousands of dollars was done to overhead telephone, telegraph and electric-service wires. Pole lines were down for long stretches along the railroads entering Chicago. In the Stockyards district of that city, in the suburb of Oak Park and in other localities the electric-supply service was crippled. In Aurora so many wires were down that the Mayor ordered the supply of electricity cut off by public-service companies until linemen could make repairs. Many of the wires leading out of Joliet were down owing to the violence of the wind and the weight of the ice coating. In Evanston the police were summoned to a store by an automatic burglar alarm which was sounded owing to the crossing of wires. Street-railway service in many cities was seriously handicapped.

### A Bureau of Safety for a Large Public-Utility Organization

The Middle West Utilities Company, of Chicago, has organized a bureau of safety, which will act in an advisory capacity for the various subsidiary companies. These subsidiaries operate electric-service, gas, heating, ice-manufacturing, interurban-railway, street-railway and water-works plants. The diversified character of the utilities has made it necessary to include in the organization inspectors familiar with safety appliances in each class. The work of the bureau will include not only the recommendation of different safety appliances but also various courses of lectures and campaigns of education relating to safer methods of conducting public-service utilities with a view to reducing both personal-injury liability and the fire hazard.

Previous to the organization of the bureau of safety the Middle West Utilities Company decided to handle its own fire and liability insurance under a trust agreement. A fund has been created, of which President Samuel Insull, Vice-president Martin J. Insull and Mr. Edward P. Russell (a director of the company) have been made trustees. These trustees have entered into liability and fire-insurance agreements with the subsidiary companies. For the present the assessments are about the same as the premiums paid to outside companies handling the same classes of insurance.

The bureau of safety acts much as a board of underwriters the business of which is to conserve the insurance fund. The trust fund accumulating from the assessments paid by the subsidiary companies will be deposited at interest, and as it grows the interest will be returned to the

different subsidiaries in proportion to their assessments, or else the assessments will be reduced, care being taken to maintain a trust fund at all times sufficient to carry the insurance. The trustees will issue participating certificates in lieu of policies in the ordinary form.

Various forms and instructions have been issued by the bureau. These include suggestions for the reduction of the fire hazard, monthly reports, accident reports and the like. The bureau of safety of the Middle West Utilities Company is in charge of Mr. Charles B. Scott, manager.

### Census on Underground Construction

Some few years ago the National Electric Light Association compiled data as to the extent to which underground conduits were used in this country and Canada. These figures having become obsolete, attempts are now being made by the association to collect up-to-date facts on the subject. Mr. H. H. Stannard, commercial engineer for G. M. Gest, who is conducting this investigation on behalf of the association, will shortly mail to every central-station manager a letter requesting information in regard to the conduit systems used by the central-station, telephone, telegraph and traction companies, inquiring how many duct feet are used by each company and whether the conduit system is owned by the municipality or the companies. When the information is collected it will be placed on file permanently at the offices of the association and will serve as a basis for future compilation of records on this kind of distribution equipment.

### Advantages of Thin-Plate Storage Batteries

A paper on the Philadelphia thin-plate storage battery was presented by Mr. James M. Skinner at the regular monthly meeting of the Electric Vehicle Association of America held in New York on Feb. 25. The author described the evolution of battery grids and showed how the present type of thin plate had been developed from the heavier types formerly in use. Special emphasis was placed upon the advantages of the "diamond grid." Lantern slides were used to show the sturdy construction of this plate and to illustrate how the active material is held firmly in place by the diagonal members of the grid frame. It was stated that the type of thin-plate battery containing grids only 9/64 in. thick has been in service for one year, and as yet no trouble has been occasioned by buckling of the plates.

Results of tests made by the Philadelphia Storage Battery Company showed that the portion of material in a lead plate which is really active is confined to that material which lies within 1/32 in. of the plate surface. It was stated that these conclusions were reached after a careful chemical analysis of discharged plates layer by layer. It is argued, therefore, that since the central core of the battery plate is inactive it should be reduced to a minimum limited only by mechanical strength. It is claimed that this point of equilibrium between mechanical strength and good service has been reached in the thin plate, which is 9/24 in. thick.

Graphical illustrations were displayed showing how with a battery of the same size and weight it is possible to obtain 54.5 per cent more plate surface with thin plates than with thick grids. The large active surface presented is said to be a great factor in maintaining constant low resistance on hills and under extreme weather conditions.

Internal resistance, ampere-hour capacity, relative length of life in number of discharges, relative cost and efficiency of the plates of different thicknesses, were contrasted in a number of curves. It is notable that in each instance the thin-plate battery showed itself to be superior to any of its heavier competitors. The internal resistance of a seventeen-cell thin-plate battery at its lowest point was given as

slightly less than 0.001 ohm. The efficiency of the thin-plate battery was given as 70 per cent.

Mr. Skinner expressed himself as a strong advocate of the "no gassing" charge and stated that in his experience the two things which are most detrimental to battery service are gassing and heating. He explained a method of charging batteries by which a full charge can be given to the battery without the occurrence of the gassing evil. In the discussion which followed the presentation of the paper the following men participated: Messrs. J. S. Codman, Bruce Ford, P. D. Bartlett, S. C. Harris, D. F. Topias, S. G. Thompson, R. E. Russell, R. M. Lloyd, H. C. Roberts, I. R. Harris and W. P. Kennedy. Mr. S. G. Thompson read a tentative program which he is arranging for the coming meetings. It was announced that if the present plans were carried out Prof. Harold Pender of the Massachusetts Institute of Technology would address the March meeting of the society.

### Midwinter Convention, A. I. E. E.

Nearly 350 attended the midwinter convention of the American Institute of Electrical Engineers at New York, Feb. 26 to 28. The meeting was essentially a working convention, forty-five papers in all being presented and discussed during the eight busy sessions, which closed with a reception and dance at the Hotel Astor Friday evening. Proposed modifications of the present Institute Standardization Rules were presented before the sessions, for comment and suggestions before adoption in the Rules.

In opening the convention President Ralph D. Merzhon introduced as chairman of the sessions Dr. A. E. Kennelly, chairman of the standards committee, under the auspices of which the meetings were held. Dr. Kennelly referred to the advance of the industry which has made advisable a revision of the present Standardization Rules to meet the best practice of to-day. Among the requirements of such rules he mentioned the need of scientific accuracy, industrial uniformity, the subservience of all commercial and industrial interests possible, and co-operation in determining national and international standards where feasible.

### TEMPERATURE AND ELECTRICAL INSULATION

Representing the sub-committee on revision of rules relating to temperature and electrical insulation, Dr. C. P. Steinmetz declared the need for constructive rather than destructive criticism in the work of revision and invited the Institute membership to offer data and evidence showing how individual rules might be improved. The sub-committee papers were prepared, he said, before the compilation of the evidence presented in the following reports, and although the degree of agreement observed is complimentary to the various authors, no attempt has been made to correlate the results obtained. No standardization committee, said Dr. Steinmetz, can legislate and make rules if these rules are contrary to the best practice and interests of the industry. Such rules, he added, can specify how a machine should operate but must not specify how results are to be obtained lest development of design be retarded instead of assisted.

Mr. B. G. Lamme, co-author with Dr. Steinmetz of the sub-committee's report on temperature and electrical insulation, followed with an abstract of the paper as presented, pointing out the unusual character of such an inquiry, merging the best scientific judgment of two rival engineering organizations.

The report of the sub-committee recommends that 90 deg. C. shall be the ultimate temperature limit for class A insulation, suggesting also that 100 deg. C. be considered as the maximum permissible for insulation where long life is a requirement. They further recommend 40 deg. as the limiting temperature for the cooling medium or room and 25 deg. as the reference air temperature. With class

B insulation 125 deg. C. is taken as the limit and 150 deg. as the maximum permissible in the insulation. From 80 deg. to 85 deg. rise is here allowable. In making final decisions on the temperature-rise question, the ultimate temperature attained is recommended as the basis, rather than the rise itself.

### METHOD OF RATING ELECTRICAL APPARATUS

Acting as a sub-committee on methods of rating apparatus, Messrs. W. L. Merrill, W. H. Powell and Charles Robbins report urging more accurate and international ratings of electrical equipment. Among the subjects treated in their discussion are capacity rating by output, with use of "kva" and "kw" rather than "kw" and "hp"; continuous and short-time service ratings; temperature of apparatus; continuous and short-time service; name-plate stamping, etc. The committee strongly recommends rating in "kva" instead of "kw," as specially desirable in the case of generators, transformers, synchronous condensers, etc., while urging the double "hp-kw" rating for motors. In place of the present inexact "intermittent ratings" a set of six A. I. E. E. standards, with appropriate name-plates, is suggested.

### Discussion

In the course of the joint discussion on the sub-committee papers, Mr. E. A. Wagner submitted a written contribution, pointing out the difficulty of classifying electrical machinery in which the insulation is not homogeneous throughout. He suggested having only two classes, one class which "can burn out," and another, like rheostats, heaters, etc., which cannot burn out. Mr. Wagner also observed that the suggested method of rating apparatus by output would prove confusing applied to auto-transformers or compensators.

Mr. C. E. Allen suggested that a third method, "preparing and applying," be added to mechanical and electrical considerations of insulation durability.

Mr. C. L. Waters pointed out the difficulty which even expert factory testers have in assigning actual internal temperatures, and declared that, after all, results will depend upon the manufacturer and the materials he uses.

Mr. G. I. Staderker advised that changes in the rules, though needed, be made slowly in order to avoid confusing the non-technical public which buys power apparatus.

Dr. F. B. Crocker, in a communication read by Mr. Arendt, suggested that machines built to maximum rating must be applied more carefully than at present. Unlike other power apparatus, an electrical machine does not automatically protect itself if overloaded. The author recommended provisions for margin of safety not allowed in the proposed rules.

Mr. James Burke said that in the design and manufacture of a machine its temperature rise must be considered as well as its ultimate temperature. He also questioned how equivalent tests might be obtained with justice and accuracy under various conditions.

Mr. H. G. Stott spoke appreciatively of the committee's work, but cited examples in his own experience where the life of insulation had been limited to four years rather than ten as proposed in the rules.

Mr. L. Schueler, representing the Verband Deutscher Elektrotechniker of Berlin, Germany, described the standardization rules adopted in Germany, comparing them with American practice. Abroad, he said, ultimate temperature is accepted as the criterion rather than mere temperature rise. Impregnated cotton is limited to 90 deg. C.; cotton without impregnation to 80 deg. Other higher limits are provided for moving coils and for coils having one layer of copper. For room temperatures the international commission has adopted 30 deg. C. instead of 40 deg. In Germany machine capacities are limited to either



"continuous ratings" or ratings for a definite time—ten, thirty, sixty and ninety minutes.

Mr. H. A. Hart described the construction of armature coils employing only copper, fiber and asbestos, with varnish which has been successfully tested to 250 deg. C.

Mr. B. A. Behrend pointed out that "standardization has always standardized the past," since the future and even the present are unknown. Too rigid standardization, he declared, would be extremely dangerous and a possible handicap to the industry. General terms, he insisted, will make the Standardization Rules more successful than an attempt to be always specific.

Mr. J. M. Smith said that an international standard would enable American manufacturers to compete abroad, but he suggested that American standards are better adapted for European use than the European standards themselves, although the latter are not suitable to meet American practice.

Mr. C. Robbins, a member of the sub-committee, said that with the increasing range of apparatus additional classifications may be needed. The proposed ratings, he insisted, would result in even more liberal machines than at present.

Dr. S. S. Wheeler protested against the application of a single rating which might effect the lowering of the standard and reduce the margin of safety.

Mr. Philip Torchio said that while transformers, motor-generator sets, rotary converters, etc., are ordinarily run at normal rating in central-station operation, marginal capacity in case of break-down becomes absolutely essential and of the utmost importance in maintaining emergency service.

Dr. M. G. Lloyd called attention to the necessary distinction between rating and capacity. The latter depends upon room temperature, power-factor, wave-form, etc., while the rating should be based primarily on the ultimate rise in temperature in the machine.

Dr. C. P. Steinmetz added that while the data gathered by the sub-committee were perhaps incomplete, since it had not been possible to get the opinions and operating experience of the consulting engineers and operating men, the meeting had been called to bring out the viewpoints of all classes, in this way working toward the desired definitions and standardization rules. He pointed out that the ideal specification calls for apparatus which will operate for a number of years under normal conditions without destruction, and that the object before the meeting was to prepare specifications to that end.

Mr. Henry G. Reist compared electrical machinery with gas engines, waterwheels and steam turbines. The speaker suggested that the rating of motors be based on ability to run with a given load during a certain length of time, this length of time to be stated with the rating. He favored conservatism and recommended low temperatures.

Mr. B. G. Lamme declared that the sub-committee has advocated cutting down, not raising the temperature. It has recommended that the actual temperature rise should not exceed 50 deg., and that beyond this the designer may go as low as he likes. The danger in the old method of rating was that there was no definite limit, and this defect in particular the committee had tried to remedy.

Prof. Alexander M. Gray mentioned that it is not always the insulating material which is the limiting factor. The iron at present available has to have fully as much consideration. Generators, he said, should be rated on the kilovolt-ampere basis and not with respect to kilowatts, as the latter often leads to misunderstandings. Bearings have not received consideration from the committee, although the speaker thought generator bearings to be of fully as much importance as those of other machinery. He also suggested that the Standardization Rules be printed and sent out broadcast so that they might reach every user and prospective purchaser of electrical equipment.

Mr. R. F. Schuchardt recommended that both continuous and special rating be given on all electrical machinery.

Mr. H. M. Hobart recommended the single rating as being sufficient, and declared that the manufacturer is in search of the best results for the whole industry. A discussion ensued, participated in by Messrs. Torchio, Behrend and Steinmetz, as to the advisability of considering the possible temperatures of the hottest points and how to determine such temperatures. Mr. Behrend forcefully emphasized the necessity of the manufacturers' guarantee as to hot points. Dr. Steinmetz gave assurance that the manufacturers were willing to give this if they could be shown some way of finding the hot spot. Thermometers and resistance coils, he said, will not necessarily show the hottest spots.

Mr. C. F. Scott illustrated the difficulty of simple standardization rules to cover all cases, citing the instance of railway-motor classifications, for which lengthy definitions are required. It will be necessary in many cases, he insisted, to determine service conditions.

Mr. C. A. Adams suggested that manufacturers might guarantee in operation given surface temperatures which, as long as maintained, would insure safe internal temperatures.

Prof. C. L. de Muralt declared that manufacturers, consulting engineers and operating engineers are all agreed that protection of insulation is essential and that the hottest point which is in touch with it should be limited in temperature.

Dr. A. E. Kennelly said that the question is only one of the temperature measurable in the hottest place, but must be definite.

Mr. W. H. Powell spoke of the necessity of defining accurately the output of the machine.

On motion of Mr. Farley Osgood, invitations were extended to the National Electric Light Association, the American Electric Railway Association and the Association of Edison Illuminating Companies to contribute, within thirty days, expressions of opinion concerning the proposed ratings.

Abstracts of the papers and discussions presented at the remaining sessions will be given in a following issue.

### Problems of Illumination Discussed at Milwaukee Joint Meeting

A successful joint meeting of various engineering societies was held at the Republican House in Milwaukee on Feb. 22. Among the participating societies were the Chicago Section of the Illuminating Engineering Society, the Engineering Society of Wisconsin and the Milwaukee Electrical League. The papers of electrical interest related to various phases of illumination. Mr. F. A. Vaughan, of Milwaukee, chairman of the Chicago Section of the Illuminating Engineering Society, did much to bring about the joint meeting, and he is entitled to praise for its success. The attendance was about 130. The out-of-town members were entertained at luncheon and dinner by the hospitable engineers of Milwaukee.

Mr. P. H. Connolly, of Racine, president of the Engineering Society of Wisconsin, presided at the joint meeting, when papers relating to lighting and air conditioning were read and discussed. After the session there was a luncheon, Mr. Vaughan making the following remarks: Messrs. C. N. Duffy, for the Milwaukee Electrical League; J. R. Cravath, for the Chicago Section of the Illuminating Engineering Society; Armand D. Keith, for the Wisconsin Chapter of the American Institute of Architects; Dr. J. S. E. Turneure, of the University of Wisconsin; Prof. J. S. Smith, of the same university, and Mr. Euclid Borden, of the Milwaukee Engineering Society. Following this there was a trip to the plant of the Milwaukee Coke & Gas Company.

## EXPERIMENTS WITH LIGHT

The afternoon-evening session lasted from 5 to 8 p.m. The first feature was some experiments made by Mr. M. Luckiesh, physicist of the National Electric Lamp Association of Cleveland, who took for his subject "Light and Art." In a little theater or booth provided with numerous sources of electric light arranged so that various combinations could be made, the speaker demonstrated the effect of the direction, intensity and color of light in bringing out the details of sculptures and pictures. Many beautiful and some amusing effects were obtained by the manipulation of light effects in the skilful hands of the lecturer. He made the statement that in his opinion daylight effects are not to be sought necessarily in artificial lighting. He dwelt upon the great possibilities in the use of colored lighting and said that in coming years esthetic effects which are now only dimly foreseen will be attained by this means.

## OCULAR COMFORT AND ITS RELATION TO GLARE

Mr. F. A. Vaughan read a paper of which he and Dr. Nelson M. Black, of Milwaukee, were the joint authors. It had for its subject "Ocular Comfort and Its Relation to Glare from Reflecting Surfaces." The authors exhibited a number of specimens of printing and lithography to show good practice and bad practice in relation to the proper kinds of paper, ink and type to be used in books and magazines in order to produce the least strain on the eyes in reading. Mr. Vaughan said that engineers, publishers, printers, paper makers, printing-ink makers and ophthalmologists should co-operate to do away with the use of highly glazed paper, which he characterized as "abominable." The work of other investigators in this field was mentioned, and the author dwelt on the general benefits of the diffusion of light. In speaking about the advantages of uncalendered papers from the viewpoint of ocular comfort Mr. Vaughan pointed out that the modern offset process of illustration produces its best effect on such papers. Speaking of the specular reflection from glazed paper, he said: "We are concerned in the elimination of that form of reflection which produces objectionable glare." However, glare is partly dependent upon the character of the illumination as well as on the kind of paper used for books and magazines. Referring to the effect of color on vision, the speaker advocated monochromatic light.

Dr. Black contributed a short dissertation on the anatomical construction of the eye and the manner in which it performs its work as the organ of vision. Mr. Vaughan alluded to the importance of the work of the Illuminating Engineering Society's committee on glare from reflecting surfaces.

## A PHOTOMETER SCREEN FOR STREET-LIGHTING TESTS

Mr. J. R. Cravath read a short paper prepared by Prof. Arthur H. Ford, of the University of Iowa, entitled "A Photometer Screen for Use in Tests of Street Illumination." The author pointed out that the ordinary method of measuring street illumination on the horizontal plane, or one normal to the ray of light, does not give the information desired. He proposes to overcome this by using as a screen a body with rounded surfaces or several plane surfaces, the mean illumination of which is determined. Such a screen would correspond to a brick, if plain surfaces are used, or to a stone, if round surfaces are used, and the illumination would be to a considerable extent independent of the direction from which the light came. The paper was a record, with diagrams, of some tests with screens having various configurations. Five screens were used. One consisted of a plate of translucent milk-white glass with a ground surface. A second was a cube of paraffin. Paraffin is not a suitable substance for making permanent screens, but from the ease with which it may be molded into irregular shapes it is well adapted for making screens for temporary use. Its optical properties are satisfactory

if the screens are carefully selected. A third screen was one-fourth of a paraffin sphere having one flat side covered with an opaque screen. A fourth was an Alba glass hemisphere having one half blackened. The fifth screen was the same as the fourth with the addition of a piece of paper on the flat side of the hemisphere. The results obtained with test readings, using one-fourth of a paraffin sphere, were satisfactory for use in street photometry. The writer suggested the use of a screen of this form made of Alba or some similar glass.

## COLORED SURROUNDINGS AND THE COLOR OF USEFUL LIGHT

The last paper of the evening was read by Mr. M. Luckiesh, whose subject was "The Influence of Colored Surroundings on the Color of the Useful Light." This paper gave results of a study made to determine the magnitude of the influence of colored surroundings on the color of useful light. Calculations given in the paper show that only a moderate yellow paper is required to change the color of tungsten light to that of the carbon-filament lamp. Both direct and indirect lighting were considered in the computations, the results obtained being plotted in several ways. Mr. Luckiesh's paper on this subject appeared in abstract in the *Electrical World* of Feb. 22.

## Spokane Convention of Engineering Societies

The first meeting of members of engineering and scientific societies of Spokane and vicinity was held in the Moorish room of the Spokane Hotel, Feb. 19, 20 and 21. There was an attendance of over 150 and twenty-five papers were discussed, as announced in our issue last week. Members of twenty-three national and local societies had been invited to the meeting. A permanent organization was effected and plans were made for annual meetings in the future. Mr. J. C. Ralston, consulting engineer, Spokane, occupied the chair and Mr. L. K. Armstrong, mining engineer, Spokane, acted as secretary.

Mr. Ralston called the meeting to order and introduced Mayor Hindley, who extended the welcome of the city. Mr. C. Z. Fowler, of Seattle, then urged affiliation with the Pacific Northwest Society of Engineers and the formation of a local chapter in Spokane. It was resolved, however, to maintain the identity of the local society for the present and to appoint a committee to take up the question of affiliation at a later date, as it was felt that it would be advisable to have a regular annual meeting in Spokane in the future.

The first day was civil engineering day, the feature being a paper on engineering education by Mr. Ralston. The author condemned the technical schools for giving the future engineer his training on technical lines only, with little attention to civics, economics, sociology and other broadening subjects. Engineering work should have three ideals, social, artistic and economic, and these should all be kept before the student. A technical man is presumably well educated, and one therefore presupposes in him an ability to use good English and to write not only accurately but with ease. There is frequent question of the adequacy of an engineer's compensation, but cannot the reason for this be found perhaps to lie with the engineer himself? Do engineers pull together as well as men in other professions? Is not the failure to do this the cause for some criticism by the public? It is perhaps a characteristic failing of engineers that they avoid contact with business men in general and make little effort to occupy prominent or influential positions in the community.

On Feb. 20, electrical day, the meeting was held under the auspices of local members and associates of the American Institute of Electrical Engineers. Mr. V. H. Greisser, chief electrical engineer of the Washington Water Power Company, was chairman for the day. A telegram



from Mr. Ralph W. Pope was read stating that the board of directors of the A. I. E. E. authorized the organization of a local section in Spokane. As some twenty-five candidates were pledged to join in addition to the members and associates now in Spokane, the formation of a local section was assured.

The first paper of the day was "Illumination and Wiring of Large Buildings," by Messrs. W. K. Stacy and H. B. Peirce, of Spokane. The first part of the paper, read by Mr. Peirce, took up the question of illumination. The writer first gave a short summary of the aims of the illuminating engineer and then showed how some problems in hotel and office building work might be treated. The author emphasized the need of not only an efficient installation but one conforming to the requirements of the architect and one that would be comfortable to the user. Mr. Stacy then took up the question of wiring, with particular regard to the adoption of specifications that would be clear and exact. Far too often specifications are submitted to bidders which repeat much that is covered by the National Electrical Code and contain little as to the real details of design, virtually leaving the whole matter to the contractor, with the result that no two contractors figure on the same requirements. The question of switchboard design was also discussed, showing the reasons for certain requirements.

The next topic on the program, "Long Lake Power Development," by Mr. C. S. MacCalla, general manager of the Washington Water Power Company, was an illustrated lecture on the work of the development to date. A number of most interesting lantern slides were shown which exhibited the history of the work from its commencement. Particular attention was given to the unusual features in the construction of the large dam and to the methods of taking care of any water that might percolate through the bedrock and establish an upward pressure on the base of the dam. The gravity system of concrete mixing as used in building the dam was also explained in detail. During the discussion, which was general, the consensus of opinion seemed to be that unless the conditions were exceptionally favorable to gravity mixing no saving was effected by that method.

The next paper, entitled "Theory of Electric Power Transmission," by Professor H. V. Carpenter, Washington State College, presented an exact solution for determining the behavior of a transmission line which he claimed is both easy to derive and easy to use in actual problems. The author first derived the well-known differential equations which express the fundamental relations in a transmission circuit and then developed the familiar solution which is expressed as an infinite series, giving the generator emf or current in terms of the line constants and the receiver emf and impedance. A practical example of a three-phase transmission was then solved.

"Notes on the Western Canada Power Company," by Mr. F. D. Nims, electrical engineer, Vancouver, B. C., described the 40,000-kw development on the Stave River. This project is noteworthy as having storage sufficient to operate the plant at full output for ninety days with no rainfall or run-off. For distribution the company is using a 12,000-volt line on the same right-of-way as the high-tension lines and is stepping down the emf from this to the consumer's pressure by means of pole-type transformers, doing away with substations in most cases. At the city the company delivers energy to a substation at 13,000 volts, where the emf is stepped down to 2300 volts and the energy is sent out in lead-covered armored cables laid directly in trenches without other protection; from these cables services are tapped to consumers' premises. As only large customers are served, this method has proved very satisfactory. The company is now using the metric system on all its plans and designs, although all drawings sent to contractors are first changed to the English system for their

convenience. This is said to have proved a great success with the company employees. Some interesting lantern slides were shown illustrating the character of the country and the problems of transmission encountered. Lively discussion followed the presentation of this paper, a question being raised as to the desirability of using steel footings for the towers instead of concrete.

The last day of the session was mining day. Among other papers was one presented by Mr. J. B. Fiskien on "Electricity in Mining." In the absence of Mr. Fiskien the paper was read by Mr. M. V. Birkett. The paper was of peculiar interest as Mr. Fiskien had been superintendent of the Washington Water Power Company even before its entering the field of supplying energy to the Cœur d'Alene mines. The paper traced the history of the application of electricity from its first use in 1874, for the ignition of blasts, to its modern applications. Energy was first supplied to the Cœur d'Alene mining district by long-distance transmission in 1903, where it proved so successful that it was soon in general use. The local water supply formerly used for small hydroelectric developments was found to be more valuable for use in the concentrators, and the timber was too valuable for the timbering of shafts to allow its use for the generation of steam power. It is now the policy of the company in serving the district to deliver energy at 60,000 volts pressure to a relatively small number of substations, distributing therefrom at 6000 volts. Electricity is now used in the mines for hoisting, blasting, air compressing and lighting; heating has been considered but does not appear to be feasible. Discussion of the paper was postponed until the next meeting of the local section of the American Institute of Mining Engineers, when it is hoped Mr. Fiskien may be present.

The session closed with a banquet at which there was an attendance of about 100, Mr. Ralston acting as toastmaster. It was the unanimous opinion that the meeting, the first of its kind in Spokane, was a great success, and it is planned to have a similar meeting annually in the future.

### Illinois University Electrical Show

On Feb. 6, 7 and 8 the fourth electrical show of the University of Illinois was held in the Electrical Laboratory at Urbana, Ill. The entire three floors of the building were devoted to displays of electrical apparatus and novel electrical demonstrations. The policy has always been to exclude commercial exhibits and to show nothing which would not in some way demonstrate new or interesting electrical phenomena. To this end, all electrical engineering students were urged to present such displays as would be of the most interest to the general public.

The result was very gratifying. Fifty-five exhibits were entered, containing features interesting and instructive to the layman as well as to the technician. The apparatus shown varied from the delicate galvanometer used to measure the resistance of the human body to the 100-kw testing transformer for break-down tests. The maximum power demand when the show was in operation exceeded 600 kw, which was furnished by the university power plant and the local lighting company.

Among the exhibits, the high-tension break-down tests and corona display were probably the most spectacular, and these caused much comment. Insulators were shown under test and were broken down, motors of special design were operated by static electricity, and other interesting exhibitions were given. The life-saving exhibit showed the most approved methods of resuscitation from electric shock and showed in detail the operation of the pulmotor and the oxygen helmet. The prevention and control of electrical fires were thoroughly demonstrated. In the telephone and telegraph department a licensed wireless station was at all times in communication with distant cities.



The latest types of telegraph and telephone apparatus, as well as a complete 200-line telephone switchboard, were operated and explained.

Among the other "stunts," eggs were fried on a cake of ice, artificial ducks swam and dived in a large tank at the will of the operator, and an aluminum bronco "bucked" persistently on a flat-topped table. An electric café was operated in connection with the show, special features being electric cooking, an electric fountain and an electric orchestra. The lighting effects and general arrangement made the café an attractive exhibit. The show was managed throughout by the Electrical Engineering Society of the university. Although the cost of giving a non-commercial show is necessarily great, the society was able to report that the proceeds from the unusually large attendance had covered all expenses.

### Boston Edison Engages English Expert

Arrangements have been made by the Edison Electric Illuminating Company of Boston to retain the services of Mr. Arthur Wright, of London, to act in a general advisory capacity. Mr. Wright is best known in this country as the originator of the Wright demand indicator system, although as a matter of fact his principal activities during the past ten or twelve years have been in connection with the construction and operation of large electricity supply companies. Mr. Wright is planning to spend considerable time in Boston in the early spring.

### Profit-Sharing Plan in Engineers' Office

One of the first applications of profit sharing to be made in the engineering profession was announced on Feb. 17 at a dinner of the architectural and engineering firm of Ballinger & Perrot, Philadelphia, Pa., by Mr. Walter F. Ballinger, senior member of the firm, who explained the twofold basis on which the division of profits will be made among the company's employees, to whose energy and industry the success of the business is largely accredited: First, a certain sum will be set aside from the profits, in which sum all employees will share equally irrespective of their salaries; second, there will be the division of an additional amount based on the proportion which each employee's salary bears to the total salary roll. Taking the men of the company wholly by surprise, the announcement was followed by the distribution of checks covering each employee's share in the profits of the last year.

### Bills to License Electrical Contractors

Bills providing for the licensing of electrical contractors are now before the State Legislatures of New Jersey and California. Mr. James F. McLaughlin, of Atlantic City, N. J., formerly of the Philadelphia city electrical department, has submitted a bill to the New Jersey Legislature which, if passed, will require the licensing of all electrical contractors and workers in that State. Under the terms of the proposed act, contractors will be required to furnish a bond in the sum of \$2,000 as a guarantee of the quality of their work.

Assemblyman W. S. Scott, of San Francisco, has introduced a bill in the California Legislature providing for the licensing of all "master electricians" and electrical workmen installing wiring and apparatus. Mr. Scott proposes a board of electrical examiners consisting of five members having terms of one, two and three years, all of whom shall themselves be "master electricians" or contractors. This board would meet quarterly at Sacramento for the

examination of candidates' knowledge of electricity, experience and good moral character. A fine of \$25 to \$100 is provided for the punishment of any person who undertakes electrical work without a license, with an alternative penalty of five to sixty days in the county jail, or both. Twenty-five dollars is fixed as the application fee for examination, and \$10 as the annual fee for renewal of license.

### Chicago Labor Unions Sued Under Sherman Law

Two local unions of the International Brotherhood of Electrical Workers were sued in Chicago on Feb. 24 by the federal government under the anti-trust law, it being alleged that the defendants had unlawfully interfered with interstate messages of the Postal Telegraph Cable Company. A strike against the company was declared recently, and the government charges that officers and members of the union combined and conspired to perform acts of violence and depredation to injure the Postal company's wires and to interfere with the transmission of government and commercial messages comprising interstate commerce. The government's bill also charges that the alleged unlawful acts have violated the rights granted under the Constitution and laws of the United States to the telegraph company and to the senders of messages. An injunction restraining the acts of the defendants is asked for by the government.

Labor troubles between the Postal company and the electrical unions arose in September last over the company's refusal to establish the "closed shop" principle. The company refused to discharge old and faithful employees who were not members of the union. But upon the imminence of a strike during October the company discharged its union employees and replaced them with non-members. The government charges that threats and acts of violence occurred soon after, the telegraph company being powerless to prevent recurring acts of violence against its outside plant in the city of Chicago, usually committed at night. The suit is of special interest because several futile attempts have been made in Congress during the past few years to exempt labor unions from the Sherman law.

### Congress Passes Corporate Value Bill

The Adamson bill, requiring the Interstate Commerce Commission to ascertain the actual value of all railroads, telegraph and telephone companies and other common carriers, passed the Senate on Feb. 24 with practically no opposition. Slight changes made in the bill will require a conference with the House. It is believed that all differences will be adjusted and the bill sent to the President before the final adjournment. The purpose of the bill is to furnish a basis for the fixing of equitable transportation rates and reasonable charges for telegraph and telephone service.

### Public Service Commission News

#### MICHIGAN COMMISSION

Mr. Lawton T. Hemans, chairman of the Michigan State Railroad Commission, addressed the State Legislature Feb. 20, pointing out the weakness of present laws relating to the supervision of telephone operation. The Giles law, intended, he said, to give the commission complete control over telephone companies in some directions, fails especially in according it power to enforce interchange of messages between systems. Advocating short-term advance payments, Mr. Hemans said he felt it unjust to force companies to furnish service to every applicant without some protection.

## INDIANA COMMISSION

A State Public Utility Commission, with powers similar to those of the Wisconsin State Commission, was created by act of the Indiana Legislature on Feb. 26. The commission is to have supervision over all privately owned and municipal utilities except railroads and will consist of five members and counsel appointed by the Governor. The act permits the newly formed commission, with the consent of the Governor, to employ attorneys, engineers and expert accountants for the prosecution of its work. The duties of the commission will consist of requiring every public utility to furnish to the public reasonably adequate service at just rates. A sum of \$75,000 annually has been appropriated to defray the expenses of the commission.

## OHIO COMMISSION

The commission has accorded to the Brookville & Lewisburg Lighting Company, of Lewisburg, Ohio, permission to issue and sell \$10,000 worth of common stock for the purpose of building a transmission line in Brookville. The company is directed to report at intervals of three months the disposition and use made of the proceeds of this sale until all of the authorized stock has been sold.

Franchises granted by a municipality to corporations or public utilities are contracts and cannot be impaired by any subsequent action of the Legislature, according to an opinion rendered by Attorney-General Hogen in the complaint before the Public Service Commission against the Columbus Street Railway Company, brought by Mr. James Ross, of Columbus.

## CALIFORNIA COMMISSION

The commission has issued an order granting the Southern Sierras Power Company permission to raise its schedule of rates for electric motor service for irrigation pumping purposes in certain portions of Riverside and San Bernardino Counties outside of incorporated cities and towns.

A decision has been rendered by the commission authorizing the Half Moon Bay Light & Power Company to accept promissory notes in payment for part of its capital stock, on condition that the stock should not be issued until the notes have been paid.

## ONTARIO COMMISSION

The Hydroelectric Commission of Ontario recently held a hearing on the complaint of the City Council of London (Ont.) setting forth that the Water and Light Commissioners are charging an exorbitant sum for street lighting. The rates had already been approved by the commission, and the city filed an appeal. The Hon. Adam Beck, chairman of the commission, stated that the hearing was held largely as a matter of policy and ruled that all municipalities in the Provinces must be treated by the commission without impartiality or discrimination. It seems unlikely that the commission will modify its former ruling.

## MASSACHUSETTS COMMISSION

Governor Foss has recommended an appropriation of \$15,000 by the Legislature to enable the Attorney-General to continue the proceedings in the courts in connection with the order of the Gas and Electric Light Commission reducing the price of gas at Haverhill. In a special message the Governor said that the whole question of public-utility regulation by the State is involved in the case. The Haverhill Gas Light Company has secured an injunction against the enforcement of the board's order and contends that the price set is confiscatory.

The proposal to extend the powers of the board to include supervision over the books and papers of voluntary associations was opposed at a hearing on Feb. 24 before the legislative committee on public lighting by Mr. E. W. Burdett, of Boston, on behalf of the Massachusetts Electric Lighting Association. He contended that the publicity proposed might result in shaking out security holders.

## DISTRICT COMMISSIONERS TO REGULATE UTILITIES

A bill passed by the United States Senate gives the commissioners of the District of Columbia the authority of a public utilities commission, with power to regulate the services and charges of utility corporations. The commissioners are directed to make a physical valuation of the properties of every public-utility concern in the District and report to Congress.

Another bill, introduced by Senator La Follette, making it unlawful for "foreign corporations to own or control the capital stocks, bonds or indebtedness of local utilities corporations in the District of Columbia," has been passed by the Senate. The bill is declared to be aimed at a Virginia holding company recently chartered to take over the public service corporations of the District of Columbia.

## Current News and Notes

N. E. L. A. CONVENTION COMMITTEES.—The headquarters of the entertainment, hotel and transportation committees for this year's National Electric Light Association convention in Chicago will be in the Hotel Sherman, owing to the fact that its location is convenient to Medinah Temple.

COMPILATION OF LIGHTING RATES.—A useful compilation of the complete lighting schedules of 140 central-station companies in the State of Ohio has just been issued by the Ohio Electric Light Association, of which Mr. D. L. Gaskill, Greenville, Ohio, is secretary. The data listed include domestic, commercial and street-lighting rates.

HONOR FOR AN OLD ELECTRIC VEHICLE.—A Chicago manufacturer of electric automobiles offers to pay \$50 to the owner driving the oldest electric brougham made by this company. The age of the car will be determined by the serial or model number. The reward will be paid only to a private owner, and the car must be driven to the factory under its own power not later than March 10.

MUNICIPAL CONTROL OF ELECTRIC SERVICE PROPOSED IN ILLINOIS.—Senator A. J. Olson, of Woodstock, has introduced a bill in the upper house of the Illinois Legislature giving cities and villages in that State the right to regulate, control and sell electricity supplied for lamps and motors. Chicago now possesses the right to regulate the maximum prices for electric service, but does not sell electricity.

A CHIEF OF POLICE ON STREET LIGHTING.—In his annual report for 1912 Mr. McVeeny, the general superintendent of police for Chicago, says that Chicago needs a better street-lighting system. "No city can hope to be well governed," he says, "unless its streets and alleys are well lighted. Crime flourishes in dark places." It may be added that when the 12,200 additional arc lamps, or their equivalent, now under contract to be furnished by the Summer District for street lighting are in service the condition complained of by the chief of police will be greatly improved.

TWENTY-FIVE THOUSAND BOOKS AND OTHER MATERIALS IN THE "TECH" ELECTRICAL LIBRARY.—President MITCHELL of the Massachusetts Institute of Technology, Boston, announces an important gift from the American Telephone & Telegraph Company of \$25,000 in the form of 25,000 books and pamphlets to be devoted to the building, maintaining and replenishing of the Institute's electrical engineering library. Mr. William Welles Bosworth has been selected as the architect for the new Technology group of buildings.

and will have associated with him Prof. James Knox Taylor, head of the local department.

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**GOVERNMENT QUARTERLY LUMBER REPORT DISCONTINUED.**—Because of the extent to which private agencies are now collecting lumber price data, the Forest Service will discontinue publication of its quarterly issue of mill and wholesale lumber prices. Under the circumstances it is considered unnecessary for the government to continue this work, except to the extent necessary for its own information. The usual January-issue containing the prices for October, November and December will not be brought out.

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**LIMITATION OF INJUNCTION POWER.**—On Feb. 25 the United States Senate passed the Crawford bill, which curbs use of the injunction power of federal courts to prevent the enforcement of state laws and the orders of state commissions. The measure, which is designed chiefly to protect the state railway commissions in their reductions of rates, provides that an application for injunction must be approved by a Supreme Court justice, a Circuit Court justice or a federal district judge. It also provides that a lawsuit to enforce a state law or a state commission's orders, when brought in a state court, shall operate to suspend hostile injunctions by the federal courts.

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**TREATY OF BRUSSELS, AND PATENTS ISSUED PRIOR THERE-TO.**—In the United States Supreme Court decision relating to the expiration of American and foreign patents, referred to on page 187 of our issue of Jan. 25, the question at issue was whether the Cameron company's United States patent expired with the British patent according to the laws in effect at the time it was issued, or whether its existence was *ex post facto* preserved by the Treaty of Brussels to the full seventeen-year term. When this patent was issued existing statutes provided that a United States patent issued on an invention already patented in a foreign country should be so limited as to expire at the same time as the foreign patent or, if more than one, the foreign patent of the same time having the shortest term, but in no case exceeding the constitutional seventeen-year limit. The object of the Brussels treaty, however, was to prevent such limiting of the term of a United States patent by a corresponding foreign patent, and since that treaty the term of United States patents has been independent of the term of any foreign patent. The Cameron patent involved in the decision was already in existence when the Brussels treaty went into effect. Therefore this patent could not be brought under the treaty's provisions, and the court accordingly decided that the patent was to be construed under the prior statutes and therefore was limited to expire with the shortest term of the corresponding foreign patent.

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#### SOCIETY MEETINGS

**MAINE ELECTRIC ASSOCIATION.**—The midyear meeting and banquet of the Maine Electric Association was held at Riverton on the evening of Feb. 24. Mr. Deane S. Small was the principal speaker of the evening. The president of the association is Mr. Harry B. Ivers, general manager of the Cumberland County Power & Light Company, of Portland, and the secretary is Mr. Walter S. Wyman, treasurer and manager of the Central Maine Power Company, Waterville.

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**JOINT MEETINGS IN CHICAGO.**—Mr. Lucius B. Andrus, general superintendent of the Indiana & Michigan Electric Company of South Bend, Ind., read a paper on "The Application of Synchronous Motors to a Water-Power Transmission System for the Betterment of Service Standards" at a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers on Feb. 24. Mr.

Ralph H. Rice presided, and there was some discussion. The next joint meeting will be held at the Western Society's rooms on March 24, when Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, will speak on "Regulation and Enforcement of Public-Utility Laws."

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**OKLAHOMA CONVENTION MAY 6, 7 AND 8.**—The convention of the Gas, Electric and Street Railway Association of Oklahoma will be held at Oklahoma City May 6, 7 and 8, the Hotel Skirvin having been chosen as the association's headquarters. It is planned to have the convention visit the State University at Norman on the afternoon of the second day. There it will be the guest of the university at luncheon, afterward holding a session in the engineering building. Among the papers to be read at the forthcoming sessions will be one by Mr. F. H. Ellis, of Kansas City, Mo., on "Liability Insurance," and one on "Electricity and Irrigation for Oklahoma Farms," by Prof. H. B. Dwight, of the University of Oklahoma. Prof. H. V. Bozell, Norman, Okla., is secretary-treasurer of the Oklahoma association.

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**MEETING OF CHICAGO SECTION, E. V. A.**—Mr. H. F. Thomson, of Boston, was the principal speaker at the meeting of the Chicago Section of the Electric Vehicle Association on Feb. 18. His subject was "Comparative Performance of Horse, Electric and Gasoline Trucks in City Service." Mr. Thomson gave a brief account, illustrated with lantern-slide diagrams and pictures, of the investigation begun by the Massachusetts Institute of Technology in May, 1911, at the instance of the Edison Electric Illuminating Company of Boston. This investigation, which has been referred to from time to time in these columns, relates to the operating costs of horse-drawn and motor-operated commercial vehicles, and also includes a study of the performance of horse-drawn wagons and motor vehicles in typical services around Boston. Mr. Thomson devoted his remarks principally to the latter subject.

\* \* \*

**ELECTRIC CLUB OF CHICAGO DISCUSSING PERMANENT QUARTERS.**—At the meeting of the Electric Club of Chicago on Feb. 20 there was a discussion of the proposal that the club engage permanent quarters. From a committee of the board of managers Mr. H. M. Webber reported that the club could obtain space on reasonable terms in the old building of the Hamilton Club, on the corner of South Clark Street and West Monroe Street. A committee of seven, not connected with the present administration, was appointed by President Keech to investigate the subject and make a recommendation. This committee consists of Messrs. J. H. Goehst, F. W. Harvey, H. A. Mott, H. E. Niesz, N. F. Obright, C. G. Sharpe and F. P. Vose. Mr. J. B. Griffith, recently of Denver, told of the activities of the Colorado Electric Club of Denver.

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**MONTREAL JOVIAN CLUB.**—At a meeting of Montreal Jovians on Feb. 17 a Jovian luncheon club was formed, Statesmen James Bennett, of Montreal, being unanimously elected president. On recommendation of a nominating committee, composed of Messrs. G. F. Perkins, J. J. Warren and G. G. McDonald, the following officers were also chosen for the club's first year: Vice-president, Mr. D. H. Ross; secretary, Mr. A. M. Muirhead; treasurer, Mr. Watson Jack; auditors, Messrs. Gordon C. Bowie and F. W. Wiggins; executive committee, Messrs. W. B. Shaw (chairman), W. J. Doherty, P. T. Davies, James Bennett and D. H. Ross; membership committee, Messrs. W. M. Turnley (chairman), A. J. Carroll and C. B. Ellis. Other committees appointed were: Finance committee, Mr. W. P. Baird, chairman; house committee, Mr. F. J. Parsons, chairman; publicity committee, Mr. A. J. Johnson, chairman. The club plans to hold weekly luncheon meetings.



## Acadia Coal Company's Steam-Turbine Plant

**Recently completed generating station for the mines at Stellarton, Nova Scotia, burning culm—Adjacent mines served by underground transmission system**

**A**BOUT a year ago the Acadia Coal Company, Ltd., of Stellarton, N. S., placed in service a new turbo-alternator plant designed for the utilization of culm and refuse fuel at the mouth of the Allan shaft, about a mile east of the above town. The company supplies electrical energy from this station to the Albion Mines, about 1.5 miles distant, in addition to the Allan shaft. The engineering features of the work are notable from several points of view. The machinery used in the power house is partly of foreign make; the superheating practice is carried considerably beyond that common to most American installations, and by the use of underground transmission between the plant at the pit's mouth and the distant centers of energy distribution economical and reliable service has been established. Bituminous coal is mined throughout the district served by the Stellarton plant, and it is noteworthy that energy developed at the mouth of one mine is transmitted electrically to the depths of another with greater efficiency and service reliability than would be secured by the use of local engines supplied with steam from local boilers using culm obtained locally.

The exterior of the new station is shown in Fig. 2, the plant being housed in a brick and steel structure divided into a boiler-room and coal-pocket section on the right of the illustration and a turbine-room, auxiliary electrical equipment and switchboard division on the left. The station is situated at the mouth of the mine and is well provided with railroad-trackage facilities for the handling of machinery and supplies, the main line of the Intercolonial Railway passing within a few hundred feet, with spur-track connections. The power house stands a little to the north

of the screening plant of the Allan shaft and is connected with the latter by a coal conveyor which provides a constant supply of waste culm for the boiler service.

The boiler room, about 125 ft. long by 75 ft. wide, contains six 450-hp B. & W. boilers equipped with superheaters and set in three batteries on one side of a firing aisle designed for an ultimate width of 8 ft. Fig. 3 illustrates the interior of the boiler room, which is supplied with an unusual volume of natural light from windows in the side walls and is equipped with mechanical devices for handling fuel and ashes and with overhead bunkers capable of storing 600 tons. The bunkers are built of wood with steel framing. Each boiler is equipped with a B. & W. chain-grate stoker with a grate surface of 108 sq. ft. Sufficient draft is obtained through a Custodis brick chimney 150 ft. in height above the grate and 12 ft. in inside diameter. The stokers are driven from a shaft belted to a 7-in. x 6-in. Robb-Armstrong non-condensing engine, and the draft is ordinarily about 0.5 in. measured by water column. In a commodious basement below the boiler room is a coal crusher operated by a 25-hp motor. The ash hoppers at the rear of and under the boiler furnaces discharge upon a conveyor driven by a 10-hp motor and delivering the ashes into a flume 7 in. deep and 2 ft. wide, which runs from the power house and bankhead of the mine to a point about 200 yd. distant on flat lands below the station. This flume carries the circulating-water discharge from the turbine condensers as well as waste water from the Allan shaft, and the flow is sufficiently strong to carry the ashes away without clogging and to distribute them over waste lands without additional cost. At the front of each furnace, but below it, is

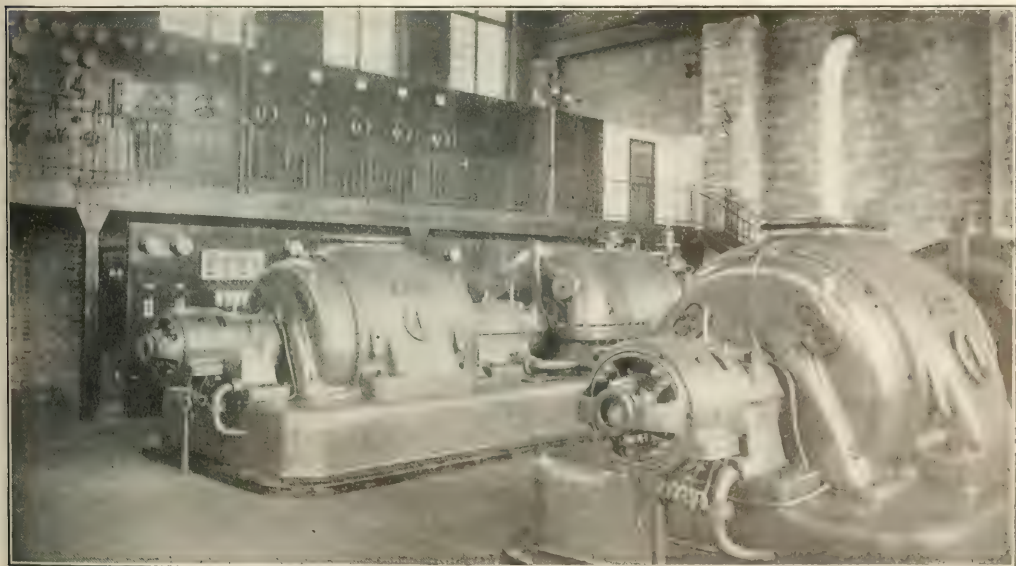


FIG. 1.—INTERIOR OF TURBINE ROOM, CENTRAL POWER STATION AT ALLEN SHAFT

a hopper into which unburned coal falls from the stokers, the large proportion of loose material found in the culm making this arrangement desirable. A partition between the two hoppers carried down vertically toward the ash conveyor from the furnace separates the ashes from the unburned culm particles, and suitable dampers enable the ash disposal to be temporarily shut down and the culm



FIG. 2—GENERAL VIEW OF POWER PLANT

collection to be substituted, the conveyor being arranged to discharge the unburned culm again upon the conveyor feeding the main coal pockets above the boilers. The culm used burns ordinarily to about 40 per cent ash, but the boiler and stoker installation handles it without difficulty. The carrying capacity of the conveyor feeding the storage pockets above the boilers is 100 tons per hour, and the conveyor is operated by a 10-hp motor. There is also a 45-hp motor-driven crusher in service on the premises near the mine head.

The turbine room is separated from the boiler room by a fire wall and contains two 1850-kva, 3150-volt, three-phase, 50-cycle Allgemeine Elektrizitäts Gesellschaft turbo-alternators, a switchboard gallery, bus structures and transformer equipment. The generating units are of the horizontal type, operating at 3000 r.p.m., with Curtis type turbines, each set having three bearings. Each generator is provided with an individual exciter overhung on the outboard bearing, and these exciters are rated at 12 kw and 15 kw respectively, the excitation being at 110 volts. There is a tachometer for each turbine, and each bearing is equipped with a thermometer. For the lubrication there is a helical pump delivering oil to the bearings under a pressure of about 30 lb. per sq. in., the oil being used also for cooling purposes. After passing through the bearings it is returned to a cooling tank in the basement. A special turbine oil, manufactured by the Galena Signal Oil Company, Franklin, Pa., is used by the company.

The floor area occupied by each turbo-generator set is about 9 ft. x 27 ft. Tests of these units show a steam consumption in one case of 14.2 lb. per kw-hr. and in the other of 14.78 lb., when operated at a pressure of 150 lb. and carrying a load of 1500 kw.

The condensing equipment for the plant is subdivided, a portion of the apparatus being located in a pump house on the East River, a small adjacent stream, and the rest located in the turbine-room basement, which is served through openings in the turbine-room floor by a 12-ton hand-operated crane spanning the latter. Fig. 4 illustrates the circulating-pump equipment and Fig. 5 the air pump and condenser plant, the latter being within the power house. The condensers are of the surface type, and the two circulating pumps, each rated at 5000 gal. per minute, are of the horizontal two-stage type and are each directly connected to a 75-hp, 500-volt, three-phase induction motor running at

965 r.p.m. The condensate is delivered to a common Weir vertical-type feed-water heater. The air pumps, directly connected to 17.5-hp, three-phase motors, are capable of discharging the condensed steam against a head of about 16 ft. Each turbine requires about 19,423 cu. ft. per hour for condensing when operated at full load. The air pumps are designed for carrying a load giving 22,000 lb. of condensate per hour, corresponding to 28-in. vacuum. The boiler-feed pumps are of the Weir marine type, the heater being of the Webster open type.

Each generator is supplied with filtered air for cooling from an intake into a duct chamber in the power-house basement, the air from out of doors being passed through a 6-ft. x 6-ft. 9-in. flannel screen. The heated air is discharged through a galvanized-iron duct in the summer, and in the winter it is used for heating the turbine room. The filter installation has a capacity of 8828 cu. ft. of air per minute. The turbine room is provided with space for the future installation of a 3000-kw unit.

The main switchboard is located on a gallery about 8 ft. 6 in. above the turbine-room floor and extends practically the entire length of the room, with the exception of two doorway openings at the ends leading into an oil-switch and instrument-transformer room at the rear. There are fifteen panels of black marble in the main switchboard, including two main generator panels, two panels controlling the service to the Albion mines, two panels controlling service to underground pumps at the Allan shaft, two transformer panels, a synchronizing panel and six spare panels. The general arrangement of the switchboard gallery provides for a clear distance of 5 ft. in front of the board, a distance of 4 ft. 8 in. behind the latter separating the rear of the board from a group of oil-switch cells built in concrete, and behind these a distance of 3 ft. 8 in. separating a group of concrete instrument-transformer cells from the latter structure. The oil switches in the cells at the rear of the main switchboard are equipped with maximum-load release coils and are re-set mechanically by levers connecting with the front of the switchboard panels. Watt-hour meters equipped with cyclometer dials are mounted on the rear of the oil-switch cell structure. The instrument transformers are set on concrete shelves 2.5 in. thick, in cells 26 in. wide and 24 in. deep.

On the turbine-room floor and under the main switch-



FIG. 3—CHAIN-GRATE STOKERS IN BOILER ROOM

board gallery is a low-tension switchboard containing two panels controlling the secondaries of transformers supplying local service, two lighting panels for the power house and external illumination around the plant, and five panels controlling various distribution circuits. There is also a bus room at the rear, providing for such main and auxiliary parallel switching of the three-phase generating units as



may be required. These buses are carried in concrete compartments and the separate leads are located 10 in. apart. Siemens-Schukert auxiliary switchboard equipment is used on the installation controlling the local service motors. All of the latter used in the mine are of the three-phase, squirrel-cage type to avoid trouble from flashing. Energy for motor service in the power house and on the surface at 500 volts is taken from two 350-kva oil-cooled transformers in the turbine-room basement, the primaries being connected to the buses through oil switches and the secondaries to the motor-service distribution board mentioned above, which is near the transformers.

Two Tirrill regulators are provided on the 3150-volt switchboard, and on the board below is mounted a signal panel containing a red and a green lamp for each Tirrill regulator, which indicates when the generator voltage runs below or above normal. A low-toned electric bell is also in use to give the operator audible information as to decrease in voltage, with a corresponding high-toned bell for excess voltage on each machine.

The motor service on the surface at the Allan shaft includes electric drives at 500 volts for varied work in the carpenter and blacksmith shops, the conveyors mentioned above, and other appliances. The most important work at the Allan shaft performed by the motor drive, however, is the operation of pumps. There are in service two units, made and fitted by the Ateliers de Constructions Electriques, of Charleroi, Belgium. They are of the Rateau high-pressure type, running at 2930 r.p.m., and each pump has five impellers, with 8-in. suction and delivery pipes. The height of the suction lift varies from 9 ft. to 17 ft., and each unit is capable of delivering 39,727 gal. per hour against a head of 1082 ft. The pumps are directly coupled to a 300-hp, 3000-volt, three-phase motor in each case, the rotors being of the squirrel-cage type, with auto-transformers for starting and contacts housed behind a protecting grille in the pump room, which is situated in a deep chamber within the mine. On the front of the grille are mounted five starting panels, including reversing switches, enabling the operator to change service from one cable to another in case of a breakdown, and automatic no-voltage and maximum current cut-outs. In starting the motors the auto-transformers give three pressure steps varying from 1500 volts to 3000 volts.

Energy is transmitted to the Albion Mines by two three-

junction boxes being used at the joints. The boxes are filled with a special insulating compound which is moisture-proof. This line is said to be the first underground transmission system in Nova Scotia. After some nine months' service it was reported to have given entire satisfaction.

Energy is distributed from a substation at the Albion Mines to a variety of machinery, including pumps, winding

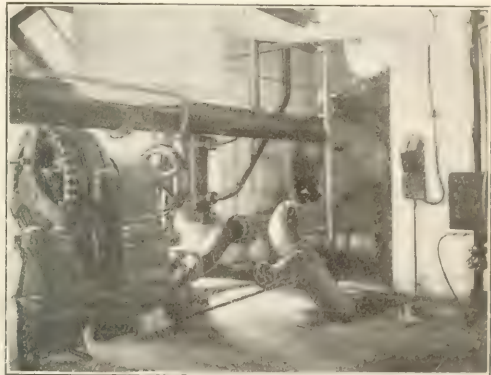


FIG. 5—DIRECT-CONNECTED VACUUM PUMPS AND CONDENSERS

equipment, air compressors, creepers, coal tipples, screens and other apparatus. All of the surface motors here are built with wound rotors and are equipped with metallic starting resistors, all being provided with overload and no-voltage-release switches. The substation switchboard equipment includes white marble panels controlling the incoming cables from the power house, compressors, fans, transformers and motors. One panel provides for the lighting of the town of Stellarton. Two 350-kw transformers provide for the 500-volt motor service as at the Allan Shaft station. A low-tension board governing the 500-volt service is located at the substation, and among the applications of electricity controlled by it are the following: a small motor-generator set in the mine life-saving station, used in charging batteries for the electric mine lamps; 45 hp in workshop motors; McGregor creepers, 10 hp; coal tipples, 10 hp each; transporting belts, 25 hp; Albion and McGregor slope haulage, 25 hp; screen service, 45 hp; knocking screens, 25 hp, and other local services. The power-factors of the motors vary from 83 to 88 per cent and the efficiencies from 84 to 90 per cent.

The larger equipment includes two directly connected underground pumps with seven impellers on each, built by the Ateliers company, of Charleroi, and of the same general design as those at the Allan shaft. The suction head varies from 9 ft. to 17 ft., and the head against which the pumps work is 1590 ft. Each pump has a 9-in. suction and delivery connection and operates at 2930 r.p.m., being directly coupled to a 440-hp, three-phase, 3000-volt induction motor with auto-transformer starting equipment resembling that at the Allan shaft. The efficiency of the equipment show it is efficient to be 63 per cent, that of the pump alone being 60 per cent. Large ventilators are also provided at the Albion and McGregor mines. The equipment being of the "Capelle" type, with fan 12 ft. 6 in. in diameter and 4 ft. wide, the capacity at a speed of 215 r.p.m. being 100,000 cu. ft. of air per minute and the water-gage height 5.5 in. Each fan is driven by a three-phase 150-hp, 3000-volt motor running at 750 r.p.m. Walker compressors are also provided, each being a 27-in. x 27-in. unit capable of delivering 1600 cu. ft. of air per minute at a pressure of 100 lb. per sq. in. A 320-hp, 3000-volt motor drives each compressor. The winders are equipped with drums 9 ft. in diameter and 4 ft. wide, and



FIG. 4—MOTOR DRIVEN CIRCULATING PUMPS

phase armored copper cables of 120 sq. mm cross-section, with lead covering, the cables being laid in a 2-ft. 3-in. by 3-ft. underground trench on a bedding of sand, the cables having been covered after laying with large brick tiles 1 in. in thickness. The cables are laid in the corners of the trench, leaving an intermediate clearance space about 2 ft. wide. They are put down in lengths of 300 m. cast iron



the cars loaded carry 11.46 tons per trip. The speed of the run is about 10 ft. per second, which enables each journey to be made in about five minutes. By the use of liquid starting resistors the speed may be cut down to 7 ft. per second when desired. This apparatus is equipped with brakes supplied with air at 100 lb. per sq. in. from a 3.5-hp, 500-volt motor-driven compressor equipped with automatic governor on the compressor tank. A motor-driven pump of about 0.25-hp rating is also used in connection with the circulation of liquid in the motor-starting resistor.

Mr. E. L. Martheleur is chief engineer of the Acadia Coal Company and Mr. Cadwallader Evans is general manager, with headquarters at Stellarton, N. S.

### Interconnected Systems Feeding Railway Load

#### Network of Waterbury-New Britain System of Connecticut Company Supplied from Three Hydroelectric and Two Steam Stations

The present-day practice of supplying electrical energy for a large territory from a central station materially improves the efficiency of the service. On the other hand, the increased seriousness of a break-down at the center leads the well-conducted system into extensive insurances. Spare units are installed, piping and wiring are so arranged that the service of any piece of apparatus can, in necessity, be taken up by the other machines of the same class, and, where practicable, connections are made with similar plants in adjoining territory. A system comprising all these



FIG. 1—CONSTRUCTION ON THE NEW BRITAIN AND THE RAINBOW LINES

methods of protection is that which supplies electrical energy to the Waterbury-New Britain district and was described by Mr. C. R. Harte, assistant engineer of the New York, New Haven & Hartford Railroad Company, in a paper which was read before a meeting of the Connecticut Society of Civil Engineers held in New Haven on Feb. 12.

### BULLS BRIDGE HYDROELECTRIC PLANT

The original plant is the hydroelectric development on the Housatonic River at Bulls Bridge, just above Gaylordsville. (See *Electrical World*, Feb. 13, 1904.) The head of a narrow gorge gives ideal conditions for the low-arched concrete dam, from which a canal skirts the hillside on the east side of the river for a distance of some

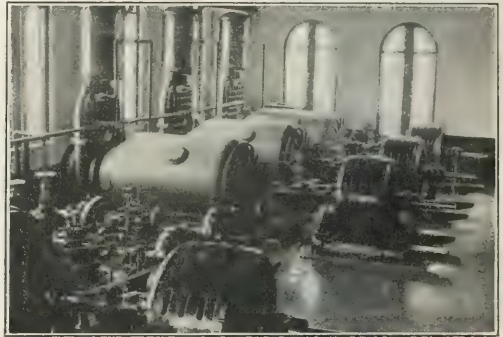


FIG. 2—INTERIOR OF BULLS BRIDGE STATION

two miles, ending in a large forebay. From the forebay a steel penstock 13 ft. in diameter leads to the first turbine connection and decreases thereafter at each turbine connection to 5 ft. diameter at the last, after which it turns up vertically as a standpipe, with its lip at the level of the main dam crest, this standpipe serving both to assist in governing and to relieve the penstock from shocks due to sudden closing down of the gates.

This concrete station contains six horizontal main units, the water end of each consisting of a balanced pair of runners controlled by a type B Lombard governor, direct-connected to a 1000-kw General Electric revolving-field, three-phase, sixty-cycle, 1150-volt generator running at 400 r.p.m. Excitation energy is furnished by two exciters driven by independent cone-flume turbines, one having in addition an induction motor for emergency use. In the fall, when the eels are migrating, these smaller turbines, although of nearly 200 hp each, are at times actually choked to a standstill by fragments of the eels chopped up by them.

A 60-in. gate valve with hydraulic operating cylinder on each supply tap permits cutting out any main unit without interference with the others, and the completion of contracts already let for an additional penstock and standpipe each 8 ft. in diameter, with valve connections to the present penstock and part of the turbines, will permit operation of at least part of the plant under almost any adverse circumstances, besides greatly assisting in the task of governing. Incidentally, the 96-in. butterfly valves in the connections are among the largest of this type ever built.

The current from the generators is led by cables in floor conduits to two sets of busbars with switches so arranged that either bus can have any combination of generators and transformers connected through it. From these busbars the energy passes to be transformed to higher voltages. A part is raised to 6600 volts for transmission to the New England Lime Company's plant at Boardman's Bridge, and a little later this line, operating at 11,000 volts, will both serve the lime company and furnish energy to the New Milford Electric Light Company. By far the larger proportion, however, is stepped up through six 850-kw single-phase water-cooled transformers to 33,000 volts, at which potential the lines to Waterbury, 27 miles away, and to New Britain, 50 miles distant, are operated. As there are seven transformers, much leeway is given for emergencies and repairs.

## TRANSMISSION LINE FROM BULLS BRIDGE

The transmission line consists of two three-wire circuits of stranded aluminum, those to Waterbury having conductors  $\frac{1}{2}$  in. in diameter, each circuit having its separate and independent pole line, except for thirteen poles in Washington, where right-of-way troubles compel the use of one line of poles for both. The poles are chestnut, the majority

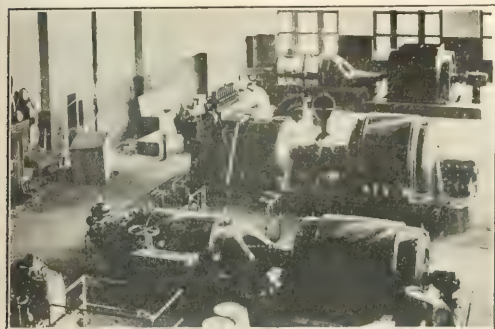


FIG. 3—TURBINE ROOM

being 35 ft. long, the wires forming an equilateral triangle 60 in. on a side where but one circuit is on a pole, the triangle being 48 in. with two circuits.

The insulators are designed for a working potential of 45,000 volts, and are carried on an oil-treated oak pole top pin 3 in. square by 20 in. long, and by a 4-in. by 5-in. two pin cross-arm. On angles the pole pin is replaced by a short two-pin arm set parallel to the general direction of the line. This arm is bolted against the pole without gaining and can rock a little to adjust itself to differences in pull in the adjacent spans. The Washington double-circuit poles have steel angle-iron arms and insulators 14 in. in diameter by 12 in., designed for 60,000 volts.

## WATERBURY STEAM PLANT

At Waterbury a steam station containing two 1500-kw Westinghouse-Parsons, one 3000-kw General Electric-Curtis and one 4000-kw Allis-Chalmers-Parsons turbo-alternator, generating three-phase, 60-cycle current at 2300 volts, is able to carry the load of the entire system, but normally takes only what the Bulls Bridge plant does not. The present turbine room has space for another unit when needed. The station is of brick, on concrete foundations, and its construction was notable chiefly for its speed, ground having been broken May 26, 1910, and the first unit started Dec. 18 of the same year. It is located on the Naugatuck River, which furnishes the condensing water.

Coal is delivered by the steam railroad to a private siding, and is hauled by an electric motor to a sunken hopper, from which it goes, through crushers and screens, to a supply bin and then by traveling weigh hoppers to the Jones underfeed stokers.

The eight 500-hp Bigelow-Hornsby boilers are in groups of two on opposite sides of a firing alley and are equipped with Foster superheaters, while Sturtevant economizers behind the batteries utilize the last available heat of the gases after they have left the boilers. Forced draft fans in the basement, one driven by a Terry steam turbine, the other by an electric motor, and engine-driven induced-draft fans in a gallery overhead insure proper movement to and out of the short steel stacks. The boiler-room basement, in addition to the forced-draft apparatus, has an industrial railway for removing the ashes and contains the feed-water pumps and the main steam and water systems. The feed-water system is connected with the city service and a well, the latter being for emergency use only.

The turbo-alternators are carried on high concrete foundations pierced by arched passages in which are set the Alberger condensers, the pumps being on the floor just outside. The cooling water is led in from the head of a pool by a long open channel with concrete walls, through a screen chamber, into the intake tunnel, which is about 4 ft. square. A similar parallel tunnel delivers the discharge to the pool at the dam. The small turbo-alternators run at a speed of 3660 r.p.m. and the two large ones at 1800 r.p.m. The turbines effect their own cooling through a fan wheel on the main shaft and a system of ducts leading out of doors. Excitation energy is furnished by a pair of 100-kw turbine-driven exciters.

## TRANSMISSION LINE FROM WATERBURY PLANT

The main units at the Waterbury plant feed into interconnected sets of 2300-volt busbars, which are connected through suitable air-cooled transformers to the 33,000-volt busbars. From the latter two three-wire circuits of  $\frac{3}{8}$ -in. diameter stranded aluminum wire run to New Britain. For the first  $2\frac{1}{2}$  miles they are on the Bulls Bridge-Waterbury line poles, after which they branch off on a single-pole line, with a triangle of 48 in. on a side. The main lines go through to New Britain, a branch leaving at Milldale to feed the Cheshire substation. Except at Waterville, where a single span of 570 ft. clears the Naugatuck River, the plant of the Waterville Corporation and the Naugatuck division of the New York, New Haven & Hartford Railroad, there are no special constructions on this line. The Waterville span, in No. 4/0 stranded hard-drawn copper, has a sag of 14 ft. and is carried by Archbold-Brady anchor towers 90 ft. high on concrete foundations. At New Britain the lines connect with 33,000-volt busbars, from



FIG. 4—SWAMP FOUNDATIONS AND SUBSTATION

which a series of air-cooled transformers feed the 2300-volt substation busbars, while three 500-kw transformers connect the system with the Hartford Electric Light Company's system some ten miles away through a 110,000-volt transmission, overhead to the Laurel Street substation, Hartford, and underground in cable to the Dutch Point station.



## PLANTS AT DUTCH POINT AND ELSEWHERE

The Hartford Electric Light Company also has a compound system. The main plant at Dutch Point has 7500 kw in Westinghouse-Parsons turbo-alternators, generating two-phase, 60-cycle current at 2300 volts. (See *Electrical World*, March 3, 1906.) The Hartford-New Britain line is fed from this station by transformers, which not only step up the lower voltage but also change the two-phase current to three-phase current, or the reverse if New Britain is feeding Hartford.

The main circuits and two other transmission lines are also taken off the Dutch Point busbars. The lighting service, however, is from the Pearl Street substation, to which go not only the 2300-volt feeders from Dutch Point but the two 10,000-volt transmission lines from the Farmington River hydroelectric plants, one at Rainbow,  $9\frac{1}{2}$  miles away, containing two 600-kw turbine-driven units operated under a head of 35 ft., the other at Tariffville, 10 miles away, with two 750-kw units operated under a 32-ft. head. The transmission line from this latter plant, of stranded aluminum  $\frac{5}{8}$  in. in diameter, is interesting because

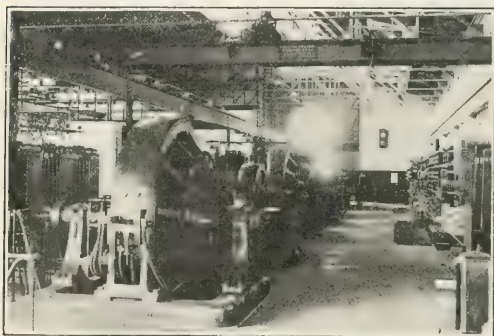


FIG. 5—SUBSTATION AT WATERBURY, CONN.

of its white porcelain insulators, a color very commonly used abroad but rarely in this country.

## SCHEME OF DISTRIBUTION

Briefly, this district is fed by five primary stations of an aggregate rating of 26,000 kw. Within the limits of the transformers at each point energy can be taken from the other plants, while duplication and interconnection of apparatus and lines permit the isolation of a broken-down unit with the least possible interference with general operation.

The substations change the energy transmitted to them into the various forms for direct use, Waterbury exhibiting to the best extent the variety of such uses.

It has been noted that the turbo-alternators and, through transformers, the 33,000-volt transmission lines come to 2300-volt busbars, and that the connections are so arranged so as to give any combination desired. From these busbars are taken directly the 2300-volt circuits, some energy being used at this voltage, but the larger portion being reduced to lower potential at the points of use through transformers. From the same busbars a series of tub transformers furnish energy for the series arc-light service. Still another set of transformers reduces the potential to 430 volts for the rotary converters, which supply the trolley lines, a portion of this direct current operating a booster which raises the potential of the feed for the Thomaston trolley so that it shall be at the desired 600 volts when it reaches the end of the line. Energy at 2300 volts is also transmitted direct from the busbars to the Field Street substation, where transformers reduce it to 170 volts, rotary converters changing it to 220-volt direct current for the three-wire lighting system. Here, too, as a safeguard, is a

storage battery which, normally idle but connected to the line, supplies energy to make up the deficiency if a sudden load exceeds the output of the rotaries, recharging as soon as the overload is past.

Besides these uses of the 2300-volt energy there are two sets of transformers directly connected to the 33,000-volt busbars. One of these furnishes 11,000-volt current for transmission 8 miles to a substation on the Woodbury line, where transformers and rotaries deliver it as 600-volt direct current for the trolley. The other set of transformers furnish 6600-volt current for transmission 10 miles to Beacon Falls, but while this is also for trolley supply, instead of transformers and rotaries this substation has synchronous motor-generator sets.

Compared to some of the great Western networks with twenty or more large stations and hundreds of miles of transmission line, this interconnected system is small indeed, but until recently it was the largest network in New England. To-day, however, the Boston Edison and the Connecticut River Power Company are operating two great networks, one fed wholly from steam stations, the other from steam and hydroelectric stations; the Amherst Power Company is pushing from Turner's Falls to Springfield and will have its lines in operation shortly, and several other large projects are approaching the construction stage. The author predicts that in five years all of New England will be covered by networks of the general character of the system described.

## Application of Hyperbolic Functions

The last two of a series of five lectures by Dr. A. E. Kennelly on the application of hyperbolic functions to electrical engineering, delivered under the auspices of the Brooklyn Institute of Arts and Sciences at the Polytechnic Institute, Brooklyn, N. Y., dealt with applications to energy transmission and telephone lines. Accounts of the first three lectures, which covered hyperbolic angles and the representation of the behavior of direct-current and alternating-current circuits, appeared in our issues dated Oct. 19, Nov. 30 and Dec. 21, 1912. Below are given outlines of the concluding lectures.

## LONG ALTERNATING-CURRENT ENERGY TRANSMISSION LINES

In his fourth lecture Dr. Kennelly explained that in the case of low-frequency lines, say, 25 or 60 cycles, and with the present commercial limit of length, or 150 to 200 miles straightaway, there is rarely any occasion to apply hyperbolic functions when considering simply the fundamental impressed frequency. The case is different, however, when considering harmonics which may be present in the generator emf wave, such as the fifth, seventh or eleventh multiples of the fundamental frequency, and in these instances such functions are very useful.

Reviewing some of the ground previously covered, Dr. Kennelly explained the method of resolving a perfectly insulated single-phase or three-phase line into its elements with the neutral plane as axis or dividing plane. This is shown in Fig. 1, where  $A$  is the generator,  $B$  is the receiver or load,  $Z$  represents the linear impedance composed of conductor resistance and reactance and  $C$  represents the shunt condensation due to electrostatic capacity between wires; the line  $a b$  is the neutral axis or the trace of the zero-potential plane. Taking only one wire of the system, for the purposes of calculation, the corresponding diagram is shown in Fig. 2. This is really the nominal  $T$  line, assuming that the real or uniform can be correctly represented by such an artificial or lumped line, with the same total linear impedance and shunt condensation.

It is somewhat preferable, however, to employ the nominal  $\Pi$  line, or the so-called split-condenser method shown in Fig. 3. Of course, this general method is applicable also to a three-phase line by taking the linear impedance and



shunt condensation per conductor with reference to the neutral, which is simple when the phase wires are equilaterally spaced, but a trifle complex when the wires have some unsymmetrical spacing without transposition, as, for example, in the familiar horizontal or vertical planes. Dr. Kennelly then discussed the solution of the circuit problem represented in Fig. 3 by means of a comparatively simple graphical method, which he illustrated with lantern slides. Assuming that the nominal  $\Pi$  line represents the real or uniform line within the permissible limits of error in the calculation, there is no need for the use of hyperbolic functions, which, as before stated, is generally true at fundamental power frequencies, but quite the opposite when the higher multiple frequencies in impure waves are considered.

The equivalent  $\Pi$  line is one which gives at the terminals precisely the same results, under like conditions, as the real line. The calculation of the proper constants for the equivalent  $\Pi$  line, or the total series, impedance and shunt condensation, is effected very simply by means of hyperbolic

functions, such as  $\frac{\sinh \theta}{\theta}$  and  $\frac{\tanh \theta}{\theta}$ , of which tables have

already been computed and are available. These correction factors, which are applied to the constants of the nominal  $\Pi$  line to find the proper constants of the equivalent  $\Pi$  line, depart more and more from unit magnitude and zero angle as the frequency increases. This fact the speaker illustrated by successive lantern slides, each showing the calculated results for a higher frequency than the

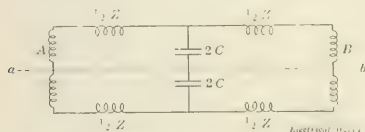


FIG. 1.—LINE RESOLVED INTO ITS ELEMENTS

preceding one. Finally, he exhibited the extreme case when the impressed frequency equals the natural period of the line and a resonant condition is set up. This condition is most likely to occur in practice when the impressed wave is impure.

The so-called "Ferranti effect," or appreciable rise of voltage at the receiver in excess of the generator emf, caused by resonance, was discussed at some length. This effect, said Dr. Kennelly, is not ascribable to distributed capacity or the fact that the capacity is uniformly distributed along the line, as some have supposed, but to the mere fact that capacity and inductance are present. This is proved by the fact that these resonant effects have been perfectly reproduced with equivalent  $\Pi$  lines, having lumped capacity. Conceivably there could be no resonant effects in the line itself, with the receiver disconnected, if no capacity were present. Rise of voltage at the distant end of the line, at no load, may be considerable under commercial conditions; and under laboratory conditions, with higher frequencies, it may equal ten or twelve times the impressed voltage, or even more.

In speaking of the practical use of the equivalent  $\Pi$ -line method, Dr. Kennelly remarked that Prof. Harris J. Ryan, who has had much to do with the long-distance, high-tension transmission systems on the Pacific Coast, had stated in a recent communication that he found this method very serviceable in the course of his computations to determine transmission-line characteristics. When it becomes desirable to investigate effects in the line itself, the number of  $\Pi$  sections can be increased as may be necessary. In extreme cases, of course, the alternative method of calculating the pressure and current at any point along a uniform line by means of the more elaborate hyperbolic formulas, which

were first published long ago, may be employed; but this naturally involves somewhat more work.

#### LOADED AND UNLOADED TELEPHONE LINES

The fifth and last of Dr. Kennelly's lectures dealt with "The Application of Hyperbolic Functions to Telephone Lines, Both Loaded and Unloaded." In this application of these functions, said Dr. Kennelly, there is great advan-



FIG. 2.—ONE WIRE TAKEN SEPARATELY

tage over other methods of computation and analysis. In the first place, telephone lines are usually long and subtend much larger hyperbolic angles than energy transmission lines. In the next place the frequency is not fixed, but variable, and the practical range is from about 100 to 2000 cycles per second. Thus it is necessary to employ the full theory of linear circuits possessing uniformly distributed resistance, inductance, capacitance and leakage. The speaker first spent some time in explaining the characteristics of telephone receivers and went over some of the details of the experimental researches conducted by Dr. G. W. Pierce and himself and reported at the Dundee meeting of the British Association for the Advancement of Science last fall.

While the range of frequencies in telephony is that given above, it has been found that so far as practical results are concerned a telephone line behaves as though a single frequency of about 800 cycles, or 5000 radians per second, were impressed upon it, and calculations of effective attenuation can be carried out on this assumption. Naturally, however, this applies solely to the calculation of the effective attenuation and reveals nothing in respect to distortion. While a single T section or  $\Pi$  section of an artificial line may be constructed to represent a telephone line at one frequency, say 800 cycles, it cannot represent it at all frequencies unless the section is comparatively short. Hence long artificial lines must be made up of successive short sections.

The speaker went over the principal characteristics of uniform lines in some detail and then took up loaded lines, showing how Campbell's formula can be derived by a brief method. Characteristic curves giving the effect of changing the number of loads or coils per wave-length were presented, showing that with seven or eight coils per wave the difference between a loaded line and a uniform line of the same total constants becomes negligible. In conclusion the speaker took up the subject of losses at the junction of two dissimilar telephone lines, caused by wave reflection. The same phenomenon occurs at the terminals of a line, especially in the case of loaded lines. In the last instance special transformers have been successfully used, and also terminal tapers which contain graduated reductions in the loading. When two dissimilar lines are joined together to form what the speaker termed a composite line, as when an aerial circuit of open wire joins

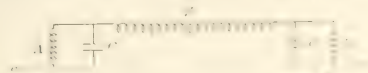


FIG. 3.—LINE AT VARIOUS POINTS CONNECTED TO THE GROUND

an underground circuit of cable, it is obvious, though in single-conductor lines the method of Dr. Kennelly becomes unsymmetrical. In his closing remarks the speaker stated that hyperbolic functions have a distinct place as one of the tools of engineering and voiced his opinion that within a few years' time, after complete tables of such functions are available, they will be employed universally.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Artificial Refrigeration in Minnesota

The Ives Ice Cream Company of Minneapolis recently entered into a ten-year contract with the Minneapolis General Electric Company which increased the previous contract for motor service by 150 hp. This enables the manufacturing concern to shut down its large steam plant and operate its factory as an all-electric plant. The transaction is of particular interest considering the long winter season and the abundance of natural ice available in that locality.

## Window Boxes in Mobile

Supplementing the flower boxes for ornamental street posts in Mobile, Ala., previously described in this journal, the Mobile Electric Company has made an arrangement with the Horticultural Society of that city by which the latter organization will place and maintain boxes containing flowers and plants in the windows of the building occupied by the electric-service company. The Mobile Electric Company loses no opportunity to identify itself with the progressive spirit of its city.

## A Washington's Birthday Display

Washington's Birthday was celebrated by the Kentucky Electric Company of Louisville with a novel window display lasting through the week of Feb. 22. In one of the show windows of the company's handsome new structure there appeared a large portrait of the Father of His Country, garlanded with incandescent lamps and surmounting a mammoth birthday cake. In the center of the cake, replacing the time-honored candles with which such confections are commonly decorated, was a frosted incandescent lamp rated at 181 cp, with an explanatory card stating that "His birthday cake should now bear 181 candles." The exhibit was much admired by the passing public.

## 2000 Tons of Artificial Ice for Town of 6347

In the Northern States the ice-making business is in a measure dependent upon the length and severity of the winter. Nevertheless, certain plants in localities where the supply of natural ice is ample are receiving good returns on ice-plant investments. A central station in northern Illinois serving a population of 6347 inhabitants operates an ice plant during the summer months, usually about six months of the year. The maximum output of the plant is 20 tons a day and the total has averaged 2000 tons per season. The plant employs absorption apparatus and distilled water and has been in operation for four years. The total investment in the ice plant was \$21,600, and the gross income from the ice business has been between \$8,000 and \$15,000 per year.

## Investment and Returns of an Illinois Ice-Electric Plant

There is an Illinois combination ice-electric plant in the broad valley of the Mississippi River where, with a station ice-making investment of \$10,000, \$4,000 worth of

ice will be sold during the coming season, at a net profit of \$2,000, earning 20 per cent on the original investment. These figures are conservative and are based on the performance of this 7-ton plant during preceding seasons. Its daily output is required during about five months of the year, the population served comprising nearly 3000. About 20 tons of ice-storage capacity is provided. The monthly cost of fuel for the ice-plant section of the station approximates \$100, while nearly the same amount is spent for labor. The product is sold at 40 cents per 100 lb. delivered retail, or at \$4 per ton wholesale from the plant platform.

## A 15-Ton Ice Plant as a 40 Per Cent Investment

During five months' operation last year the 15-ton ice plant operated by the electric company in a Kentucky town of 3000 population earned net profits of \$3,600, a return at the rate of nearly 40 per cent on the \$9,500 invested in the local ice business. The equipment comprises steam-driven ammonia-compression apparatus, with 36 tons' storage capacity.

The actual plant cost of freezing a ton of ice at this plant, including fuel, labor, etc., averages \$2. Sold wholesale on the plant platform, this ice brings \$5 a ton. It is delivered to local users at a regular rate of 40 cents per 100 lb., which is equivalent to \$8 per ton, although out of this must be met, of course, the heavy cost of the delivery service.

Altogether the gross income from the ice business alone during last season was \$6,100. The expenses the same year totaled \$2,500, including fuel, labor, depreciation, etc., giving \$3,600 as the net return, or nearly 40 per cent on the investment.

Needless to say, the management is enthusiastic in describing the operation of its ice business as extremely satisfactory and cordially recommends that other small stations follow its successful example.

## Exhaust-Steam Ice Making Brings 42 Per Cent Return

In certain of the eastern Gulf Coast states the ice-making season lasts the year around, the only reasonable distinction to be drawn being "seven good months and five poor ones." Selling 1700 tons of ice a year, there is one 10-ton Florida combination ice-electric plant in a community of 1700 population which does a gross ice business turning over each year an amount equal to the entire investment in its plant and earning an annual profit of \$5,000, after paying \$7,000 operating expenses.

This station utilizes the exhaust steam from its electric-plant engines to operate a 10-ton absorption-type "generator." The distilled water is at the same time reclaimed for freezing into ice. The ice plant, including building, equipment, can tank, two delivery wagons, etc., represents an investment of \$12,000.

The product is sold wholesale at \$5 to \$7 per ton, while the retail domestic supply is delivered at the rate of 50 cents per 100 lb. or \$10 per ton. Last year the gross income from this central station's ice-making business alone was \$12,000, exactly equal, as already pointed out, to the

total amount of the investment in this department of the business. Including depreciation, interest and all other charges, the operating expenses for the twelve months totaled \$7,000, leaving \$5,000 net profit, or a return at the rate of 42 per cent on the \$12,000 invested.

### Skill and Care Required to Make Small Ice Plant Pay

The operator of a 3-ton ice plant in a combination station supplying electricity and ice to an Ohio River community of 1500 population calls attention to the requisites for making a small equipment of this kind a commercial success.

In his opinion such an ice-electric plant will pay in a small town only if the producing conditions are right. Among these he mentions cheap fuel, cheap and good water, minimum haulage, modern efficient machinery (bought at a good figure if possible), "and the plant owned and operated by men knowing the business." The average small stock company which depends upon results from hired and often incompetent help stands a risky chance of success, he points out, for the cost of producing a kilowatt-hour of electrical energy or a ton of ice in a small plant like that described is much greater than similar unit costs possible in a larger station.

This operator has an 80-can freezing tank in connection with his 3-ton absorption-type ammonia equipment and disposes of his output at the rate of 25 cents per 100 lb. wholesale and 50 cents per 100 lb. retail.

### Value of Ice Making in Opening Up Twenty-four-Hour Electric Service

Three years ago the electric company operating a plant in a town of several thousand population just south of the Ohio River decided to install ice-making equipment, utilizing the exhaust from the plant engines for distilled make-up water. Then, since steam had to be kept up that summer and the engineer was at the station all day long tending the refrigerating machinery, it was determined, not without some misgivings, to operate day electric service. Since the plant was already virtually in operation all day long, the cost of furnishing this twenty-four-hour service imposed slight additional expense.

Almost from the very first this day service proved to be a marked success locally. A number of customers bought electric fans, and soon with a little sales effort electric irons became popular. A motor load, too, was established, the latter having now attained a magnitude of 95 hp, divided among seven customers.

At the end of the first ice-making season it was proposed to shut down the day service, but the customers had become so pleased with its operation and convenience that they raised sturdy and successful objection to its interruption. The twenty-four-hour service was accordingly continued during the winter, and by the next summer season had thoroughly established itself through the accretion of desirable motor load until it is now one of the most profitable parts of the central station's electrical business.

### Diesel-Engine Performance in Oklahoma Ice-Electric Plant

A record of 6.2 gal., or 44.1 lb., of oil per 100 net brake-hp-hours at full load has been established by a 225-hp Diesel engine in operation at the plant of the Hugo (Okla.) Ice & Electric Company. This performance is apparently unexcelled by even the best European records obtained with the same highly efficient type of engine, thus speaking

well for the engineering practice and construction work prevailing in this country.

Dr. A. C. Scott, of Dallas, Tex., conducted the test, which was made while the engine was in the regular daily service of the Hugo Ice & Light Company. The engine had been in operation about six months when the test was made and there was no tuning up or other special preparation. The test extended over a period of three days and records were taken at all stages from no load to 10 per cent overload.

These records show a fuel consumption of 10.8 gal. of oil per 100 net brake-hp-hours at 0.25 load, 6.8 gal. at 0.5 load, and 6.2 gal. at full load. This is equivalent to 0.441 lb. of oil per net brake-hp-hour.

Thermo-dynamic records taken, based on net useful output, show 17.4 per cent efficiency at 0.25 load, 27.8 per cent at 0.5 load, 29.5 per cent at 0.75 load, 30.3 per cent at full load, and 30.2 per cent at 10 per cent overload.

The engine in the Hugo plant is of the heavy-oil type, built under the patents of Dr. Rudolph Diesel, by the Busch-Sulzer Brothers-Diesel Engine Company, St. Louis, Mo., in the shops of the Power & Mining Machinery Company, at Cudahy, Wis. The engine has now been in operation at Hugo during the last twelve months.

### Combination Ice-Plant Investment in a Town of 1800

A combination ice-electric company operating in a town of 1800, about 60 miles southwest of Washington, D. C., has approximately \$9,000 invested in its ice plant. This is a steam-driven compressor outfit, refrigerating 120 300-lb. cans besides about 50 tons storage capacity. The equipment is operated six months in the year, during which period it turns out about 1000 tons of ice.

The cost of making a ton of ice delivered to the platform is estimated by the local manager to be about \$2.25, including fuel, labor, etc. Two engineers, who take shifts in looking after the combination electric and ice-making plants, each receive \$1.16 per day, and the two firemen earn \$1 each per day. Boiler-feed water is purchased from the town at 6 cents per 1000 gal., the exhaust from the compressor engine providing the distilled-water make-up.

For such ice as is sold at wholesale on the plant platform the company receives \$5 per ton, while for retail quantities the local price is 45 cents per 100 lb., or \$9 per ton. Assuming that it receives at least \$5 per ton for its output, without crediting any profit on delivery (for which two wagons are required), the plant would earn \$2.75 profit on each ton of ice, netting at a conservative estimate over \$2,000 on the season's output. Such a profit of 20 per cent on the \$9,000 invested in the ice business represents, of course, a desirable addition to the central-station income in a community the size of this one.

In general, the management declares the local ice business to be entirely satisfactory and advises other electric companies contemplating ice manufacture to install compression outfits if a market can be developed for the output. The making of ice is of special advantage to the small electric plant, declares this particular operator, because it tides over the slack period and enables the management to hold its help together. Such ice business is, he concludes, well-nigh indispensable to small stations operating no day service.

### Rates for Electric Cooking

A number of central-station companies have already either adopted special rates for electric cooking and heating or have adapted their existing schedules to fit conditions for domestic and commercial service not covered by their regular rates. The accompanying table shows some



of the companies which have filed copies of their rate sheets with the rate research committee of the National Electric Light Association, together with the rates charged for electric cooking and heating, conditions of special service, etc. Among the special cooking rates of particular interest in the table is that in use at Omaha, Neb., where a discount of 5 per cent is made to customers who install

DATA ON ELECTRIC SERVICE FOR DOMESTIC AND OTHER SPECIAL PURPOSES

City	Cents per Kw-hr	Remarks
Atlanta, Ga.	6 to 3	Heating demand figured at 50 per cent of connected load.
Altoona, Pa.	4 1/2	Separate meter.
Boston, Mass.	10	For first 20 kw-hr.
	3	For excess; minimum, \$12 year.
Des Moines, Ia.	4 1/2	Separate meter.
Detroit, Mich.	4	Maximum power rate.
Duluth, Minn.	3	With 20 per cent prompt-payment discount.
Kansas City, Mo.	4.5	Separate meter.
Los Angeles, Cal.	3	Separate meter, \$3 minimum.
Memphis, Tenn.	3	Plus \$1.50 per kw of demand.
Omaha, Neb.	6	5 per cent discount if all cooking by electricity.
Portland, Ore.	4	Minimum charge, \$1 per month.
Redding, Cal.	3 to 1.5	Minimum, \$1 per month.
Salt Lake City, Utah.	6 1/2	\$2 minimum, 10 per cent discount.
Seattle, Wash.	1	Separate meter, minimum, \$2.
Spokane, Wash.	5	Industrial rate.
Springfield, Mass.	6	Heating rate; no special cooking rate.
Superior, Wis.	5	4 cents above 50 kw-hr.

equipment enabling them to use electricity exclusively for cooking.

Reports received by the committee from Glasgow, Scotland, indicate that for cooking purposes electrical energy may be purchased at the rate of 3d., or 6 cents, per kw-hr. for a certain number of hours' use of maximum demand, ranging from 40 hours in the summer months to 300 hours in December and January. For all used in excess of this the rate is 1d., or 2 cents, per kw-hr.

### Combination Steam-Electric Ice-Making Plant in Chicago

Electrically operated ice-making plants have become a considerable factor in smoothing out the load curves of central stations. Among the seven or eight plants of this character supplied with electricity by the Commonwealth Edison Company of Chicago, the installation of the Knickerbocker Ice Company (recently succeeded by the Consumers' Company) at 6105 Lexington Avenue may be of interest in that it has a larger motor load than any of the others. Instead of obtaining its water supply from Lake Michigan through the city mains, this plant, in normal operation, pumps all the water used for ice-manufacture, cooling and boiler-supply purposes from a 1900-ft. well on the premises. The water used for ice is distilled before being frozen.

To supply steam for distilling, two boilers were installed, and a few of the accessories, such as the stoker engine, boiler-feed pumps and two other small pumps, are driven by steam. The electric motors used have a total rating of 589 hp. They drive two ammonia compressors, one deep-well air compressor for lifting water, two cooling-water pumps, eight agitators, one ice hoist, two hoists on cranes and two brine circulators.

Electricity for driving these motors and furnishing plant illumination is supplied by the electric-service company over a three-phase, 60-cycle, 3800-volt line to six 75-kw, 3800-230-volt Westinghouse transformers outside the plant. These transformers are mounted about 20 ft. above the ground on a platform built on cross-arms attached to three 30-ft. poles arranged in a line about 9 ft.

apart. The high-tension line is supported on cross-arms on the poles, above the transformers, short wires leading to the high-tension terminals of the transformers, which are star-connected. Lead-covered cables conduct the energy from the delta-connected, 230-volt taps, through steel conduit, to a switchboard located in the compressor room.

#### GENERAL LAYOUT OF THE PLANT

The building, which is a brick structure one story high, is divided into five compartments which front on Lexington Avenue, two anterooms used for storing ice for immediate use, and eight cold-storage rooms. In the north end of the building is the 1900-ft. well from which all water used in the plant is pumped by the Harris air-lift system. An Ingersoll-Rand compressor, belt-driven by a 100-hp Western Electric squirrel-cage motor, running at 720 r.p.m., furnishes compressed air for pumping the water. Fig. 1 shows the deep-well room and the motor-driven compressor. A Wagner polyphase starter and a case containing a three-blade switch and fuses are installed in this room for operating the motor.

The compressed air is conducted through a 2-in. pipe to the Harris injector, which is located 369 ft. below the floor in a 6-in. well casing. When the compressor is in operation water at 50 deg. Fahr. is delivered at the rate of 600 gal. a minute from the top of the well casing di-

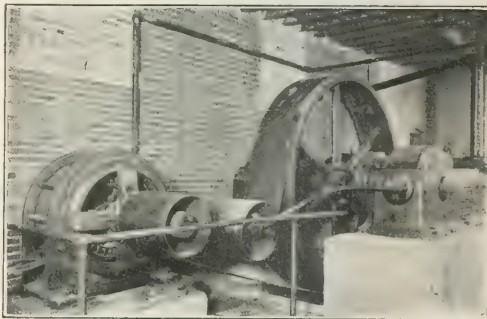


FIG. 1—MOTOR-DRIVEN AIR COMPRESSOR

rectly into an open-storage reservoir built below the floor.

The two steam boilers, which carry 200 lb. pressure per square inch, are located in a room adjoining the deep well. Each boiler is rated at 100 hp and is fed by a Swift automatic stoker. At present the stoker hoppers are filled by hand, but since 67 tons of coal are consumed every twenty-four hours, an electrically driven bucket elevator is being considered to facilitate handling of the fuel. The plant is located in the resistance district, so that its smoke has to be disposed of at a greater height than would be necessary were draft conditions the only ones imposed. The stack, which is constructed of brick, is 125 ft. high and 6 ft. in internal diameter at the top. To eliminate scale as much as possible in the boilers and evaporators, the Fetta water-softening system is used. The tank in which the water is treated is located in the boiler room.

#### THE DISTILLATION PROCESS

Perhaps the most complex apparatus used in this plant is located in the evaporating room. In this portion of the building are two boiler-feed pumps, one evaporator feed pump, one sweet-water (distilled-water) feed pump, a wet vacuum pump, a double-pipe fore-cooler, an exchanger, two electrically driven circulating pumps and a nest of eight Reilly multi-coil evaporating units.

Fig. 2 shows the evaporating units. A steam main direct from the boilers is run just above each of the evap-

orators, and two pipes tap off from this main for each "effect." Valves are placed in each branch line, and bypass valves are located in the steam main so that any one effect can be cut out for repairs or cleaning. One of the two pipes leading to each effect connects with a hollow tin-lined brass header in the top of the evaporator. Thirty coils of tin-lined copper tubing connect the upper header

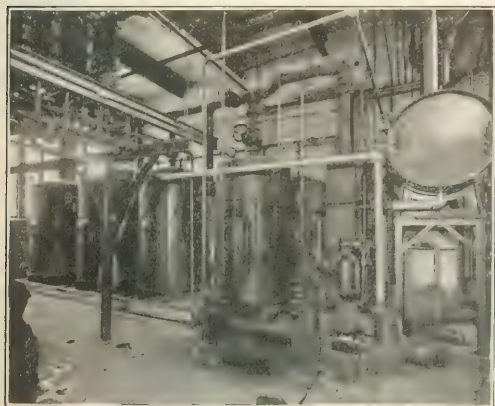


FIG. 2—EVAPORATING UNITS IN CHICAGO ICE-MAKING PLANT

with a lower header which drains into an automatic Kieley & Mueller trap. The space surrounding the coils is kept filled with treated water, and a definite level is maintained by an automatic feeder. Opening out of the top of this space is the other pipe which connects with the steam main.

Live steam at 120-lb. pressure is admitted to the coils of the first effect only, evaporating the water surrounding them. In doing this it is condensed and is then drained off through the trap. The steam generated in the first effect is used to generate steam in the next succeeding one and so on. A vacuum of 26 in. is maintained in the last effect by the wet-vacuum pump, so that the maximum amount of water is distilled for the number of pounds of steam used.

Double-pipe exchangers utilize the heat in the sweet water drained from the traps by transferring it to the treated water fed to the evaporator. Any air which may remain in the sweet water is extracted by a reboiler. A dry-vacuum pump maintains a vacuum in the reboiler, and any moisture drawn from the latter is condensed and returned to the system. The water is pumped from the reboiler through double-pipe forecoolers to a sweet-water storage tank located in the anteroom just off the tank room on the south end of the building. Tin-lined copper or brass pipes are used exclusively in the sweet-water pipe line to avoid contamination and prevent discoloration of the ice.

Two electrically driven circulating pumps are used to supply all the cooling water and are installed in duplicate for emergency. These turbo-centrifugal pumps supply 450 gal. a minute and are directly driven by 20-hp Wagner squirrel-cage motors running at 1750 r.p.m. Fig. 3 shows one of the circulating-pump units. Each of these motors is connected with the main switchboard through a knife switch and a Wagner polyphase starting box.

#### MOTOR-DRIVEN COMPRESSORS AND SWITCHBOARD CONTROL

The ammonia-compressor room, which is larger than the evaporator room, contains two vertical, single-acting York ammonia compressors, each capable of making 50 tons of ice in twenty-four hours. Both compressors are supplied

with a 16-ft. flywheel and are driven through a 30-in. belt by two 220-hp Wagner slip-ring induction motors running at 500 r.p.m. Fig. 4 shows these compressor motors. The motor cables run into terminal boxes, from which they are led to the switchboard through 3-in. conduits. The switchboard comprises seven black-slate panels mounted on a steel frame, and is divided up into the control of the lighting, the compressor motors and the auxiliary motors.

The two panels controlling the ammonia compressor motors are duplicates. Mounted on each is a polyphase watt-meter and a General Electric overload relay and oil switch, with no-voltage and overload release. In front of these panels are two flow-type Cutler-Hammer controllers for varying the speed of the compressor motors. Fifty-five per cent speed variation is obtained by introducing resistance into the rotor circuit. The resistance grids for the controllers are mounted above the switchboard. Both compressor motors have shaft handles which short-circuit the slip-rings when the motors reach full speed, thus eliminating losses that may occur between the motor and the controller.

The main service panel is equipped with a "printometer," which registers the number of kilowatt-hours used during each thirty minutes. An indicating wattmeter and a voltmeter are mounted at the top of this panel.

One of the panels controls the general lighting, which is measured through a Wagner induction-type watt-hour meter. In conjunction with this board there is also a distributing panel which controls the lighting by rooms. A three-wire lighting system is installed, ten 250-watt tungsten lamps being used in the compressor and tank rooms, and about 100 lamps, mainly 40-watt tungsten and 60-cp carbon-filament lamps, being used in the other rooms.

Power for the auxiliaries, such as the deep-well pump

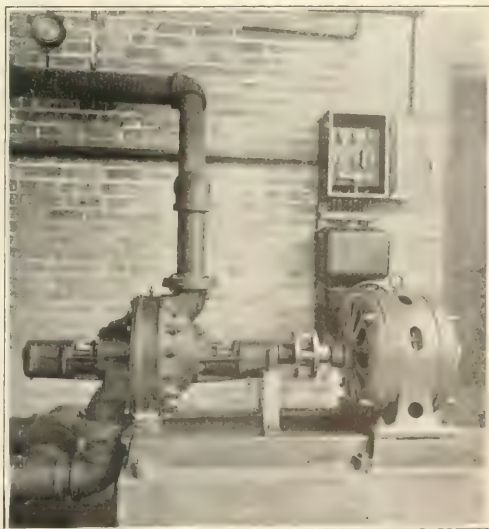


FIG. 3—CIRCULATING PUMP DRIVEN BY INDUCTION MOTOR

motor, ice-hoist, circulating pumps, brine circulators and agitators, is distributed from one panel and metered on an adjoining panel. All of the motors connected to the board are of Wagner manufacture.

#### ICE MAKING AND HANDLING

The compressed ammonia is conducted from the compressors to ammonia condensers located on the roof, and



from there the liquid ammonia is drained into two storage tanks located in the compressor room.

Two freezing tanks, operated on the flooded system, are located in the large room adjoining the ammonia compressors. Each tank is divided by baffles into three parts. Circulation of the brine (a calcium-chloride solution, density 80) used for freezing is maintained by agitators driven by eight 3-hp Wagner squirrel-cage induction mo-

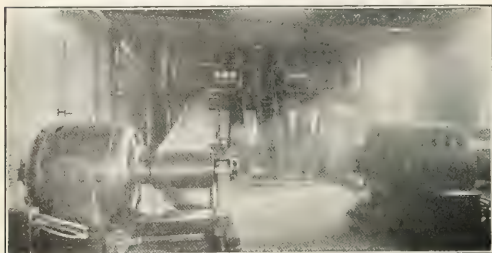


FIG. 4—INDUCTION MOTORS DRIVING AMMONIA COMPRESSORS

tors. Three hundred feet of 1.25-in. ammonia cooling pipe is installed per rated ton of ice manufactured. The tanks, which are built below the floor, accommodate 1400 300-lb. cans, 1000 cans being harvested every twenty-four hours. These cans are filled with sweet water by Burns automatic can fillers.

Ice pulling is accomplished by two 1-ton Sprague electric hoists, each suspended from a hand traveling crane, which spans its respective tank. To free the cakes of ice from the cans the latter are dipped in tanks containing warm water brought from the forecoolers. Since immediate immersion in the dip-tanks would crack the ice, the cans are stacked along the walls of the tank room for about thirty minutes before immersing. The electrical energy used for the ice hoist is supplied from wires beneath the tracks upon which the cranes operate.

#### STORAGE OF THE PRODUCT

After the ice is removed from the cans it is transferred either to the storage room or the shipping rooms just off the tank room, the latter being used for holding ice which is to be used immediately. An electrically driven endless-chain conveyor is to be installed in the near future for transporting the ice from the tank room to the storage rooms.

Eight storage rooms, each of 1000 tons capacity, open from a runway which communicates with the tank room. These rooms are about 120 ft. by 24 ft. in area and 32 ft. high and are kept at a temperature of 28 deg. Fahr. by brine circulating through pipes running along the ceiling. This brine is drawn off from the freezing tanks by two brine-circulating pumps, which are directly connected to 7.5-hp Wagner squirrel-cage induction motors, and is returned to the tanks through the forecoolers.

An ice hoist, driven by a 10-hp Wagner squirrel-cage motor, is employed for stacking the ice in the storeroom. All motors in the plant are of the three-phase, 60-cycle, 220-volt type. Besides local switches and starting compensators each motor can be shut down from the main switchboard.

Mr. J. S. Field, president of the Knickerbocker Ice Company before it was merged into the Consumers' Company, reports that while the Lexington Avenue motor-driven ice plant has not yet been run long enough to give definite operating costs, he feels from his experience with the other two Knickerbocker electrically operated plants in Chicago that electrical operation will here also be shown much more desirable than steam for the production of artificial ice.

## Illumination and Wiring

### Electric Signs in Stockton, Cal.

As the result of the intelligent activity of the Western States Gas & Electric Company the merchants of Stockton, Cal., are taking a renewed interest in the subject of electric signs and the consequent added attractiveness of business streets after nightfall. It is said that about fifty merchants have recently installed electric signs or are about to install them. Furthermore, the subject of special curb lighting is attracting attention in connection with the sign campaign. Signs recently installed or on order will have a total of over 8000 lamps and will cost nearly \$15,000.

### Decorative Lighting for Peoria Interurban Railway Building

An elaborate ornamental exterior lighting scheme will be a feature of the terminal station to be erected at a cost of \$350,000 for the Illinois Traction Company at Peoria, Ill., under the direction of Vice-president H. E. Chubbuck. According to the architects, this station and office building, when completed, will be one of the most strikingly illuminated buildings of the country. About 10,000 small tungsten lamps will stud the exterior of the structure, which will be of white terra cotta. Between the windows, on all four sides of the seven-story edifice, will be clusters of five lamps each. The cornices and architectural decorations will also be outlined by incandescent lamps. Adjoining the building will be a train shed, constructed of steel and concrete, capable of accommodating twenty cars at a time. The Illinois Traction System will occupy four stories of the building, the remainder being rented to tenants. Work on the foundations will be commenced during the early part of March. The structure will be erected at the corner of Jefferson and Hamilton Streets on the site of the old National Hotel.

### A 130-Ft. Sign with 1110 Lamps

On a rocky bluff commanding the site of the city of Bluefield, W. Va., stands the huge central-station sign illustrated herewith, which measures 130 ft. in length, with 8-ft. letters. The steel frame of the display is carried on fourteen wooden poles of varying lengths conforming to the rough topography of the hilltop. These sticks average 40 ft. in height and are set at 10-ft. intervals. A total of 1110 5-watt tungsten sign lamps are contained in the huge display, including the letters, the flame device and a depiction of a motor belted to a pulley. The sign, as built by the Green-



130-FT. CENTRAL-STATION SIGN

wood Advertising Company, is provided with flasher effects by which the play of the flames in the overhead design is faithfully reproduced, while chaser contacts set motor, belt and pulley in apparent movement. The Appalachian Power Company is one of the Byllesby properties and supplies central-station energy to a large mining and industrial territory in Virginia and West Virginia.



### Special Illumination for the Mobile Carnival

Some further details in relation to the recent Mardi Gras Carnival illumination at Mobile, formerly referred to in this journal, may be of interest. The work was carried out by the Mobile Electric Company, Mr. R. E. Flower, manager of the new-business department of that company, being a member of the illuminating committee of the Mobile Carnival Association. About 5000 incandescent lamps were used. About 2000 of these were installed in Bienville Square. On the four sides of the square were erected lamp-posts connected by festoons of incandescent lamps. The oak trees forming a cross in the square were entwined with garlands of small incandescent lamps. The trees directly surrounding the fountain in the square were decorated in an unusual manner, small lamps being placed among the branches, where they twinkled like fireflies. The fountain was illuminated with colored light obtained by means of an automatic projector suspended among the trees above the fountain with the light focused on the fountain and basin only. Color changes were achieved by the movement of an automatically operated disk, and the flowing water was brilliantly illuminated.

Other features consisted in outlining the tower at the head of Government Street with about 500 lamps and an illuminated sign with letters 5 ft. high, bearing the word "Welcome." About 2500 lamps were distributed on streets designated by the committee. These were fastened in festoons stretched across the streets from curb to curb. These festoons were peaked in the center, with pendants at each end. Each festoon consisted of twenty-five lamps (except in the case of Government Street, where the festoons contained fifty lamps), and there were from four to six festoons in each block. Colored lamps were used in Bienville Square, but clear glass bulbs were used in the other streets.

### Illumination of Belmont Chapel, Cathedral of St. John the Divine

In the illumination of monumental church edifices built to withstand the ravages of time and to outlive the genera-



FIG. 1—ILLUMINATION OF ALTAR IN BELMONT CHAPEL, CATHEDRAL OF ST. JOHN THE DIVINE

tion in which they are erected special care must be exercised in the choice of fixtures where such are installed in order not to detract from the architectural features of the edifices and also not to mar the ecclesiastical setting. As a rule, edifices like the Cathedral of St. John, Morningside Heights, New York, are rarely used at night, and it would be impossible, moreover, to employ simple fixtures in the main

body of the edifices except on the side walls. The various memorial chapels surrounding the choir suffice for private devotions, and it is necessary at times to have some source of artificial illumination to counteract the dim, sepulchral light usually found in memorial chapels of this kind owing to the employment of dense and highly colored glass in the memorial windows.

The accompanying illustrations show the method of

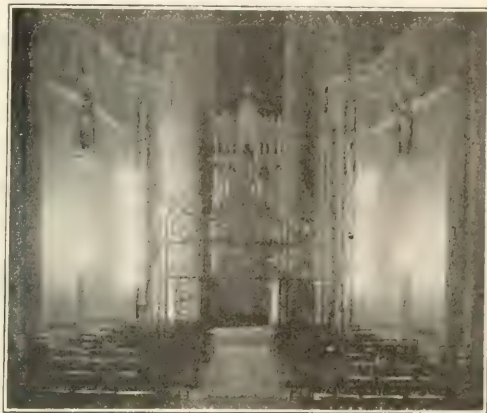


FIG. 2—VIEW SHOWING SIX LAMPS IN REFLECTOR STRIP BACK OF PILLARS

illuminating the Belmont Memorial Chapel of St. Saviour, back of the reredos. General illumination is afforded by means of four candelabra made of Carrara marble which have a height of 9 ft. Each marble column is surmounted by an alabaster globe 24 in. in diameter at the top, within which is a cluster of six incandescent lamps. Brilliant sources of illumination are thus avoided and the semi-indirect light imparts a soft glow to the entire chapel. In order to heighten the effect two reflector strips containing six lamps are hidden behind the pillars in the manner shown in Fig. 2.

The four candelabra represent an expenditure of approximately \$5,000, and inasmuch as there is no indication of artificial light by day the general ecclesiastical effect remains unchanged. The candelabra are of course rich in carvings of architectural and religious design. The cathedral is lighted from the mains of the New York Edison Company, and the general illumination of the choir was described in these columns some time ago. (See *Electrical World*, April 13, 1911, page 927.)

### Crane-Suspended Arc Lamps Proposed for Clark Street, Chicago

Merchants and others doing business on Clark Street, in Chicago, both in the downtown Loop district and on the North Side, are forming an organization to build a street-lighting system to make the street more attractive and conspicuous at night. Several systems of lighting have been suggested. The use of curb-lighting posts with tungsten lamps has been considered, but owing to the number of poles used to support the overhead street-railway construction on this street, it has been thought best to avoid the use of additional posts. It has been proposed to suspend lighting-arc lamps from the tops of the street-railway poles, but the Commonwealth Edison Company has suggested what it believes to be a better plan. This contemplates the use of 110-volt, 6.5-amp flaring-arc lamps suspended from 10-ft. ornamental cranes to be swung in swivels from the fronts

of buildings. This would facilitate trimming the lamps from nearby windows.

The idea is to have the lights suspended about 25 ft. above the sidewalk and spaced about 80 ft. apart, staggered on each side of the street. At this height the crane-suspended lamps would probably be high enough to clear most of the signs. It is proposed to burn all of these special arc lamps from dusk until 1 a. m., and perhaps a third of them from 1 a. m. until daylight. It is also proposed to make a flat rate for this lighting service, part to be paid by the owners of the buildings and part by the tenants. The plan of apportioning some of the expense to the owners is made on the theory that this special illumination enhances the value of the property. It is possible that this illumination will be carried as far south as Twelfth Street and north of the Chicago River to some point not yet decided upon. The plans, however, are in a tentative state.

## Wiring Buildings with Cinder-Filled Floors

By GEORGE HARTLEY

Occasionally in wiring old buildings a wireman will encounter a floor partly filled with cinders between the joists. Floors are seldom built in this way now, but fifteen or twenty years ago the construction was common in the bet-

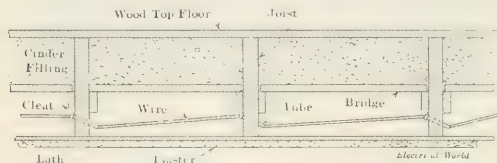


FIG. 1—WIRE INSTALLED BENEATH CINDER FLOOR

ter class of residences and business buildings. The cinder filling was intended to prevent the transmission of sound from one floor to another and to stop the ravages of rats.

In running circuits beneath such a floor the wireman can take out some of the cinders after removing the floor boards parallel to the run. Only enough cinders should be taken out between each pair of joists to expose a complete "bridge" board so that it can be pried out. The bridge board out of the way, the holes for the tubes, or for flexible conduit if such is used, are bored below the cleats with a long bit. The latter type is necessary because one of ordinary length cannot be used, owing to insufficient working room. If a long bit is not at hand, one can be made by having a blacksmith weld a shank of the necessary length, possibly 30 in., to an ordinary carpenter's bit. Fig. 2 illus-

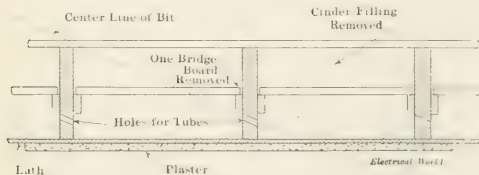


FIG. 2—BORING TUBE HOLES THROUGH JOISTS

trates the conditions that prevail while the joists are being bored.

After the porcelain tubes have been inserted and the wire threaded through them, or after the flexible conduit has been run through the holes, the bridge pieces may be nailed in place. The cinders may then be scraped back and the top floor boards relaid. Fig. 1 illustrates a sectional view of a finished job.

## Recent Telephone Patents

### SWITCHBOARD SYSTEMS

To-day there are found three distinct classes of telephone switchboards, the manual, the automatic and the semi-automatic. The two former are sufficiently well established, so that the mode of operation is practically settled, but with the latter this is not the case. A patent recently granted to Mr. E. E. Clement, of Washington, D. C., and assigned to the North Electric Company, has omitted but one of the features of the automatic system. With this new system the subscriber registers his own number with a dial and, although he does not communicate with the operator, he cannot make a call until he has through the aid of the operator been connected to a selector. For example, when an attempt to call is made, a manual-type line lamp appears before the operator, who connects the necessary jack to the jack of a free selector, without regard to the wants of the subscriber. The latter then selects the number which he wishes automatically. It is claimed that this system avoids the more expensive parts of both the others.

Another patent granted to this same inventor describes an automatic system designed for use by party-line exchanges. A feature of this system lies in the fact that it allows a call to be made automatically between persons on the same party line. Such a selection would ordinarily result in a busy signal, which must be taken care of by special means.

### AUTOMATIC SWITCHES

Automatic switches sometimes give trouble by allowing the machines to get off normal. By this is meant the condition where, without the existence of a call, the moving contacts of the selector machine are not in contact with their back stop but are touching the multiple bank. When this condition prevails the system will not operate and manual assistance at once becomes necessary. Mr. T. F. Crocker has recognized the advantage of restoring such switches automatically to their normal position, and he has devised a means for accomplishing this. When the switch is left off normal for a predetermined length of time without the existence of a call, a time-limit thermal relay is caused to operate, and this in turn causes the operation of a release magnet.

One of the sources of complaint in manual systems is the difficulty of calling the operator in upon an existing connection, an operation usually accomplished by moving the receiver hook and causing flashes at the board. If the hook is moved too quickly the signal is lost, as the time element involved in cooling and heating the lamp is sufficient to defeat the signal. Again, if the hook is moved but a few times, the few momentary flashes may escape the attention of the operator. This is a problem which has attracted the attention of Mr. James Kennedy, of St. Louis, Mo., and he arranges his circuits so that if both parties to a connection hang up their receivers, both lamps glow steadily to indicate the completion of a conversation. If, however, one hook be down and the other up, a locking relay comes into operation to apply an intermittent current until a response is made by the operator, and the calling lamp will flash regularly and continuously until the listening key releases the locking relay, incidental to the operator's response. This patent has been assigned to the Dean Electric Company.

A patent granted to Mr. H. G. Webster, of Chicago, Ill., and assigned to the Kellogg Switchboard & Supply Company, relates to automatic ringing. The operator starts the ringing by depressing a key to select the proper type of current, and this causes a locking control relay to be energized and maintain a ringing current until response is made at the called station. Upon this response the contact relay is released through the differential action of a second winding of the contact relay.

## TELEPHONE CALL REGISTER

Under this title Mr. C. V. Richey, of Washington, D. C., has patented a combination call register and telephone locking device. The register is operated by means of two electromagnets, which work in conjunction with each other. A count is registered by ringing current applied to the receiver while off the hook. With the receiver on the hook no count is recorded when the ringing current is applied, as the auxiliary magnet opens the circuit of the key-operated magnet under this condition. Whenever it is desired to prevent calls being made by unauthorized persons, the armature of the auxiliary magnet may be locked out of service by applying a locking key.

## MISCELLANEOUS APPLIANCES

Mr. E. E. Clement, of Washington, has received a patent for an impulse transmitter. This transmitter is provided with ten digit keys, each of which is mounted on a bar having a rack cut in its under surface. Extending under all the racks is a single gear, which is attached through a ratchet to an impulse wheel. Each push-bar is provided with a stop, these stops being so placed at different relative distances from each other that each push-bar turns the gear a distance proportional to the number of impulses desired. Normally the push-bars are out of mesh with the gear, but when any one of them is depressed to its stop the gear is encountered by the rack, giving the proper displacement to it and to the impulse wheel. When the bar is released a spring returns both it and the gear to their normal positions, the impulse wheel standing idle through the action of the ratchet.

A patent granted to Mr. H. P. Claussen, of Chicago, relates to a magneto party line wherein it is desired that stations may signal each other without calling the exchange, and vice versa. This is accomplished by providing an exchange signal responsive to direct current alone. The generators of the various stations give both direct and alternating currents and a key determines which shall reach the line for any given call.

## Letters to the Editors

### Return of Energy from Alternating-Current Series Motors

To the Editors of the *Electrical World*:

SIRS:—In the *Digest* of your issue dated Dec. 28, 1912, on page 1383, is shown a diagram relating to the recovery of energy from alternating-current motors with series characteristics, which was reproduced from *Elektrotechnische Zeitschrift*, Dec. 5, 1912. Your attention should be called to the fact that this same diagram (Fig. 1) with a complete theory was published by my assistant, Dr. Siegel, and myself in the *Elektrotechnik und Maschinenbau*, Vienna, on Sept. 1, 1912.

Brünn, Austria.

PROF. DR. F. NIETHAMMER.

[The possibility of returning energy to the supply system from alternating-current motors possessing series characteristics seems to have been known for some years. A simple method for accomplishing this result was described and illustrated in our columns on Feb. 13, 1914, page 320.—Eds.]

### Truing of Commutators

To the Editors of the *Electrical World*:

SIRS:—The trouble mentioned in the item headed "Spark-ing and Turning of Commutator," on page 256 of your issue of Feb. 1, may be caused by the mica working above the surface of the copper, or else the mica may be harder and wear more slowly than the copper and thus prevent the brushes from making proper contact. When the commu-

tator is newly turned it is of course smooth and the mica is no higher than the copper. After it has run for a while the trouble develops for the above reason. The remedy is first to make sure that the commutator is thoroughly tight. It should then be re-turned to be perfectly smooth. If this treatment does not effect a cure, the mica should be cut slightly below the surface of the commutator.

New Orleans, La.

H. F. CAMERON.

### Discrepancy in Skin-Effect Coefficients

To the Editors of the *Electrical World*:—

SIRS:—On page 1156 of the *Electrical World* of Nov. 13, 1912, there appeared a letter deprecating the discrepancy in the values for skin-effect coefficients obtained from the formulas of various authors. This letter, I believe, voices an inquiry which has recently been in the minds of a good many electrical engineers.

In connection with other work, the writer has found occasion to examine the equations of several authors and may be able to throw some light on their use and results, although attempting no theoretical discussion.

Examining the values of the coefficient given by various authorities for copper conductors of various sizes operated at 60 cycles, the values as obtained from Pender and Del Mar check so closely with those obtained from Maxwell that it is to be concluded the basis is the same. To this testimony is added that of Kenyon in the McGraw Standard Handbook, and also of Russell, both of whom accept Maxwell's equation. The only other equation applicable to small conductors is given by Rushmore, as published in the A. I. E. E. *Proceedings*, June, 1912. This is avowedly approximate, and although the values obtained are somewhat high as compared with Maxwell's, the formula is easier to apply.

Maxwell's equation deduced strictly from theoretical considerations is as follows:

$$K = 1 + \frac{1}{12} \left( \frac{\mu}{\omega} \right)^2 + \frac{1}{180} \left( \frac{\mu}{\omega} \right)^4 + \dots$$

where  $l$  = length,  $\omega = 2\pi f$ ,  $\mu$  = permeability, and  $R$  is absolute ohmic resistance. This series is quite satisfactory for small conductors at moderate frequencies, say, up to the point where the product of circular mils and frequency equals  $10^7$ . This limit may be advanced to  $1.8 \times 10^7$  if another term is added to the above series. It becomes very unwieldy for values beyond these, requiring, as it does, a very large number of terms which oscillate between wide positive and negative limits. It has, however, the advantage of being accurate and is indeed the only formula which may be used within the prescribed limits.

Beyond the limits stated above, Steinmetz's equation giving the effective penetration of the current for flat conductors affords satisfactory results. Here the penetration

$$S = \frac{5030}{\sqrt{f \mu}}$$

where

$$f = \text{frequency in cycles per second}$$

From which the coefficient is evidently

$$K = \frac{R}{R - \frac{1}{S^2}}$$

where  $R$  is the resistance of the conductor. The formula having been derived for flat conductors, is obviously applicable only to cylindrical conductors with small surface curvatures. Indeed, for small conductors it becomes less than unity, which is of course meaningless. It may therefore be satisfactorily used beyond the point where (area  $\times$  frequency) equals  $1.8 \times 10^7$ . Thus it is concluded that the best results for skin-effect coefficients can be obtained by the use of these two formulas within their prescribed fields.

Urbana, Ill.

A. B. VAN DEUSEN.



# Field of the Operating Engineer

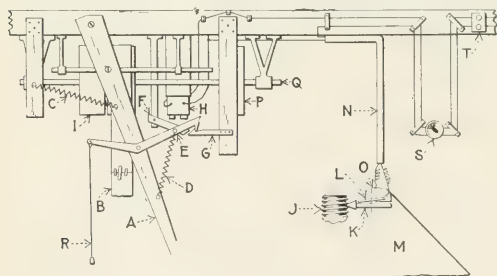
A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Electric Belt Shipper

By A. P. BROADHEAD

An electric belt shipper used on an automatic jig spring machine, which by means of springs, magnets, etc., shuts down, or rather ships the belt of the spring machine from the running to the idle pulley instantaneously when the main screw guide of the machine is disarranged in the least, is shown diagrammatically herewith. The auto jig spring machine winds springs on a vertical arbor from which the spring drops into a basket after it is wound and cut. The feeding mechanism is driven by a piston which on the forward stroke feeds the wire to the arbor that is inserted into a chuck, the top of which is represented at *J*. The guide *K* is the means of regulating the length of the spring and therefore supports the chuck by meshing closely with the threads in *J*. Frequently, owing to the vibration of the machine, this guide *K* slips or becomes loosened and allows the chuck *J* to fall; then when the piston moves on its forward stroke something has to give, usually the base of the machine, and this is very costly.

Several mechanical attachments or preventives were



DIAGRAMMATIC VIEW OF ELECTRIC BELT SHIPPER

made, but none worked so effectually as the electric belt shipper which was designed and installed by the writer of this article.

The following is a brief description of the lettered sketch: *A*, belt shipper lever; *B*, belt to machine from countershaft; *C*, spring tending to hold shipper *A* to off position; *D*, spring which causes *E* to snap in groove in *G*; *E*, dog which engages in slot in *G* and holds shipper in running position; *F*, latch armature which is attracted by magnet *H* and kicks out *E*; *G*, notched strip which holds shipper in running position against stress of spring *C*; *H*, electromagnets; *I*, loose pulley; *J*, threaded end of chuck which holds arbor; *K*, screw guide for adjusting length of spring; it is the seat of trouble; *L*, electrical contact insulated from machine and which comes in contact with *K* when it slips back; *M*, head of machine which supports *K*; *N*, conduit to machine; *O*, where line is grounded to machine; *P*, pulley carrying belt from line shaft; *Q*, countershaft; *R*, cord used to trip *E* out of its socket *G* to enable setting up or readjusting machine; *S*, double-pole snap switch, controlling 110-volt direct-current circuit, and *T*, cut-out.

Further explanation of this apparatus does not seem necessary, and the writer wishes to say that it has been in operation for considerably more than a year and has worked remarkably well.

## First Aid in Case of Electrical Burns

The revised "Rules for Resuscitation from Electric Shock," to which frequent reference has been made in these columns, provide also for the first care of electrical burns. When natural respiration has been restored, burns, if serious, should be attended to before the doctor comes. The commission, representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers, suggests the following rules as embodying the approved methods for first care of electrical burns:

"A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off; cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0.5 per cent). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil such as machine oil, transformer oil, vaseline, linseed, carron or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs or other soft cloth, held lightly in place by a bandage.

"The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

"Do not open blisters."

## Electric Thawing of Frozen Water Pipes

The mildness of the present winter season has resulted in the freezing of fewer water-supply services than was brought about by the unprecedented cold spells of last winter, but all possibility of crisp weather is not yet past and many localities which to date have been immune from frozen water pipes may still require the services of the central station's pipe-thawing gang.

As was remarked last season, the majority of the cases of frozen pipes did not occur until the first mild day or night following the severest temperatures of the cold snaps. For this anomaly human nature is accountable, for while the householder can be depended upon to keep his water running during the very cold weather, with the advent of a rise in outdoor temperature he promptly concludes that the danger of freezing is past and leaves his faucets closed, unmindful that the ground is already thoroughly frozen around his pipes and is therefore ready to congeal at once any standing water in the pipes. Records of preceding seasons show, indeed, that the pipe-thawing crews have usually been busiest during March.

### IMPORTANCE OF DISCONNECTING HOUSE WIRING

The principle of electrical thawing consists in sending through the pipe a large current, usually several hundred amperes, the resulting *I<sup>2</sup>R* loss producing heat which melts the ice. Connection for applying this heavy current can be made at any two convenient points, such as an indoor house faucet or pipe and an outside fire hydrant or meter box, the requisite being that the frozen section of service pipe be included in the circuit. Disconnection of the house piping from the service pipe is desirable, to prevent the

heavy currents finding paths to ground through other plumbing and causing fire or damage in remote parts of the house. One large electric company which suffered the loss of a dwelling in this way now requires that the house system be first of all disconnected from the street pipe where the latter enters the cellar, electrical connection being made to the open stub end alone, while all the rest of the house piping is kept clear.

Several manufacturers make special pipe-thawing transformers and equipment which are very useful and convenient, but in an emergency almost any spare 10-kw or 15-kw lighting transformer can be utilized for the purpose. Usually an emf of from 50 volts to 100 volts will be required, with carrying capacity for 200 amp to 300 amp.

One operating company has had good success with a 15-kw, 2300-110-volt transformer connected in series with a water-barrel rheostat. The rheostat solution was strengthened by adding 10 lb. of salt to the barrelful. By means of an ammeter in series with the rheostat, the current flowing could be measured. In one instance this apparatus melted ice in a 100-ft. length of 1-in. pipe by the application of 150 amp at 60 volts for twenty-five minutes. An upwardly curving goose-neck trap was cleared in ten minutes with 100 amp to 200 amp at 60 volts.

Another improvised equipment in use comprises one 5-kva and one 7.5-kva transformer, stepping down from 2300 volts to 110 volts, with secondary connections through water rheostats made from ash cans. Transformers and auxiliaries are mounted on a low stone wagon, so that they can be moved from place to place. The primary circuit includes a pole service cut-out with fuses, and a Wright demand indicator has been employed in lieu of a meter. The most stubborn case attacked required 127 amp at 110 volts for five minutes.

### SERIES-PARALLEL CONNECTION OF TRANSFORMERS

Last year a northern central station arranged several motor trucks with pairs of 10-kw or 15-kw transformers, connected in series on the 2300-volt side and in parallel on the 110-volt side. A coil of wire used in series with the transformers has sufficient resistance to limit the current flow to 200 amp or 300 amp, and the switch is left closed until the pipe is freed.

To meet the emergency of 2000 calls for pipe-thawing assistance last year, a large metropolitan company equipped about twenty crews, each manned by a driver, foreman, two linemen and a plumber. Pairs of 10-kw or 15-kw transformers were connected as shown in the sketch. Except for the primary fuses, no current-limiting or measuring

men's time was charged to the customer, the average cost being but \$10 to \$13.

## THAWING SINGLE SERVICES WITHOUT TRANSFORMERS

While the above transformer method accomplishes individual results quickly, the trouble and expense required to assemble the apparatus may be prohibitive for an occa-

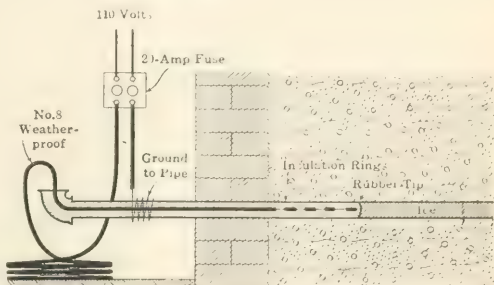


FIG. 2 THAWING WATER PIPES WITH 110-VOLT HOUSE CIRCUIT

sional job or two. In such a case a less elaborate though slower method, for which no transformer or other apparatus is needed, is to cut the insulation from a piece of No. 8 weatherproof wire, as shown in Fig. 2. After disconnecting the house piping the wire is threaded into the frozen service line, to which the other side of the circuit is grounded. An elbow screwed on the end helps hold water in the pipe to provide a conducting path, and the current flow is limited by a 20-amp fuse.

Such a water rheostat method thaws at the rate of 3 ft. to 4 ft. per hour. In one case a 16-ft. plug was thawed at the expenditure of 10 kw-hr., costing \$1. Only one man was required, and after starting the job he turned it over to a boy to feed the wire into the pipe as the ice was melted. For thawing a few services in houses where electricity is available the electrolytic method may therefore prove to be very convenient and economical.

A variation of the same scheme has been suggested in the use of a slender cartridge heating unit of such diameter that it may readily be introduced into the pipe by rodding. Despite its efficiency, this method is, of course, limited to straight service runs where the frozen section is found to be directly accessible.

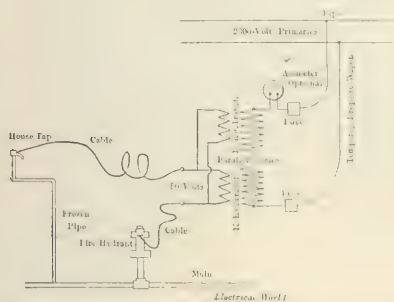


FIG. 1—ASSEMBLY OF APPARATUS FOR THAWING WATER PIPES

devices were necessarily employed. The first crews equipped were provided with meters, but these were found unnecessary after the men had gained a little experience and confidence. Currents of 200 amp to 300 amp were employed at 50 volts, the average duration being from five to fifteen minutes. It is estimated that 2 kw-hr. to 4 kw-hr. was required per service thawed. Only the cost of the

### Location of Underground Pipes

What method for electrical heating can be employed for the heating of underground pipes without excavating to find them? M. N. O.

The exploring-coil scheme, depending on the electromagnetic induction between an interrupted "howler" current and a hand coil in which a telephone receiver is included, is often successfully used for locating underground pipes or unidentified conductors of any kind. The howler apparatus comprises an induction coil with spring-vibrator interrupter, several batteries supplying the energy required. The secondary induced current from the coil is connected to the pipe or conductor to be located, in sections along its length at its known ends. By holding the hand-coil near the ground, a position is finally reached where the ordinary "buzz" heard in the telephone reaches a maximum, at once indicating the location of the pipe. If the exploring coil axis be turned parallel with the direction of the current, the sound in the receiver will practically disappear, thus indicating distinctly by the contrast in loudness when the nearest approach is made to the pipe. A similar method of using the exploring coil often proves useful in tracing out annunciator and bell circuits, etc., record of which has been lost.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Phase Advancers.**—An account of the discussion which followed M. Walker's recent paper on this subject at Birmingham. G. Kapp said that power companies' charges should discriminate between the consumers' power-factors, and that this could be done by using Ricardo Arno's meter. As to the question whether at full load the input into the motor is the same whether a phase advancer is used or not, he answered this in the affirmative. Some power is, of course, required to keep the phase advancer going, but some waste of power is saved in the motor, and the two approximately balance. There might even be a little advantage in the use of the phase advancer. T. F. Wall said that the action of the Scherbius type of phase advancer might be explained in a simple manner as follows: The apparatus can be represented as shown in Fig. 1A, in which  $a$  is a ring of iron provided with holes in which a winding is arranged, in a manner similar to that of a ring-wound armature of a direct-current machine with embedded active conductors. In practice the winding is of the drum type, but a ring winding is easier to illustrate. The ring and commutator are fixed on a shaft which can be driven. Three brushes are provided on the commutator, displaced relatively to one another by 120 electrical degrees, and these brushes receive the currents of the slip frequency from the secondary of the induction motor. When the ring is stationary, it acts like a three-phase choking coil, the currents producing a field  $F$ , which revolves in space at a speed of  $S$  r.p.m., corresponding to the frequency of the currents supplied to the brushes. The vector diagram for the phase emf  $E$  at the brushes and the current  $I$  fed to the brushes would be as shown in 1B, in which  $RI$  is the component to overcome resistance and  $XI$  is the component to overcome the emf produced by the revolving field

the ring is driven at the speed  $S$ , in the direction in which  $F$  revolves, the relative motion of the field  $F$  and the winding become zero, and that is equivalent to the disappearance of the self-induction effect. The vector diagram of phase emf  $E$  at the brushes and the current  $I$  fed into the brushes become as shown in Fig. 1; that is, the current is now in time-phase with the emf. If the ring be driven at a

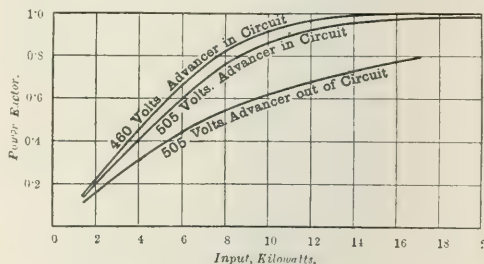


FIG. 2.—RELATION OF POWER-FACTOR TO INPUT

higher speed than  $S$  r.p.m., the  $XI$  component of Fig. 1 becomes reversed in sign, and the vector diagram is now as shown in 1D; that is, the current leads the emf. The angle of lead might be adjusted by adjusting the speed at which the apparatus is driven. G. Shearing gave some results of tests made on a Scherbius three-phase induction motor. The motor was a 25-hp, 50-cycle, 450-volt machine having a synchronous speed of 1000 r.p.m. The phase advancer was fixed on one end of the rotor shaft. The advancer itself was a three-phase commutator dynamo with no stator field, the exciting flux being produced by the armature itself. The stator terminals were connected to three brushes on the commutator; in this way the necessary leading emf was produced in the secondary winding. Tests were made at 505 volts and 460 volts. In one test at 505 volts the advancer was cut out; in the other test at 460 volts the advancer was in circuit. The relation between the power-factor and kilowatt input were as shown by the curves Fig. 2. The conclusions to be made from the test are very favorable to the use of phase advancers. The motor was very light for the output, its net weight, 798 lb., giving 14.5 kg per hp for the rated load. From the maker's figures he found that, as a rough average value for a motor of the same output, frequency and speed, but with no advancer and a power-factor from 86 to 88 per cent, the weight is from 14 kg to 15 kg per hp. Thus the decrease in weight of the motor resulting from the use of the advancer compensates for the increase due to the weight of the advancer itself. Without an advancer, to secure a high power-factor the air-gap must be very small. With its use the air-gap need not be so small and the mechanical difficulties associated with a small air-gap disappear. For these reasons the cost of the motor and phase advancer should not necessarily be greater than that of a motor with no advancer. The efficiency of the motor was 92 per cent at full load. The additional losses due to brush and ohmic resistance of the advancer are thus small, and the gain resulting from the reduction of the current for a given output is far greater than the additional losses.—London Electrician, Feb. 7, 1913.

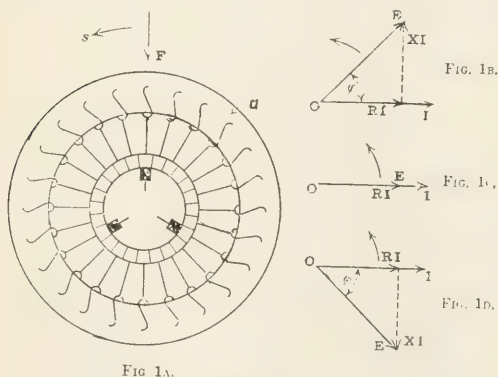


FIG. 1.—PHASE ADVANCER AND VECTOR DIAGRAMS

$F$ , and the latter component, therefore, corresponds to the emf necessary to overcome the self-induction of the winding. Suppose the apparatus were driven in the same direction as that in which the field  $F$  revolved, the speed of rotation of  $F$  in space is independent of the speed of rotation of the ring, because the points at which the currents are led into the winding are fixed in space. Hence, when



**Theory of Commutation.**—F. NIETHAMMER endeavors to show in a long letter that Pichelmayer's formula for the commutation voltage is the same as that of Parshall and Hobart and criticises some experiments of Pichelmayer. Pichelmayer replies at length showing the difference of his theory from that of Parshall and Hobart and others.—*Elek. Zeit.*, Feb. 6, 1913.

**Synchronous Booster Rotary Converters.**—J. L. MCK. YARDLEY.—The author points out the various losses in synchronous booster rotary converters and gives the figures for a machine of recent design. The efficiency at 100 per cent power-factor and normal voltage is 96.3 per cent.—*Elec. Journal*, February, 1913.

**Portable Rotary Converters.**—V. W. KERN.—An illustrated note on the principles and uses of the portable rotary converter substation.—*Elec. Journal*, February, 1913.

### Lamps and Lighting

**Ductile Tungsten.**—O. RUFF.—On the basis of patent specifications and experiments made by himself the author describes the method of producing pure tungsten and of making it ductile.—*Zeit. f. Angew. Chemie*, Vol. 25, 1912, page 1889; abstracted in *Elek. Zeit.*, Feb. 6, 1913.

### Generation, Transmission and Distribution

**Norwegian Water-Power.**—An illustrated article on the power station at Leinoffs in Norway, which is situated 3 km (1.8 miles) above Notodden on the River Tin. There are four 6600-kva, 10,000-volt generators.—*London Elec. Review*, Feb. 7, 1913.

**Mixed-Pressure Steam Turbine.**—E. D. DICKINSON.—A paper on the mixed-pressure steam turbine with special reference to the use of the steam regenerator. Mixed-pressure turbines are broadly divided into three types, which may be distinguished as follows: (1) Turbines designed to give highest efficiency on low-pressure steam, but arranged to admit high-pressure steam automatically to the low-pressure header; (2) turbines designed primarily for low-pressure steam but supplied with nozzles for the admission of high-pressure steam, and (3) turbines designed for continuous operation on mixed pressure but capable of giving good efficiency on high pressure and of carrying some load on low pressure. In order to realize the best results from a given installation, that type should be used which by design is intended for the conditions of service at hand. What these conditions should be for the different types is briefly outlined by the author. The latter portion of the article is devoted to a discussion of the principles governing the action of the steam regenerator—storing heat during excessive supply of low-pressure steam and regenerating steam when the supply falls short. Included in this section are some figures based on data secured from an actual installation, which show that the regenerator may effect a very considerable economy in many instances.—*Gen. Elec. Rev.*, February, 1913.

### Traction

**Aerial Electric Mountain Ropeway.**—A note on a new suspended ropeway for taking passengers from the Eisack Valley, near Bozen, in the Tyrol, up to Kohlernberg. Everything is in duplicate. One car ascends, while the other descends. Each car runs on two rope rails and is pulled by two ropes, and duplicate braking arrangements are provided. The power station is equipped with continuous-current motors, and a storage battery, capable of maintaining the service for an hour, is placed at the high-level station. A telephone line has been erected on the mountain parallel to the rope track. With the aid of a rod the driver or inspector can get into telephone communication with the power station; the current is at once cut off then, and the driver may afterward ask that the car be pulled up or down at various speeds, both for conducting tests and for direct ing the service in cases of emergency. The brake devices

for excessive speed comprise a new centrifugal detent.—*London Eng'ing*, Feb. 7, 1913.

**High-Tension Trolley Lines.**—E. E. SEEFEHLNER.—The first part of an illustrated description of modern practice in overhead high-tension trolley line construction for single-phase railways.—*Elek. Zeit.*, Feb. 6, 1913.

### Installations, Systems and Appliances

**Booster Battery Plant.**—A note on a recent British patent (No. 28,913, 1911) of R. Rankin and the Chloride Electrical Storage Company. This invention relates to the means employed for controlling booster-battery plants of the type in which external automatic devices are utilized for regulating the booster field. In such arrangements of plants the booster is excited from the regulator or from an exciter having its field current controlled by the regulator, the booster field current being obtained from the exciter armature. In the latter case the size of the exciter (which is usually designed to give a multiple exciting effect, so as to insure quick alteration of the booster field) and the capacity of the regulator increase rapidly with an increase in the size of the booster. The invention comprises the provision, in electric regulating or equalizing apparatus, of an automatic regulator in combination with a variable-voltage reversible exciter arranged in series with, and so as to act as a starting agent or booster in, a field the variation of which is the cause of the equalizing action. In a booster-battery plant the field is that of the booster, while in a fly-wheel plant the field is that of the driving motor. In Fig. 3, the armature *a* of the exciter and the field *b* of the booster are in series with one another between the main *c* from the

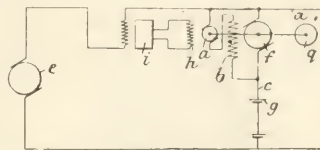


FIG. 3.—CIRCUIT OF BOOSTER BATTERY PLANT

battery and the main *d* from the generator *c*, between which points the booster armature *f* is connected. For the best results the booster field *b* should be designed to give on the booster armature a voltage equal to the voltage across its own terminals, so that the energy for the excitation of the booster field is supplied by the battery *g* or the main generating plant *c*, instead of wholly by the exciter, as is usual at present. The exciter thus serves merely as a starting agent or booster and is adapted to give a multiple effect whenever a change in the booster field is necessary for current-equalizing purposes. To obtain such effect and to prevent the occurrence of large variations in the current to be equalized, the inventors provide for the regulation and control of the exciter field *h* from the external automatic regulator *i*, which is responsive to small variations in the current. With the aforesaid arrangement the motor *d* started charging or discharging in such a way as to keep the generator load from varying farther than the small amount necessary to commence the equalizing action, and means of driving the booster *f* and exciter *a*.—*London Eng'ing*, Feb. 7, 1913.

**Central-Station Statistics.**—The yearly statistical tables issued by the *London Electrician* are now published, and a summary is given showing the development of electricity supply to British electric supply stations from 1880 to 1912. One of the diagrams emphasizes the fact that the number of provincial stations has overtaken that of the London undertakings. In 1909, for the first time, the connections to provincial stations exceeded those to London. In 1912 the connections to municipally owned provincial stations exceeded that figure. In the provinces the connections to municipal stations are four or five times as large as those

to the stations owned by companies, while in London the connections to stations owned by companies are twice the connections to municipal stations. In the whole of Great Britain and Ireland municipal connections are somewhat more than double the company connections. As to the system used, during the past year the total connections to purely direct-current or alternating-current stations increased but little, while the number and output of combined stations are steadily increasing. While London has connections amounting to 421,939 kw, the whole of the provinces are not able to show very much more than three times that amount, while population of the two areas is 4,521,685 and 59,523,600 respectively.—*London Electrician*, Feb. 7, 1913.

**Slot Machines.**—K. MARKAU.—An article pointing out the advantages of slot machines (prepayment meters) for electric installations. They become especially popular if the wiring installation is made free of charge by the central station and the price of the kilowatt-hour is fixed at a rate to pay in time for the installation. In order to allow discounts it is recommended that special coin disks be used instead of real money and that these coins be sold in quantities at a discount.—*Elek. Zeit.*, Feb. 6, 1913.

**Switchboards.**—C. H. SANDERSON.—In his second article on switchboards for alternating-current power stations the author deals with self-contained switchboards for 6600 volts or less with oil circuit-breakers and busbars supported from the back of the panels.—*Electric Journal*, February, 1913.

**China.**—A review of various electric lighting plants in Chinese cities, with special reference to installations which have been made by Germans. While for electric machines Germany has a leading position in China, the steam plant is chiefly imported from England.—*Elek. Zeit.*, Feb. 6, 1913.

### Wires, Wiring and Conduits

**Wiring.**—W. KLEMENT.—A profusely illustrated paper read before the Berlin Electrical Society on modern tendencies in wiring materials, electric installations, fittings, switches, etc.—*Elek. Zeit.*, Jan. 16, 1913.

### Electrophysics and Magnetism

**Flow of Energy.**—J. W. MILNOR.—An application of Poyntin's theory of the flow of electromagnetic energy. The author traces the direction of the energy flow in the immediate vicinity of various typical generators of electric current—a thermocouple, a primary battery and a dynamo-electric machine.—*Gen. Elec. Rev.*, February, 1913.

**Contact Potential Between Metals.**—A. NORMAN SHAW.—An account of experiments on charged surface layers in contact potential between metals. Ionization methods for measuring contact potential which are described were found to be exceptionally effective. A study of the rate of charging due to contact potential in the case of an insulated plate in ionized gas leads to new direct evidence of the presence of charged surface layers. The time necessary for their formation and change is found to be observable, and effects due to their capacity are shown to be detectable. Their behavior agrees with the conception that contact potential phenomena can be explained by the different amounts of work done by electrons in escaping from different metals. The rate of charging or removal of the layers responsible for contact potential is shown to be apparently independent of the metal and identical with the behavior of ordinary charges imparted by external means. The influence of the dryness of the gaseous medium and the nature of the gas is examined, and it would appear that although chemical action may cause large contact effects, it is not usually responsible for more than a small part of the phenomenon.—*Phil. Mag.*, February, 1913.

**Chemical Effects of Cathode Rays.**—E. JACOT.—An account of an experimental investigation of a relation between ionization by cathode rays and certain chemical effects. The action of cathode rays on white phosphorus is specially studied. The action is at least twofold: (1)

There is a purely thermal effect of the rays, resulting in the formation of red phosphorus; (2) there is a more direct chemical effect due to an effect of the corpuscles on the nitrogen in the tube, followed by a reaction between the modified gas and the phosphorus. The latter effect is proportional to the equilibrium ionization of the nitrogen, but the total number of active atoms or molecules in the gas is of a much higher order than the number of ions present in the gas at the instant of combination. The function of the ions may be that of assisting a combination which does not otherwise effect itself. More probably, the activity of the gas is not directly due to its ionization, but rather to an atomizing effect of the cathode rays on the gas—the active product being monatomic nitrogen, and the total number of modified gas molecules showing an exact proportionality to the ionization in gas by the rays. The ionization in nitrogen by cathode rays varies inversely as the kinetic energy of the rays, for rays of velocities ranging from  $2.92 \times 10^9$  cm. per second to  $4.76 \times 10^9$  cm. per second. The ionization also varies linearly, with the pressure over the range from 0.083 mm to 0.025 mm of mercury.—*Phil. Mag.*, February, 1913.

**Radium.**—E. RUTHERFORD AND H. ROBINSON.—An account of an experimental investigation of the heating effect of radium and its emanation. The distribution of the heating effect between radium and its products and radiations is as given in the following table:

HEATING EFFECT IN GRAM CALORIES PER HOUR CORRESPONDING TO ONE GRAM OF RADIIUM

	Alpha Rays	Beta Rays	Gamma Rays	Total
Radium	25.1	.....	.....	25.1
Emanation	28.6	.....	.....	28.6
Radium A	30.5	.....	.....	30.5
Radium B	39.4	4.7	6.4	50.5
Radium C	.....	.....	.....	.....
Totals	123.6	4.7	6.4	134.7

Hence the total heating effect of 1 gram of radium for complete absorption of the alpha, beta and gamma rays is about 135 gram calories per hour per gram.—*Phil. Mag.*, February, 1913.

**Scattering of Roentgen Radiation.**—D. L. WEBSTER.—In a discussion of a recent paper by J. A. Crowther the author concludes that the secondary cathode particles, while they must produce some radiation, possibly a part of Barkla's homogeneous secondary radiation, cannot produce any distributed like the secondary radiation on which Crowther's experiments were performed. And since the results of his experiments, as well as those of Kaye, are well accounted for by the theory of Roentgen rays as electromagnetic pulses, and are necessary consequences of this theory, they are also important confirmations of its fundamental assumptions.—*Phil. Mag.*, February, 1913.

**Electronic Theory.**—C. G. DARWIN.—According to Rutherford's theory, an atom is composed of electrons and a nucleus of positive electricity of charge such as to neutralize them. The nucleus is seated at the center of the atom, bears nearly the whole mass, and has its charge concentrated inside a very small region. In the present highly mathematical paper the author investigates the orbit of a beta particle as it passes such a nucleus.—*Phil. Mag.*, February, 1913.

**Roentgen Rays.**—C. G. BARKLA AND G. H. MARTYN.—An account of an experimental investigation of the photographic effect of X-rays and X-ray spectra.—*Phil. Mag.*, February, 1913.

**Effect of a Magnetic Field on Ionization Currents.**—W. DUANE.—An account of an investigation in which the



author studied the effect, if any exists, produced by a magnetic field on ionization currents in which the ionization is due to Roentgen rays and radium rays. One of the conclusions reached is that a large number of the positive ions in air must have masses of the order of magnitude of those of the nitrogen and oxygen atoms and molecules.—*Amer. Jour. of Science*, February, 1913.

**Electron Theory of Magnetism.**—ELMER H. WILLIAMS.—A pamphlet of sixty-six pages giving in five chapters an outline of the essential features of the electron theory of magnetism, the results of experimental determination of the magnetic properties of crystals, an account of the effect of temperature upon the magnetic properties of bodies, a summary of the experimental evidence in favor of the electron theory of magnetism, and a bibliography of the subject. The author says: "The large number of exceptions to the electron theory in its present form requires either that it be abandoned or that the theory be modified to fit more exactly experimental results. The fact that it agrees in such a large number of cases with experiment, and that by its application the fundamental quantities of nature can be obtained in such close agreement with observation, gives hope that ultimately the present theory will be modified so that it will hold universally."—*University of Illinois Bulletin No. 62*.

### Units, Measurements and Instruments

**Small Alternating-Current Power Measurements.**—J. T. IRWIN.—Some difficulty is generally experienced in measuring very small power losses at very low power-factors and high frequencies. The reason is that for very small power-

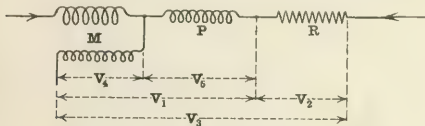


FIG. 4—CIRCUIT DIAGRAM FOR MEASURING SMALL ALTERNATING-CURRENT ENERGY LOSSES

factors, if a three-voltmeter method is used, the voltage across the inductance is practically in time quadrature with the voltage across the series resistance, and therefore a small error in measuring one of the voltages will make a large error in the power. A wattmeter is generally out of the question, on account of the lack of sensibility and the self-induction of the pressure circuit. An attempt was made to measure the total losses in four Pupin coils placed in series by means of the three-voltmeter method, but the results were very discordant, varying by as much as 40 or 50 per cent between different readings. The author devised a modification, the arrangement being shown in Fig. 4, and quite satisfactory results were obtained. The current passed through the primary of a mutual inductance  $M$ , then through the Pupin coils  $P$ , and then through the non-inductive resistance  $R$ . The secondary coil of  $M$  could be moved relatively to the primary to alter the mutual induction of the two coils, and was joined in series with the Pupin coils, as shown, and so that the voltage was equal to but opposing the voltage of the Pupin coils—that is, the voltage  $V_1$  was made a minimum. When this is so the voltage  $V_1$  is practically equal to the current in the Pupin coils times their effective resistance, and this voltage is easily read, as it is in time phase with the voltage  $V_2$ , and can be read as an increase in the voltage from  $V_1$  to  $V_3$ . Use should be made of an electrostatic voltmeter or one that has a very high resistance. Some notes are added on the theory of the method and results of tests are given.—*London Electrician*, Feb. 7, 1913.

**Magnetic Testing of Sheet Iron.**—F. E. GUMMICH AND W. ROGOWSKI.—A paper summing up their results obtained at the Reichsanstalt with their method of magnetic tests of

sheet iron. They think their method is the best one for exact measurements, while for factory purposes the method of Lonkhuyzen is thought to be superior to that of Epstein. Some criticisms are made of Epstein's method. There is a brief reply by Epstein.—*Elek. Zeit.*, Feb. 6, 1913.

**Electrical Constants of Air Coils.**—HUGH A. BROWN.—A description of a method employing only simple diagrams and formulas by means of which the constants of practically any coil can be obtained with a fair degree of accuracy and calculation.—*Gen. Elec. Rev.*, February, 1913.

**Induction Meter.**—An official communication by the Reichsanstalt in which a modification of the single-phase induction meter of the Aron Meter Company is admitted for calibration.—*Elek. Zeit.*, Feb. 6, 1913.

### Telegraphy, Telephony and Signals

**Telephone Disturbances from Single-Phase Railways.**—F. MARGUERRE.—An illustrated translation of his recent German paper in which the telephone disturbances associated with the working of a single-phase railway in Norway are discussed and the main cause is traced to the slot (or tooth) ripple in the generator pressure wave, which is considerably increased by a wattless load. This phenomenon is investigated by means of the oscillograph, and it is shown how the trouble can be overcome by means of a resonance circuit.—*London Electrician*, Feb. 7, 1913.

**Telephone Lines and Three-Phase Transmission Lines.**—O. BRAUNS.—A continuation of his illustrated article on disturbances in telephone lines from star-connected three-phase transmission lines when the neutral point of the generator is earthed or not earthed. The outline of the theory is concluded and numerical examples are given. The author then begins to give the results of measurements made on the Eberswald transmission system. The paper is to be concluded.—*Elek. Zeit.*, Feb. 6, 1913.

## Book Review

**INDUSTRIAL COMBINATIONS AND TRUSTS.** Edited by William S. Stevens, Ph.D. New York: The Macmillan Company. 593 pages. Price, \$2.

Dr. Stevens in compiling this volume has greatly lessened the labors of future students and historians of the trusts. He has collected from original sources the principal agreements and laws relating to trusts, pools and holding companies, together with testimony and exhibits in suits for their dissolution and court decisions regarding them, the volume closing with chapters on the results of dissolution decrees and proposed methods of dealing with the trust problem. We have here such interesting and important documents as the original gunpowder, distillery, oil and sugar trust agreements, the text of many federal and state anti-trust laws, and all of the noteworthy trust decisions of the last twenty years. The chapter on patent monopoly is particularly interesting for the shoe machinery, motion-picture and crown-cork agreements it contains, and the decision in Henry versus the Dick Company. Nearly 100 pages are devoted to exhibits of methods of competition and restraint of trade, all of which would have been more valuable had not the editor in most cases left out the names of the companies and individuals concerned. If the volume as a compilation is open to any criticism, it is on the ground that the compiler's notes are too brief and infrequent, for where they do appear they add significance to the documents reprinted. In view of the worth of some of the material regarding the Steel Trust's absorption of the Tennessee Coal, Iron & Railroad Company, Judge Gary's statement before the Stanley committee, which is all that is given here, seems hardly adequate. However, so useful is the matter that the book contains that it would be ungrateful to complain that something else might have been included.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Electricity in the Packing Industry

By W. D. BEARCE

That the United States occupies a most important place in the production of the world's supply of fresh meats is indicated by the fact that this country, according to recent statistics, produces one-third of the world's supply of beef,

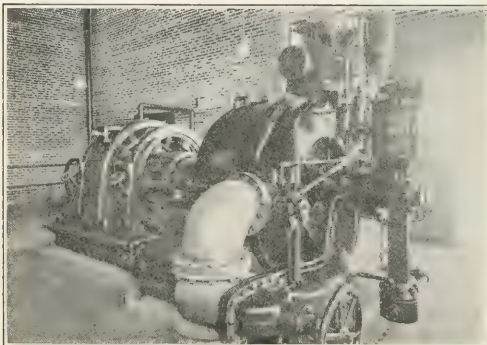


FIG. 1—DIRECT-CURRENT TURBO-GENERATOR IN PLANT OF WOLF PACKING COMPANY, TOPEKA, KAN.

more than one-half the pork and about one-seventh of the mutton. The total output easily exceeds that produced by any other country. While the consumption of fresh meats in the United States is greater than in any other country, large quantities are exported, Great Britain obtaining one-third of its total supply from this country.

The term "packing industry" as now understood includes not only establishments for the packing and curing of meat products, but also for the slaughter, dressing and shipment of beef, pork, mutton, veal and poultry. In more recent years the packers have been compelled by economic conditions to take up the various kindred industries for the utilization of by-product and waste materials. In fact, the possibilities of profit depend almost entirely upon the proper disposal of such products. The diversity of these by-products has required greatly increased floor area, which has usually been secured by erecting small detached buildings and equipping them with the necessary manufacturing machinery with electric drive instead of the wasteful line and counter shafting formerly employed. A number of large producers in the Middle West operate extensive car shops for manufacturing and repairing their refrigerator cars. For the manufacture of wooden boxes, barrels and tin receptacles, box shops, cooperages and tin shops are maintained. Power plants for the generation of electrical energy and for supplying refrigeration are essential to practically all large packing establishments.

Under the present strict inspection of food factories it has become necessary to employ cleaner methods for manufacturing meat products than in former years, and the application of motor drive to the various machines has probably been of greater assistance to this end than any other improvement. In many instances it has been possible to eliminate numerous belts and much line shafting, with

the unavoidable dirt, dust and oil, by individual drive for each machine.

One of the greatest difficulties encountered by electrical engineers in making comparisons with the various mechanical systems of drive is the lack of definite records of power costs. These systems of power supply depend upon the records of fuel consumption almost entirely and there are thus no means of checking losses between the coal pile and the factory equipment. With electric-motor drive an absolute record of total amount of energy used can be taken at the main switchboard and further checks on department and individual machine consumption can be made by the installation of suitable electric meters.

A large percentage of the packing houses have considered it essential to generate electrical energy on the premises from the same boilers used to supply steam and hot water to the operations in the factory. Others have found it both profitable and convenient to purchase energy from local central stations.

Owing to the long hours of service, widely varying loads and the necessity for uninterrupted service, the electric motors employed in this industry must be exceptionally reliable and capable of withstanding severe use without expert attendance. These working conditions have been most successfully met by the induction motor. In all plants of this kind the alternating-current equipment has proved more satisfactory than the direct-current type on account of the more durable construction of motors, elimination of commutator troubles and the greater economy possible with three-phase transmission. Very few packing-house machines require variable speed so that the induction motor with constant speed is particularly suited to all machinery.

A careful inspection of the meat-packing establishments



FIG. 2—ONE 5-HP AND ONE 10-HP MOTOR BELTED TO WASHING MACHINES OF CUDAHY PACKING COMPANY IN LOS ANGELES, CAL.

of this country discloses the fact that the advantages of individual drive are not at present fully understood. As a matter of fact, only the more recently constructed plants have employed individual drive to any great extent. It is difficult to estimate the saving which can be effected by changing from group to individual drive, but conservative engineers have asserted that group drives require from

one-half more to four times the energy taken by the machines themselves.

It is frequently necessary in packing plants to rearrange the apparatus in a department or to move machines from one building to another to meet the changing requirements of manufacture. The individually driven machine is a unit in itself and can therefore be relocated with much less inconvenience and loss of time than the group-driven machine.

Artificial refrigeration has probably been the most important factor in building up the packing business as it is now conducted. Previous to the introduction of these machines only local markets were supplied with fresh meat during the warm weather. Steam-driven compressors, therefore, were quite generally installed before the electric motor had come into prominence for industrial uses. Newer packing-house equipments which have been primarily designed for electrical operation have utilized the electric

TABLE I—COOLING EFFECT OF ONE TON OF REFRIGERATION

Meat	Number	Weight Each, Pounds
Beef...	5 to 7	700
Hogs...	15 to 24	250
Calves...	45 to 55	90
Sheep...	55 to 70	75

motor for driving the refrigerating machines, thus entirely removing the necessity for high-pressure steam. Low-pressure boilers are usually more efficient for furnishing steam for washing and heating purposes, and in the case of old plants changed over to electric drive the old steam boilers may be used for this purpose even after they have become useless as high-pressure units.

Where two or more compressors are used and for installations under 25 hp the squirrel-cage induction motor answers every requirement. Where variable speed is required, however, the slip-ring type induction motor should be used.

Where direct current is available the adjustable-speed commutating-pole motor can be arranged to give practically any speed from 50 to 100 per cent of normal. Many pork packers and sausage plants have found motor-driven re-

frigerating outfits much less expensive than any other system of cooling.

Refrigerating machines are usually rated in tons of refrigeration per twenty-four hours. Under proper conditions one ton of refrigeration will preserve one ton of meat for twenty-four hours after cooling. The amount of refrigeration necessary to cool fresh-killed meats from



FIG. 4—SPICE MILL IN SAUSAGE DEPARTMENT OF CUDAHY PACKING COMPANY, OMAHA, NEB., DRIVEN BY ELECTRIC MOTOR

authorities under which a ton of refrigeration shall be calculated. The power required varies with the temperature of the cooling water, the efficiency of the compressor, the suction and condensing pressures and the nature of the vapor used for refrigeration, that is, whether ammonia, carbon dioxide or sulphur dioxide. In a general way Table II gives the nearest available sizes of standard motors for the compressors of the rating listed. It is usually advisable to obtain more accurate figures from the manufacturers of the refrigerating machine.

#### CUDAHY PACKING COMPANY

That electricity is essential to the economical and efficient operation of packing houses is clearly shown by the success with which the Cudahy Packing Company has employed electric drive in its several establishments in various

TABLE II—POWER REQUIRED FOR REFRIGERATION AND ICE MAKING

Rating of Motor in Horse-power	Ice Making Capacity, in Tons per Twenty-four Hours	Refrigeration in Tons, per Twenty-four Hours
7 1/2	1 1/2	3
10	2	4
15	3	6
25	5	10
30	7 1/2	15
	10	20
35	12 1/2	25
50	18	30
75	25	45
100	30	60
150	45	90
175	50	100
250	75	150
350	100	200

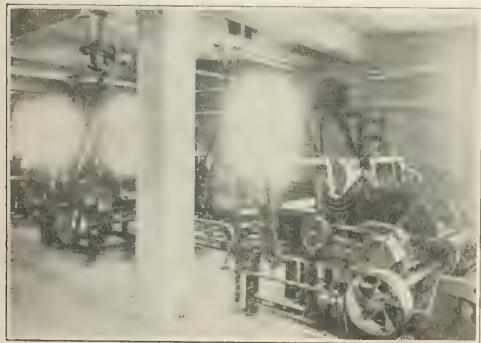


FIG. 3—MOTOR-DRIVEN CARDING MACHINES IN CURLED-HAIR DEPARTMENT

parts of the country. These plants are all electrically operated. As in all large packing plants, many of the machines manufactured which are either by-products of the industry or accessory apparatus and machinery used in such plants, as to warrant the investment of capital in manufacturing equipment.

The main plant of this company is located at South Omaha, Neb., and has ample facilities for the slaughter of cattle, hogs, sheep and calves. In addition to the production of fresh, salted and smoked meats, this plant manu-

factured which are either by-products of the industry or accessory apparatus and machinery used in such plants, as to warrant the investment of capital in manufacturing equipment.

The main plant of this company is located at South Omaha, Neb., and has ample facilities for the slaughter of cattle, hogs, sheep and calves. In addition to the production of fresh, salted and smoked meats, this plant manu-



factures soap, soap powders, pepsin, glycerine, fertilizers, and other products.

Electrical energy is supplied by a 400-kva, 550-volt, 60-cycle directly-connected generator installed in the main engine room. Additional energy is purchased from the Omaha Electric Light & Power Company at 5300 volts, the emf being stepped down at the engine room to 550 volts by two 200-kva oil-cooled transformers. The engine room

TABLE III—EQUIPMENT OF SOUTH OMAHA PLANT OF CUDAHY PACKING COMPANY

Machines	Rating of Motor in Horse-power	Speed of Motor in R. P. M.
Hog casing machines	5	1200
Bone saw	5	1200
Six dried-beef slicers and belt conveyor..	5	1800
Vacuum sealers and pumps	30	900
Six silent cutters.....	15	1200
Four lard rolls.....	30	1200
Agitators in oleo kettles	10	1200
Battery of oleo presses.....	7½	1200
Two lithograph presses and driers and one varnisher.....	7½	1200

also contains a belted exciter set, engine-driven refrigerating machines and an eight-panel distribution board.

A total of approximately 1500 hp of squirrel-cage induction motors, ranging from 1 hp to 50 hp, are installed, distributed in about twenty buildings. The group system of drive is most generally employed, but large groups are avoided wherever possible. Practically all of the motors installed in the past few years are below 15 hp in rating.

The use of electricity on the killing floors is limited to hoists for raising and lowering the carcasses during the process of dressing and for conveyors which move them along the system of overhead trackage from one operation to the next. The sixteen double hoists are group-driven by a 40-hp motor belted to a line shaft conveniently located above the killing floor. The conveyors for moving the trolley hooks are operated by 5-hp motors employing variable-speed friction drive for changing the rate of movement of the beef.

The new hog abattoir at this plant is probably one of the most modern and sanitary in the United States. The

consisting of a scraper and washer, is driven by a 15-hp motor. Trolley tracks are inclined so that the dressed pork is carried by gravity to neighboring buildings.

Several individual drives are used in the manufacturing processes, but in most cases several machines of the same type or designed for consecutive operations are driven in groups from one counter shaft, which in turn is belted to

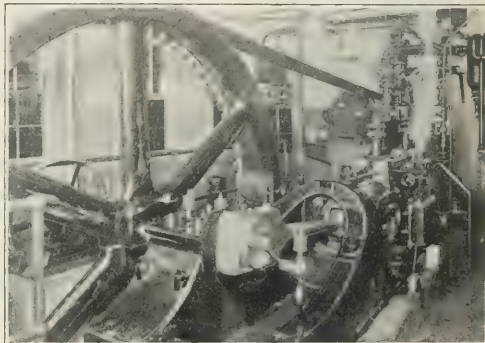


FIG. 6—HORIZONTAL 30-TON COMPRESSOR DRIVEN BY THREE-PHASE MOTOR

the driving motor. This arrangement reduces the total power required and at the same time takes advantage of the intermittent and varying loads of the several machines of the group.

A similar arrangement is employed in all departments of the plant, including machine and wood-working shops, soap-powder plants, etc. All elevators, fans and blowers are electrically operated. Many of these motors have been in operation for fifteen years or more and are still giving good service.

The plant is lighted throughout by incandescent lamps supplied with energy through lighting transformers at 110 volts and 60 cycles. A total of 7200 lamps are installed in the various buildings. About sixty-five soldering irons are also connected to this circuit, mostly in the canning department.

The Calumet plant of the same company, located at East Chicago, Ind., is devoted to the manufacture of refrigerator cars and packing-house by-products, including soap, cleansing powder, curled hair, etc. The manufacturing equipment at present occupies four buildings with about 100 acres of ground available for additions. This plant has been in operation for only about four years and is representative of recent engineering practice.

Electricity purchased from the Northern Indiana Gas & Electric Company at 6600 volts, three-phase, 60 cycles, is utilized at 220 volts for motor service and at 110 volts for lighting. The total energy consumption for motors and lighting averages about 1500 kw-hr. per day. The motors, ranging from 30 hp down, are of the squirrel-cage induction type, and all above 7.5 hp are provided with starting auto-transformers equipped for both no-voltage and overload protection.

The car shops include both machine and wood-working shops, foundry and forge shops, with facilities for making six complete refrigerator cars per week. In these departments all machines are either directly connected or belted to the driving motor. Table IV gives a few of the most interesting applications.

The present equipment in the curled-hair department has a manufacturing capacity of 5 tons per day. This branch of the industry manufactures the by-product hair from cattle and hogs into the commercial curled hair used for filling in mattresses, automobile and wagon cushions, furniture, etc.



FIG. 5—MOTOR-DRIVEN TABLE IN BEEF HOUSE OF ARMOUR & COMPANY, CHICAGO

dressing and inspection floors are exceptionally well lighted by natural illumination from ceiling windows supplemented by an adequate installation of incandescent electric lamps.

The hog hoist is of the double-drum type with a maximum hoisting capacity of 720 hogs per hour. The wheel is driven by a 5-hp squirrel-cage induction motor directly connected through a gear reduction box, making a very compact and reliable outfit. The remaining machinery,



The various preliminary operations, all of which require more or less electric energy, are washing and cleaning, dyeing, bleaching and mixing. The hair is then put through a picker and passed on to the spinning machines which twist it into a thick hair rope. After several months' storage the stock is again worked over by opening machines, carders and picker and packed up in 50-lb. bags.

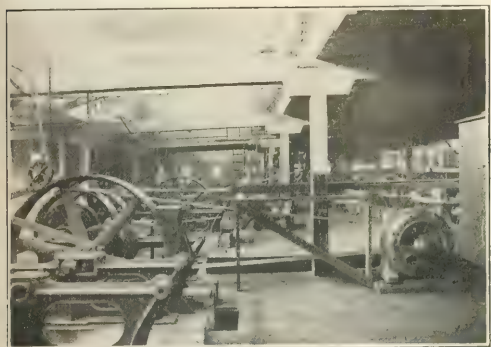


FIG. 7.—MOTOR DRIVING BEEF HOISTS IN UNION STOCK YARDS, CHICAGO

The machinery in this department is mainly driven in groups, some of which are listed in Table V. The output of the soap and soap-powder department is 100 tons of so-called "Dutch Cleanser" per day, besides a large quantity of soap and ground pumice stone. The motor-driven machinery includes drying drums, mixers, conveyors, can fillers and similar apparatus. The body of the powder is first put through a drying drum 40 ft. long by 4 ft. in diameter. This drum is driven by a 20-hp motor. The equipment for grinding pumice, which is in a way a separate enterprise, is confined to a Sturtevant rock emery mill driven by a 20-hp motor.

TABLE IV.—EQUIPMENT OF CAR SHOPS OF THE CUDAHY PACKING COMPANY

Machine	Rating of Motors in Horse-power	Speed of Motors in R.P.M.	Method of Driving
Car wheel borer	10	900	Gear'd
200-ton hydraulic press	7.5	1200	Gear'd
48 in. fan	15	1800	Belted
Gauger	15	900	Direct-connected
Back and front connected planer, 12 m. by 24 m.	25	900	Belted
Cut-off saw	15	720	Belted
Shears and bulldozer, . . .	20	900	Belted

One of the more recently electrified plants of the Cudahy Packing Company is at Los Angeles, Cal. This establishment is completely equipped for the production of fresh and salted meats, accessories and by-products. Electrical energy purchased from the Southern California Edison Company is used for operating all machinery through standard squirrel-cage induction motors. The energy is utilized at 220 volts for motor service and at 110 volts for lighting. About thirty 50-cycle induction motors are installed. These motors have an aggregate rating of approximately 300 hp and drive the various machines either individually or in small groups.

PLANTS OF JOHN MORRELL AND COMPANY  
A modern packing plant is that of John Morrell & Company at Ottumwa, Ia., electrically equipped throughout.

The plant is equipped for the slaughter and packing of beef, pork, mutton and veal and all by-products. Extensive shops are also maintained for repairing refrigerator cars. Electrical energy is supplied to the various buildings by a 500-kva, 2200-volt, three-phase, 60-cycle Curtis turbo-generator. About 110 motors, ranging in size from 0.5 hp to 100 hp, are in service, all operated at 220 volts.

TABLE V.—EQUIPMENT IN CURLED-HAIR DEPARTMENT OF CUDAHY PACKING COMPANY

Machine	Rating of Motors in Horse-power	Speed of Motors in R.P.M.
Picker and heating fan	15	1200
Six carding machines	15	1200
Hair-rope spinning machine	10	1200

The 100-hp motor and other large motors are directly connected or belted to elevators, air compressors, hog-scrapping machines and centrifugal pumps. In the box factory each machine is driven by a separate motor either directly connected or belted from the floor below. All overhead shafting and belting is thus eliminated, increasing the floor space available for handling the work. In other parts of the plant the machinery is driven in small groups by motors ranging from 5 hp to 20 hp. In common with many other progressive packers, the tendency has been to reduce gradually the size of group drives and in many cases to apply the motors individually. At the Sioux Falls plant use is made of about thirty motors, all being of the squirrel-cage induction type.

NORTH PACKING & PROVISION COMPANY

An important pork-packing plant in New England is operated by the North Packing & Provision Company at Somerville, Mass. This plant, which was one of the first establishments of its kind in New England, was formerly operated by steam engines with line shafting and belting. During the past few years, however, all mechanical drives have been replaced by electric motors. All change-overs have been made without interrupting the manufacturing, and many of the group drives retain the same line shaft as formerly used.

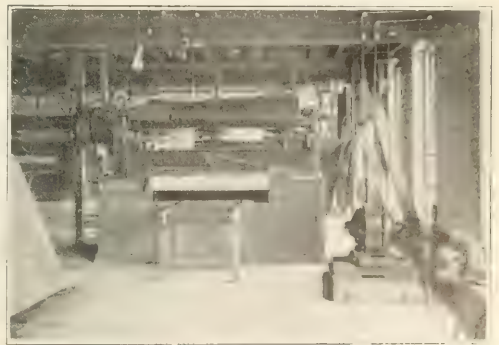


FIG. 8.—LARD OIL PRESSES DRIVEN BY INDUCTION MOTORS

Electrical energy is purchased from the Cambridge Electric Light & Power Company and supplied to three-phase squirrel-cage induction motors at 550 volts. Motors aggregating about 1200 hp are now installed, mostly under the group system of drive, ranging from 2 hp to 50 hp. All of these motors above 7.5 hp are equipped with starting auto-transformers with no-voltage release and overload protection.

In some instances where a heavy starting torque is required motors with internal starting resistors are used. One of the larger group drives is in the sausage room, where a 35-hp motor operates meat grinders, mixers, rockers, etc. Small motors are used for fans and blowers. In the cutting room a 5-hp motor drives a group of machines including flattening rolls, conveyor and meat saws.



FIG. 9—MOTOR-DRIVEN SOAP-POWDER GRINDERS AND MIXERS IN PLANT OF JOHN P. SQUIRES & COMPANY, EAST CAMBRIDGE, MASS.

In the lard refinery two 15-hp motors are used to drive leaf-lard hashers, one belted and the other geared to the hasher.

The wiring in this plant is in conduit or carried on petticoat insulators, and the danger of interruption of service is thus reduced to a minimum.

#### JOHN P. SQUIRES & COMPANY

An extensive packing plant is operated at East Cambridge, Mass., by John P. Squires & Company. Within the past decade this entire plant has been changed over from mechanical to electric drive, using three-phase induction motors for both group and individual drives. Electrical energy is furnished by the local central-station company at 550 volts and 60 cycles and utilized at 110 volts for lighting. Induction motors totaling nearly 1000 hp are now in service.

A very interesting group consists of a 7.5-hp motor belted to a group of six lard-oil presses. Advantage is taken of the intermittent operation of these machines to install a motor of much smaller rating than the total maximum requirements of the group. According to the manufacturers' estimate, each one of these presses requires a maximum of 5 hp. The soap-powder mills and mixers are driven by 20-hp and 50-hp motors belted from the floor above, thus affording partial protection from soap-powder dust.

In order to secure accurate information from time to time as to the average load of the motor, each starting panel is provided with a set of testing terminals. A portable testing board is conveniently arranged for plugging into the circuit and can be connected to give readings of kilowatt-hours, current and voltage. A recording wattmeter is used to give average load on the motor during the period of test. Electricity is also used extensively for heating branding and soldering irons.

#### SWIFT & COMPANY, CHICAGO

One of the first manufacturing establishments in this country to employ polyphase induction motors for factory operation was the Chicago plant of Swift & Company. Nearly twenty years ago this company realized that transmission of power by means of long lines of shafting and heavy belts was both wasteful and unreliable. The alternating-current system was selected and standard induction motors were installed.

In the generating station three engine-driven units are now installed, rated at 300 kw, 600 kw and 1200 kw respectively. These generators, with a total rating of 2100 kw, provide for any load from 300 kw up with good economy. These alternators work in parallel, feeding into the main busbars of the feeder switchboard, from which energy is distributed to all parts of the plant. It is thus only necessary to operate units of sufficient capacity to carry the load of the entire plant, where, if mechanical transmission were used, engines would be in service wherever power was required.

Energy is distributed to the more remote parts of the plant at 2300 volts and to the buildings near the power plant at 220 volts. Electric motors ranging in sizes up to 100 hp and aggregating more than 3000 hp are now in service.

Practically every department of the establishment employs electric motors. Some of the larger users of electrical energy are the car shops, sausage and butterine factories, fertilizer plants, glue plants, soap factory and the lard refinery.

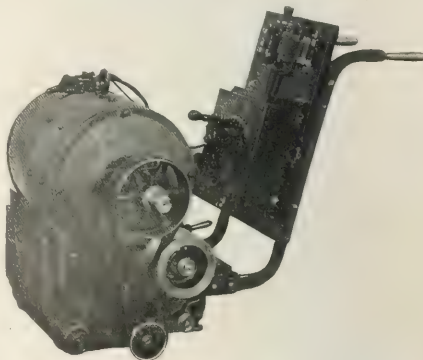
Practically all of the electrical installations in the plants described above have been furnished by the General Electric Company, Schenectady, N. Y.

### Electric Drive of Floor-Planing Machine

The motor used with the floor-planing machine illustrated herewith is of light weight and small size. It is operated by one person, who controls the movements of the knives by two guiding handles and the motor through the switch and rheostat which are mounted upon a panelboard within easy reach.

The motor is a steel-frame, shunt-wound, commutating-pole machine, operating at 2200 r.p.m. It is able to withstand the sudden and severe overloads imposed upon it when knives strike unforeseen hard spots and knots for which no provision can be made. It drives the cutting cylinder containing the knives by means of a belt with idler. It is totally inclosed with solid end bonnets and a steel-strap hand-hole cover fitting snugly about the frame and is secured by the two wing nuts, which give ready access to the brushes and the commutator when desired. Its weight is approximately 575 lb.

The whole machine is mounted on rollers of hardened



MOTOR-DRIVEN FLOOR-PLANING MACHINE

steel, the back set of rollers being so arranged that they can be adjusted according to the depth of cut. When drawing the machine backward for starting a new cut the knives are automatically raised clear of the floor. The electrical equipment for this machine was made by the Diehl Manufacturing Company, Elizabeth, N. J.

### Three-Phase Converter Station at Stamford, Conn.

The Stamford substation of the Connecticut Company is one of three converter substations now installed and designed for operation from the three-phase, 11,000-volt, 25-cycle circuit fed from the Cos Cob power station of the New York, New Haven & Hartford Railroad Company. This substation contains three rotary converters rated at 300 kw each, and with each converter are three oil-insulated, self-cooled transformers and a suitable three-phase reactor.

In laying out this station a number of problems had to be considered. The resistance of the line between Stamford and Cos Cob was very low, the distance being only 3.5 miles, the unbalancing and fluctuation of voltage due to the single-phase railroad system was considerable and surges of voltage were often encountered. The conditions which would exist when one leg of the transmission line was opened had also to be considered.

By providing sufficient taps on the 11,000-volt side of the transformers it was found possible to reduce the maximum unbalancing of the line, so far as the rotary converters themselves were concerned, to a value somewhere about one-half that on the primary circuit, and this arrangement, together with the reactance coils and liberal design of the converters, is said to have given results which were in every way satisfactory.

To take care of the single-phase condition resulting from the opening of one leg of the transmission system, the specifications called for an equipment which would disconnect one leg and for converters which would be capable of carrying full load for five minutes when supplied with single-phase energy. The ability of the machine to do this has been demonstrated, there being only a slight momentary sparking when one leg is opened under conditions of full direct-current load. The disconnection of any one leg is obtained by the use of three single-pole, electrically operated oil circuit-breakers on the incoming line and by means of undervoltage relays controlling the breakers in the "power" and "trolley" circuits respectively.

The incoming three-phase, 11,000-volt line is controlled by single-pole, outdoor-type electrically operated oil circuit-breakers, set at a rather high tripping point, so that under normal conditions overload protection is afforded by electrically operated oil circuit-breakers, mounted in the busbar structure in the building. These are operated and tripped by energy obtained from a storage battery which was in the station.



INTERIOR VIEW OF CONVERTER STATION

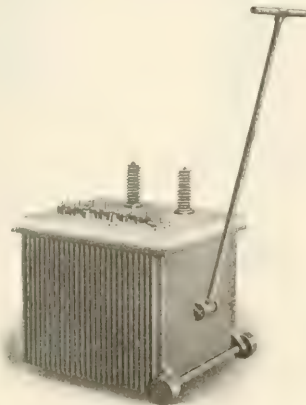
The switchboard consists of a small panel for control of the outdoor-type single-pole oil circuit-breakers. Lightning protection is afforded by a specially designed electrolytic arrester.

It is interesting to note that under the new arrangement of connections now being installed by the railway engineers

the requirements of single-phase operation of the converters will not be necessary in contemplated substations, as this condition will not then arise. This installation was made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

### Cable-Testing Transformer

The accompanying illustration shows a portable cable-testing transformer manufactured by the Foster Engineering Company, Ltd., Wimbledon, London. The transformer



TRANSFORMER FOR CABLE TESTING

unit is inclosed in a corrugated cast-iron case and is provided with wheels and a handle for convenient transportation.

One man can easily move this apparatus from place to place. It gives a range of pressures extending from 200 volts to 30,000 volts at 60 cycles.

### Soldering Material

"Tinol" solder stick is a combined solder and non-acid flux just placed on the market by Hess & Son, 1031 Chestnut Street, Philadelphia, Pa. It is made up in sticks 5 in. long and is ready to use simply by applying to a hot surface. The surface must first be cleaned or scraped and then heated by a match, gas flame or soldering iron.

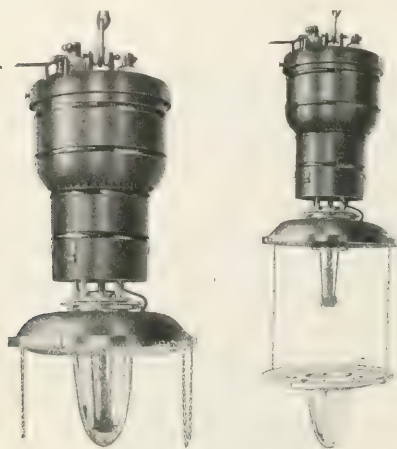
### Flaming-Arc Lamp Attachment

The accompanying illustrations show the new Supreme attachment recently brought out by the Dyer Lamp Attachment Company of Philadelphia, Pa., for converting any inclosed arc lamp into a flaming arc lamp. This attachment can be applied to any type of inclosed lamp, alternating-current or direct-current, series or multiple, regardless of voltage. Without increasing the lamp's original energy consumption, the device, it is declared, will increase the candle-power to that of any corresponding flame-arc lamp which is now on the market.

To apply the attachment, the lower central burner and globe are first removed from the inclosed arc lamp, exposing the gas check. The top plate of the attachment is drilled in accordance with the measurements obtained, and as soon as the attachment is made fast the lamp is ready to burn.



The upper carbon employed is similar to that used in the inclosed-arc lamp, except that its length is increased to 15 in. to make up for the added length of attachment and lamp. The lower electrode is of special flaming composition,



FIGS. 1 AND 2—FLAMING-ARC LAMP ATTACHMENT

tion, producing either yellow or white quality of light. The spent gases circulate in the upper gas chamber and wash down the walls of the globe.

### Electric-Vehicle Charging Equipment

In the present practice of charging electric vehicles it is usual for each charging rheostat to be a separate unit placed near the vehicle which is being charged, the charge being regulated by reading the vehicle meters. Considerable difficulty has been experienced in charging by this method because the operator cannot see the vehicle meters when operating the rheostat, and, moreover, the vehicle meters are apt to be inaccurate on account of vibration and rough usage.

A new line of battery-charging equipment has been

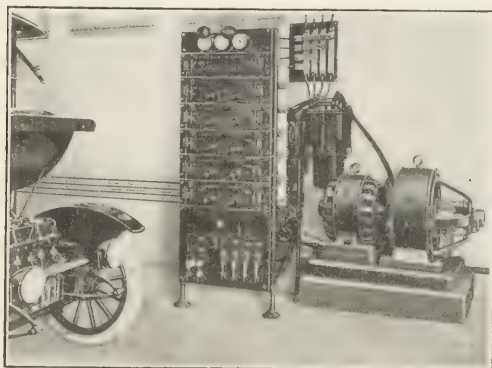


FIG. 1—EQUIPMENT FOR ELECTRIC-VEHICLE CHARGING

placed on the market by the Westinghouse Electric & Manufacturing Company in which these difficulties are overcome. The feature of this equipment is the mounting of all control apparatus on one board. The operator makes the proper connections, regulates the rheostat and reads

the charging rate from accurately calibrated meters while standing at the board.

The switchboard is made up of sections. The top section carries the meters which give readings of current and voltage both of the incoming direct-current supply and of each battery being charged.

Below the meter sections are the charging sections. Any desired number of such sections can be installed, from one

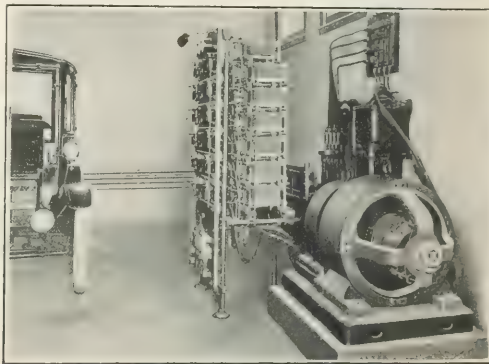


FIG. 2—A SIDE VIEW OF THE SWITCHBOARD

to as many as the limitations of height will permit. If more sections are required than will conveniently go on one board, they can be mounted on extra panels. Each charging section furnishes a complete equipment for charging two separate batteries. The rheostats can be mounted on the back of the panel, as shown in the illustration, or can be separately mounted wherever desired. Rheostats can be furnished for any type of battery and for any number of cells. As each rheostat is independent, the switchboard can be made up to charge any desired variety of cars.

The bottom section carries apparatus to control the incoming direct-current supply, and also, if necessary, the motor-generator set. If the motor-generator set is operated from alternating current, the auto-starter for the motor is mounted on the wall, as shown in the illustration. If a field rheostat is used to adjust the generator voltage, it is also mounted on the bottom section.

### Western Electric Exhibition Conference in Chicago

About 150 salesmen of the Western Electric Company attended an exhibition conference held in Chicago during the week ended March 1. The Chicago, St. Louis, Minneapolis, St. Paul, Omaha, Cleveland, Cincinnati, Indianapolis, Detroit and Kansas City offices were represented. The plan of exhibits by manufacturers in booths, which were studied by the salesmen, as first undertaken in the New York exhibition conference of Jan. 22-24, was repeated in Chicago. The exhibitors were much the same at both shows, except that the list for Chicago, in addition to those at New York, as given in the *Electrical World* of Jan. 25, included the Frank Adam Electric Company, American Cross-Arm Company, George Cutter Company, Duncan Electric Manufacturing Company, Hughes Electric Heating Company, Pierce Specialty Company, Pittsburgh Reinforcing Pole Company, and the R. Thomas & Sons Company. On Feb. 28 there was an informal banquet at the Chicago Athletic Club. The committee in charge of the conference comprised Messrs. M. A. Oberlander, New York; F. A. Ketcham, Chicago; Gregory Brown, New York, and F. B. Uhrig, Kansas City. The banquet committee was composed of Messrs. H. L. Grant, Paul Joslyn and C. E. Cullinan.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**General Electric's Business at Record Rate Thus Far in 1913.**—Orders received by the General Electric Company since the beginning of the present calendar year have been at the rate of \$115,000,000 per annum. One especially promising feature of the 1913 business to date is that it has been of a very diversified nature. All departments of the company have received a generous amount of business. The demand for miscellaneous supplies has been particularly heavy. Small-order business has also been in satisfactory proportions. The rapid increase in the number of public-utility companies and the extensive improvements and additions made by existing companies have brought a large amount of new business to the electrical manufacturers. Much of the business received thus far in the current year by the General Electric Company has been from this source. It may also be stated that in view of the highly prosperous aspect of the public-utility field the outlook for the electrical manufacturing companies is fully as promising. As was first stated in these columns on Jan. 11, 1913, the gross business of the General Electric Company last year was slightly in excess of \$102,000,000. Total sales billed, however, were between \$80,000,000 and \$85,000,000.

**Twin Falls (Mich.) Plant in Operation.**—The 3600-hp hydroelectric plant of the Peninsular Power Company at Twin Falls on the Menominee River, Michigan, has been placed in active service. In addition to this hydroelectric station, the company has also erected an auxiliary steam plant. While built chiefly for supplying energy for iron-mining operations on the Menominee range, the Twin Falls station is also furnishing electric service in Iron Mountain. The mines which the plant is supplying are located in the Iron River district, at a distance of about 30 miles from it. The Peninsular Power Company is a Wisconsin corporation. Otto C. Davidson, of Iron Mountain, general superintendent of the Menominee and Gogebic range mines of the United States Steel Corporation, is its president.

**Behind on Aluminum Deliveries.**—Advises from Pittsburgh say that the pressure for deliveries of aluminum sheets on contracts placed over a year ago is so heavy that the Aluminum Company of America is months behind on its orders. The aluminum producers will shortly open their books for the 1915 requirements of the automobile trade, there being no free tonnage available for 1904 delivery now in sight. The Stone & Webster Engineering Corporation is to build a plant at New Kensington, Pa., for the Aluminum Company of America, the cost of which is placed at \$1,500,000. The tonnage from this plant, it is said, has already been anticipated for the rest of this year and for 1914.

**Co-operative Warehousing for Electrical Manufacturers.**—R. L. Thayer & Company have just opened a large warehouse for electrical manufacturers at 424 South Clinton Street, Chicago. Here they will carry stocks for out-of-town manufacturers with Chicago representatives who wish to make Chicago deliveries without going to the expense of an individual warehouse and attendance. Thayer & Company will act as storekeepers and shipping clerks. Mr. Thayer has been engaged in the electrical business in Chicago for a number of years. The Oshkosh Manufacturing Company, maker of construction tools, carries its Chicago stock with Thayer & Company.

**Will Install Large Horizontal Turbo-Generators.**—Contracts for two large turbo-generators of the horizontal type have been placed with the Westinghouse Machine Company by Eastern public-utility companies. One of these machines, a 21,000-kva, 6000-volt, 25 cycle, three-phase unit, has been ordered by the New York Edison Company for its Waterside station No. 2, where it will be substituted for an old 7500-kw turbine unit of the horizontal type. The other, a 20,000-kw, 13,000-volt, 60-cycle, three-phase unit,

has been ordered by the Public Service Electric Company, of New Jersey, for its Marion station, Jersey City.

**Public-Utility Activities in Missouri.**—Hugo Wurdock, Henry Ittleson and David May, who were the incorporators of the United States Public Service Company of St. Louis, which was incorporated recently with a capitalization of \$10,000,000 and has taken over a number of the properties of the Light & Development Company of St. Louis, as noted Feb. 15, 1913, are also the incorporators of the Missouri Public Utilities Company, which has increased its capital to \$1,500,000 and will acquire public service properties in the eastern portion of that State.

**Vehicle Sales Increase.**—The pleasure car sales of the Baker Motor Vehicle Company of Cleveland for January, 1913, showed a net increase of 211 per cent over January, 1912. The officers of the company attribute this big gain to the popularity of new types of pleasure cars and the expansion of service operations which customers appreciate. Better organization has also done its part in bringing about this big business.

**Commonwealth Edison Company's Annual Meeting.**—At the annual meeting of the Commonwealth Edison Company of Chicago on Feb. 24 the annual report was presented to the stockholders, who re-elected the old directors. The directors are Henry A. Blair, Benjamin Carpenter, Samuel Insull, Robert T. Lincoln, John J. Mitchell, James A. Patten, John G. Sheed, Byron L. Smith and A. A. Sprague.

**Susquehanna Power Company Sold.**—Following an action begun recently to foreclose the mortgage on the property of the Susquehanna Power Company, as noted Jan. 18, 1913, the company has been sold at foreclosure to Frank J. Hoen, of Baltimore, for \$300,000 subject to a mortgage of \$150,000. The company was organized to construct a hydroelectric station at Conowingo, on the Susquehanna River.

**Pacific Gas & Electric to Issue \$5,000,000 Bonds.**—The Pacific Gas & Electric Company has announced that, pursuant to a resolution adopted at the directors' meeting on Feb. 5, a special meeting of the stockholders has been called for April 8 to authorize an increase of \$5,000,000 in the company's funded debt, in the form of ten-year 6 per cent debenture bonds.

**Diesel Engine Factory Nearing Completion.**—The manufacturing plant which the Busch-Sulzer Brothers-Diesel Engine Company has been erecting in St. Louis is nearly completed and will begin operations about June 1. When finished it will represent an outlay of over \$1,000,000. A reference to this plant appeared in the *Electrical World*, June 1, 1912.

**Will Install a 10,000-kw Turbine Unit.**—The Toledo (Ohio) Traction, Light & Power Company, which succeeded the Toledo Railways & Light Company, following the reorganization of the latter, is in the market for a 10,000-kw turbo-generator unit.

**Ice Machinery Installations.**—Since Jan. 23, 1913, the York Manufacturing Company has installed refrigerating machinery with an aggregate rating of 310 tons in all sections of the country, including a 4-ton machine for Arecibo, Porto Rico.

**Electric Trucks for a Brewery.**—The Manhattan Brewing Company, of Chicago, has ordered from the General Vehicle Company five 5-ton electric trucks. The trucks will be equipped with Edison batteries.

**Kentucky Electric Company Elections.**—All directors of the Kentucky Electric Company were re-elected at the annual meeting of the company held recently in Louisville. The directors will meet shortly for reorganization.



**Defends New Jersey's New Corporation Laws.**—President-elect Wilson, in a statement issued last week, commented upon certain features of the new corporation laws enacted by the New Jersey Legislature, to which a reference appeared in these columns in the issue for Feb. 22. In part, he said: "Senate bill No. 43, the act defining trusts and designed to promote free competition and commerce in all classes of business, makes it criminal to make an agreement which directly or indirectly precludes a free and unrestricted competition in the sale or transportation of any article or commodity either by pooling, withholding from the market or selling at a fixed price or in any other manner by which the price might be affected. It was urged upon the Legislature that the bill be amended by adding the word 'knowingly' so that it would read that any person or persons who wilfully and knowingly make an agreement in restraint of trade should be punished. I do not see how agreements can be made without the knowledge of those who make them, but I do understand how exceedingly difficult it is to prove knowledge to the satisfaction of a court, and it was perfectly evident that the proposal to superadd the word 'knowingly' was merely a plausible scheme devised by those who would escape the just penalties of illegal acts by compelling the prosecution to prove that the inhibited acts were done knowingly. I understand that it is a general principle of law that there must be a guilty mind to constitute a guilty act. It seems to me that this affords ample protection to any honest man. It has been said in some quarters that these laws will help big business and hurt the small dealers. That is, of course, not the intention, and it cannot be the effect. The purpose is to strike down monopoly and restraint of trade, big or little, and I confidently predict that these laws will prove a blessing to the whole people. The salutary provision of the act defining trusts is that it makes it unlawful to make any agreement directly or indirectly which will preclude free and unrestricted competition in business. Monopolies have too often accomplished by indirection what they could not do directly. The holding company is an example of this. Where two or more companies by existing law could not make an agreement in restraint of trade they hit upon the scheme of fusing and merging into a holding company which regulated the business of the subsidiaries in such a way as to restrict trade and increase prices. Honest business and honest men may be sure they have nothing to fear from these acts. Those who would engage in the heartless practices of ruining rivals and filching from the pockets of the people more than they ought reasonably to demand are the only ones who will have cause to regret their enactment. I predict that under them the people of New Jersey will enter upon a new era of prosperity."

**Indiana Railways & Light Company's Holdings.**—The Kokomo, Public Utility Company, the Kokomo, Frankfort & Western Traction Company, and the Kokomo, Marion & Western Traction Company were recently liquidated and consolidated into the Indiana Railways & Light Company, with \$2,000,000 common stock and \$1,000,000 preferred stock, \$350,000 of which is to be issued at once. The company also has an authorized issue of \$5,000,000 in thirty-year gold bonds, of which \$1,780,000 has been issued. The officers of the company are: George J. Marott, president; L. J. Kirkpatrick, vice-president; T. C. McReynolds, secretary-treasurer and general manager; P. H. Palmer, assistant general manager, and C. C. Trees, assistant secretary. The new company is transacting all the business formerly conducted by the three old companies, that is, the operation of the traction lines between Frankfort and Kokomo and those between the latter and Marion, together with the city lines in Kokomo. It is also furnishing the entire electric service, including street lighting, in Kokomo, Greentown, Swayzee, Converse, Amboy, Russiaville, Forest and Michigantown.

**Republic Railway & Light Extends Its Transmission System.**—An additional system of transmission lines has been installed by the Republic Railway & Light Company in the Mahoning and Shenango Valleys, Ohio. It centers at the company's new power station at Lowellville, Ohio, which, as noted in these columns Jan. 18, 1913, has been practically completed by the Stone & Webster Engineering Corporation. The new lines are also connected with the

company's station at Youngstown, Ohio. They run north from Youngstown and west to Girard, Avon Park and Niles; toward the east to Hubbard, Masury, Roseville Park and Sharon. Between Youngstown and Hubbard this line connects with the northern extension from East Youngstown. The East Youngstown line runs from Lowellville. There are also two other lines running from the Lowellville station. One crosses the Mahoning River and extends southward to Bessemer, and the other runs along the north side of the river through several small towns to New Castle, Mahoningtown and New Castle Junction, connecting at the last-named place with the transmission system of the Pennsylvania Power Company, which was acquired by the Republic company last March. The company is expecting to secure a large increase in its power load this year from the active industrial section which it serves.

**Stone & Webster's 1912 Statement.**—The combined statement of the electric-railway, electric-lighting, gas and water-power companies operated under the management of the Stone & Webster Management Association for the year ended Dec. 31, 1912, shows gross earnings of \$23,925,414, as compared with \$22,969,868 in 1911; a balance available for dividends of \$5,555,360, as compared with \$5,461,257, and a balance for reserves and depreciation of \$1,856,240. The total disbursements for the year 1912 for interest on bonds and notes and for dividends were \$7,774,342. The total connected lighting load of the various properties was equivalent to 2,136,960 16-cp lamps. The total commercial power load was approximately 137,400 hp. The total combined power station rating was approximately 276,780 hp, of which 110,200 hp is generated by water-power. The total gas output was 1,306,940,800 cu. ft. The mileage of equivalent single track owned was 1,224.8, and the number of passengers carried, including transfers, 318,203,000.

**Increase in Business of San Diego Company.**—For the year ended Jan. 31, 1913, the San Diego (Cal.) Consolidated Gas & Electric Company reported gross earnings of \$1,053,723, compared with \$771,840 for the preceding year. The net earnings were \$523,661 and \$397,998 respectively. After paying interest charges, the balance on Jan. 31 last was \$351,592. The business of this company is growing rapidly. The number of customers served with electricity on Jan. 31 last was 14,762, compared with 10,307 the year before. This is an increase of over 43 per cent. The capital stock of the San Diego Consolidated Gas & Electric Company is owned by the Standard Gas & Electric Company.

**American Capital in Mexico.**—According to figures compiled by Consul Letcher at Chihuahua, Mexico, American investments in Mexico represent \$1,057,770,000, as compared with \$321,302,800 by England, \$143,446,000 by France and \$118,535,000 by all other foreign countries. The greater part of the American capital is in railway and mining securities. In the public-utility field American capital is greatly exceeded by that of other countries. According to the consular report, in Mexican tramways, power and electric lighting plants, American capital aggregates only \$760,000, as compared with \$8,000,000 in English capital, \$5,155,000 in Mexican and \$275,000 of other countries.

**To Sell Aaron Electric Company, of Chicago.**—Frank M. McKey, 1047 First National Bank Building, Chicago, as receiver, has given notice that bids will be received up to 9:30 a. m. on Monday, March 3, on the property of the Aaron Electric Company, of Chicago. This property consists of motors, dynamos and materials, machinery and fixtures used by the company in its business of manufacturing electrical supplies and apparatus.

**Status of Louisville Electric Companies.**—Practically all of the stock of the Louisville Lighting Company, the Louisville Gas Company, the Campbell Electric Company and the George H. Fetter Lighting & Heating Company is now owned by the Mississippi Valley Gas & Electric Company, the stock of which is owned by the Standard Gas & Electric Company.

**Ottawa Light, Heat & Power Increases Dividend.**—At the annual meetings of the Ottawa Light, Heat & Power Company, the Ottawa Electric Company and the Ottawa Gas Company on Feb. 24, the first named, the holding company, authorized an increase in the quarterly dividend from 1¼ per cent to 2 per cent. All the directors were re-elected.



### Electric Securities

Security	Outstanding	Q-Quarterly		M-Monthly		S-Semiannually		A-Annually		DIVIDEND	LAST QUOTATION	Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	\$9,500,000										18			20	
Adirondack Elec. Power, pf	2,500,000										58			60	
Amer. Gas & Electric (\$50), c.	2,500,000	1	Q								844			86	
Amer. Gas & Electric (\$50), pf	1,537,500	1	Q								454			47	
Amer. Light & Traction, c.	10,395,400	2	Q								385			393	
Amer. Light & Traction, pf	14,236,200	2	Q								107			109	
Amer. Power & Light, c.	5,631,400										74			76	
Amer. Pwr. & Lt., 6% cum. pf.	5,631,400	1	Q								84			86	
Amer. Pwr. & Lt., opt. warr.	1,604,000										13			15	
Amer. Pwr. & Lt., 6% notes	2,199,100	3	S								99			100	
Appalachian Power, c.	6,000,000										22			23	
Appalachian Power, pf	2,180,000										72			73	
Arizona Power, c.	3,000,000										12			13	
Arizona Power, pf	850,000										45			50	
Asheville L. & P., 1st s. f. 5s, '42	1,100,000	2	S								93			96	
Aug'ta-Aiken R. & E., s. f. 5s, '35	2,588,000	2	S								90			94	
Augusta-Aiken Ry. & Elec., c.	2,250,000										23			25	
Augusta-Aiken Ry. & Elec., pf	1,500,000	1	Q								75			85	
Augusta Ry. & El., 1st 5s, '40	967,000	2	S								100				
Central Maine Power, 1st 5s...	2,502,000	2	S								97			99	
Cities Service, c.	5,499,430	5-12	M								135			140	
Cities Service, pf	10,195,360		M								87			88	
Col'bus R. Gas & El., 1st 5s, '36	2,454,000	2	S								93			95	
Columbus Ry., G. & Elec., c.	2,000,000										60				
Columbus Ry., G. & Elec., pf	840,000	1	Q								85			95	
Commonw. Edison, cap. stock	37,764,140	7	A								142				
Con. Gas, El. & Pr. (Balt.), 4 1/2s	11,564,000	2	S								89			90	
Consum. Pwr. (Mich.), 5s, '36	10,088,000	2	S								95			97	
Consum. P. (Minn.), 1st 5s, '29	9,528,000	2	S								89			92	
Consum. Elec. Corp., 5s, '22	3,659,000	2	S								95			97	
Denver Gas & El. Lt., c.	7,001,300	1	M								220				
Denver Gas & El. Lt., gen. 5s	6,000,300	2	S								94			96	
Edi. El. Ill., Boston, cap. stock	15,603,700	3	Q								281				
Federal Light & Traction, c.	4,750,000										31			33	
Federal Light & Traction, pf	2,500,000	1	Q								82			84	
Fort Worth Pwr. & Lt., 1st 5s	1,500,000	2	S								96			98	
Harwood Electric, 5s, '39	1,000,000	2	S								101			102	
Kansas City Ry. & Lt., c.	9,543,080										15			16	
Kansas City Ry. & Lt., pf	9,407,500	1	Q								34			36	
Kan. City R. & Lt., 1st ref. 5s	10,220,000	2	S								91			93	
Kan. City R. & Lt., con. 6s, '12	5,478,000	3	S								88			90	
Lincoln Gas & Electric, c.	2,250,000										29			32	
Lincoln Gas & Electric, 5s, '41	796,000	2	S								85			90	
Northern States Power, c.	5,975,000										23			24	
Northern States Power, pf	8,386,700	1	Q								85			86	
Pacific Gas & Electric, c.	31,908,750	1	Q								60			60	
Pacific Gas & Electric, pf	10,000,000	1	Q								89			91	
Philadelphia Electric (\$25)	24,987,750	1	Q								23				
Portland General Electric, 5s	8,000,000	2	S								100			102	
Republic Railway & Light, c.	5,200,000										26			27	
Republic Railway & Light, pf	6,360,000	1	Q								78			80	
St. Joseph's R., L., H. & P., 5s	4,637,000	2	S								98			100	
Seattle Electric Co., con. 5s, '29	7,417,000	2	S								98			100	
Southern Calif. Edison, 5s, '30	10,043,000	2	S								96			98	
Southern Power, 5s	5,000,000	2	S								99			101	
Standard Gas & Elec. (\$50), c.	9,343,150										18			19	
Standard G. & Elec. (\$50), pf	10,977,950	2	Q								47			48	
Tennessee R., L. & Pwr., c.	20,000,000										21			22	
Tennessee R., L. & Pwr., pf	10,250,000	1	Q								75			76	
Tri-City Railway & Light, c.	9,000,000										56			60	
Tri-City Railway & Light, pf	2,826,200	1	Q								93			96	
Virginia Railway & Power, 5s	10,345,000	2	S								84			85	
Western Power	14,670,000										19			21	
Western Power, 6% cum. pf.	6,000,000	6	A								46			48	
Western States Gas & El., c.	3,503,000	1	Q								48			55	
Western States Gas & El., pf	1,800,000	1	Q								90			95	
W. Sta. G. & E., 1st & R. 5s, '41	3,400,000	2	S								92			95	

### Industrial Securities

Security	Capital Stock Listed	DIVIDEND		PERCENTAGE	Feb. 19	Feb. 26
		Per Cent	Period			
Allis-Chalmers, t. r., 3d pd.	\$15,501,800				38	24
Allis-Chal., pf., t. r., 3d pd.	14,105,500				10	10
Amalgamated Copper	353,887,900	1 1/2	Q		67	67
American Tel. & Tel.	335,001,000	2	Q		132	132
Electric Storage Battery, c.	16,074,425	1	Q		51	51
General Electric	101,203,500	2	Q		139	137
Mackay Cos., c.	41,380,400	1 1/2	Q		86	86
Mackay Cos., pf.	80,000,000	1	Q		67	67
Western Union Tel.	99,745,400	1	Q		64	64
Westinghouse, E. & M., c.	33,821,200	1	Q		70	69
Westinghouse, E. & M., pf.	3,998,700	1 1/2	Q		11	11

\*Last price quoted.

### NEW YORK METAL MARKET PRICES

Metal	Feb. 18		Feb. 26	Feb. 26
	Asked	Bid	Asked	Bid
Copper	14 1/2	14 1/2	14 1/2	14 1/2
Standard spot	14 1/2	14 1/2	14 1/2	14 1/2
London, standard spot	14 1/2	14 1/2	14 1/2	14 1/2
Penn. Lake	14 1/2	14 1/2	14 1/2	14 1/2
Electrolytic	14 1/2	14 1/2	14 1/2	14 1/2
Casting	14 1/2	14 1/2	14 1/2	14 1/2
Copper wire, base	14 1/2	14 1/2	14 1/2	14 1/2
Lead	14 1/2	14 1/2	14 1/2	14 1/2
Nickel	14 1/2	14 1/2	14 1/2	14 1/2
Sheet zinc, f.o.b. smelter	8.50	8.50	8.50	8.50
Spelter, spot	8.50	8.50	8.50	8.50
Tin, spot	48.50	48.50	48.50	48.50
Aluminum	26.00	26.00	26.00	26.00
Prompt delivery	26.00	26.00	26.00	26.00
Future	26.00	26.00	26.00	26.00

### OLD METALS

Heavy copper and wire	13 3/4	13 3/4
Brass, heavy	8 7/8	8 7/8
Brass, light	7 7/8	7 7/8
Lead, heavy	4 1/2	4 1/2
Zinc, scrap	5 3/4	5 3/4

### COPPER EXPORTS IN FEBRUARY

Total tons to Feb. 26..... 24,047

## Personal

Mr. Holt Daniels has become assistant general manager of the Danville Light, Power & Traction Company, Danville, Ky.

Mr. A. T. Appleton has resigned his position as superintendent of the Dublin Electric Company, of Dublin, N. H., to go to Weymouth, Mass.

Mr. W. G. Seelye, formerly treasurer of the Essex Light & Power Company of Essex, Conn., has been appointed vice-president of the company.

Dr. Edward B. Rosa, physicist of the Bureau of Standards, Washington, D. C., has been elected a member of the council of the French Physical Society.

Mr. James G. Biddle, of Philadelphia, well known as a manufacturer of electrical measuring instruments, has returned from an important trip to England and Germany.

Prof. H. E. Clifford of Harvard University will go to Annapolis for the second half-year to organize courses in graduate study in electrical engineering at the Naval Academy.

Mr. Austin A. Cushing, manager and contract agent of the Manchester (Mass.) Electric Company, resigns his position March 1 to join the staff of the Bay State Railroad Company at Boston.

Mr. Arthur Lovering has been appointed local manager and contract agent for the Manchester Electric Company, of Manchester, Mass. Mr. Lovering was formerly connected with the Bay State Street Railroad, at Boston.

Mr. Benjamin Jerome, who with Mr. Albert P. Ball recently formed the engineering firm of Ball & Jerome at Grand Rapids, Mich., was formerly associated with the Cadillac Motor Car Company of Detroit, Mich., the Michigan Power Company of Lansing, Mich., and the Peerless Motor Car Company of Cleveland, Ohio.

**Mr. J. M. Fried**, formerly connected with the Milford (Mass.) Electric Light & Power Company, has been appointed commercial agent of the Northumberland County Gas & Electric Company with headquarters at Sunbury, Pa.

**Mr. W. R. Molinard**, manager of the Oklahoma Gas & Electric Company, of Oklahoma City, has accepted an appointment as lecturer at the University of Oklahoma at Norman, Okla. He will address the senior class in electrical engineering.

**Mr. C. O. Bailey**, who has been assistant purchasing agent, has been made purchasing agent of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, to succeed Mr. P. C. Kaercher, who has been promoted to the power sales department.

**Mr. C. A. Stacy**, formerly engineer of the Virginia-Western Electric Company, Clifton Forge, Va., has accepted a similar position with the Charlottesville & Albemarle Railway Company at Charlottesville, Va. He will be in charge of the rebuilding work on the plant, which was recently destroyed by a flywheel explosion.

**Mr. Bion J. Arnold**, chairman of the Board of Supervising Engineers, Chicago Traction, has been called in as an adviser by the sub-committee of the local transportation committee of the Chicago City Council, which is trying to outline a tentative ordinance for the merger of all the street and elevated railway companies of Chicago.

**Mr. Hugo Wurdack**, president of the Light & Development Company of St. Louis, it was announced would address the Jovian Chapter of the St. Louis League of Electrical Interests Feb. 25, on the subject of "Engineering Problems Connected with Lighting and Motor-Service Distribution of Several Companies Under the Same Management."

**Mr. W. W. Briggs** has been appointed assistant to Mr. Mortimer Fleishacker, general manager of the Great Western Power Company, of San Francisco, Cal., and will have charge of the sales and commercial work of the company. Mr. Briggs was formerly manager of the San Francisco office of the Westinghouse Electric & Manufacturing Company.

**Mr. W. L. Abbott**, chief operating engineer of the Commonwealth Edison Company, was one of the speakers at the dedication of Lincoln Hall at the University of Illinois on Lincoln's Birthday. The new building, which is said to have cost \$250,000, is devoted to the study of the humanities. Mr. Abbott is president of the board of trustees of the university.

**Mr. D. C. Green**, manager of the Oregon Power Company, Marshfield, Ore., was by unanimous vote elected president of the Marshfield Chamber of Commerce at its February meeting. Mr. Green is a graduate of the 1908 class of Purdue University, and during the last four years has been associated with the Byllesby interests, which control the Oregon property.

**Mr. J. H. Pieper** has been appointed illuminating and electric-vehicle engineer for the Southern California Edison Company, Los Angeles. In addition to his duties of giving expert advice on lighting and battery matters, Mr. Pieper will arrange a course of lectures to be given before the various district office staffs of the system. Business men will be invited to attend these lectures.

**Mr. Albert P. Ball**, who has acted as electrical engineer for the Couple-Gear Freight Wheel Company, of Grand Rapids, Mich., has opened an engineering office at Grand Rapids with Mr. Benjamin Jerome. Mr. Ball was formerly connected with the Muralt Engineering Company, New York; the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and the United States Reclamation Service projects in Arizona.

**Mr. Harold G. Payne** has become associated with Mr. N. J. Neall, of Boston, as assistant in consulting electrical engineering and the management of electrical utilities. Mr. Payne, who is a graduate of the University of Minnesota, was for several years connected with the Stone & Webster organization at Minneapolis and elsewhere. For the last four years he has been a member of the engineering staff of D. C. & William B. Jackson and has been engaged in electrical and allied engineering in Boston and Chicago.

**Mr. Henry F. Griffin** has been appointed advertising manager for the Crocker-Wheeler Company, Ampere, N. Y. Like his predecessor, Mr. Roy Mason, he has had a broad newspaper and advertising experience. He comes to his new position from the copy service department of *Collier's Weekly*, prior to which connection he was for three years the telegraph editor of the New York *Evening Sun*. Mr. Griffin is a native of Buffalo, N. Y., and was graduated from Yale in 1903 with the degree of bachelor of arts.

**Mr. E. C. Bradley**, vice-president and general manager of the Pacific Telephone & Telegraph Company, has announced his intention of resigning from active work March 5, after forty years' service in the telegraph and telephone fields. Mr. Bradley started as a telegraph operator and in time became third vice-president of the Postal Telegraph Company. Later he was associated with the American Telephone & Telegraph Company in Boston and New York, and he came to the Pacific Telephone & Telegraph Company after the San Francisco fire.

**Mr. Leonard S. Small**, of Fairhaven, Vt., who has been contract agent of the Rutland Railway, Light & Power Company, Rutland, Vt., for three and a half years past, has resigned to become manager of the Tyler Electric Company, Tyler, Tex. This is one of the large number of subsidiary companies owned by the Texas Power & Light Company of Dallas. Mr. Smith's resignation became effective Feb. 26. Prior to his connection with the Rutland Railway, Light & Power Company he was associated with the Rutland Manufacturing Company and with Ford & Johnson.

**Mr. Ralph H. Rice**, of the Board of Supervising Engineers, Chicago Traction, has been appointed assistant to Mr. George Weston, engineer to the board. Mr. Rice has been in charge of the engineering for power generation and transmission and electrical distribution, but will now have charge of all engineering work. Mr. Rice, who is a graduate of the Armour Institute of Technology, was made assistant engineer of electrical distribution in 1907. After the resignation of Mr. Edward N. Lake, now of Boston, he was made division engineer, and when the division organization was dropped he took on added duties. Mr. Rice is chairman of the Chicago Section of the American Institute of Electrical Engineers.

**Mr. W. R. Thompson**, of Chicago, recently promoted to be manager of engineering and construction for H. M. Byllesby & Company, was graduated from the Pennsylvania State College in 1897. For several years he was connected with J. G. White & Company, of New York, engaged in electrical engineering work, and later he was associated with the engineering department of J. G. White & Company, Ltd., of London. In 1903 Mr. Thompson accepted a position with the British Westinghouse Electric & Manufacturing Company, and in this employment he had much to do with problems of power-house design and heavy steam-railroad electrification. Mr. Thompson returned to the United States in 1906 and was again employed by J. G. White & Company, being engaged on the investigation of special technical subjects. In 1908 he was employed as assistant electrical engineer by the Public Service Commission, First District, New York. A year later he was appointed acting electrical engineer of this commission. He resigned from this position to affiliate himself with H. M. Byllesby & Company of Chicago, becoming assistant chief engineer. His appointment as manager of engineering and construction of this company was dated Jan. 1, 1913. The work under his direction is of a widely varying nature. In addition to an extensive consulting engineering practice it relates to the operation of various classes of utilities. Mr. Thompson is a member of the American Institute of Electrical Engineers.



W. R. THOMPSON



## Construction

**BIRMINGHAM, ALA.**—The Birmingham Ry., L. & Pwr. Co. has applied to the Board of Revenue for a franchise to construct and operate a railway along the county road to Lewisburg, a distance of 3 miles. The cost of the line is estimated at \$125,000.

**BIRMINGHAM, ALA.**—Louis V. Clark is contemplating the installation of an electric-light and heating plant in connection with an apartment house and store building. The cost of the building is estimated at \$50,000. H. B. Wheelock, of Birmingham, is architect.

**SCOTTSBORO, ALA.**—A franchise has recently been granted for the installation of an electric-light plant here.

**TUSCALOOSA, ALA.**—The Tuscaloosa Ice & Lt. Co. has been re-organized and the capital stock increased from \$50,000 to \$100,000. The company will issue \$250,000 in bonds to retire outstanding bonds and to provide for improvements and extension of properties. M. P. Jemison is president and A. M. McGehee general manager.

**GLOBE, ARIZ.**—The United States government surveyors are locating a route for an electric transmission line to run from the hydroelectric plant at the Roosevelt Dam to Superior. The proposed line will supply electricity for a number of mines and other industries.

**BOG SPRINGS, ARK.**—Preparations are being made by J. M. Johnson, of Ashdown, A. Dulaney and others for the erection of a hotel and sanatorium at Bog Springs. The plans provide for installation of an electric-light plant and water-works system. The total cost is estimated at from \$50,000 to \$60,000.

**CAMDEN, ARK.**—The Camden Pwr. Co. is planning the erection of a new building, feeder lines and to remodel all the lines throughout the city within the next three months. The company also expects to purchase within the next three months one 100-hp boiler, steel casings, a 56-in. by 100-ft. stack, one 300-kva alternating-current generator and engine directly connected, three pumps directly connected to alternating-current motors, one switchboard panel, complete with instruments, for 300-kva generator; 70 35-ft. poles with 7-in. tops, 100 30-ft. poles with 6-in. tops, and 3000 lb. No. 00 weather-proof wire and insulators. The Camden Pwr. Co. has purchased the property of the Camden Wtr. Co. and will rebuild the water plant as well as move the power plant to the property of the water company. E. T. Reynolds is manager.

**SULPHUR SPRINGS, ARK.**—Contracts for construction of the proposed municipal electric-light plant will be called for in about 30 days. Albert C. Moore, of Joplin, Mo., is engineer in charge.

**COLUSA, CAL.**—The Board of Supervisors of Colusa County has granted the Oro El. Corp., of Oroville, a 50-year franchise to erect and maintain electric transmission lines on the streets and highways of the county. Work on the proposed line must begin within four months.

**LOS ANGELES, CAL.**—Bids will be received by the Board of Education for furnishing and installing electric-light fixtures in seven school buildings in accordance with specifications which are on file with the secretary of the board, 730 Security Building. William A. Sheldon is secretary.

**LOS ANGELES, CAL.**—Bids will be received by the Board of Public Works until March 7 for furnishing the city with miscellaneous electrical material, consisting of lead-covered cable and terminals, copper tubing and fittings, bus supports and disconnecting switches, in accordance with specifications No. P 32, which may be obtained at the Aqueduct Bureau, 1116 Central Building, Los Angeles.

**OCEANSIDE, CAL.**—Preparations are being made by the Oceanside El. & Gas Co. to erect 7½ miles of three-phase, 6600-volt transmission line, contract for which will be awarded at once. The equipment of the power plant includes Atlas boilers, 12-in. by 36-in. Corliss and 12-in. by 14-in. Atlas engines, 50-kw and 75-kw, two-phase, 60-cycle, 2200-volt Westinghouse generators. E. V. Griffe is engineer in charge of the work.

**PASADENA, CAL.**—The city of Pasadena has made formal application to the Los Angeles Public Service Commission for estimates upon 2000 hp to be furnished by the Los Angeles-Owens River aqueduct C. W. Koerner is general manager and chief engineer of the municipal electric plant.

**SAN FRANCISCO, CAL.**—The Great Western Pwr. Co. is planning to install two complete generating units at the Big Ben plant on the Feather River, 20 miles from Oroville. Mortimer Fleischer is president of the company.

**SAWTELLE, CAL.**—Bids will be received until March 10 by Major E. W. Moore, treasurer, for furnishing and installing an electric elevator at the Soldiers' Home at Sawtelle.

**SELMA, CAL.**—Bids will be received by the Board of Trustees for the installation of an automatic fire-alarm system.

**STOCKTON, CAL.**—The Oro El. Corp., of Oroville, has awarded a contract to C. C. Moore & Co., of San Francisco, for the construction of a steam power plant near Stockton as an auxiliary to its extensive hydroelectric system. The initial installation will provide for 1000 hp; provision will be made for installation of larger units as needed.

**TRINIDAD, COL.**—Steve Patrick, Louis Tarbino and S. Fells are interested in a project to erect an electric-light plant on the site now occupied by the Central Park. The proposed plant will cost about

\$600,000 and will supply electricity for lamps and motors on the street lighting system.

**WASHINGTON, D. C.**—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 5, under proposal 640, for furnishing 350 spools buzzer wire, ¼ mile per spool, 10,000 ft. single bridge wire No. 16, 10,000 ft. twisted-pair bridge wire, 25,000 ft. outside distributing wire, 300 spools buzzer wire, single insulated; 75,000 ft. inside twisted-pair wire, 20,000 ft. type 251, one-pair rubber-insulated, lead-sheathed, galvanized flexible-steel armor cable, and 5000 ft. rubber-covered and braided single wire. Further information may be had upon application to Captain W. L. Clarke, disbursing officer.

**WASHINGTON, D. C.**—Proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until March 7, under proposal 641, for furnishing 100 buzzers, 100 strap keys, 21 pliers, 100 spiral springs for relays, 100 do for telegraph sounders, 20 terminals, 400 lb. rubber tape, 750 pounds friction tape, 150 tubular fuses, 75 extension bells, 12 terminal strips, 10-pair, and 12 do, 20-pair, 250 bridge rings, 500 lb. bluestone, 50 fuse clips, 100 standard do, 20 lb. compound, 150 w.e. No. 24 fuses, 12 plugs, 40,000 paper sleeves, 200 choke coils, 250 heat coils, 24 signal line coils, 100 tubular fuses and 25 w.e. signals. Further information may be secured upon application to Captain W. L. Clarke, disbursing officer.

**WASHINGTON, D. C.**—In the sundry civil appropriation bill report to the House of Representatives Feb. 17 there is a provision authorizing the Secretary of the Treasury to have constructed in Washington, under the direction of the supervising architect of the treasury, a central heating, lighting and power plant to furnish light, heat and power for various government buildings in the immediate vicinity of the plant. The total cost of the plant, including buildings, equipment, ducts, tunnels, etc., is not to exceed \$1,494,104. The provision also authorizes the Secretary of the Treasury to enter into contracts to the full limit of the cost. It also gives authority for making a cross-connection between the proposed new plant and the Capitol plant so that either plant may supply electricity to the other in case of breakdown or any emergency. The sum of \$150,000 is appropriated for the commencement of the plant.

**TAMPA, FLA.**—The capital stock of the Tampa El. Co. has been increased from \$1,870,000 to \$2,244,000. The company contemplates improvements to its plant and will consolidate with the Tampa & Sulphur Springs Trn. Co.

**FAIRBURN, GA.**—The Fairburn & Atlanta Ry. & El. Co. will equip the railroad from Fairburn to College Park, a distance of 11 miles, for electrical operation. The contract has been awarded to J. B. McCrary & Co., of Atlanta, Ga. The work will include the installation of a 200-kw to 300-kw rotary converter, 11 miles of 00 feeder pole-line construction, 7½ miles of 4-0 feeder wire and carry 40 passenger double-track passenger cars, all equipped. Material and machinery to be furnished inmediately.

**JONESBORO, GA.**—Bids will be received by E. W. Hutchinson, chairman of electric light committee, until March 6 for electric equipment as follows: (Schedule 1)—chestnut poles; (2)—cross-arms, insulators, pins and brackets, break-arms, etc.; (3)—guy anchors, thimbles, guy cable, lag screws, carriage bolts, washers, pole steps, etc.; (4)—insulated wire; (5)—transformers, switchboards, lightning arresters, choke coils, disconnecting switches, wattmeters, brackets, incandescent lamps, etc.

**ROCHELLE, GA.**—The establishment of a combined electric-light and water-works system in the near future is contemplated by local business men and citizens of Rochelle.

**PEARL HARBOR, H. T.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 22, for furnishing one 200-kw motor-generator set and switchboard accessories at the naval station, Pearl Harbor, H. T. Specifications may be obtained on application to the bureau. H. R. Stanford is chief of bureau. The cost of the work is estimated at \$6,800.

**ASHTON, IDAHO.**—Application has been made to the Council for a franchise to supply electricity in Ashton by N. M. Holm, engineer, of Idaho Falls. Mr. Holm proposes to build a large hydroelectric power plant on the Snake River, about 3 miles from here, where it is estimated that 5000 hp can be developed. The proposed plant will supply electricity in St. Anthony as well as in this district.

**NEZPERCE, IDAHO.**—The Nezperce El. Lt. & Pwr. Co. of Nezperce, ville, has filed articles of incorporation in this territory, and are extending its system to Nezperce.

**ARMINGTON, ILL.**—At an election held recently the proposition to establish an electric-light plant in Armington was carried.

**BELLELEVILLE, ILL.**—The Belleville Centennial Association is contemplating the installation of incandescent lamps in the city.

**CHAMPAIGN, ILL.**—The Champaign Electric & Light Co. has applied to the city council for a franchise to build a plant on Wayne, Bailey and Market Streets and Third Street, Astoria.

**CHANDLERVILLE, ILL.**—The Chandler Electric & Light Co. has applied to the city council for a franchise to build a plant on the main street, Chandler, Ill. The plant will supply electricity in Chandlerville.

**CHICAGO, ILL.**—A new incandescent electric-light plant will be erected in Dearborn Street, from Lake to Park Street. The new lamps are to be installed at the corner of the Dearborn Street Improvement Association, which are given to the city for the installation and maintenance of the lamps. The lamps are to be attached to traffic poles. The Clark



Street Improvement Association is now making arrangements for additional lamps. According to City Electrician Ray this system will extend to other Loop streets.

**CHICAGO, ILL.**—Sealed proposals will be received by John McGillen, clerk, Sanitary District of Chicago, 1500-76 West Monroe Street, Chicago, until March 13 for furnishing electrical apparatus and supplies as follows: Division A—cast-iron post heads with reactance coils and equipment; B—cast-iron post heads with series receptacles and equipment; C—lamp globes; D—arc-lamp counterweights; E—pole doors and pulleys; F—manholes, frames and covers; G—pole tops; H—pole bases; I—ornamental pole bases; J—arc-lamp windlasses; K—tubular steel poles; L—underground conduit; M—single-conductor armored cable; N—single-conductor lead-covered cable; O—paper-insulated, lead-covered cable; P—12,000-volt multiple-conductor, varnished-cloth-insulated, lead-covered cable; Q—series tungsten lamps; R—4-amp air-cooled regulators. All bids must be made upon blank forms of proposal furnished by the Sanitary District of Chicago. Specifications and plans may be obtained upon application to the above office. Thomas A. Smyth is president of board of trustees of Sanitary District of Chicago.

**GRANITE CITY, ILL.**—Property owners on Ninth Street have filed a petition with the City Council asking for the installation of ornamental street lamps on nine blocks, the property owners to pay for the installation of lamps and the city to maintain same.

**MEREDOSIA, ILL.**—The City Council has awarded the Central Illinois Pub. Ser. Co. a contract for lighting the streets of the city for a period of ten years. The contract provides for 40 tungsten incandescent lamps of 40 cp at \$16 each per year. The company has also been granted a 50-year franchise by the Council.

**MONMOUTH, ILL.**—The merchants on West First Avenue are contemplating the installation of ornamental street lamps.

**OQUAWKA, ILL.**—The Walsh Brothers interests, which control the Rock Island Southern Interurban Railway, are said to be negotiating for the purchase of the local municipal electric-light plant.

**PALMER, ILL.**—The Hillsboro El. Lt. & Pwr. Co., of Hillsboro, is contemplating the erection of a transmission line to Palmer.

**PROPHETSTOWN, ILL.**—The local office of the Illinois Northern Utilities Co. has been instructed to secure the right-of-way for a transmission line from Prophetstown to Geneseo.

**RAYMOND, ILL.**—The Hillsboro El. Lt. & Pwr. Co., of Hillsboro, has been awarded a ten-year contract for lighting the streets of the village. The street-lighting system will probably be changed to tungsten lamps.

**RIVERSIDE, ILL.**—The village of Riverside has accepted the report of Dabney H. Maury, consulting engineer, Monadnock Building, Chicago, and has authorized plans and specifications be prepared for the construction of a new water-works plant. The equipment will consist of two electrically driven reciprocating deep-well pumps, two centrifugal fire pumps, two centrifugal or triplex service pumps, one elevated steel tank of 150,000 gal. capacity. A new pumping station will be erected. All machinery will be automatically controlled. The cost of the work is estimated at about \$42,000.

**WOODRIVER, ILL.**—The Madison County Lt. & Pwr. Co., of Granite City, has been awarded a contract to furnish electricity to operate machinery at the refineries of the Standard Oil Co.

**CENTERVILLE, IND.**—The Board of Town Trustees has decided to call an election on March 15 to vote on the proposition to issue bonds for the installation of an electric-light system. Electricity for operating the proposed plant will be purchased. The cost of the system is estimated at \$6,000.

**CLAYTON, IND.**—The citizens have voted to install an electric-light system here. Electricity for operating the system will be furnished by the Terre Haute, Indianapolis & Eastern Trac. Co.

**FORT WAYNE, IND.**—A hydroelectric plant to furnish electricity to maintain 800 incandescent lamps to illuminate Foster Park, after it has been improved, and the driveway leading to it, has been suggested by A. W. Grosvenor, engineer, employed to prepare plans for the dam that will be built 300 ft. south of No. 3 pumping station. The cost of the plant is estimated at about \$5,100.

**GARY, IND.**—The Gary Lt., Ht. & Wtr. Co. has notified the Secretary of State of an increase in capital stock from \$100,000 to \$1,250,000.

**MARTINSVILLE, IND.**—The City Council has granted a franchise to Charles J. and Edgar V. Mitchell to operate an electric light and power plant and a hot-water steam-heating system in Martinsville. A company will be organized under the name of the Citizens' Lt., Ht. & Pwr. Co. to operate the plant.

**MULBERRY, IND.**—The Mulberry Lt. & Pwr. Co., recently organized, will supply electricity in Mulberry. Energy for operating the system will be purchased from the Terre Haute, Indianapolis and Eastern Trac. Co. The equipment will include General Electric switchboard equipment for alternating current, Kuhlman El. Co. (Elkhart) transformers, meters and Mazda "sunbeam" lamps. About 4 miles of wire will be used and cedar poles. No contracts will be awarded for construction. O. T. Hancock, of Marion, Ind., is engineer in charge. A. I. Yundt is treasurer.

**ODON, IND.**—The Town Board has granted R. F. Myers a 50-year franchise to install and operate an electric-light plant and a contract for lighting the town for a period of ten years. The proposed plant will be driven by 120-hp engines.

**WOLCOTTVILLE, IND.**—Steps have been taken toward the installation of an electric-light plant here. E. L. Cutler, it is said, will install the plant if sufficient patronage is guaranteed.

**BEAMAN, IA.**—The Iowa River Lt. & Pwr. Co., of Eldora, has been granted a franchise to supply electricity in Beaman.

**CONRAD, IA.**—The Iowa River Lt. & Pwr. Co., of Eldora, has been granted a franchise to supply electricity for lamps and motors in Conrad.

**CRESTON, IA.**—We are informed that the property of the Creston Mutual El. Lt., Ht. & Pwr. Co. was not purchased by Detroit and Chicago capitalists, as reported in these columns some time ago. However, Chicago and Detroit capitalists took over the Creston Gas & El. Co. George E. Cornelius is manager of the Creston Mutual El. Lt., Ht. & Pwr. Co.

**HOLSTEIN, IA.**—A special election will be held on March 10 to vote on the proposition to grant an electric light, heating and power plant franchise in Holstein.

**KIMBALLTOWN, IA.**—The proposition to grant a franchise to install an electric-light plant in Kimballtown will be submitted to the voters on March 10.

**MASON CITY, IA.**—Negotiations have been closed whereby the United Lt. & Ry. Co., of Grand Rapids, Mich., has purchased the properties of the People's Gas & El. Co., the Mason City & Clear Lake R. R. Co., the Mason City heating plant and kindred Brice interests. The first improvement contemplated is an extension of the Interurban railway to Charles City to connect with the Illinois Central R. R.

**PETERSON, IA.**—The Peterson Pwr. & Milling Co. has nearly completed the construction of its power plant and will begin work on the erection of a transmission line, 10 miles long, for the purpose of furnishing electricity in four towns, as soon as frost is out of the ground. The equipment of the plant consists of two generators, one 75-kva and one 125-kva alternating-current, three-phase, 60-cycle, 2300-volt generator, two Woodward waterwheels, operating under 11-ft. head, one 116-hp and the other 183-hp; four-panel switchboard and Wagner instruments, transformers; steam plant, for use during high-water and low-water periods, including one 150-hp boiler and one 150-hp Murray Corliss engine. About 10 miles of overhead line material will be used, consisting of No. 6 wire and 30-ft. cedar poles with 6-in. tops. A. W. Jones is manager and secretary.

**WHITTEN, IA.**—At an election held recently the proposition to grant the Iowa River Lt. & Pwr. Co., of Eldora, a 25-year franchise in Whitten was carried.

**BUFFALO, KAN.**—The Buffalo El. Lt. & Pwr. Co. was recently organized with a capital stock of \$10,000 for the purpose of installing an electric light and power plant in Buffalo.

**HAMLIN, KAN.**—At an election held recently the proposition to issue bonds for the installation of an electric-light system was carried. The present plans provide for the erection of a transmission line from Hamlin to Morrill. Electricity for operating the system will be secured from the plant in Sabetha.

**PARSONS, KAN.**—At an election held Feb. 11 the proposition to issue \$75,000 in bonds for the construction of a municipal electric-light plant was defeated.

**EARLINGTON, KY.**—The St. Bernard Mining Co. is preparing to install an electric plant to furnish electricity for lighting and operating machinery in its mines. The equipment will consist of one Curtis 250-kw, 2300-volt, alternating-current turbo-generator, one 500-kw and one 625-kw, 2300-volt, three-phase, 60-cycle Curtis turbo-generator and General Electric switchboard equipment; three substations, one equipped with a 200-kw synchronous motor-generator set, one equipped with a 150-kw synchronous motor-generator set and one equipped with a 100-kw induction motor-generator set. Orders have been placed for machinery. Frank D. Rash, of Earlington, is vice-president and general manager.

**HAZARD, KY.**—W. M., S. H. and J. R. Jones, all of Barbourville, have purchased coal fields and will develop about 1200 acres. Electrical machinery will be installed to operate four 6-ton motors, four fans and eight machines; also four rock drills. Bids for electrical machinery will be received about May 1. The company will also apply for an electric-lighting franchise in Hazard.

**HICKMAN, KY.**—The Hickman Ice & Coal Co., which owns the power plant, ice factory and water-works, has sold its property to the National Lt. & Pwr. Co., of St. Louis, Mo. The new owners will take over the property March 3.

**LOUISVILLE, KY.**—R. E. Wathen & Co. expects to purchase an electric elevator for a large warehouse to be erected soon.

**LOUISVILLE, KY.**—The American Creosoting Company, of Louisville, contemplates the purchase of motors to be installed in connection with pumps in new plants being erected by the company.

**LOUISVILLE, KY.**—The contract committee of the Board of Commissioners has been instructed to ask for bids for the installation of an electric-lighting system fed by underground wires on Eastern Parkway from Castlewood to Floyd Street.

**PLEASUREVILLE, KY.**—The Town Board has sold the Kentucky Utilities Co., of Lexington, an electric and heating franchise in Pleasureville.

**ABBEVILLE, LA.**—The Town Council has adopted an ordinance calling a special election to vote on the proposition to levy a tax of 3 mills on all assessable property in the town, for a period of ten years, in aid of the Louisville Trac. & Pwr. Co.

**NEW ORLEANS, LA.**—Sealed proposals will be received by the

Sewerage and Water Board, fifth floor, City Hall Annex, New Orleans, La., until April 18, for furnishing one 150-hp motor, to be known as Contract 54-D. Specifications, with blank form of proposal, may be obtained on application at the office of the board. F. S. Shields is secretary and George G. Earl general superintendent.

ST. FRANCISVILLE, LA.—Improvements are contemplated to the municipal electric-light plant and water-works system, to cost about \$6,000.

AUGUSTA, MAINE.—Acts have been introduced in the State Legislature to incorporate the following companies: The Sheepscot Valley Conservation Pwr. Co. with a capital stock of \$200,000 to distribute electricity for lamps and motors in Albion, China, Winslow, Somerville, Whitefield, Jefferson and Palermo (incorporators, Charles E. Achorn and Madison T. Leavitt of Whitefield, Arthur Dodge and Parker Marr of Somerville, and others); the Washington County Lt. & Pwr. Co.; the Sullivan-Sorrento El. Lt. & Pwr. Co.; the Brownfield El. Co.; the Bowdoinham Wtr. & El. Co.; the Lincoln Lt. & Pwr. Co., with a capital stock of \$10,000, to supply electricity for lamps, heaters and motors in Lincoln (incorporators, George H. Haines, Elmer H. Haines and Austin G. Haines); the Androscoggin El. Co., to be capitalized at not less than \$250,000 or more than \$2,000,000, to acquire by purchase or consolidation the properties, franchises, etc., of the Mechanic Falls El. Lt. Co., of Mechanic Falls, and the Portland, Gray & Lewiston R. R. Co. and other public service corporations doing business in Androscoggin County.

BALTIMORE, MD.—Plans are being prepared by Lighting Superintendent McCuen for the installation of an ornamental street-lighting system on the streets surrounding the Polytechnic Institute buildings on North Avenue. The extension of the ornamental lamps on Charles Street as far as North Avenue and the installation of the system on Maryland Avenue and St. Paul Street is under consideration.

OCEAN CITY, MD.—The Mayor and City Council are considering the question of installing a municipal electric-light and power plant.

SPARROW'S POINT, MD.—The Maryland Steel Co. has entered into a contract with the Consol. Gas & El. Lt. & Pwr. Co., of Baltimore, Md., for electrical energy to operate various departments. At present it will use 6500 hp, and later it may extend the use of electrically driven machinery. The Consolidated company will furnish electricity from the Highlandtown substation, 8 miles distant.

ATHOL, MASS.—The Massachusetts Northern Ry. Co. is planning to erect a transmission line from Westminster to Ashburnham, connecting the power station at Westminster with the Connecticut River Pwr. & Trans. Co.'s line at Ashburnham, so as to supply power for operating the local railway. At present the Gardner, Westminster & Fitchburg street railway is operated by power from the Westminster station. A new 500-kw generator has been installed and will be ready for use soon. When the transmission line from Ashburnham to Westminster is completed the Westminster station will be used for auxiliary purposes.

BOSTON, MASS.—Louis K. Rourke, commissioner of public works, in his annual report recommends abolishing all gas lamps and the substitution of tungsten electric lamps for street lighting. He estimates that it would result in an annual saving to the city of from \$27,000 to \$59,000.

BOSTON, MASS.—The New England Pwr. Co. has decided to do some new financing in the near future under the recent authorization of 15,000 shares of additional preferred stock, the proceeds to be used to complete next summer the company's so-called No. 3 power station on the Deerfield River. The new plant when completed will generate 20,000 hp, which will be used to operate the New England railroad lines. The plant will include a dam and canal 3 miles long and will add 80 per cent to the output of the first three Deerfield River plants.

SHIRLEY, MASS.—G. M. Balou has sold his electric-light plant to local parties, who, it is said, will enlarge and improve the plant.

WESTFIELD, MASS.—The Warren Pwr. Co., of Springfield, with generating plant at Warren, has submitted a proposition to furnish electricity in Westfield.

ALPENA, MICH.—The city of Alpena is considering the installation of a Gamewell fire and police alarm system.

GRAND RAPIDS, MICH.—Merchants in the immediate vicinity have asked for estimates of cost of the installation of the boulevard lighting system on Ionia Avenue from the city hall to Oakes Street.

MILFORD, MICH.—At a special election held Feb. 19 the proposition to grant franchises to the Edison Co. and Frank S. Hubbell to erect transmission lines on the highways in this township was carried.

PAYNESVILLE, MINN.—The Lethert El. Co., of St. Paul, is contemplating extending its service to Paynesville. The company, it is understood, will submit two propositions to the Village Council. One is to supply energy to operate the municipal electric-light plant; the other to purchase the local plant and operate it.

ROCHESTER, MINN.—The Detroit United Ry. Co. is making extensive improvements to its power house in this village, including the installation of a 3000-kw generator.

ROSEAU, MINN.—The proposition to issue bonds for the installation of a municipal electric-light plant will be submitted to the voters this spring.

VESTA, MINN.—The Vesta Hardware Co. is installing an electric-light plant in Vesta. The equipment will include a 15-kw direct-current generator driven by an oil engine. H. Reichert is engineer in charge.

YOUNG AMERICA, MINN.—The Lethert El. Co., of St. Paul, has applied to the Village Council for a franchise to supply electricity for lamps and motors in Young America.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co. is making improvements and extensions to its properties. Three miles of new track will be laid and new equipment added; the light and power systems will also be extended and improved.

MARYVILLE, MO.—Arrangements have been made for the installation of an ornamental street-lighting system in the business district. The contract provides for 72 ornamental standards, each carrying five-lamp clusters.

MEXICO, MO.—The Mexico Pwr. Co. has submitted a proposition to the City Council for installing a new street-lighting system. The plan contemplates the use of incandescent lamps instead of the arc lamps now in use. The company proposes to install and maintain 300 lamps in the business district as follows: 8 of 200 cp., 15 of 100 cp. and 16 of 60 cp.; 300 lamps in the residence districts, 15 of 200 cp., 10 of 100 cp. and 275 of 60 cp., at \$5,250 per year (including maintenance, \$2,000) and a 10-year contract; or a contract for 10 years for \$4,750 per year and the renewal of the present franchise for gas, water and lighting.

NEVADA, MO.—The Fort Scott & Nevada Wtr., Lt. & Pwr. Co. contemplates improvements and extensions to its plant and expects to purchase a 500-kw, three-phase, 60-cycle, 2300-volt generator and accessories; poles, wire, meters and supplies for 10-mile extension of pole-lines; 500 desk fans, 12 in., and 14 in. C. E. Hart is general superintendent of the company.

BEAVER CITY, NEB.—At an election held recently the proposition to issue bonds for the construction of a municipal electric-light plant was carried.

KEARNEY, NEB.—The City Council has adopted an ordinance providing for a 25-year franchise for the Kearney Lt. & Pwr. Co. to furnish electricity for lamps and motors in Kearney. A special election will be called on March 11 to submit the proposition to the voters.

LINWOOD, NEB.—The local electric-light plant was destroyed by fire recently, causing a loss of about \$1,000.

EIKO, NEV.—The Lamolle Pwr. Co., Lamolle, has applied to Board of Supervisors for a franchise to erect transmission lines on the streets and alleys of Eiko and for a right of way across the county from Lamolle to Eiko.

WOODSVILLE, N. H.—The electric plant of the Woodsville Aqueduct Co. was badly damaged by fire on Feb. 17, destroying two large generators and switchboards, causing a loss of about \$15,000. At present the village is without electrical service.

ALAMOGORDO, N. M.—George Carl and associates contemplate the installation of an electric-light and power plant here. Transmission lines will be erected to irrigation pumping plants in this section.

TUCUMCARI, N. M.—We are informed that the Tucumcari Lt. & Pwr. Co. does not contemplate enlarging its power plant, as reported in the issue of Feb. 15. The company is negotiating with the city of Tucumcari with a view of pumping the city water, and if contract is secured will inaugurate a 24-hour service. Details have not yet been worked out, but there will be required motor-driven deep-well (350 ft.) pumps, motor-driven fire and service pump, water meter, about 4 in., transformers, etc. S. B. Richey is resident manager.

FREDONIA, N. Y.—The proposition to enter into a contract with the Niagara & Erie Pwr. Co., of Buffalo, N. Y., to operate and maintain the municipal street-lighting system for a period of five years will be submitted to the voters on March 10.

GENEVA, N. Y.—The Council has accepted the proposition of the Central New York Gas & El. Co. for lighting the inner lighting district with five-lamp clusters, the same as now used on Exchange Street. The new system calls for 72 standards. On Exchange Street from the Central tracks to North Street 18 poles will be erected, each carrying a single 60-cp lamp, to cost \$24 each per year. The five-lamp standards will be furnished at \$49.20 per standard per year.

GLENS FALLS, N. Y.—The Alenhead El. Pwr. Co., of Glens Falls, has announced that it will erect another hydroelectric transmission line from its power plant at Spier Falls, extending through Watervale, via Ballston, thus furnishing a new and entirely independent source to the capital district.

MIDDLETOWN, N. Y.—The New York & New Jersey Trust Co. has applied to the Public Service Commission, Second District, for permission to construct a hydroelectric power plant on the Neversink River, about 6 miles southeast of Monticello, and to exercise its franchise in Orange County and the towns of Fallsburg and Thompson. It later intends to operate in Port Jervis, Middletown and other places in Orange County, and in Patterson, Passaic and Newark, N. J. The company also applied for authority to increase its capital stock from \$100,000 to \$5,000,000 and to execute a general mortgage on its assets for a bond issue. The headquarters of the company are located in Middletown.

NEWARK, N. Y.—Several persons will be named by Henry Stebbins, president of the board of trustees of New York State Colonial Asylum, New York, until March 6, for construction of a cold-storage building and a contagious-disease pavilion, including heating, plumbing, electric work and refrigerating and the making apparatus also for employees' building, including heating, plumbing and electric work, at the



**NEW YORK STATE CUSTODIAL ASYLUM, NEWARK, N. Y.** Bids will be received for each division of the work and no combination of bids will be considered. Drawings and specifications may be consulted and blank forms of proposal obtained at the New York State Custodial Asylum, Newark, and at the office of the state architect, Albany. Complete sets of plans and specifications may be obtained upon application to Herman W. Hoefer, state architect, Capitol, Albany.

**NEW YORK, N. Y.**—Sealed bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until March 3 for installing electrical equipment in new Public School 52, on Kelly Street, near St. John's Avenue, borough of the Bronx. Blank forms and specifications may be obtained or seen at the above office.

**SCHOHARIE, N. Y.**—The Middleburg & Schoharie El. Lt., Ht. & Pwr. Co. has been awarded a contract for lighting the streets of the village for a period of five years. The arc lamps now used for street lighting will be replaced with tungsten lamps.

**BURLINGTON, N. C.**—At a special election held recently the proposition to sell the municipal electric-light plant to the Piedmont Trac. Co. was carried. The Piedmont company proposes to take over the local plant and build a large central power plant between this city and Graham, to cost about \$400,000. The proposed plant will supply electricity in Burlington, Graham, Mebane, Haw River, Elon College and Swepsenville. The traction company has already taken over the Graham water and light plant and also the ice plant, which it proposes to increase to a capacity of 30 tons a day.

**FAYETTEVILLE, N. C.**—The Carolina Pwr. & Lt. Co., with headquarters at Raleigh, has notified the City Council that it would like to submit a proposition to light the streets of the city and to furnish electricity for commercial and power purposes in Fayetteville. The company has power plants in Raleigh and at Buchhorn Falls, on Cape Fear River. Charles E. Johnson, of Raleigh, is president of the company.

**TARBORO, N. C.**—The Town Commissioners are considering the question of issuing \$50,000 in bonds for improvements to the municipal electric-light plant and extensions to sewerage system and streets.

**DAWSON, N. D.**—Preparations are being made by J. S. Werner for the installation of an electric-light plant in Dawson.

**JAMESTOWN, N. D.**—The report submitted by the C. L. Pillsbury Co., of Minneapolis, Minn., estimates the cost of the proposed electric-light plant at \$42,500 and that of the distributing system at \$32,500, making a total of \$75,000.

**BROOKVILLE, OHIO.**—The Brookville & Lewisburg Ltg. Co. has been granted permission by the Public Service Commission to issue \$10,000 in bonds, the proceeds to be used for the installation of a lighting plant in Brookville.

**CLEVELAND, OHIO.**—Plans have been announced by F. W. Ballard, engineer of the municipal electric lighting department, for supplying electricity for lamps and motors in the entire central business district of the city. The plans provide for extending the ornamental street-lighting system throughout the entire downtown section; also to supply electricity for commercial lighting and power purposes. About 422 ornamental lamp standards will be erected. A distributing station for the downtown service will be located in one section of the new high-pressure pumping station on Lakeside Avenue, N. E., east of Ninth Street, work on which is already in progress. It is proposed to issue \$500,000 in bonds, of which \$118,000 will be used for the downtown lighting system. The city has closed a contract with the Cleveland Provision Co. to furnish energy from the municipal electric plant to operate its ice plant in the flats.

**COLUMBUS, OHIO.**—Service Director Kinnear will employ a consulting engineer to supervise the construction of the municipal electric-light plant when funds are available through the \$265,000 bond issue, an ordinance for which has been introduced in Council. Through error this item appeared under Cleveland, Ohio, in the issue of Feb. 15.

**FREDERICKTOWN, OHIO.**—The Village Council has granted the Frank Bal El. Co., of Mount Vernon, a franchise to supply electricity for lamps and motors at Fredericktown. Work will begin on erection of the feed line to this village as soon as possible.

**PATASKALA, OHIO.**—The proposition to issue \$40,000 in bonds for improvements to the municipal electric-light plant and water-works system will be submitted to the voters in April. E. Williams is city clerk.

**RAVENNA, OHIO.**—Plans are being prepared for improvements to the water-works system, including the installation of motor-driven centrifugal pump, having a capacity of 2000 gal. per minute, 300-kw turbo-generator, with one mile of transmission line, storage reservoir and filtration plant. The cost of the work is estimated at \$40,000. W. H. Linton is director of service.

**TOLEDO, OHIO.**—The Toledo Trac., Lt. & Pwr. Co. is planning to increase the output of its power plant and expects to purchase a 10,000-kw turbo-generator.

**HINTON, OKLA.**—Bids will be received by the town of Hinton about April 1 for the construction of an electric-light plant and water-works system. Exact date will be announced later. The Benham Engineering Co., of Oklahoma City, has been engaged as consulting and supervising engineer.

**QUINTON, OKLA.**—The Quinton Commercial Club has appointed a committee to investigate the proposition of installing an electric-light plant in Quinton and report to the club.

**TULSA, OKLA.**—The Sand Springs Pwr., Lt. & Wtr. Co., of Sand Springs, recently granted a franchise in Tulsa, will erect a substation on Third Street, to be equipped with Westinghouse switchboard equipment and six 110-kva Westinghouse transformers. Eleven blocks of underground conduits will be built. C. H. Tingley is interested in the company.

**MILTON, ORE.**—The Pacific Lt. & Pwr. Co., of Portland, contemplates extensions and improvements to its substation in Milton, involving an expenditure of \$10,000. Transformers and other machinery will be installed, increasing the capacity of the station from 500 hp to 1000 hp.

**OSWEGO, ORE.**—The Oregon Iron & Steel Co. is extending its power system. The transmission line is being extended 2 miles west of the city.

**PENDLETON, ORE.**—The city of Pendleton has purchased a water-power site and the installation of a municipal light and power plant is under consideration.

**PORTLAND, ORE.**—The Portland Ry. & Lt. Co. will soon begin work on the extension of the Hawthorne Avenue car line through South Mount Taber.

**PORTLAND, ORE.**—The Northwestern El. Co., of Portland, will petition the City Council for a 25-year franchise to operate a heating plant and distributing system for the purpose of furnishing steam heat to the office buildings and department stores in the business district.

**ERIE, PA.**—The Independent Order of B'nai B'rith has purchased 100 acres of land outside of the city of Erie as a site for an orphanage. The present plans provide for the erection of an administration building, an infirmary, hospital, power house and about 15 cottages. Henry Allen Jacobs, architect, 320 Fifth Avenue, New York, N. Y., has been engaged to design the buildings.

**JOHNSTOWN, PA.**—The Dale Lt., Ht. & Pwr. Co. has authorized an increase in its capital stock from \$30,000 to \$150,000. The company was recently granted a franchise to extend its lines into Johnstown. The company, it is understood, will not start work on extension of its lines in Johnstown for some time. W. A. Scanlon is president of the company.

**LACEYVILLE, PA.**—Plans are being considered for the installation of an electric-light plant here. A. L. Vandervort, of Laceyville, is interested in the project.

**NEW BLOOMFIELD, PA.**—The Perry El. Lt., Ht. & Power Co., of Newport, has completed arrangements for taking over the system of the New Bloomfield El. Co., owned by Ralph L. Barnett. The sale includes the distributing system and franchise but not the plant. The Perry company furnishes electrical service in Newport and New Bloomfield.

**PITTSBURGH, PA.**—Application will be made to the State Department at Harrisburg, on March 4, for charters for 13 companies to be known as the Leetsdale, Oakdale, Osburn, East Deer, Corapolis, Edgeworth, Glenfield, Hays, Crescent, Albion, Fawn, Forward, and Harmer Light Companies. The companies will supply electricity for lamps, heat and motors in the townships and boroughs named in Allegheny County. Applications will be made by H. W. Kalberer, A. B. Dampman and W. E. Miller.

**WILMORE, PA.**—The Penn Central Lt. & Pwr. Co., of Altoona, has been awarded the contract for lighting the town of Wilmore. Incandescent lamps will be used for street lighting.

**CENTRAL FALLS, R. I.**—Part of the mill building formerly operated by the Samoset Co. on Broad Street is being equipped with electric-generating machinery, to be used as an auxiliary station for the Black Stone Valley Gas & El. Co. The plant will be driven by water-power.

**PROVIDENCE, R. I.**—Improvements are under way at the Manchester power station of the Rhode Island Co., involving an expenditure of about \$750,000, which will eventually increase the output to about 75,000 hp. The New York New Haven & Hartford R.R. Co., which owns the local traction company, is to erect a separate power plant or make additions to the Manchester Street station, giving the plant an output of 115,000 hp. The plans include the erection of two additions to the present building, 35 ft. by 160 ft. on the north side and 72 ft. by 150 ft. on the west side of the present building, and the installation of two 15,000-kw General Electric steam turbines, contracts for which have already been placed. The railroad company, it is said, is preparing plans for the erection of three power plants—a 115,000-hp plant in Providence, a 66,000-hp plant in Boston and another of similar capacity in New London. H. M. McHenry, of New Haven, is vice-president of the railroad company.

**MCCOLL, S. C.**—The proposition to issue \$60,000 in bonds for the construction of an electric light, water and sewer system will be submitted to the voters.

**HIGHMORE, S. D.**—The City Council has granted the Winckler El. Lt. Co., of Pierre, a 25-year franchise to construct and operate an electric-light system here.

**ARLINGTON, TENN.**—Proposals will be received by the Mayor and Board of Aldermen until March 7 for construction of the following improvements: Water-works improvements—3300 ft. 6-in. cast-iron water pipe, 9560 ft. 2-in. wrought-iron pipe, seven hydrants, three valves, one steel tank and tower, one combination gas engine and pump; alternate bid on steam unit, consisting of boiler-feed pump and heater and deep-well pump. Electric-light department—one small brick power house, one 30-kva generator, one automatic high-speed engine, one switchboard and pole-line construction, consisting of transformers, etc. Plans and



specifications are on file at the office of the city recorder, Arlington, and at the office of R. C. Huston & Co., Memphis Trust Building, engineers, Memphis. Plans and specifications will be mailed upon receipt of \$5 to cover cost. W. A. Taylor is Mayor.

**CHATTANOOGA, TENN.**—We are informed that the Chattanooga & Tennessee River Pwr. Co. does not contemplate the construction of a steam-power plant as reported in the issue of Feb. 22.

**BRYAN, TEX.**—The Bryan College Station Interurban Ry. Co. is building an extension of its electric railway from Bryan to Stone City, a distance of about 6 miles.

**FORT SAM HOUSTON, TEX.**—Proposals will be received at the office of the constructing quartermaster, Fort Sam Houston, Tex., until March 19 for construction of and plumbing, electrical wiring and fixtures in a telephone exchange building at Fort Sam Houston. R. H. Rolfe is constructing quartermaster.

**GALVESTON, TEX.**—The Board of County Commissioners has passed an order authorizing the county auditor to advertise for bids for the installation of five-lamp standards to be erected on both sides of the Seawall Boulevard from the east side of Nineteenth Street to the east side of Twenty-seventh Street.

**GALVESTON, TEX.**—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 22 for the construction of pole line, exterior lighting system, interior wiring system and lighting fixtures for the United States Quarantine Station at Galveston, Tex., in accordance with plans and specifications, copies of which may be obtained at the office of the custodian at Galveston, quarantine station, or at the above office. O. Wenderoth is supervising architect.

**GALVESTON, TEX.**—Proposals will be received by John D. Kelley, city secretary, until March 6 for furnishing f.o.b. Galveston one 20-kw constant-current, 4-amp, 2200-volt primary voltage transformer, together with switchboard, etc., and also one 50-lamp combination transformer and rectifier set for 4-amp series luminous magnetite-arc lamps. Specifications may be seen at the office of the city secretary or at the office of W. D. Masterson, city superintendent of electricity. Bids will also be received at the same time and place for construction complete of an addition to the building now used by the city for the electric-light machinery. Specifications may be seen at the office of the city secretary or at the office of W. D. Masterson, city superintendent of electricity.

**HALETTVILLE, TEX.**—The City Council contemplates the installation of additional machinery and equipment in the municipal electric-light and water-works plant.

**HOUSTON, TEX.**—The County Commissioners have granted the Houston El. Co. a franchise to extend its street-car lines over the Lyons Avenue extension from the city limits to the Houston Harbor addition.

**JACKSBORO, TEX.**—The Jacksboro Ice & Pwr. Co. is installing new engines and other equipment in its electric plant here.

**PEARSALL, TEX.**—The City Council has decided to extend the street-lighting system in Pearsall.

**SALT LAKE CITY, UTAH.**—Being unable to persuade the Utah Lt. & Pwr. Co. to distribute electricity generated by the state power plant in Logan Canyon to the various institutions in Salt Lake City, Judge Le Grand Young, representing the agricultural school at Logan, has applied to the city commission for a separate franchise through the streets of the city.

**SALT LAKE CITY, UTAH.**—The Utah Lt. & Ry. Co. will soon install two 2500-kva Westinghouse generators to be driven by hydraulic turbines manufactured by the S. Morgan Smith Co. These units will be in addition to its present Pioneer power station. A new switchboard and switching equipment will also be installed at this point. An 800-kva Westinghouse generator driven by a hydraulic turbine manufactured by the S. Morgan Smith Co. will also be installed at the Status station. Orders have already been placed for the above equipment. C. A. Cohn is engineer of power stations.

**CHARLOTTESVILLE, VA.**—The power plant of the Charlottesville & Albemarle Ry. Co. was damaged on Feb. 14 by an explosion, causing a loss of about \$15,000.

**FREDERICKSBURG, VA.**—The Fredericksburg Pwr. Co. will enlarge its canal by increasing the width from 40 ft. to 70 ft. and the depth from 6 ft. to 10 ft. The canal is 2 miles long. The company will also construct headgates and four bridges across the canal. Total cost of improvement is estimated at about \$60,000. Cecil L. Reid, resident engineer, has charge of the work.

**CAMAS, WASH.**—The Washington-Oregon Corp. will build a line from Camas to Vancouver; the company also will construct a line from a point near Orchards, Wash., to Olympia, thence to Tacoma.

**NORTH YAKIMA, WASH.**—C. H. Swigart, supervising engineer of the Reclamation Service, has received authority for the expenditure of \$600,000 in the development of Lake Keechelus as a storage reservoir during 1913.

**SPOKANE, WASH.**—The Chicago, Milwaukee & St. Paul Ry. Co., it is reported, contemplates the purchase of the property of the Washington Wtr. Pwr. Co. and using the four power plants to furnish energy to operate the Milwaukee main line between Avery, Idaho, and the Columbia River, which it proposes to equip for electrical operation.

**TACOMA, WASH.**—Nicholas Lawson, commissioner of water and

light, recommends the installation of cluster lamps in the business district to replace arc lamps.

**TACOMA, WASH.**—The City Council has voted to build a municipal street-car line from Eleventh and A Streets over the new Eleventh Street bridge and the tide flats to the city limits at Sitkom Avenue.

**CLAY, W. VA.**—The installation of an electric-light plant in Clay is under consideration. Arthur W. Copenhaver, of Peirson & Copenhaver, is interested in the project.

**CHIPPEWA FALLS, WIS.**—The Chippewa Valley Ry. & Lt. Co., it is reported, has decided to build a new concrete dam across the Chippewa River to replace the wooden structure recently purchased by it from the Chippewa Lumber & Boom Co.

**GREEN LAKE, WIS.**—The village of Green Lake is considering a proposition submitted by O. C. Irwin, of Berlin, to establish an electric-light plant here. If granted a satisfactory franchise Mr. Irwin will establish a plant here.

**SHAWANO, WIS.**—Preliminary surveys have been made for construction of a dam for the municipal electric-light plant. W. E. Wescott is city clerk.

**NANAIMO, B. C., CAN.**—The Vancouver Island Hydro-Electricity Tramway Co. is planning to install a tramway service from Nanaimo to Nanoose and Departure Bay. About 200 miles of road will be built.

**VANCOUVER, B. C., CAN.**—The Canadian Northern Ry. Co. is reported to have acquired the charter of the Chehalis Pwr. Co. and will utilize the power plant to furnish power to operate the branch line to Okanagan. Improvements will be made by the Canadian Northern company, costing about \$400,000.

**VICTORIA, B. C., CAN.**—The Burrard-Westminster Boundary Ry. & Navigation Co. contemplates the construction on electric line between Stave River Falls and Pitt River. Work will be started in May.

**VICTORIA, B. C., CAN.**—The British Columbia El. Ry. Co. has decided to erect a new substation on the Richmond Road near the Royal Jubilee Hospital grounds, for which an appropriation of \$40,000 has been made.

**RIVER GLADE, N. B., CAN.**—Tenders are called by F. Neil Brodie, architect, for the construction of a concrete power house for the Jordan Memorial Sanitarium at River Glade. The plant will eventually supply electricity and heat for the entire institution. The initial installation provides for one generator and boiler. A small incinerator will be installed in connection with the power plant.

**BOWMANVILLE, ONT., CAN.**—Sealed tenders will be received by John Lyle, town clerk, until March 19 for work in connection with a water-works system and a sewerage system for the town as follows: Contract A, (1) laying water mains, (2) laying sewer pipes; B—constructing pump house; C—constructing three reservoirs; D—furnishing iron pipes; E—furnishing hydrants, valves, etc.; G—furnishing electrically operated booster pump; M—laying gravity conduit line about 8 miles long; S—furnishing sewer pipes; X—constructing sewage disposal works. Plans and specifications may be seen at the office of Chipman & Power, engineers, Mail Building, Toronto. S. C. Hillier is Mayor.

**ELORA, ONT., CAN.**—The Council has adopted a resolution to ask the Hydro-Electric Power Commission to submit estimates of cost for furnishing energy to be transmitted from Guelph to Elora.

**HAWKESBURY, ONT., CAN.**—The Riondon Pulp & Paper Co., of Hawkesbury, contemplates developing about 9000 hp on the Rouge River.

**REGINA, SASK., CAN.**—Tenders will be received by the City Commissioner, Regina, Sask., until March 15 for six 500-hp water-tube boilers, complete with mechanical stoppers and internal superheaters for 200-lb. pressure and 125 degrees Fahr.; two 133,000-cu. ft. per minute,  $\frac{3}{4}$  and  $\frac{1}{4}$  houses, induced-draft fans arranged to discharge through one vertical stack 12 ft. in diameter and 70 ft. from base of fans. Equipment to be erected on foundation built by the city. Copies of specifications may be obtained from E. W. Bull, superintendent of light and power, Regina, Sask.

**MATAMORAS, MEX.**—A. B. Cole and B. B. Rentfro, of Brownsville, Tex., have been granted a 50-year franchise to build and operate an electric railway system in Matamoras. They also contemplate the installation of a water-works plant and distributing system.

## New Industrial Companies

**THE AMPERE ELECTRIC COMPANY, INC.**, of Lockport, N. Y., has been incorporated in the State of New York. It is owned and controlled by Charles L. Nichols, 45 Madison Street, Lockport, N. Y. The company is capitalized at \$25,000 and proposes to manufacture autos, auto locks and switches.

**BALL & HEROME**, of Chicago, Ill., has been organized by Albert P. Ball and Herbert Herome, at Chicago, Ill. The company will design and supervise mechanical and electrical installation, develop and design special machinery and electrical apparatus.

**THE COMBINED PROTECTIVE BURGLAR ALARM COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$2,500 to manufacture and install burglar and fire alarm systems. The incorpo-

rators are: John Thorsen, S. E. Smeby, Friederich M. Walter and Alfred C. Anderson.

**THE EDISON STORAGE BATTERY COMPANY**, of West Orange, N. J., has been incorporated with a capital stock of \$10,000 to manufacture electrical apparatus. The incorporators are: Harry F. Miller, William H. Meadowcroft and William G. Roe.

**THE HEWITT ELECTRIC COMPANY**, of New Haven, Conn., has filed a certificate of incorporation with the Secretary of State. The company has offices in New Haven and Torrington. The officers are: R. W. Hewitt, of Torrington, president; H. Fried, of New Haven, secretary, and A. H. Lamb, of Torrington, treasurer.

**THE NATIONAL ELECTRIC BULLETIN CORPORATION** of New York, N. Y., has been incorporated with a capital stock of \$100,000 to manufacture bulletin machines. The incorporators are: John G. Miller, James W. Johnson and Arthur Knowlton, 253 Broadway, New York, N. Y.

**THE RICHARDSON-WAYLAND ELECTRICAL CORPORATION**, of Roanoke, Va., has been incorporated with a capital stock of from \$4,000 to \$10,000. The officers are: J. M. Richardson, president, and W. E. Wayland, secretary and treasurer.

**THE G. E. SCHWAB CHANDELIER COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$15,000 by Graydon E. Schwab, Alfred P. Waters and Willis H. Warnsky. The company proposes to deal in electrical fixtures, chandeliers, etc.

**THE SPRAGUE DEVELOPMENT CORPORATION**, of New York, N. Y., has been incorporated by Charles M. Sprague, Philip W. Allison and Weymer H. Waitt, 165 Broadway, New York. The company is capitalized at \$100,000 and proposes to do a general engineering business.

## New Incorporations

**LAPORTE, IND.**—The Laporte Gas & El. Co. has been incorporated with a capital stock of \$1,000,000 to supply water, light, heat and power in Laporte and other towns and villages. The directors are: William A. Martin, Charles M. Cook, Edward F. Michael, of Laporte; Claud M. Hurd and Benjamin C. Robinson, of Grand Rapids, Mich.

**MONTPELIER, IND.**—The Montpelier Utilities Co. has been incorporated with a capital stock of \$75,000 for the purpose of constructing and operating electric light, power, heat and water systems in Montpelier.

**COVINGTON, KY.**—The Licking River Pwr. Co. has been incorporated with a capital stock of \$5,000 for the purpose of installing an electric-light plant in Covington. James B. Cox is interested in the company.

**FAIRFIELD, MAINE.**—The D. M. Susi Pwr. Co. has been organized with a capital stock of \$10,000 for the purpose of supplying electricity for lamps and motors in the towns of Troy, Unity, Thorndike, Burnham and Freedom. The officers are: G. E. Weeks, of Fairfield, president, and G. E. Libby, of Waterville, treasurer.

**PORTLAND, ORE.**—The North Pacific Gas & El. Co. has been organized with a capital stock of \$1,000,000 for the purpose of supplying water, gas, light, heat and power to towns and corporations in Oregon. The incorporators are: W. W. Seymour, F. C. Brewer, Harvey E. Lounsbury, F. L. Shulb and C. J. Franklin, of Portland.

**OACOMA, S. D.**—The People's Gas, Lt. & Pwr. Co., of Oacoma and Chamberlain, has been incorporated with a capital stock of \$25,000 for the purpose of furnishing the above-named towns with light and power. The incorporators are: Peter B. Dirks, W. R. Tapper, Henry McGrath and George M. Kennedy.

**REMINGTON, VA.**—The Remington Lt. & Ht. Co. has been incorporated with a capital stock of \$5,000. The officers are: J. T. Morton, president; J. R. Culp, vice-president, and W. Ashby, secretary and treasurer, all of Remington.

**CLEVELAND, WIS.**—The Cleveland Lt. & Pwr. Co. has been incorporated with a capital stock of \$5,000 by Charles Lorfield, August Erdman and Charles Wimmer.

**PRAIRIE DU SAC, WIS.**—The Prairie du Sac Lt. & Mill Co. has been incorporated with a capital stock of \$25,000 by C. E. Blake, M. Fitzgerald and J. B. Sanborn.

## Trade Publications

**SYNCHRONISM INDICATOR.**—Bulletin No. 4975 of the General Electric Company deals with synchronism indicators.

**VULCANIZER.**—The Westinghouse electric tire vulcanizer is the subject of a four-page folder entitled "Saving the Tires Without Fire." With this vulcanizer tire repairs are quickly and easily made.

**OIL SWITCHES.**—Oil switches intended primarily for use in small and isolated alternating-current plants of voltage not greater than 3300 are made the subject of Bulletin No. A4001 recently issued by the General Electric Company.

**GUY ANCHORS.**—Matthews guy anchors are the subject of a four-page folder recently issued by W. N. Matthews & Brother, St. Louis, Mo. Some pen-and-ink illustrations accompanied by brief reading matter show the advantages of this appliance.

**INDICATORS.**—The General Electric Company in its Bulletin A4002 describes and illustrates its polyphase maximum-watt-demand indicator, type W. This instrument is suitable for recording the maximum load of alternating-current circuits irrespective of the power-factor and voltage fluctuations.

**GRAPHITE PRODUCTIONS.**—The Joseph Dixon Crucible Company, Jersey City, N. J., has issued a 104-page illustrated catalog showing its interesting comprehensive line of graphite products. The lubricating graphite, automobile greases, belt dressing and other well-known graphite electrical specialties made by the Dixon company are described.

**EXAMINATIONS AND REPORTS.**—The department of examinations and reports of H. M. Byllesby & Company, Chicago, in charge of Mr. Harold Almert, has issued the first of a series of bulletins concerning its work. This service is of interest and value to financiers, public-utility owners, bondholders and others. A picture shows one corner of the extensive law library of H. M. Byllesby & Company. It is said that this library contains not only the laws of every state in relation to public utilities, including state public-utility commissions, but also all important court decisions affecting utility companies.

**BATTERIES FOR AUTOMOBILES.**—The Electric Storage Battery Company, Philadelphia, Pa., has issued a number of booklets of vest-pocket size referring to its "Exide" batteries for automobiles. In one brochure, entitled "It Will Pay Electric Car Owners to Know What Other Users Say About the 'Exide' Batteries," are printed fac-simile letters from satisfied users of these batteries. The sixteen-page booklet bearing the title "Motor Cars and the 'Exide' Batteries" makes brief reference to the "Exide," "Hycap-Exide," "Thin-Exide" and "Ironclad-Exide" batteries for electric vehicles, gas-car starting, lighting and ignition. Some general information on power for cranking automobile engines is given in an eight-page publication issued by this company.

## Business Notes

**THE HOLMES-GUTHMAN COMPANY** has recently established itself in business in Chicago, with headquarters in the Marquette Building. The company will engage in general electrical engineering and construction work.

**DOSSERT & COMPANY.**—The Delta-Star Electric Company, 617-631 West Jackson Boulevard, Chicago, has taken over the agency in Illinois and adjacent territory, including Milwaukee and the States of Indiana and Iowa, for connectors made by Dossert & Company, New York.

**BALL & JEROME.**—Messrs. Albert P. Ball and Benjamin Jerome, of Grand Rapids, Mich., have formed the engineering firm of Ball & Jerome, with offices in the Houseman Building, Grand Rapids. The new firm will design and supervise mechanical and electrical installations, develop and design special machinery, etc.

**THE H. W. JOHNS-MANVILLE COMPANY** has moved its Newark (N. J.) office to 239 Halsey Street, in the heart of the city, where 4000 sq. ft. of floor area affords ample space for the display of its asbestos roofings, packings, pipe coverings, brake lining, automobile accessories, fuses and protective devices, lighting fixtures and other specialties.

**WHITFIELD POWER EQUIPMENT COMPANY**, 1040 Wells Building, Milwaukee, Wis., has been organized by Mr. T. F. Whitfield, who for the past fourteen years has been connected with the Northern Electrical Manufacturing Company at Madison, Wis. The new company will make a specialty of engineering and will install dynamos, motors, engines and boilers.

**THOMPSON-LEVERING COMPANY.**—Owing to the steady increase in its business, the manufacture of electrical measuring instruments, thermometers and scientific apparatus, the Thompson-Levering Company has found it necessary to move to larger quarters. It has moved from 244 Arch Street to 323 Arch Street, Philadelphia, where it has nearly four times the space formerly occupied. As is well known, the company's line of precision instruments is used by many of the leading telephone, public-service and railroad companies and also by many testing engineers and scientific bodies.

**THE SPLITDORF ELECTRICAL COMPANY** will extend its activities by the establishment of a European corps of experts on magnetos, coils and ignition matters in general, with London as headquarters. This organization will be under the supervision of Mr. O. J. Rohde, treasurer and general manager of the company, who sailed on Feb. 20 to undertake this work. Service stations will be established under the charge of practical men. Mr. Rohde's successful experience in systematizing the service stations in New York, which have reached a high degree of perfection, will serve as a basis for the successful operation of similar stations abroad.

**McMEEN & MILLER**, 1454 Monadnock Block, Chicago, Ill., have incorporated under the same name as the former well-known partnership. The personnel of the new firm includes Mr. Samuel G. McMeen and Mr. Kemper B. Miller, partners for ten years, and Mr. Leigh S. Keith, who for a number of years has been associated with the firm as managing engineer. The organization of the company has been increased to include a corps of engineers qualified to undertake the general work of a consulting engineering business and also the more specialized details of economical construction of steam or hydroelectric stations, high-tension transmission lines and overhead and underground distribution systems.



# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Roylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 13-15.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. E. Bowden, Birkbeck Building, Toronto, Ont., Can. Annual convention, Port Arthur, Can., June 23-25.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRIC SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbaugh, 411 South Union St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveloy, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Borell, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERS' SOCIETY. General secretary, I. D. Israel, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. N. Thompson, 1124 Middle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, T. V. Zartman, 120 South Meridian St., Indianapolis, Ind.

INSTITUTE OF HEATING ENGINEERS. Secretary, L. Hamilton, 24 West 39th Street, New York.

INSTITUTE OF RAIL ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meetings, 15 West 42d St., each month.

INTERNATIONAL ASSOCIATION OF ELECTRIC MOTORS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMMERCIAL ELECTRICAL ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month, at Lucas Building.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (International body representing various national electrical engineering societies contributing to its support). General secretary, C. de Meester, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Japier (president), F. E. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 25-26, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Chicago, June, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. E. Russell, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga. Annual meeting, Atlanta, Ga., 1914.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silverstein, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, Mobile City, Miss. Annual meeting, Nashville, Tenn., 21-23.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, Day Union, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW JERSEY SECTION. Secretary, Miss O. A. Bess, 100 Hudson St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTH CAROLINA SECTION. Secretary, N. W. Bledsoe, Person Bldg., State Capitol, Raleigh, N. C.

NATIONAL ELECTRIC LIGHT ASSOCIATION, SOUTH CAROLINA SECTION. Secretary, L. H. Conklin, Spartanburg, S. C.

NATIONAL ELECTRIC LIGHT ASSOCIATION, TEXAS SECTION. Secretary, L. H. Conklin, 141 Main St., Dallas, Tex. Annual meeting, Houston, Tex., 26-27.

NATIONAL ELECTRIC LIGHT ASSOCIATION, VIRGINIA SECTION. Secretary, H. H. Valentine, Janesville, Wis.

NATIONAL ELECTRIC LIGHT ASSOCIATION, WISCONSIN SECTION. Secretary, H. H. Valentine, Janesville, Wis.

NATIONAL ELECTRIC LIGHT ASSOCIATION, WYOMING SECTION. Secretary, H. H. Valentine, Janesville, Wis.

NATIONAL ELECTRIC LIGHT ASSOCIATION, ZEPHYRUS SECTION. Secretary, H. H. Valentine, Janesville, Wis.

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NATIONAL ELECTRIC LIGHT ASSOCIATION, ZEPHYRUS SECTION. Secretary, H. H. Valentine, Janesville, Wis.



NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CARMENERS ASSOCIATION. Secretary, H. H. McKinney, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkeny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.) Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York. General conference, New York, March 4-5.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

## Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 18, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,053,144. ELECTRIC LOCOMOTIVE FOR COAL CARS FOR USE IN MINING; L. E. Armentrout, Borderland, W. Va. App. filed Dec. 17, 1910. Has a reel for winding up the feed cable.
- 1,053,174. PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed July 17, 1911. Lever and gear action.
- 1,053,175. PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed July 17, 1911. Lever, rack and gear action.
- 1,053,177. PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed May 6, 1912. Centrally mounted switch and operating bar.
- 1,053,219. RHEOSTAT; T. Rhodus, Chicago, Ill. App. filed May 10, 1912. Spiral contact and rotating member.
- 1,053,242. RESISTANCE DEVICE; H. G. Thompson, Glen Ridge, N. J. App. filed Nov. 12, 1909. Adjustable device for car-lighting system, etc.
- 1,053,245. ELECTRIC SWITCH; M. E. Turner and R. A. Fulton, East Cleveland and Cleveland, Ohio. App. filed Aug. 6, 1909. Push-button interlocking switches.
- 1,053,266. ELECTROLYTIC CELL; E. O. Barstow, Midland, Mich. App. filed June 15, 1911. Bi-polar electrode of carbon with independent carbon pins.
- 1,053,280. ELECTRIC COOKER; L. G. Copeman, Flint, Mich. App. filed July 28, 1911. Cooking utensil suitable for holding the food when served.
- 1,053,311. SAFETY DEVICE FOR CONTROLLERS; J. F. Miller and W. V. Turner, Edgewood, Pa. App. filed July 8, 1911. Hand-operated device with safety lock.
- 1,053,340. ELECTROMAGNET; A. A. Ziegler, Boston, Mass. App. filed June 6, 1912. Horseshoe type with rotatable armature.
- 1,053,354. LOCKING MECHANISM FOR ELECTRIC LAMP SOCKETS; W. Broad, Beaver Falls, Pa. App. filed March 26, 1912. The lamp can only be removed by breaking the bulb.
- 1,053,362. BOLD SIGNAL SYSTEM; E. R. Cunningham, Des Moines, Ia. App. filed Oct. 7, 1910. Motor-operated semaphores operated by the train.
- 1,053,390. GALVANIC CELL; A. Heil, Frankfort-on-the-Main, Germany. App. filed Jan. 3, 1911. Depolarizing mass of carbon and brown manganese hydrate.
- 1,053,422. COMBINATION METALLIC AND CARBON ELECTRODE HOLDER; G. Hills, Westfield, N. J. App. filed March 2, 1912. For electric welding tool.
- 1,053,430. DETECTOR FOR PARTY-LINE TELEPHONES; J. W. Nilsson, Balfour, N. D. App. filed April 11, 1912. To give a warning on cut-in or cut-out.
- 1,053,484. ELECTRIC CONTROLLER; A. C. Eastwood and J. H. Hall, Cleveland Ohio. App. filed June 20, 1911. For shunt-field-wound motor protection.
- 1,053,489. ELECTRIC SWITCH; H. E. Frost, Cleveland, Ohio. App. filed Jan. 26, 1911. Magnetically operated.
- 1,053,494. CIRCUIT-CONTROLLING SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Nov. 28, 1910. To prevent unintentional restarting of motors.
- 1,053,495. CIRCUIT-CONTROLLING SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Dec. 22, 1910. Magnetically operated switches for varying the current.
- 1,053,496. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed April 25, 1911. The regulator is cut out during acceleration.
- 1,053,497. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed Oct. 30, 1911. Series-parallel motor switches.
- 1,053,498. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed Oct. 30, 1911. Master-controlled switches for series-parallel system.
- 1,053,499. ELECTRIC CONTROL SYSTEM; J. H. Hall, Cleveland, Ohio. App. filed Sept. 26, 1910. Magnetically operated switches for motor control, with reverser.
- 1,053,500. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed July 27, 1911. Reversing electric motors having series fields operating in parallel.
- 1,053,501. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed July 27, 1911. Overload device opens circuit magnetically operated switches.

- 1,053,502. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed June 7, 1911. Prevents operation of the main switch in case a resistance cut-out is closed.
- 1,053,503. ELECTRIC CONTROLLER; J. H. Hall, Cleveland, Ohio. App. filed Oct. 30, 1911. Series-parallel controller governed by relays.
- 1,053,505. GALVANIC CELL; A. Heil, Frankfort-on-the-Main, Germany. App. filed Jan. 3, 1911. Depolarizing mass of manganese dioxide hydrate and carbon.
- 1,053,550. ELECTRIC WATER HEATER; E. M. Wright and R. W. Bents, Ore. App. filed March 25, 1912. Automatic control for soda-fountain heater, etc.
- 1,053,552. ELECTRIC SWITCH; F. Barr, New York, N. Y. App. filed Feb. 15, 1911. Pull-lamp socket with rigid spindle.
- 1,053,553. PULL SOCKET FOR ELECTRIC LAMPS; F. Barr, New York, N. Y. App. filed Aug. 12, 1910. Insulating switch housing.
- 1,053,563. ELECTRIC FURNACE; J. M. Boucse, Lyons, France. App. filed Oct. 8, 1912. Crucible heated by an external electric arc.
- 1,053,581. ELECTRIC PNEUMATIC SWITCH; J. Desmond, Chicago, Ill. App. filed July 17, 1911. Means for adjusting the operating pressure.
- 1,053,584. TRANSMITTER FOR SELECTIVE SIGNALING SYSTEMS; W. Durbin, Brookline, Mass. App. filed May 16, 1910. Train-dispatching telephone apparatus.
- 1,053,606. FUSE; J. B. Johnston, Utica, N. Y. App. filed March 15, 1909. Cartridge type held together by friction.
- 1,053,640. AUTOMATIC CONNECTING PLUG; J. N. Maas, Los Angeles, Cal. App. filed Jan. 19, 1912. Lamp socket plug split longitudinally.
- 1,053,642. CONTROLLER REGULATOR FOR ELECTRIC MOTORS; J. Y. Porter, Detroit, Mich. App. filed Feb. 9, 1912. Compels slow starting.
- 1,053,680. COMPENSATED DYNAMO-ELECTRIC MACHINE; L. Torda, Wilkinsburg, Pa. App. filed Feb. 29, 1908. The coils embrace only alternate main-pole separating spaces.
- 1,053,684. GROUND-JOINT CLAMP; J. C. Vogel, Philadelphia, Pa. App. filed June 22, 1910. Metal strap for connection to gas or water pipe.
- 1,053,693. TRAIN-CONTROL SYSTEM; J. Ames, Montrose, Ia. App. filed Nov. 2, 1911. The track is divided into electrically independent sections.
- 1,053,697. ELECTRIC LAMP SOCKET; F. Barr, New York, N. Y. App. filed Aug. 5, 1911. Pull-switch mechanism, insulation, operating mechanism and lamp contact.
- 1,053,722. STRIKING MECHANISM FOR CLOCKS; B. Z. Friedman, Fort Worth, Tex. App. filed Oct. 3, 1911. Automatic operation and timing device.
- 1,053,743. LAMP-SOCKET SHELL; H. T. Paiste, Philadelphia, Pa. App. filed June 13, 1911. Telescopic interlocking parts.
- 1,053,745. DISTRIBUTING CANOPY FOR ELECTRIC WIRING; J. N. Pierce and F. L. Rancisco, Chicago, Ill. App. filed Oct. 29, 1910. Canopy attached to outlet box.
- 1,053,800. TROLLEY; J. Gosh, Buckland, Conn. App. filed Oct. 20, 1908. For removing ice from the live wire.
- 1,053,830. ELECTROMAGNET TRACK BRAKE FOR RAILWAY CARS; G. G. Kibbee, Forest City, Ia. App. filed Aug. 31, 1912. Magnet support.
- 1,053,864. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; J. Petucky, Prague, Austria-Hungary. App. filed June 24, 1909. Automatic connection and disconnection.
- 1,053,881. COMPOSITION OF MATTER; C. Scott and W. Deats, Yonkers, N. Y. App. filed Sept. 21, 1911. A contact made of intermingled carbon and metal.
- 1,053,899. TRAIN-STOP SYSTEM; J. H. Boom, New York, N. Y. App. filed Jan. 10, 1912. Automatic type with two inter-track conductors.
- 1,053,940. UNIVERSAL MOTOR; J. Burke, Erie, Pa. App. filed Sept. 9, 1909. Operates either on single-phase alternating current or direct current; variable speed and reversible.
- 1,053,946. SYNCHRONIZING DEVICE; L. Gaumont, Paris, France. App. filed Dec. 2, 1909. Automatic control of talking pictures.
- 1,533 (reissue). TELEPHONE TRANSMITTER; F. Gottschalk, Stirling, N. J. App. filed Nov. 26, 1912. Diaphragm mounted in the entrance to the mouthpiece. Original patent No. 977,616, dated Dec. 6, 1910.

# Electrical World

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No. 10

## For Greater Progress!

To make two kilowatts grow where only one grew before is, in the fewest possible words, the purpose of the Society for Electrical Development, whose inaugural sessions we report at length this week. It is characteristic of the spirit responsible for American industrial growth that the electrical industry should not be satisfied to double upon itself every five years, but should get together in an effort to make its growth at the rate of 100 per cent every two and one-half years—or less! It was evident throughout Tuesday's and Wednesday's sessions that the society has within itself the ideas backed by the determination and resources necessary to accomplish great good. As a means for the correlation and acceleration of all forces now working for electrical progress; for carrying the gospel of electricity to all the people; for inculcating sound ideas on questions of public policy; for the education from within of every department of the industry in its greater opportunities; for the elimination of the unhealthy practices which have mainly developed in distribution, and for getting everybody to work, the society has not merely justified its existence; it has shown even in the first hours of its birth the promise of a giant's strength.

## Electrical Exports for November

The figures of electrical export for November, 1912, would indicate a maintenance of the tendency to expansion of foreign trade. The total given for the month is \$2,270,553, as compared with \$1,679,566 in November, 1911. The totals for the eleven months of the last three years range as follows: 1910, \$15,528,304; 1911, \$17,276,323, and 1912, \$21,026,549. Here is evidence of a marked gain which the figures for December should only accentuate. As has been remarked already in these columns, the details of the statistics are not such as to help one in useful comment or criticism, but after a time the new data in the new shape may render the reports from the Bureau of Foreign and Domestic Commerce valuable. Still, when one-half of the total is merged in "all others," it is hard to offer any opinion that would be of much weight as to the relative importance of various branches or the unsuspected opportunities that might lurk in business still to be worked up from an undeveloped state. The month's importation of arc lamps is given as 270, with a value of \$3,957. The number of incandescent lamps, carbon type, was 352,110, valued at \$20,579, and of metal-filament lamps 312,146, valued at \$23,926. There are no figures of comparison with previous months nor with previous years; but for the eleven months of the year the importation of arc lamps was 1015, valued at \$16,088; of carbon-filament lamps, 796,562, valued at \$52,666, and of metal-filament lamps, 1,505,782, valued at

\$136,755. Those prices look pretty low, especially for the metallic-filament lamps, but may herald the glad time of lower cost of living electrically when the new President and the new Congress get through with the tariff.

## A Railway's Electrical School

Several years ago the Pennsylvania Railroad Company began planting trees from which the road's supply of ties might be drawn in years to come. Following the same wise policy of prevision, this company has established a correspondence electrical school to train the men from whom it will draw the crews for its electric trains and the workers who will be responsible for the shop maintenance of these trains. It would be hard to find evidence more suggestive than this of the imminence of the day when, in the opinion of the officers of one of our most progressive transportation systems, electrification will spread far beyond terminal districts and supplant the steam locomotive in trunk-line operation. Sooner than many even of the electrical fraternity realize, electric trains will be running between New York and Washington, D. C. It is because the railroad does realize this that it is planning to educate its present employees—not those of the next decade—in at least the fundamentals of electrical engineering. Meanwhile there are so many uses of electricity on roadway and train and in shops that, whatever else a railway man is, he should be something of an electrician and familiar with things electrical. Looking at it, then, either as a sign of the near approach of the long-prophesied era of steam railway electrification or as significant of the progress already made by electricity in steam railroading, the establishment of the Pennsylvania's school is an incident from which the imagination can easily draw a mental picture of the time when electricity will be doing as much in the heavy transportation work of the world as it is now doing in other major departments of industry.

## Sleet Loads on Overhead Wires

A note in another column in reference to data concerning sleet loads gathered from the results of a storm in Ohio adds to the rather meager information on the subject. Sleet storms do not occur with great frequency, and opportunities for securing accurate data are not numerous. Moreover, the period for observation is usually short, because the sleet seldom remains for many days. The opportunities for useful research in this field are very large and we encourage engineers to take it up. The only expensive equipment needed is a good camera; for the rest a tape line, a wire gage and a notebook are the chief essentials. The conclusion reached by Mr. W. R. King, that the

accumulation of sleet can be said to be a function of the wire diameter, seems to us to require further investigation and corroboration. In the first place his formula takes no account of the total sleet precipitation on a horizontal plane, which is no more the same in two different storms than the rainfalls in two cases would necessarily be alike. Moreover, the precipitation during any given storm varies at different places, and the critical temperature at which sleet forms is not likely to exist simultaneously over wide areas. It seems logical that the total precipitation, at least, should appear in the formula. Mr. F. F. Fowle some years ago deduced a theoretical formula showing that the radial thickness of sleet accumulation on a cylindrical wire would be at the most 32 per cent of the precipitation, but this needs experimental verification. In fact, the whole subject needs careful investigation.

### Energy Transmission for Pyrenees Railway

We give a brief account this week of a plant for railway electrification in the French Pyrénées which includes some rather unusual features. The line is part of the system of the Southern Railway and is a standard-gage third-rail installation worked at about 850 volts. The road is 35 miles long, terminating near the Spanish frontier, and is characteristically a mountain road, crossing a pass in its course at an altitude of more than 5000 ft. and having maximum grades as high as 6 per cent. The generating plant at La Cassagne has a very unusual equipment in that its generating units are double-current machines feeding direct-current energy to a section of the railway directly from the commutators and also delivering three-phase energy for transmission to converter stations along the line. These generators are eight-pole machines of 650-kw rating, each directly coupled to a 1500-hp Pelton wheel through an elastic clutch. The generators are compound-wound for 850 volts on the direct-current side, and have six collector rings for the three-phase transmission at the other end of the bar-wound armature. The three-phase voltage is approximately 600, and the output of each machine is received directly on a three-phase transformer which delivers it to the line at 20,000 volts. There are five substations for delivering direct-current energy at 850 volts. Each station contains a three-phase synchronous converter receiving energy at 600 volts from a three-phase transformer. These rotaries are started as direct-current motors from the third-rail.

The transmission line is worth at least a moment's consideration because it is for the most part on pine poles treated with copper sulphate as a preservative, while the cross-arms are of creosoted oak. The only portion of the line which is not thus constructed is built of concrete poles. The use of the double-current generators has been comparatively seldom tried, although suggested a good many years ago. It is to be noted that in this instance the generators are of the interpole type, which steadies the commutation to an extent which evidently clears away many of the difficulties previously met. The commutating pole has proved itself a good thing for many purposes, of which the present example is by no means the least important.

### The Acetylene-Electric Flame

It has long been known that flames are affected by both magnetic and electric fields. The actions which take place in a flame when subjected to an electric field are necessarily very complex, so that our knowledge of the effects produced has been very limited and superficial. In the article which we print this week Mr. C. F. Lorenz presents some interesting new experimental observations and deductions concerning fuel flames in general, and acetylene flames in particular, when subjected to an electrostatic field. Among other things, the increase in luminosity in an electrified flame is a curious and significant phenomenon.

Altogether apart from the question as to whether practical use can be made of the increase of luminosity for lighting, the possibilities of using such increase for the purposes of photographic measurement are suggested by the article. Oscillographs are instruments employed to record the variations of rapidly pulsating or alternating electric currents. They ordinarily employ mechanical vibrating systems of very high natural frequency. When the frequency of the alternating currents to be recorded approaches or passes the natural frequency of the oscillographic vibrator, the apparatus becomes unserviceable. Flames, on the other hand, are almost devoid of inertia, and oscillations might possibly be recorded by them at frequencies beyond those at which the ordinary oscillographs fail.

### A Prussian Transmission Network

In the *Digest* this week will be found a suggestive report on a recent project of the Prussian government in the utilization of its water-powers. The region involved is one in the vicinity of Cassel and covers an area more than 60 miles in length and of two-thirds that width. Primarily the network utilizes the water-powers on the Weser. The project includes the complete supply of electrical energy to the territory mentioned from three large hydraulic stations united by a 40,000-volt transmission system, which is connected into a 40,000-volt distribution network with nearly a score of transformer stations reducing the pressure to 6000 volts for the secondary distribution.

From the hydraulic standpoint the proposition presents some difficulties inasmuch as provision at two of the three stations has to be made for large variations in head—in one case by providing turbines of special design to work on a head varying from 22 m to 41 m; in the other case by the more desperate resort of providing two sets of turbines, one for work under normal ranges of head, the other to deal with cases of extreme high water. In addition to these hydraulic stations, steam reserve is obtained at the municipal electricity works in Cassel and Göttingen, forming thus a fairly typical distribution network, with three hydraulic and two steam stations available, and deliberately designed from the start completely to cover a large territory. The project has involved considerable difficulty in working out the details on an economical basis. The complete cost of the installation runs close to \$2,500,000. Financially the project had to be considered on the basis of the result, on this investment, of various possibilities of output combined with various degrees of completeness in



the initial plan. It turned out, as it usually does in such cases, that the indications favored the carrying out of the complete scheme. It is the complete undertaking, therefore, that the Prussian government is now backing, the first time that it has gone into an operation of this kind on anything like so extensive a scale. It means the general supply of electricity to a large and important territory by the organization of just such a network as has become familiar in American practice.

It is interesting to note that the project is based on a classified system of rates for various kinds of service, the list prices varying from about 3.5 cents to about 10 cents per kw-hr., the highest figure being reached for private lighting and the lowest for certain classes of motor service. The whole affair is a striking example of the far-sightedness of the Prussian government in looking after the material prosperity of its citizens, and particularly in standing behind the progress of industry even to the extent, as in this instance, of taking an exceptionally long stride in advance toward the organization of a general public distribution of electrical energy. Whether or not it will prove more advantageous than a privately owned and operated system only experience extending over several years can determine.

### Standardization by the A. I. E. E.

With the rapid progress of electrical engineering, it has recently become manifest that the Standardization Rules of the American Institute of Electrical Engineers were lagging behind the vanguard. It was therefore decided that the best way to start a revision of the rules was to have a number of papers presented for discussion on proposed changes, so as to elicit all opinions and points of view. Forty-six papers were prepared, and printed in advance, in the February A. I. E. E. *Proceedings*, making a volume of nearly 700 pages. These papers were all presented and were fully discussed in three successive days, eight sessions in all being held.

The attendance at the convention was good, and the discussions were very effective. The subjects which, perhaps, attracted the greatest attention and interest were the subcommittee papers on temperatures and ratings of machinery. According to the existing Standardization Rules, the temperature of machines for continuous operation should not rise by more than 50 deg. C., under continued load, above that of a room at 25 deg. C., but should still have a margin of 15 deg. C. extra rise under two hours of overload. In the proposed new rules overload thermal capacities are not recognized. Continuous rated load is the only criterion offered for continuous-service machines. The rise of temperature of such machines is not to exceed 50 deg. C., with no correction for ambient or room temperature, provided that the latter does not exceed 40 deg. C.

The proposed new rule starts with the consideration that if treated fibrous insulation—or Class A insulation, as it is called—of cotton, treated cloth or paper is not allowed to attain the normal boiling point of water, or 100 deg. C., it will have a satisfactorily long working life. For example, the mummy cloths of ancient Egypt are sometimes found in very fair mechanical condition. Of course, mummy cloths

are not subjected to a temperature of 100 deg. nor to the mechanical and electrical stresses of modern dynamo-electric machinery. Above the temperature of 100 deg. C., or 373 deg. absolute, fibrous insulations speedily degenerate, and at 125 deg. C. they probably lose their mechanical strength in a few months. Consequently, the primary requirement is not as to any particular permissible temperature rise under load, but that the maximum actual temperature shall not exceed 100 deg. C.

Even in cases where the hottest outside spot of the insulation can be identified and reached by a thermometer, the corresponding inside wall of the insulation at this point is likely to be still hotter, and it is difficult to say precisely how much hotter. It was, therefore, suggested in the subcommittee papers that 10 deg. C. margin should be allowed on fibrous insulation for the unmeasurable internal gradient, and that the highest temperature to be allowed by conventional measurements at any accessible place in a winding should be 90 deg. C. Allowing for a room temperature as high as 40 deg. C., this represents a maximum permissible temperature elevation of 50 deg. C. in the hottest spot accessible from the outside. If the room temperature should be, say, 25 deg. C., this would imply a safe margin of 15 deg. C., but no change in the rating of the machine should be made on that account.

The suggestion of ultimate temperature rating without reference to overloads seemed to meet with general approval. Differences of opinion were indicated, however, on two matters of detail—first, as to whether 90 deg. C. at the hottest outside accessible spot was the desirable limit to set, and, second, as to whether the same temperature limit should be set on converters as on generators, owing to the great differences in their respective overload demands in actual service. As regards the first point, it would, of course, be possible to select, say, 85 deg. C., as the highest temperature at the hottest outside accessible spot. If, however, the room temperature or ambient temperature of the machine may include 40 deg. C., then the rise of temperature would be limited to 45 deg. C., no matter whether the temperature in the testing room happened to be 25 deg. or 15 deg. C. This would mean that a number of machines which have been placed in steady, satisfactory service up to the present time would have to be derated and cut down in load, in order to come within the new rule thus amended. As regards the second point, it is true that in actual service some types of continuous-service machines have to be allowed upon for a much greater range of overload than others. Thus, while in some cases a 1000-kw machine may never be expected to supply any except momentary maximums, in other cases, a 1000-kw machine may have to carry full load for several hours. This is a matter for special inquiry in each case. Neither the range nor the amount of intermittent loads is inherently predictable. It seems therefore desirable that continuous-service machines should be selected for specific duty according to their ambient rating. If a machine ordinarily required for 1000 kw was found to give 1500 kw, then its conventional rating, according to the proposed new rule, might have to be as high in some cases as 1500 kw. In other words, the purchasing engineer should provide for expected excesses or irregularities of service.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Convention of Association of Edison Illuminating Companies

The next convention of the Association of Edison Illuminating Companies will be held at the Otesaga Hotel, Cooperstown, N. Y., on Sept. 8, 9, 10 and 11. The hotel is situated on Otsego Lake and is readily accessible by rail as well as by automobile through the Catskill Mountains. The president of the association is Mr. Arthur Williams and the secretary Mr. George C. Holberton, San Francisco, Cal.

### Electrophysics Meeting, A. I. E. E.

A meeting of the American Institute of Electrical Engineers will be held under the auspices of the electrophysics committee in the Engineering Societies Building, New York, on March 14, at 8:15 p. m. Two papers will be presented, one on "Air as an Insulator When in the Presence of Insulating Bodies of Higher Specific Inductive Capacity," by Messrs. C. L. Fortescue and S. W. Farnsworth, and another on "The Application of a Theorem of Electrostatics to Insulation Problems," by Mr. C. L. Fortescue. The usual smoker will be held at the close of the technical session.

### Industrial Lighting

At a co-operative meeting to be held in the Engineering Societies Building on the evening of March 13 the following persons as representatives of the societies indicated will present papers dealing with the general subject of industrial lighting: Dr. A. M. Alger, of the committee for the prevention of blindness and the New York Association for the Blind, on "Eye Strain and Light"; Dr. W. H. Tolman, of the American Museum of Safety, on "Mechanical Safety," and Mr. Ward Harrison, of the Illuminating Engineering Society, on "Industrial Lighting." The American Society of Mechanical Engineers will also be represented. Preceding the meeting members of the various societies will attend an informal dinner at Keen's Chop House, in accordance with the usual custom of the New York Section of the Illuminating Engineering Society.

### Pennsylvania Railroad Electrical School

A free course of correspondence study in electrical engineering and associated subjects has been inaugurated by the Pennsylvania Railroad under the supervision of Mr. J. C. Johnson, superintendent of telegraphs. Although the plan was announced a little more than a month ago, the school already has more than 10,000 students enrolled. Use will be made of a series of instruction papers in pamphlet form, each covering a different field, and the course will include elementary work on direct-current and alternating-current circuits and apparatus; mathematics, mechanical and geometrical drawing; magnetism and its application to electric generators, motors, measuring instruments, telegraph, telephone, signal, lighting, traction and general electrical equipment; every-day troubles developing in each type of apparatus, and methods of locating and overcoming them.

Besides providing a means for the education of its employees in existing applications of electricity, it is understood that the company has adopted this method of training the largest possible number of its men to assume the duties that will devolve upon them when electric traction is substituted for steam-locomotive haulage. Students are invited to ask questions, and a course of supplementary reading of textbooks and periodicals is recommended. The first textbook in the educational course deals with elementary arithmetic. It will be followed by pamphlets on primary cells and direct current. Fourteen of these pamphlets, concluding with electric traction and power-plant design and apparatus, will complete the series.

### Maine Association's Midwinter Meeting

The midwinter meeting of the Maine Electric Association was held at Riverton, Me., Feb. 24, with an attendance of nearly 100 members present. At the business session which preceded the dinner it was voted to include street-railway and telephone companies in the membership of the association.

Mr. Henry B. Ivers, general manager of the Cumberland County Power & Light Company, of Portland, introduced as the toastmaster for the evening Hon. W. M. Bradley. Following a brief address by Mayor Curtis of Portland, Mr. John R. Graham, chairman of the executive committee of the Cumberland County company and president of the Bangor Railway & Electric Company, in his address described the development of the electrical properties with which he is connected in Maine. The session closed with a short talk by Mr. A. W. Jordan, of the street-lighting committee of the Portland City Council.

### Electrical Progress in Buenos Aires

Reporting to his home government, a British consul gives some recent information of interest about the progressiveness of Buenos Aires. He says that underground railways are about to take the place of the surface lines common to almost every street in the Argentine metropolis. The Anglo-Argentine Tramway Company has been entrusted with the preparation of plans for a tube railway from the Plaza de Mayo to the suburb of Palermo. British capital is conspicuously represented in large enterprises in Buenos Aires, but the new underground railway running under the Avenida de Mayo has been built by a German concern and will be opened to traffic shortly. According to the local newspapers, a syndicate of British, French, Belgian and American bankers has formulated a project for the building of an electric-service system in Buenos Aires for supplying electricity at rates considerably lower than those at present prevailing. A concession has been applied for which, if granted, will bring the German monopoly of the supply of electricity in Buenos Aires to an end. The proposed contract stipulates that the plant shall become the property of the government at the end of 1957. Italian financiers are also said to be endeavoring to obtain a similar concession. However, the German company, having its mains extended to every part of the city, is firmly established.

### A. I. E. E. Pittsburgh Meeting

A meeting of the American Institute of Electrical Engineers will be held in Pittsburgh on Friday and Saturday, April 18 and 19, under the auspices of the new committee on the use of electricity in mines, of which Mr. George R. Wood, consulting engineer of the Berwind-White Coal Mine Company, is chairman. A number of interesting papers covering the various phases of this subject have been promised, and it is expected that an interesting discussion will take place.

Owing to the location of the meeting place in the heart of the bituminous coal-mining district, a large number of coal-mine papers will be presented. The Institute headquarters during the meeting will be at the Fort Pitt Hotel, where the sessions will be held.

### Electrical Projects for New South Wales

Among the schemes under consideration by the officers of the Public Works Department, New South Wales, is a project for generating electrical energy at one of the coal fields in the southern part of the state for delivery to the populated areas not now served by the Sydney City Council. They are also considering the establishment of electro-chemical industries for the manufacture of calcium carbide, cyanamide and caustic soda. At present the government has a timber depot and brick works in the vicinity of Uhr's Point, and the public works committee will be asked to consider an appropriation of \$250,000 for an electric generating plant at that point to supply energy to the state enterprises. It is probable that the plant, if authorized, will be of a temporary character.

It is estimated that the demand for electrical energy by the state enterprises and by the municipalities and private enterprises in the southern area will be so great that it will be imperative for the government to take the matter in hand. The scheme just mentioned provides for the joint utilization of the state coal and water-power resources through the establishment of a generating station in each of the important coal fields and upon those streams which may be depended on to provide sufficient power to justify their commercial development. It has been proposed that the scheme be launched with the initial establishment of a large plant at some convenient point on the southern coal field, either at Picton or Wollongong. The general plan contemplates that this station would eventually be linked by transmission lines with stations at Burrinjuck, on the Shoalhaven River, and in the other coal fields. Towns along the routes of the transmission system or within reasonable distance would be supplied with service.

### Niagara Power Companies Allowed 4000 Cu. Ft. per Second Addition

The full quota of 20,000 cu. ft. of water per second from Niagara Falls, which is the amount stipulated by the treaty of 1911, is now made available for the American power companies by the withdrawal of the extension to the Burton act made by Senator Burton himself on March 4. The Burton law, which has been in force several years, limited the diversion of water from Niagara to 16,000 cu. ft. per second on the American side. The international treaty later increased this amount to 20,000 cu. ft. per second, but the Burton law precluded the use of this full quantity. On March 2 the House of Representatives passed an extension to the act prolonging its tenure to March 4, 1914. In the Senate next day the resolution was withdrawn by Senator Burton, thus killing the bill and removing restrictions concerning both the water-power

developed by the American plants and the amount to be imported from the Canadian side. It is understood that the power companies will at once take advantage of the increased flow available.

### Baltimore Contractors Guests of Consolidated Company

The Consolidated Gas, Electric Light & Power Company of Baltimore, Md., tendered the electrical contractors of the city a banquet Feb. 28 at the Hotel Belvedere. This dinner, at which covers were laid for 100, was the first of a series which is planned by the central-station company of Baltimore for the local contractors. Owing to the illness of Mr. Douglass Burnett, Mr. R. F. Bonsall, of the Consolidated company, acted as toastmaster, the speakers and their subjects being as follows: Mr. W. D. Young, of the Electro-Mechanical Company, "The Baltimore Contractor;" Mr. Herbert Wagner, vice-president of the Consolidated Company, "The Consolidated Gas, Electric Light & Power Company;" Mr. Melvin H. Jones, Maryland statesman of the Jovian Order, "The Co-operative Movement;" Mr. Washington De Vereaux, of Philadelphia, "The Philadelphia Underwriters;" Mr. Joseph C. Forsythe, of New York, "The New York Underwriters;" Mr. B. L. Cates, of Philadelphia, "The National Contractor;" Mr. William J. Flannery, of the Baltimore Electrical Supply Company, "The Supply Man." After the banquet the diners were entertained by a vaudeville performance.

### New York Subway Operating Contracts

The Public Service Commission of the First District of New York on March 4, 1913, approved the contracts with the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company for the operation of the dual subway system. The agreement provides that the city shall construct the new lines, the company to contribute not less than \$58,000,000 (or one-half the total) toward construction, and not less than \$22,000,000 toward equipment. The company is to get a lease of all lines for operation, including the present subway and the new lines, for a term of forty-nine years from Jan. 1, 1917, and the lease is to expire at midnight on Dec. 31, 1965. The city reserves the right to take over any or all of the lines at any time after ten years and terminate the contract. Provision is made in the contract for the temporary operation of parts of the system as soon as they are completed.

### The Work of the Underwriters' Laboratories

Mr. William H. Merrill, manager of the Underwriters' Laboratories and past-president of the National Fire Protection Association, addressed the Electric Club of Chicago on Feb. 27. He mentioned the fact that the annual fire loss of the United States reaches the appalling sum of \$250,000,000. It is not only "good business" but a patriotic duty to reduce this sum, for in fact everybody pays a proportion of this tax. Mr. Merrill, discussing the work of the Underwriters' Laboratories, the headquarters of which are in Chicago, said that from 15 to 20 per cent of the work is of an electrical nature. The underwriters and the men representing the various electrical societies and industries have co-operated harmoniously, in the main, and one result of their work is seen in the National Electrical Code. The rules set forth in this book are probably enforced to a greater extent than any other set of engineering specifications.

The speaker gave some attention to the labeling system



in vogue at the laboratories. These labels mean that the products to which they are attached have been manufactured in compliance with the specifications of the Underwriters' Laboratories. The manufacturer may also put out what may be termed "culls," but these will not bear the underwriters' label.

In relation to rubber-covered wire, the engineers of the laboratories are attempting a more elaborate work, endeavoring to ascertain the service value of the material in addition to certifying that it has been manufactured in compliance with standard specifications. Samples of wire used in actual installations are taken out and tested, and monthly bulletins giving reports of the results are mailed to thirty-five manufacturers. These manufacturers are marked as to merits and demerits according to the results of these tests in the field. However, identifying numbers or symbols are adopted which are known only to the individual manufacturer and to the laboratories, so that the results of the tests are not given by name but rather by the secret method of identification adopted. Ultimately it is hoped that the whole label service of the Underwriters' Laboratories will serve as a certificate that there is a certain service value in the material bearing the label, in addition to the fact now certified; that is, that the material has complied with certain specifications.

### Increase in the Use of Electrical Energy in Northern Indiana

More than \$750,000 is to be expended on the steam-driven electrical generating plant which is being erected at East Chicago, Ind., by the Northern Indiana Gas & Electric Company of Hammond, Ind. Construction operations have been in progress since the early part of December, and the steel work and radial-brick stack are well under way. This station is being constructed to meet the rapidly increasing demand for electrical energy from the cities and towns of northern Indiana. Since 1911 there has been an increase of 60 per cent in the electrical business of the Northern Indiana Gas & Electric Company, owing to the growth of industries in Hammond, Gary, Indiana Harbor, East Chicago, Whiting, Michigan City and other cities and towns. From this spectacular increase in the demand for electricity and from the number of industrial works which have sprung up, Manager W. D. Ray predicts that this portion of Indiana will prove a second Pittsburgh region.

The power plant will be situated at the intersection of the Calumet River and the government canal, so that it will have plenty of water for condensing purposes. It has been designed for an ultimate output of 30,000 kw, but only two 5000-kw, 60-cycle, three-phase Westinghouse generating units will be installed at first. They will be driven by two Westinghouse-Parsons steam turbines running at 3600 r.p.m. Heine boilers and Westinghouse surface condensers will constitute part of the steam equipment used.

Electricity will be generated at 11,000 volts and transmitted to the steel mills and other factories in the neighboring towns without the use of intermediate transformers except for lighting. Electricity for lighting will be stepped down through 11,000-2300-volt transformers before being sent out on the lines.

At present there is a 33,000-volt, three-phase trunk line, with an overhead ground wire running from the company's generating station at Hammond to Michigan City, a distance of 35 miles. This line supplies small towns on either side of the right-of-way. In the spring it is the intention of the company to erect wooden-pole lines extending from the new plant at East Chicago to Dyer, Griffith, Highland and New Chicago.

Several of the larger steel manufacturers using electrical energy supplied by the Northern Indiana company are already operating night and day, and special inducements,

such as off-peak rates, will be offered to the other industrial concerns to bring the night load up to the day load. According to the specifications, one of the new 5000-kw units to be installed at East Chicago will be in operation about May 1, 1913.

### The Electric Vehicle at Boston

At a meeting of the Electric Motor Car Club of Boston, Feb. 27, an extended discussion of the forthcoming electric-vehicle publicity campaign took place. Plans are being made for the concentration of advertising efforts under appropriations covering several months' work instead of the former policy of carrying separate displays in scattered locations.

Special efforts will be made to place pleasure-car advertisements on pages of the daily press devoted to social interests, while commercial-vehicle publicity is to be carried close to the financial pages. Mr. C. D. Marsh, New York, and Mr. O. G. Draper, business secretary of the club, emphasized the importance of "boosting" the electric vehicle without "knocking" gasoline competitors' machines. Each type, they declared, has its own field of economical service. The club's meetings in the near future will be addressed by speakers capable of bringing out actual experiences with the electric vehicle.

A campaign is also afoot to increase the membership of the organization among users of trucks and pleasure cars of this type. Public electric garages are being informed about the club and its work. A booklet of twenty-two pages has just been published listing the members and outlining what has been done at Boston in the past two years to introduce the electric vehicle. There are now 401 passenger and 240 commercial electric vehicles in service in eastern Massachusetts, excluding Worcester. The club has over 100 members, a permanent paid secretary with headquarters at 39 Boylston Street, Boston, and committees working on civic relations, rates, garages and other problems of interest to the industry.

In addition to the work already accomplished the plans of the club include the establishment of a bureau for motor-truck drivers, a bureau of information which will record data upon the details of electric cars, their mechanical construction and other points of service to electric-car owners, the establishment of a theater-district electric garage in Boston and the arrangement of New England tours and mapping of charging stations in the territory.

### Ice Coating on Overhead Conductors

As a result of observations made upon ice-coated wires after a sleet storm at Portland, Ore., on Jan. 16, 1912, which brought down from 500 to 700 miles of live wire and caused the loss of from 300 to 500 poles, Mr. William R. King, consulting engineer, Portland, has arrived at the following conclusions:

Whether merely a coincidence or an exemplification of some unrecognized law cannot be definitely stated, but it is evident that some definite relation exists between the cross-sectional area of the original wire and that of the combined areas of the wire and its ice covering when the latter has been corrected for breakage and deformation. The combined areas seem to vary approximately as the square root of the diameter of the original wire.

Thus, where  $A$  represents the combined cross-sectional area of ice and wire in square inches,  $d$  the diameter of the supporting wire in inches and  $K$  a constant, we have  $A = K \sqrt{d}$ . The value of  $K$  was found to vary between the limits 2.640 and 2.357.

At the termination of the Portland ice storm the actual ice load carried by the wires was in close agreement with

the maximum coating, "0.5 in. thick all around the wire," assumed by the committee on overhead-line construction of the National Electric Light Association. The meteorological conditions which obtained throughout the Portland storm, although not usual, were certainly not unique. Mr. King argues that, in the light of the above data, it would appear that the maximum loading assumed by this committee may possibly be too small to provide an adequate factor of safety.

### An Electric-Service Decoration

Decorative insignia to mark length of service of employees are something of a novelty among central-station companies, but the idea has been taken up by the Commonwealth Edison Company of Chicago. This company on the first of the year distributed to 935 of its employees a service badge in the form of a gold pin, which may be worn as a mark of distinction. The badge is awarded only to those who have been in the service of the company for five years or longer and, subject to that condition, is given to all employees without distinction. It is in the shape of an oval button,  $\frac{3}{4}$  in. wide and not quite  $\frac{1}{2}$  in. high, and bears the legend "Commonwealth Edison Service," the center portion consisting of a relief representation of an incandescent lamp with rays surrounding it.

The plain badge indicates a term of service of at least five years and not exceeding ten years. Additional five-



COMMONWEALTH EDISON BADGE

year periods of service are indicated as follows: Ten years, one blue enamel star; fifteen years, two stars; twenty years, three stars; twenty-five years, four stars; thirty years, three stars and one ruby; thirty-five years, two stars and two rubies; forty years, one star and three rubies; forty-five years, four rubies. The completion of fifty years of service will be marked by four rubies and one diamond. The matter of preparing and distributing these badges has been assigned to the service annuity committee, which as soon as practicable after the first of January and of July of each year will attend to the distribution of new badges and to the addition of stars and jewels to old ones.

The badges were sent out to the employees with a letter from President Samuel Insull, in which he said that he hoped the recipients would have the same feeling of pleasure and pride in wearing the badges as he had in presenting them. On the back of each badge is the owner's name with the date when he or she entered the service.

### Settlement of Mercury-Vapor Lamp and Rectifier Litigation

The patent controversies which have been pending for many years between the Cooper Hewitt Electric, the General Electric and the Westinghouse Electric & Manufacturing companies with reference to mercury rectifiers and mercury-vapor lamps have been brought to a conclusion by an exchange of licenses under the patents of Dr. Peter Cooper Hewitt, Ezechiel Weintraub, Percy H. Thomas, C. P. Steinmetz, and others. Both the Westinghouse Electric & Manufacturing Company and the General Electric Company have been licensed to manufacture mercury rectifiers. At the same time an exchange of licenses has been effected between the General Electric Company and the Cooper Hewitt Electric Company with reference to mercury-vapor lamps of all types so that such lamps, which are formally known as Cooper Hewitt lamps, may be manufactured by each of these two companies.

### National Independent Telephone Convention at Chicago

A resolution that the National Independent Telephone Association favor vesting in the Interstate Commerce Commission complete powers to fix telephone rates, control competition and prevent discrimination caused a heated discussion at the sixteenth annual convention of the association, held at the Hotel LaSalle, Chicago, Feb. 18, 19 and 20. The proposed resolution was drawn up by a committee of which Judge N. G. Hunter, of Indiana, was chairman, and further authorized the association's board of directors to suggest to the Interstate Commerce Commission methods of regulation.

Mr. D. M. Neill, of Minnesota, who opposed the resolution, insisted that since the board of directors had considered it without coming to any decision, careful deliberation ought to be taken by the convention. A motion was made that the resolution be laid on the table indefinitely. Mr. H. D. Critchfield, of Chicago, said that the matter was one needing immediate attention. The present powers of the Interstate Commerce Commission, he declared, are so ill defined as to be barely subject to interpretation. He expressed the belief that public utilities ought to be regulated and governed by a commission whose duties are clearly defined. Mr. E. B. Fisher, of Grand Rapids, cited cases where the Interstate Commission regulates exchange rates in Maryland and Virginia, but said that he did not believe in the commission controlling intrastate business. Both sides of the discussion were well supported, but as matters seemed to come to no satisfactory end, a substitute motion was carried, referring the question to the incoming board of directors.

All parts of the United States were well represented at the convention. The sessions were opened with an address of welcome by Mr. Leon Hornstein, assistant corporation counsel of Chicago, who spoke in behalf of Mayor Harrison. Judge N. G. Hunter, of Indiana, responded.

#### PRESIDENT SAVAGE'S ADDRESS

The address by Mr. Manford Savage, president of the association, dealt with general problems. The lack of progress toward a general adjustment of existing unfavorable telephone conditions he attributed to the enactment of new statutes creating utility commissions whose duties and powers are ill defined. In some cases these laws are so obscurely worded as to make the best commissions proceed with extreme slowness until sure of their ground. But beyond this, it was asserted, the one thing that has prevented putting the telephone business on a better and more enduring basis generally has been the attitude of the parties most concerned toward each other. Hopes were entertained, he said, that in the near future a legislative dam might be constructed which would, to the great advantage of legitimate investors, prevent the unrestricted flow of the people's money into speculators' reservoirs in distant places. Telephone securities would then no longer have to compete in the money market with stocks on which a fictitious value is placed. There would be left in the home market, too, funds for legitimate investment, now sent to distant places, he said, by custom and by the drawing power of a gambler's percentage. The speaker believed further that no fine distinction will be permitted as to what is competition and what is monopoly.

"Would it be too drastic," asked Mr. Savage, "to amend the bankruptcy act so that if a corporation called into being under the provision of some law should be guilty of unfair competition, discrimination between individuals or communities, or any other act prohibited by public sentiment, that act or acts shall operate to declare the offending corporation an involuntary bankrupt, and call for the appointment of a trustee to wind up the affairs of the concern and sell its assets to the highest bidder and render its charter forever invalid?"



Since local ownership and operation are inseparably connected, Mr. Savage asked that Congress limit national statutes and the jurisdiction of the Interstate Commerce Commission so as to apply only to toll business and to such companies as do interstate exchange business, leaving the local exchange, the manner of its operation and its duties and privileges entirely to state regulations.

The national association, said Mr. Savage, furnishes a forum in which the best thought in the nation along telephone lines can be brought forth. He expressed his belief that the National Independent Telephone Association should take steps toward having the independent telephone business placed fully and thoroughly before Congress and other governmental bodies having jurisdiction over telephone operation. These and other matters of equal, if not greater, importance could be handled by a national association, with the sincere support of the telephone men of the country. In closing, the speaker said: "We are independent of any monopolistic control, but not independent of each other."

Committees on resolutions and on credentials were appointed, with Messrs. N. G. Hunter and W. F. Goodrich as the respective chairmen.

#### TELEPHONE SERVICE

The program of Feb. 19 was conducted by the Telephone Service Association, of which Mr. R. L. Barry, of St. Paul, was chairman. A talk was given by Mr. J. W. Callahan on the subject of the service association and its purpose.

Some conclusions from field observation were given by Mr. F. L. Eldridge, who is field manager of the Central States Telephone Service Association. He found, he said, that many companies were paying dearly for what the association was furnishing to its members without charge. Company members of this association can have the services of an engineer by paying merely his traveling expenses.

An illustrated lecture followed, by Mr. M. H. Moffett, of the National Carbon Company, on "The Manufacture and Care of Dry Batteries."

Mr. H. S. Durant, of the American Steel & Wire Company, next gave an illustrated lecture on the "Manufacture and Use of Steel Wire in the Telephone Industry." From the crude state, he traced the iron through the blast furnace and rolling mills to the wire-drawing operation and finally to the annealing and galvanizing processes.

Mr. B. W. Borton in his talk on "Advertising" said that persistent methods are necessary to get good results from advertising. Some novel and effective ways in which the independent telephone company in Chicago has increased the number of its existing subscribers were also mentioned by Mr. C. W. Winkler.

"Manufacture, Care and Maintenance of Storage Batteries" was the subject of Mr. H. M. Beck's illustrated lecture. He described the best methods of telling when the limits of charge and discharge are reached, and recommended the gravity test as the best indication for discharge. Suggestions were also given on the choice of pilot cells, when used, and on the care to be taken in order that the readings may be of value.

Because of delay in holding the election of directors, the program of Feb. 20 was late in starting. The remaining papers, on "Telephone Transmission," by Mr. R. L. Stadermann, of Terre Haute, Ind., and "Telephone Traffic," by Messrs. H. D. Stroud, Chicago, and W. F. Vivian, Grand Rapids, Mich., were read hurriedly, in order that the association business might be concluded. Mr. Stadermann's paper pointed out the places where energy losses are to be encountered in telephone transmission and suggested how these losses could be minimized by the careful choice of equipment and the right kind of line construction. He mentioned the troubles contended with by independent telephone companies owing to other companies holding the patents on loading coils.

The joint talk by Messrs. Stroud and Vivian gave an idea of how the traffic of a telephone company can be systematically analyzed and how the percentage of lost calls and lost subscribers can be cut down. The data compiled revealed that many traffic managers neglect keeping an account of overtime, the average revenue from which amounts to 6 per cent of the total long-distance revenue.

Prof. R. S. Butler, of the University of Wisconsin, followed with a brief talk on his subject, "Some Phases of Efficiency in Business."

The convention closed with the report on the election of the board of directors. Of the seventeen elected, eleven were members of the outgoing board. The officers will be elected at a special meeting of this board held in March. The men who make up the board are Messrs. J. W. Callahan, Chicago, Ill.; H. D. Critchfield, Chicago, Ill.; J. B. Earl, Waco, Texas; E. B. Fisher, Grand Rapids, Mich.; P. C. Holdoegel, Rockwell City, Ia.; N. G. Hunter, Wabash, Ind.; L. D. Kellogg, Chicago, Ill.; F. B. McKinnon, Abilene, Kan.; H. B. McMeal, Chicago, Ill.; C. Y. McVey, Cleveland, Ohio; Warren Pratt, Kenney, Neb.; G. W. Robinson, St. Paul, Minn.; Manford Savage, Champaign, Ill.; E. D. Schade, Johnstown, Pa.; W. J. Thomas, Shelbyville, Ky.; H. C. Todd, Marysville, Mo., and Richard Valentine, Janesville, Wis.

Nearly 400 attended the convention banquet held at the Hotel LaSalle, Wednesday evening, Feb. 19. Following the dinner a theatrical and musical entertainment was given on a temporary stage. A number of manufacturers took part in the exhibit held in connection with the convention.

#### Proposed Licensing of Engineers in Iowa

Civil engineers in Iowa are advocating the passage of a law providing for the licensing of engineers and surveyors in that State. Civil engineering, for the purposes of the act, is held to embrace, among other things, the design and supervision of the construction of "works for the development, transmission and application of power, and of electrical, mechanical, mining, industrial, hydraulic, municipal, sanitary, structural and other works." Licenses are to be granted by a state board of examining engineers to be appointed by the Governor. Each member of this board shall be "a professional civil engineer" of recognized standing. For the first year the board may issue licenses without examination to reputable persons in responsible charge of engineering work; after that licenses shall be issued only to candidates passing an examination. Penalties are provided for the punishment of persons claiming to be licensed engineers without legal authority.

#### President Eliot on the Expert Witness

In his address on "The Causes of Dissatisfaction with the Courts," delivered before the Massachusetts Bar Association, Dr. Charles W. Eliot, president emeritus of Harvard University, named several of the abuses of legal practice in this country, mentioning among the number the introduction of the expert witness whose testimony is relied upon to prove the case of the side on whose behalf he appears. President Eliot said:

"With the enormous extension of applied science into commerce, trade, manufacturing and transportation a new kind of advocate has found a place in the courts, namely, the expert witness; and from the frequent employment of such experts in both civil and criminal cases a new source of popular distrust and disaffection has appeared in the courts. Many suits involving large amounts of money turn on expert testimony, and the experts summoned on either side turn out to be not witnesses but advocates.



"In two classes of cases these hot disputes between men of science, enlisted on opposite sides of the same case, have brought great discredit on judicial procedure and on men of science as candid students of the truth. These two classes of cases are patent cases and criminal cases involving testimony about insanity. Remedies have been suggested but not adopted. The employment by the court of official experts is the most promising of these remedies. Another proposal is a limitation of the number of experts that shall be called in a given case.

"A better remedy might perhaps be found in a reformed public sentiment concerning expert testimony within the professions of the engineer, chemist, physicist and physician or surgeon. It ought to be a disgrace to members of any of these professions to appear in court, for money, to set forth so much of the truth as tells in favor of one side of the case, while suppressing all parts of the truth which support the contention of the other side.

"In other words, it ought to be made clear in all those professions that honor requires their members to appear in court only as impartial expositors of scientific truth so far as it is ascertained."

### Franchise Adjustment at Fort Collins, Col.

The City Council of Fort Collins, Col., has now contracted for its supply of electrical energy with the Northern Colorado Power Company, of which Mr. H. N. Wallace is manager. The company agrees to relinquish all claims it may have or purport to have to a franchise upon the streets of the city, although the city in turn confers upon the company the use of the streets and alleys for a period of ten years, upon the expiration of which time the city shall have the option of purchasing the distribution system at its "going value." Meanwhile the company is to continue in use of the streets until the city shall have decided to exercise such option. A net rate of 8.5 cents per kw-hr. is established by the contract, which provides that magnetite-arc lamps are to be substituted for the present carbon-arc lamps. Mr. R. McF. Doble represented the city as consulting engineer. This contract ends a two-years' conflict which for a time tended toward the construction of a municipal lighting plant.

### The Technical Staff in Public-Utility Regulation

In a paper read before the Indiana Sanitary and Water Supply Association at Indianapolis, Feb. 26, Prof. W. D. Pence, chief engineer for the Wisconsin Railroad Commission and professor of railway engineering at the University of Wisconsin, described the functions of the joint technical staff of the Wisconsin railroad and tax commissions in the regulation of the public utilities of the State. The situation in Wisconsin is to be regarded with special interest on account of the thorough-going scheme of regulation there provided for in the initial legislative enactment and the broad powers that have been exercised in a vigorous way by the regulating commission.

The organization scheme of the Wisconsin commission's engineering corps includes its division into the following staffs: administrative, office, civil engineering, mechanical engineering, electrical engineering, gas engineering, gas and electric service, telephone service, railway service and miscellaneous.

The administrative staff consists of the chief engineer, assistant chief engineer and the heads of departments responsible for the direction of the work. The mechanical engineering staff is engaged in the inspection and valuation of mechanical details of the physical property of utilities, including such items as power-plant machinery and equip-

ment, steam and hot-water plants (except street mains), machinery and tools, etc.

The electrical-engineering staff inspects and appraises electrical machinery and appliances in power plants and elsewhere, electric-railway rolling stock, electrical distribution systems, overhead and underground, telephone plants and various tools, stores and supplies related to the above items. It also makes investigations with the aid of other departments and of plant operators with a view to suggesting improvements in the operating conditions of electrical properties.

The gas and electric service staff inspects and investigates gas and electric service, formulates and revises rules for standards of service, tests and calibrates instruments used in service measurements, investigates electrolysis of mains, and suggests improvements.

The technical staff is made up almost exclusively of technical graduates who are appointed in part through a formal rule of the State Civil Service Commission and in part by special authorization by the Railroad Commission. In the recruiting of the engineering staff there is entire freedom from political influence or pressure of any description.

The commission has established uniform systems of accounting for the various utilities of the states and in accordance therewith has formulated a classification scheme for grouping the various items of physical property. For electric utilities these are as follows: A—land: (1) power-station land, (2) substation land, (3) all other lands; B—transmission and distribution: (1) transmission system, (2) distribution system, (3) transformers, (4) meters, (5) commercial lamps and lamp equipment, (6) municipal-contract lighting systems; C—buildings and miscellaneous structures: (1) power-plant buildings, (2) substation, transformer-station and storage-battery buildings, (3) general office buildings, (4) miscellaneous buildings; D—plant equipment: (1) steam-power-plant equipment, (2) gas-power-plant equipment, (3) hydraulic-power-plant equipment, (4) boiler-plant equipment, (5) producer-gas equipment, (6) dams, canals and flumes, (7) substation, transformer-station and storage-battery equipment; E—general equipment: (1) utility equipment, (2) general office equipment, (3) shop equipment, (4) miscellaneous equipment; F—paving: paving over trenching; H—materials and supplies: (1) electric-line supplies, (2) power-plant supplies, (3) general office supplies, (4) fuel, (5) miscellaneous supplies.

For gathering information concerning the quality of the utility service rendered in the State, traveling laboratory equipments have been provided, service investigations being made as follows: (1) Accuracy of meters; methods of testing; limit of error allowable. (2) Uniformity of voltage; allowable variation from normal; interruptions. (3) Lamp efficiency; provisions for lamp renewals; voltage. (4) Installation; safety; voltage limits; adequacy of wiring.

"It was early seen," said Professor Pence, "that to adopt the drastic basis of enforcement would require a large outlay in the way of field staff and laboratory equipment, and the decision was made to adhere to the policy of moderation which had pervaded the previous work of the commission. It was also seen that undue pressure at the outset would discourage and possibly even disable certain of the smaller and weaker utilities which ought to have reasonable rates and assistance in adjusting themselves to the change of situation brought about by the enactment of the act. Besides, the opportunity to stimulate, on the part of the utilities, the habit of self-criticism on a sound and scientific basis and to cultivate the element of pride and satisfaction in the rendering of a good quality of service was not to be wantonly sacrificed. The wisdom shown in the adoption of this policy on the part of the commission has been amply confirmed by the results attained in the course of the four years and more since these rules were first adopted."

### Cleveland Contractors' Methods Questioned

Assistant Prosecuting Attorney Samuel Doerfler and County Detective James Doran visited the offices of the Cleveland Electrical Contractors' Association in the Caxton Building, Cleveland, Ohio, last week and confiscated the books and records of the organization. Secretary Frank M. Grant was summoned before the grand jury and questioned as to the manner in which the members conduct their business. An attempt was made to show that the contractors maintain a certain fixed price. Mr. Doerfler declares that the data and sales books by which the contractors are said to be guided were secured among the other property taken from the offices.

Recently a raid was made on the offices of the Cleveland Insurance Exchange, its books and records were taken and its secretary and clerical force were called before the grand jury. In this case indictments were returned against a number of prominent agents on the charge of violating the anti-trust law.

### Arkansas Bill Defining Newspapers as Public Utilities

The bill introduced before the Arkansas State Legislature by Senator Covington to declare newspapers public utilities and to regulate the placing and heading of news concerning crimes and criminal cases passed the State Senate Feb. 27. The bill not only renders a newspaper liable for false statements by a fine of \$1,000 to \$5,000 but makes the reporter responsible for such items subject to a heavy fine and imprisonment. It provides that a newspaper shall give equal space and prominence to articles in refutation of misleading statements.

### Application for New Franchise at Lexington, Ky.

A schedule of charges placing the maximum for residential lighting at 14 cents per kw-hr., for motor service at 10 cents per kw-hr. and for commercial lighting at 12 cents per kw-hr., with liberal discounts, has been filed with Commissioner Charles Pulliam, of Lexington, Ky., by the Lexington Utilities Company in a petition asking that a new franchise be granted it. The Lexington Utilities Company seeks a new twenty-year franchise, for although its present permit does not expire for three years it is desirous of marketing new bond issues and desires to extend its privileges. The new schedule of charges as specified by the company is slightly lower than the original one, and it is believed that the franchise which has been asked will be given. The Housewives' League of Lexington has protested vigorously before Commissioner Pulliam against any increase in rates.

### Public Service Commission News

#### MASSACHUSETTS COMMISSION

The Gas and Electric Light Commission has approved the issue by the Gardner Electric Light Company of 400 shares of additional common stock at \$150 per share, and of an equal amount of preferred stock at \$105 per share, to meet the cost of extensions and improvements. The company recently built a high-tension line from Gardner to Barre at an expense of about \$52,000, constructed distribution systems in the towns of Westminster, Hubbardston and Barre costing \$35,000, and made additions to its generating station and distribution system in Gardner costing \$37,000. The excess of these expenditures over the proceeds of stock previously approved is about \$102,000.

Chairman Barber of the Gas and Electric Light Commission recently appeared before the legislative committee on ways and means in support of the resolve to appropriate

\$15,000 to enable the Attorney-General to meet the proceedings in the Haverhill gas case, as outlined recently in these columns. An injunction has been obtained by the gas company in the federal courts against the enforcement of an order of the board reducing the price of gas. Chairman Barber has declared that the future of public-utility regulation in Massachusetts is at issue in the case.

#### NEW YORK COMMISSION

The New York Public Service Commission of the Second District has authorized the Chatham Electric Light & Power Company to exercise franchises for furnishing service in Ghent, Claverack and Philmont, Columbia County. The application was supported by the Philmont trustees. The application of the Philmont Lighting Company for approval of franchises previously granted by the village of Philmont and town of Claverack was denied.

#### MARYLAND COMMISSION

In an order signed Feb. 25 by the Maryland Public Service Commission the Consolidated Gas, Electric Light & Power Company of Baltimore was authorized to sell \$312,000 of 4.5 per cent bonds dated April 1, 1904, part of an issue of \$15,000,000.

#### OHIO COMMISSION

The Ohio Public Service Commission has granted permission to Mr. T. J. Smith, sole owner, to sell to the American Gas & Electric Company all assets, franchises and property belonging to the New Lexington (Ohio) electric-light plant.

#### CALIFORNIA COMMISSION

The Railroad Commission has rendered a decision denying without prejudice the application of the Arrowhead Reservoir & Power Company to issue \$4,000,000 of bonds. Suits were pending against the company in the Superior Court of San Bernardino County and in the United States Circuit Court at Los Angeles, and the commission held that it would be improper to authorize the issue of bonds.

A decision has been rendered granting the application of the San Diego Consolidated Gas & Electric Company to issue \$204,000 of bonds. The San Diego company was also granted authority to exchange lands with the Park-Grable Investment Company in La Mesa, San Diego County.

The City Electric Company of San Francisco has applied to the commission for authority to sell \$833,000 of bonds which it had been previously authorized to pledge as collateral security.

#### WISCONSIN COMMISSION

Upon complaint that the electric rates in Columbus, Wis., were discriminatory and unsatisfactory, the commission has ordered the present schedule discontinued and the following rates put into effect: Primary rate, 10 cents net for the first thirty hours' use per month of the active connected load; secondary rate, 8 cents net for the next sixty hours' use; excess rate, 6 cents net. In class A, consisting of residences, the active load is to be 60 per cent of the connected load up to 500 watts and 33⅓ per cent of the connected load in excess of 500 watts. In class B, consisting of stores, offices, etc., 70 per cent of the total connected load is to be active. In class C, consisting of churches, industrial establishments, hotels, schools, etc., 55 per cent is to be active. The minimum bill is fixed at 50 cents. The rate for motor service consists of a charge of 25 cents per hp of nominal rated capacity plus an energy charge of 5 cents per kw-hr. For series tungsten street lamps a charge of \$3.50 per 100-watt lamp per year and an energy rate of 4.5 cents per kw-hr. was considered reasonable.

#### MISSOURI COMMISSION

The Missouri State Senate has passed the public-service commission bill by a vote of 26 to 5. The bill provides for the regulation and control of all utilities in the State and from the Senate will go to the Governor for his signature.



## Current News and Notes

**ARGENTINE "WIRELESS" SIGNALS REPORTED AT NEWPORT.**—Operators at the naval wireless-telegraph station at Newport, R. I., on March 4, reported catching messages which, it is supposed, were being exchanged between two stations in the Argentine Republic, 7000 to 8000 miles distant. If these signals were correctly identified, this may be the greatest transmission distance yet reached with "wireless."

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**LEGAL STATUS OF THE ENGINEER.**—At a meeting of the Western Society of Engineers in Chicago on March 3 there was a topical discussion on the "Legal Status of the Engineer." Messrs. W. H. Finley, Lyman E. Cooley, B. J. Arnold, John W. Alvord, W. C. Armstrong and others took part. Relative to a licensing law in Illinois it was said that the licensing of structural engineers will follow naturally after the enactment of a state building code. Other engineers in Illinois do not appear to think a licensing law necessary.

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**LARGE HYDROELECTRIC PLANT IN SWITZERLAND.**—The Löntsch Power Works, on the Klönthalensee, near Glarus, Switzerland, are making arrangements for the installation at their power station of a 15,000-hp turbo-generator set which is being built by the Theodor Bell & Company, of Kriens, and Brown, Boveri & Company, of Baden. The present equipment consists of six 6500-hp turbines directly connected to their respective generators. With the additional unit the plant will have an aggregate rating of 54,000 hp, making it the largest power plant in Switzerland.

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**ELECTRIC PLANT PUTS TO SEA.**—According to reports, the electric-light plant which has supplied the town of Ocos, Guatemala, for the last four years is about to weigh anchor and put out to sea. Four years ago a steamer of the Kosmos line, while making a voyage to San Francisco from European ports, was carried into shoal water near Ocos by a tidal wave, but rested on an even keel with undamaged machinery. An enterprising Guatemalan is said to have run wires from the ship to the shore and made effective use of the ship's generating plant to supply the local community. A Philadelphia salvage company has succeeded in refloating the ship, however, and oil lamps will probably come into fashion again in Ocos.

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**INSTRUCTION IN SAFETY.**—The Brooklyn Rapid Transit Company has entered into an arrangement with the American Museum of Safety for a six months' campaign in the public schools of Brooklyn on the subject of safety in the streets of the borough. The Museum has been working along similar lines in the Borough of Manhattan for some time and has in this matter the hearty co-operation of the Board of Education. It is hoped that through the school children the instruction will reach all those who use the streets as pedestrians, travelers on the surface cars or drivers of vehicles. The president of the Museum is Mr. Arthur Williams, and the director under whose supervision this campaign will be conducted is Dr. W. H. Tolman.

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**UNIVERSITY OF CALIFORNIA SCHOLARSHIPS.**—Among the fellowships and scholarships established by the University of California for the academic year 1913-1914, there are two Flood fellowships in economics, yielding \$600 each; one or two fellowships in physics under the Whiting fund, yielding \$600 each; one James M. Goewey scholarship in natural science, yielding \$250, and one research fellowship in problems of city growth (established by the Order of the Native Sons of the Golden West), yielding \$1,000. These fellowships and scholarships are open to graduates of other

colleges and universities as well as to those of the University of California. Applications for the research fellowship must be filed by March 15, and for the others by March 20 and sent to the recorder of the faculties, University of California, Berkeley, Cal.

**ELECTRICAL INSTRUMENTS IN ENGLAND. Special Agents' Series No. 55,** just issued by the Department of Commerce and Labor, Bureau of Manufactures, Washington, D. C., is a report by Mr. H. B. Brooks, commercial agent of the Department of Commerce and Labor, dealing with the manufacture of electrical instruments in England. The equipment, number of employees and hours of labor, and more particularly the nature of the products manufactured by seven leading makers of electrical instruments in England, and a number of consular reports relating to the use of electrical switches, make up the contents of this thirty-eight-page report.

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**COLORADO ELECTRIC CLUB'S PLAN FOR EDISON STATUE.**—In connection with the electric show to be held in the city of Denver in the fall, the Colorado Electric Club is considering commissioning a sculptor of national reputation to produce a bronze statue of Mr. Thomas A. Edison, to be placed in the new civic center. Plans are under way to make the unveiling and presentation of this statue an imposing ceremony at which there will be a gathering of the leading electrical men of the industry. Mr. Edison has asked the club to refrain from carrying out the project, stating that he deeply appreciated the sentiments that actuated the Colorado Electric Club in its desire to honor him in the manner indicated, but feels that the Rocky Mountain country has already honored him sufficiently by the present expression of its good will and regard. But the end is not yet.

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**"WIRELESS" DETERMINATION OF LONGITUDE.**—Four officers of the French army and navy have sailed for this country to assist in the experiments with the Arlington wireless-telegraph station by which it is planned to determine accurately the longitude difference between Washington and the Eiffel Tower "wireless" station. A United States army officer has also been dispatched to Paris to be present at the measurements on the Continental side. The Arlington station has already picked up messages from the Eiffel Tower, but as yet no messages have been transmitted from Washington to Paris. The scout-cruiser *Salem* is now somewhere in the North Atlantic Ocean to determine the maximum sending range of the New Arlington station. When last heard from by the ship's wireless telegraph, the *Salem* was 2000 miles distant, but it is expected that signals have been received from the powerful land station at distances much greater than the cruiser's apparatus could return an answer.

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**MINING IN THE MALAY STATES.**—The Department of Commerce and Labor, Bureau of Manufactures, Washington, D. C., of which Mr. A. H. Baldwin is chief, has recently issued as Special Agents' Series No. 54, an eight-page report on "Mining in the Federated Malay States," by Commercial Agent D. C. Alexander, Jr., with special reference to methods and equipment and the market for American machinery and supplies. Some information with respect to the supply of energy in the Malay part of the British empire is given. The reasons for small unit installations are of interest, and one learns that, although the enormous oil fields of Sumatra, Java and Borneo are within 100 miles of these mining towns, coal at as high as \$10 to \$12 per ton is being used in India. Some of the best-equipped mines, however, are now driving their mills by means of producer gas engines, all of English manufacture. They are of the suction type, with wet and dry scrubbers, and most of the engines are of the single-



cylinder four-stroke cycle design, generating from 30 to 60 brake-hp. The units are frequently installed in duplicate. In Pahang Diesel engines aggregating 245 hp are proving very satisfactory. The Chinese and Malay engineers appear to run them with little difficulty. Descriptions of the various mines are given, and the illustrations add interest to Mr. Alexander's comprehensive monograph.

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### SOCIETY MEETINGS

**ELECTRICITY AT PANAMA CANAL.**—Mr. E. A. Lof, of the General Electric Company, presented a paper on March 1, 1913, before the American Society of Swedish Engineers on the electrical features in the construction and operation of the Panama Canal.

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**ELECTRIC-RAILWAY PROBLEMS.**—Mr. Richard McCulloch, vice-president and assistant general manager United Railways of St. Louis, on the evening of March 4 presented a paper on "Electric-Railway Problems" at the meeting of the Jovian Chapter of the League of Electrical Interests of St. Louis, Mo.

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**OKLAHOMA ASSOCIATION'S ANNUAL MEETING.**—The second annual convention of the Gas, Electric and Street Railway Association of Oklahoma will be held on May 6, 7 and 8, at Oklahoma City, with headquarters at the Skirvin Hotel. Prof. H. V. Bozell, Norman, Okla., is secretary and treasurer of the organization.

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**COLUMBIA UNIVERSITY ELECTRICAL SOCIETY.**—At a meeting of the Electrical Engineering Society of Columbia University to be held March 13, at 8:15 p. m. in the Engineering Building, One Hundred and Seventeenth Street and Broadway, New York, Mr. P. R. Goodwin, of the Western Electric Company, will lecture on "System in Manufacturing."

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**CENTRAL-STATION EMPLOYEES TO GIVE A CIRCUS.**—The annual entertainment given by the Commonwealth Edison Company Section of the National Electric Light Association will this year take the form of a circus. The entertainment will be held in the new Medina Temple on the North Side, the date being Saturday, May 10. Some unusual "stunts" are promised.

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**CLEVELAND SECTION, A. I. E. E.**—At the recent meeting of the Cleveland Section of the American Institute of Electrical Engineers, Prof. George Goldman, of the department of electrical engineering, Syracuse University, gave an address on the subject of "Transformers for Multi-Frequency Operation." Mr. G. A. Thornton also spoke on the subject of "The Constant-Current Transformer."

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**CANADIAN CONVENTION, JUNE 23, 24 AND 25.**—The Canadian Electric Association will hold its next annual convention at the twin cities of Port Arthur and Fort William June 23, 24 and 25. Favorable transportation arrangements have been made, and a big convention is anticipated. Mr. W. L. Bird, of Fort William, general superintendent and secretary of the Kaministiquia Power Company, is president of the association.

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**N. E. L. A. COMPANY SECTION IN ST. LOUIS.**—The monthly meeting of the Union Electric Light & Power Company Section of the National Electric Light Association was held in the company's assembly hall in St. Louis on Feb. 28. Mr. H. W. Eales, assistant superintendent of distribution and assistant chief electrical engineer, gave a talk on "Adaptability of Electrical Machinery to Industrial Loads," illustrated by lantern-slide pictures. There was a good attendance and the Union Electric Orchestra and the Glee Club furnished music.

**MICHIGAN CONVENTION, OTTAWA BEACH, AUG. 19-21.**—The 1913 convention of the Michigan Section of the National Electric Light Association will be held at the Ottawa Beach Hotel, Ottawa Beach, Mich., Aug. 19, 20 and 21. The former plan of holding the Michigan meetings on board ship during lake cruises has been given up this year, since it was found that many central-station men were kept away on account of the resulting four or five days' enforced absence from their business. Ottawa Beach is located on the eastern shore of Lake Michigan and affords excellent facilities for boating, fishing, bathing, playing golf, horseback riding, etc. Mr. Herbert Silvester, 18 Washington Boulevard, Detroit, Mich., is secretary of the Michigan Section.

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**MARCH PROGRAM OF THE ST. LOUIS JOVIANS.**—The League of Electrical Interests, Jovian Chapter, has arranged an interesting program for the remainder of this month, including a paper by Mr. George McD. Johns, superintendent of the Fire Alarm Telegraph System of St. Louis, on "New Developments in Fire Alarm Telegraph Systems," which will be given March 11. The following week Mr. Fred Adam, vice-president and general manager of the Frank Adam Electric Company, will speak on "The Relation of the Electrical Interests to the Architect," on which occasion the architects of St. Louis will be the guests of the league. "The Use of Electricity in the Largest Office Building in the World" will be the subject of a paper by Mr. H. H. Humphrey, consulting engineer, on the evening of March 25. Mr. Claude L. Matthews, of W. N. Matthews & Brother, St. Louis, is chairman of the entertainment committee of the League of Electrical Interests.

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**KILOWATT CLUB OF BROOKLYN EDISON COMPANY.**—The regular monthly meeting of the Kilowatt Club, whose membership includes employees of the Edison Electric Illuminating Company, of Brooklyn, and electrical contractors in that city, was held on the evening of Feb. 24. Mr. S. D. Sprong, electrical engineer of the local company, spoke on "The Brooklyn Edison System in Its Relation to the Electrical Contractor." In the course of his remarks he spoke of the policy of American public utility companies of giving free renewal of incandescent lamps to certain of their customers, stating that this is contrary to European practice. Last year, he said, the cost to the Brooklyn company for free lamp renewals was \$112,000. This amount, he considered, was well spent, since by giving to its customers lamps which it knew were efficient the company promoted standardization of its lighting service and gave assurance to the customer that he was obtaining the most economical medium through which to use that service.

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**NATIONAL FIRE PROTECTION ASSOCIATION.**—The electrical committee of the National Fire Protection Association, whose annual meeting is to be held this month, as mentioned in our issue of Nov. 23, 1912, page 1088, has arranged for the meeting on March 26 and 27, at 10 a. m., at the rooms of the New York Board of Fire Underwriters, 123 William Street. A recently issued *Bulletin* refers to matters that were brought to the attention of the electrical committee at the last meeting which were deemed of sufficient importance for further discussion before action was taken. The reports of the sub-committees which have been active during the past year will be considered by the full committee and brought before the New York meeting for final action. The *Bulletin* contains general suggestions for changes in the National Electrical Code made by the committee on the New York Code, giving also reports of other committees and suggested changes in rules. Mr. Ralph Sweetland, 141 Milk Street, Boston, Mass., is secretary of the electrical committee.

## Conference of Electrical Development Society

**A far-reaching and significant movement marked by two-day inaugural sessions of the society for promoting commercial expansion—All branches of the industry enlisted and represented**

For the fertility of practical ideas which it produced, for the unmistakable evidences that were shown of the keen desire on the part of all who attended to give and to receive constructive suggestions and criticisms for the common good, and for the broad-minded attitude in which many of the ever-present problems of the electrical field were discussed, neither with bitterness nor with harshness, but in a spirit of real co-operation, the conference which the Society for Electrical Development, Inc., held in the United Engineering Societies Building, New York, on March 4 and 5 may be regarded as marking a new era of progress in the history of the electrical industry.

This conference was the first tangible result presented to the electrical industry at large of the vast amount of detail work that has been performed by the committee which was appointed by representatives of the central stations, manufacturers, jobbers, contractors and dealers at the meeting held by these interests at Association Island, New York, on Sept. 3, 1912, to create an organization to carry on a co-operative electrical movement throughout the whole of the United States.

The progress of the organization committee—the names of whose members appeared in the *Electrical World* Sept. 7, 1912—leading to the incorporation of the Society for Electrical Development, Inc., has been recounted in these columns and the plans and purposes of the society have also been given.

The personnel of the society's officers and executive committee, whose names were given in the *Electrical World* Jan. 18, 1913, is composed of men of long and successful experience in all branches of the electrical industry. Representative as these men are of the highest thought in the field, their affiliation with the society and the indorsement given to it by the interests which they represent furnish assurance that in so far as is within the possibilities of human endeavor, the society will become a potent force for the mutual benefit of those engaged in the manufacture, sale or utilization of electrical energy or appliances and for the greater uplift of mankind.

About 175 were present when President Henry L. Doherty called the conference to order at 10 a. m. on March 4.

After making an opening address, Mr. Doherty presented Mr. James M. Wakeman, general manager of the society, who spoke on the "Aims of the Society." He was followed by Mr. Frank H. Gale, of the General Electric Company, who read a paper on "The News Value of Electricity."

After a long and animated discussion of Mr. Gale's paper, an adjournment was taken until 2:30 p. m. At the beginning of the afternoon session, Mr. Doherty introduced Mr. Philip S. Dodd, secretary of the Society for Electrical Development, Inc., who gave a brief outline

of the program that had been prepared for the session. A paper on "Electricity and the Architect," by Mr. Frank E. Wallis, of Wallis & Goodwillie, architects, New York, was then read and discussed.

Dr. Talcott Williams, director of the School of Journalism, Columbia University, followed Mr. Wallis with an eloquent address on "The Dissemination of News," in which he gave an exposition of the excellent work that is being done at the school and told of some of the ways in which this work would ultimately be of benefit to the electrical industry.

Mr. T. Commerford Martin, executive secretary of the National Electric Light Association, then told where that association and the Society for Electrical Development, Inc., have a common interest.

The next paper was by Mr. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company, whose subject was "Efficiency in Local Advertising." This paper induced a vast amount of useful discussion and, owing to the lateness of the hour, further business was postponed until

the evening session, which was started at 8:00 p. m.

At this session interest was aroused to a high pitch by the reading by Mr. T. Commerford Martin of a digest which had been made by him of the many ideas and suggestions for carrying on the society's work that had been received by mail from individuals, electrical associations,

luncheon clubs and other sources in the various large cities and elsewhere. This brought out an abundance of discussion, some of which had to be reserved for the opening session on the morning of March 5.

Upon completion of this discussion, a paper by Mr. J. Robert Crouse, the pioneer in the movement for co-operation in the electrical field, was read and discussed.

This was followed by a paper on "The Sales End" by Mr. James H. Collins, whose articles on commercial topics in the *Saturday Evening Post* have attracted much favorable attention.

The morning session on March 5 was brought to a close by the reading of a paper on "Merchandising Co-operation" by Mr. W. E. Robertson, of the Robertson-Catacarter Company, Buffalo, N. Y. This paper served to reopen the long-standing controversy between the central-station companies and the contractors and dealers on the question of the course to be followed by each in the sale of appliances.

Although this discussion was taken up with vigor by the representatives of both of these branches of the industry, the entire debate was carried on without bitterness and all who participated signified their willingness to act harmoniously in arriving at the solution of this complex problem.

After the reading of Mr. Robertson's paper, adjournment was taken until 2 p. m. Many of those at the con-



HENRY L. DOHERTY



JAMES M. WAKEMAN

ference accepted the invitation of the Luncheon Club of the Jovian Order in New York to attend its semi-monthly luncheon held on March 5, and when the conference was resumed a large number of the Jovians were in attendance.

Upon completion of the discussion, in which the speakers were limited to five-minute speeches, Mr. William D. McJunkin, of Chicago, read a paper on "An Electrical Advertising Campaign," in which he suggested with great detail, a plan for an advertising campaign which the society might adopt to accomplish its purposes.

After this paper, a number of moving pictures portraying uses of electricity were given through the courtesy of Mr. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company.

The conference was then adjourned until 7 p. m., when a banquet was held at Delmonico's.

On March 6 the executive committee of the society took under consideration all of the ideas and suggestions that had been produced at the conference, with a view to determining which of these could be used efficaciously by it in its work.

#### OPENING SESSION, MARCH 4

Mr. Henry L. Doherty gave the opening address, but before going into the chief features of it, made a few remarks to explain the reasons for holding the conference. First, he said, the organizers of the society had been anxious to get the movement actually under way as soon as possible and, secondly, it had been thought that a much broader line of ideas would be developed at a meeting open to the entire electrical fraternity than would have been the case had the society simply presented its own plans. Had the latter method been followed, the industry at large would probably have given more attention to merely improving the details of the society's plans than to developing valuable ideas for carrying on the work.

He stated that while no active steps have yet been taken to solicit funds, voluntary subscriptions to the amount of over \$100,000 have already been received. The society wants to raise a fund of \$200,000 as a minimum for carrying on its work.

He mentioned the four groups of electrical interests represented in it—the central-station, the manufacturing, the contracting and the jobbing and dealing branches—and read the names of the twenty directors of the society, the list of which appeared in the *Electrical World*, Jan. 18, 1913, page 129. The fact that these men, and the business interests represented by them, had indorsed the Society for Electrical Development, Inc., was an indication, Mr. Doherty said, of the extent to which interest has already been taken in it.

"Electricity is in its infancy" is a bromide, he continued. What this expression really means, he said, is that as far as being a science is concerned, it is one of the best developed of the industries, but when considered from the standpoint of commercial application, it is exceedingly young. In other words, he pointed out, the commercial application of electricity lags far behind the technical or scientific side of the art. The work of the society is to bring about a general, harmonious movement to stimulate the commercial application of electricity.

He asked each man present to view the conference from the standpoint of what he would do if he had given to him a fund of \$200,000 to be used for developing the application of electricity to best advantage.

#### THE OPENING ADDRESS

After these explanatory remarks, Mr. Doherty asked Mr. A. W. Burchard, of the General Electric Company, to preside, and then gave his opening address. In it he first stated that there is a strong sentiment at this time in this country against "big business" or large aggregations of capital and expressed some doubts as to the future of prosper-

ity in this country if this present attitude toward these questions on the part of the government is continued.

He contrasted conditions in this country with those in Germany, saying that prosperity prevails in that country since its head is a man of great business acumen. Over there, he said, they have realized the advantages of stimulating and encouraging the business man, as is shown by the decrease in the rate of emigration from Germany. Oftentimes, he observed, a man was knighted over there for meritorious services in a business way, while in this country a man is indicted for similar services.

What the society wants to do, Mr. Doherty continued, is to bring about a consolidation that will be beneficial to everyone and objectionable to none.

The first point which the speaker wanted to emphasize, he said, was that the progress of civilization can be roughly measured by the extent to which electricity has been substituted for manual labor. In so far as it can work toward increasing the uses of electricity, the society will be helping to establish a higher plane of civilization.

The work before the society amounts to more than a national advertising campaign, Mr. Doherty stated. Such an advertising plan, however, had his hearty approval and he felt that none present could doubt its value. Statistics showed, he said, that the electrical consumption of all kinds in this country, per capita, is \$30 per year. Many successful national campaigns are being carried on to advertise products with a far less per capita consumption than this, so that it would certainly be profitable to advertise the electrical industry on a national scale.

Mr. Doherty said that he expected that the amount of free publicity which the society would receive in the daily press would be enormous, since its affairs would be of real news value.

#### EXAMPLES OF GOOD WORK WHICH THE SOCIETY CAN DO.

To indicate a few lines of work which the society can do, Mr. Doherty said that it could accomplish much of practical value by doing what one or two central-station companies with which he is familiar have recently done. These companies have gone to the owners of some typical manufacturing plant in their territory, such as a flour mill, or a shoe factory and have induced them to equip their plants for electrical operation to the "last gasp" in return for the promise of the central-station company to give a great deal of free publicity to these plants after they have been so equipped. In this way, these companies have obtained a great deal of useful data on the cost of operating these industries electrically, which they have been able to take to other concerns in the same line and convince them of the economies and desirability of central-station service. The society, the speaker said, could do this on a large scale, extend it to all industries, have this data printed and sent to all central-station companies with the result that complete data could be presented to prospective customers in any line of industry and large gains made in the business of the central-station company.

#### ELECTRICITY ON THE FARM

With the wide use of the motor car, there has come a large use of country roads, Mr. Doherty continued. If these roads were lighted by electricity many benefits would result. Not only would this lighting be a source of revenue to the central-station companies, but it would help to stimulate the use of electricity for farming operations, and incidentally to reduce the cost of farm products and hence the cost of living.

#### ELECTRICITY IN THE AUTOMOBILE FIELD

Electrical men little realize, Mr. Doherty went on, the opportunity that awaits them in the many uses to which electricity can be utilized in the gasoline car. Within the



next two years an automobile without an electric self-starter will be unsalable, he said. With this small electric power plant for a beginning, there are at least thirty additional uses for electrical energy in a gasoline motor car, the speaker said, which a well-known automobile manufacturer had recently told him were as yet unthought of by electrical men. This automobile company has been induced to undertake experiments for developing the use of electricity in every possible way on a gasoline car. Examples of this kind, Mr. Doherty said, should indicate to the electrical industry something of the aims of the society and should justify people in taking an interest in it. Federal bureaus of all kinds and state and civic boards and bodies will be asked to give their co-operation to the movement, all of which will help to encourage universal thought on electrical matters. In conclusion, he expressed the willingness of the society to receive suggestions from any source so as to insure the highest possible efficiency in its work.

#### Discussion

Mr. A. W. Burchard said that the proposed work is unique and that he knew of nothing in the history of civilization corresponding with it. He considered it fortunate that this work should have been undertaken by the youngest of the great industries. It is very easy, he said, to enunciate general principles; in the society's work progress must be made through specific suggestions and by united effort along parallel lines by the four groups into which the industry has been divided by the society.

#### AIMS OF THE SOCIETY

Mr. Doherty then resumed the chair and introduced Mr. James M. Wakeman, general manager of the society, who spoke on the "Aims of the Society." Up to the last minute, he said, it had been hoped to have Mr. Thomas A. Edison at the conference, but this had been found impossible owing to pressure of business. He read a letter, however, from Mr. Edison expressing the latter's regret and wishing every success to the society.

The latter, Mr. Wakeman observed, was the result of thought, money, time and effort on the part of hard-headed business men and hopes to be a potent factor for increasing the demand for electrical energy, supplies and apparatus. He pointed out that a great deal more can be accomplished by joining forces than by individual effort. Co-operative, constructive work is now needed, he felt, in the commercial side of the electrical industry, which has reached a stage of successful production.

#### SOME METHODS FOR SECURING PUBLICITY

Publicity of a kind that will induce the public to realize the advantages and economies of electrical energy is what is needed, he thought. Some of the methods he suggested for securing this were: advertising on a large scale in magazines and newspapers and having articles of electrical news value written by well-known men whose names will insure that these articles shall be read; supplying the daily press with electrical news; exhibiting moving pictures of electrical interest; having the technical press analyze the business practices of successful electrical manufacturing concerns, contractors and supply dealers; educating farmers, architects and others in the great merits of electrical service.

For the last purpose a traveling force could be maintained by the society, while a corps of trained solicitors could also be maintained and placed at the service of small companies, at a small charge, for special campaigns.

In conclusion, Mr. Wakeman stated that the society had received the indorsement of many of the national electrical associations, manufacturers and the technical press, and that its far-reaching connections can make it the greatest "booster" ever known.

#### THE NEWS VALUE OF ELECTRICITY

Mr. Frank H. Gale, of the General Electric Company, then read a paper on "The News Value of Electricity," in which he said that news should be written and treated from the standpoint of the reading public, not from that of the advertising writer. Only items of real, legitimate news value, of interest and benefit to the public, should be furnished to newspapers.

There is a vast amount of news value, he said, in all branches of the electrical industry. There is something new happening every day of interest electrically, so that there is an almost unlimited field for good material open for use in newspaper publicity campaigns.

Of this material, part of it, that of a technical nature, does not appeal to the general public, but is useful to the technical press. On the other hand, there is always much in which the general public would take an interest. Real news and press-agent matter must be kept entirely separate.

Public-service corporations have long since found out that frankness and publicity pay, said Mr. Gale. Where officers of such companies have been close-mouthed and loath to talk to representatives of the local press, the reporters have often turned in unfavorable items pertaining to the central-station companies for lack of other news. Central-station managers should keep in touch with the newspaper men in their territory and encourage them to visit their offices.

The fiction of the day, Mr. Gale said, now contains many electrical references. He looks, he said, for an increase in the use of electrical terms in current literature.

Old-fashioned reading notices are no longer acceptable by trade or class journals, the speaker continued, but there is always a place for a good electrical article. All publicity work should be conducted fairly and the article tested for real news value, and no subterfuge of any kind attempted.

#### AN ELECTRICITY WEEK

He suggested that an "electricity week" be inaugurated, to occur simultaneously all over the country. Local dealers and central-station companies could make special offers at this time. The occasion, Mr. Gale felt, would become one of local interest which editors could not ignore and would greatly stimulate the use of electricity and publicity in the daily press. Electricity fulfils every requirement from a news standpoint, he said, which of itself is an indication of the youth of the industry, so that the present is a most opportune time to benefit by proper publicity methods and to put these into effect.

#### Discussion

Mr. W. E. Robertson, vice-president of the Robertson-Catacart Company, Buffalo, N. Y., and vice-president of the society, then replaced Mr. Doherty in the chair, so that the latter might participate in the discussion of Mr. Gale's paper.

Mr. Doherty stated that nowadays newspapers realize that press-agent work has been greatly overdone and the newspaper tendency is to reject business items. He thought that the newspapers should point out to business men where they should draw the line. He felt that there are hundreds of untold items concerning the electrical industry that are far better than those appearing in the press.

Mr. Wakeman mentioned as an indication that newspapers would accept an item of a business nature if of real news value the fact that the announcement of the conference, a business item, had appeared in over 200 newspapers.

Mr. C. G. Durfee, of the Rochester (N. Y.) Railway & Light Company, said that it is not difficult to get newspapers to publish items if approached in the proper way. In explanation, he told how difficult it had been in Roch-

ester a few years ago to get any electrical news in the local papers, and how after Mr. R. M. Searle, vice-president of the company, had told each employee that he might say anything whatsoever to reporters concerning the company's affairs, provided he always told the truth, conditions had been vastly improved.

In this way every person in the organization had been made an intermediary between the company and the local press, and the only restraint placed on any man was the proviso that he should always tell the truth.

Mr. Durfee said that as a result of this policy Rochester papers have few editions in which a good legitimate piece of electrical news cannot be found, and the effect of this has been the growth of much better relations between the company and the public, and the company and the newspaper, all of which, he stated, probably was more beneficial to the company than its paid advertising in the newspapers.

All of those in the company are in accord with the reporters, and the latter visit the higher officials each day and make at least one visit per week in all the departments.

Oftentimes, Mr. Durfee said, the name of the man who gave the story to the reporter appeared in print, and some discussion had taken place at meetings of department heads as to whether this was desirable. It had been decided, he said in conclusion, that the articles would lose much of their news value if the name of the person was omitted. This added the personal, or human-interest, feature to the item, Mr. Durfee said.

Mr. L. W. Sammis, who was the next speaker, said that, speaking from twenty-five years' experience on New York papers as a reporter and editor and also an advertiser, he knew of no trouble in getting items in the daily press whenever they had real news value. Some press agents are "blacklisted," he said, and their matter rejected, but this is usually because the press agent is trying to get matter into the news column when it really belongs in the advertising or income-producing part of the paper. Editors naturally resent such practice. As long as the exploiter's name is not pushed to the front, it is not a difficult matter to get items pertaining to the use of any product into the newspapers. Mr. Wakeman's announcement had been accepted readily by the newspapers, because it was one which exploited the entire industry, not an individual or a manufacturing concern.

Be frank with the newspapers, said Mr. Sammis; see that what you send them is in a concise form with something of interest in it. The papers really want enlightenment on such matters as the use and application of electricity. Give them what they want and they'll use it.

Mr. James H. McGraw, president of the McGraw Publishing Company, paid a high tribute to Mr. Doherty, as president of the society, and stated that he should have been a newspaper man as he has newspaper logic and almost spoke the newspaper language. Mr. McGraw said that Mr. Gale's paper was an excellent one and had interested him greatly. News items written along the line suggested by Mr. Gale would be real news and would be welcomed as such by the papers. There is no mystery of any kind concerning publicity work, the speaker continued; it is a straightforward, definite matter nowadays. The man who does not give intelligent thought to the subject is the one who does not understand the language in which publicity items should be treated, he said. What had been done in Rochester—convincing the newspapers that the public-service company there was telling the truth to them at all times—can be done everywhere, in every town and city, and if that policy is followed, the industry need have no fear of the daily press.

#### WHAT THE PUBLIC WANTS

Mr. Z. W. Carter, Boston, stated that the thought to be kept in mind is, "What does the public want in the way of electrical news in the daily press?" He believes that

business men are greatly interested at all times in electricity and in his experience has always found them keenly interested in visiting electrically operated factories. The editor of a Boston paper told him recently, he said, that he was greatly interested in electricity and wanted to hear more of it, which indicated that there is no trouble in giving away legitimate news. There is a great deal of such news, Mr. Carter said, which is not published because not given to the papers.

Mr. D. T. Pierce, of the McGraw Publishing Company, stated that in many years of experience as a newspaper man he had found that corporation heads often lost sight of the vast amount of benefit which their corporations could receive from proper publicity work at the right time. One of the best things the society can do, he thought, is to educate central-station managers to act effectively and intelligently in obtaining publicity in their local matters. Although the matter might often be prepared by a central bureau, it would be more efficacious if sent to local men so that they could hand it to the local papers. He emphasized this by telling of a railroad company which had followed this method, sending information to its station agents from its publicity office and letting the agents give local reporters the news items. This method had made the station agents a factor in the local news. The idea is capable of great extension, Mr. Pierce thought. He told something of the vast amount of matter that comes into a daily newspaper office and is rejected. For this reason care must be taken to get something of special interest in a news story in order to make it acceptable.

Mr. Earle Whitehorse, of *Selling Electricity*, said that he had found Mr. Durfee's remarks of great interest. He said that there is an army of special writers who stand ready to co-operate with the society, should the latter take up the idea of creating a central news bureau.

It being 1 p. m., adjournment was taken.

#### AFTERNOON SESSION

When the meeting reconvened at 2.30 p. m. President Doherty read a telegram from Mr. Charles F. Brush, the pioneer inventor in electric-arc lighting, who expressed his sympathy with the movement and his best wishes for the success which he prophesied was certain, owing to the high ideals of the society.

Mr. Doherty then introduced Mr. Philip S. Dodd, secretary of the Society for Electrical Development, Inc., who, Mr. Doherty said, was the second pioneer in the co-operative electrical movement, Mr. J. Robert Crouse being the first.

Mr. Dodd gave a short résumé of the program that had been prepared for the afternoon session.

#### ELECTRICITY AND THE ARCHITECT

Mr. W. H. Johnson, of Philadelphia, who had been asked by Mr. Doherty to take the chair, then introduced Mr. Frank E. Wallis, of Wallis & Goodwillie, architects, New York, who read a paper on "Electricity and the Architect." This paper was written in a happy vein and contained many valuable suggestions for improving relations between architects and electrical men. Light, said Mr. Wallis, is the fundamental feature of architecture and for that reason the architect and the electrical man have much in common. The use and misuse of electric light must always be taken into consideration by architects. Electrical men, he asserted, can get on much more favorable terms with the architect if they understand the architect's reasons for doing things; that is, his reasons for making changes in electrical installations for the purpose of softening and accentuating the design features of a room or building, etc.

#### ARCHITECT NEEDS AID OF ELECTRICAL MEN

He preferred to consider things from the attitude of the artistic and beautiful, but felt also that the financial



side should not be ignored. The architect, he said, often finds it difficult to provide an economical system for lighting, heating or wiring a building without the aid of the electrical man. Light, he continued, is the most important factor to be taken into consideration in the design of public libraries, civic centers and imposing structures of every nature, but he regretted to say that this factor is one that is greatly neglected.

He suggested that the society appoint a committee to act with the American Institute of Architects for the purpose of bringing about closer relations between the electrical man and the architect. The American Institute of Architects, he said, is doing a great public work in its own field, but co-operation with it on the part of the electrical man would result in developing much better work in both the architectural and electrical fields. Far better financial results would be obtained through the economies of design and construction that would be made possible by friendly co-operation.

#### LIGHT AN ENEMY TO CRIME AND DISEASE

Without heat, light and power, the speaker pointed out, we would return to barbarism. Light, and better light, are the enemies of crime and disease. In their hands, he continued, the electrical men have the power of bringing happiness to the world at large, and he urged that this tremendous power be used to the utmost advantage for all mankind. He then spoke of the work which is being done abroad by Mr. Leon Gaster in bringing about highly improved conditions in manufacturing establishments through the introduction of improved systems of illuminating. Through these systems production is being increased many times and the health of workmen is being conserved.

#### CO-OPERATION BETWEEN ARCHITECTS AND ELECTRICAL SALESMEN

Mr. Wallis, returning to the commercial, or what he called the "purely selfish," side spoke of the great assistance which he receives from the central-station salesmen, supply dealers and electrical contractors who call at his office to discuss business matters with him. In these men, and also in many other salesmen in other lines of business who call upon him, he finds a great fund of information which is useful to him in business.

#### Discussion

Mr. Doherty, in discussing Mr. Wallis' paper, said that he thought his suggestion to co-operate with the American Institute of Architects a very excellent one and one to be greatly welcomed by the society. He agreed with Mr. Wallis that the artistic side of design should be encouraged as much as possible, but said that as far as he personally was concerned his mind ran to the use of large quantities of electricity rather than to the artistic side of the art.

Mr. W. H. Johnson said that his company had employed a special man for the past four or five years to visit the architects for the purpose of getting their business, and that the relations between them and his company had been improved and that much business had resulted.

Mr. Wallis then said again, in a whimsical way, that his desire for co-operation with the Society for Electrical Development, Inc., was a purely selfish one and that it was the first time since 1876, when he started in as a practising architect, that such a society as the Society for Electrical Development had been organized, according to his knowledge. He said that he could be of great service to the members of the society in getting them in touch officially with the American Institute of Architects and would be glad to do so, that both bodies needed each other and that the architect needed the electrical man most.

Mr. Robertson said that he had been delighted with the artistic side of Mr. Wallis' paper, and that is what all are working for in the final analysis.

Mr. Dodd spoke of the great necessity that exists for co-operation between the electrical man and the architect in obtaining the best electrical equipment possible in all new buildings. Furthermore, he said, one rarely sees anything of an electrical nature in architectural magazines. He thought possibly an exchange of information between the electrical men and the architects would be of mutual service.

#### THE DISSEMINATION OF NEWS

Mr. Doherty then introduced Dr. Talcott Williams, director of the School of Journalism, Columbia University, New York, who was escorted to the chair by Mr. Dodd and was greeted with great applause.

Dr. Williams, after thanking the society for the hearty welcome which it had accorded him, gave an eloquent address in which he explained the work of the School of Journalism and the objects which it hopes to accomplish and told how the training which is being given to young men who are to become reporters on newspapers in all parts of the country contains an element which will be of the utmost service to the engineering industry.

There is not a calling, he said, which suffers so much with respect to the lack of knowledge of what is being done by it as that of engineering. The work of the engineer is often misrepresented in the daily press, he continued, not intentionally, but owing solely to the lack of training of the ordinary reporter. What the School of Journalism is doing among other things is to give to the students instruction upon the general principles of physics, chemistry and electrical engineering so that they will be able to express electrical and engineering matters in the proper phraseology and to appreciate the news in an engineering matter when they come in contact with it.

The whole effect of this training, he said, will be to insure more clarity and accuracy in the reporting of engineering matters for the daily press. The course which the students are given in engineering matters is not meant in any way for an engineering course, but, as stated before, is for the purpose of giving them the basic principles of the engineering industry. As a result of this work, the gap between the engineer and the American public will be more quickly bridged. Particular attention, he said, is being given in the School of Journalism to training the men in the industrial history of the country rather than its political history, the feeling being that knowledge of the history of industrial progress will be a far more valuable equipment to the present-day reporter than the usual course that is given in history.

Every effort is being made to condense courses in engineering history, etc., so that the student will get just the salient features of these and will obtain a sufficient knowledge of basic principles of all kinds so as to have a proper background for his work.

#### Discussion

Mr. Doherty, in discussing Dr. Williams' paper, said that there had been few speakers who had interested the society more than Dr. Williams had, and that as far as he himself was concerned he had totally failed to appreciate the work which the school is doing for the progress of American engineering and capital. He expressed himself as heartily in accord with the principle of giving to the students only the things that will be most useful to them. He felt sure, he said, that the men graduating from the School of Journalism will be centers of energy which will be helpful in developing journalism to a point which will be exceedingly useful to those present at the conference.

Mr. Max Lowenthal then expressed a rising sentiment thanks to show the society's appreciation of Dr. Williams' remarks. Mr. Doherty, before putting this before the conference for action, said that he had found in Dr. Williams' work a message of great cheer to those who are disturbed by the present trend in business and engineering affairs of



this country. The work of the engineer is a good one for the community, said Mr. Doherty, but it is little appreciated by the newspapers, which tear down capitalization and destroy its beneficial results. Hence the fact that Dr. Williams is training the young men in the industrial history of the country will certainly result in their appreciating more fully the work which the engineer and the capitalist are doing and presenting their side of the case more fairly.

A rising vote of thanks was then given to Dr. Williams, who said that the appreciation given to him by those present, representative of many technical interests, carried a message of great encouragement and hope to him, for the reason that his "short-cut" methods had come in for a great deal of challenge and criticism from all sides when he first inaugurated them. He offered to the society his aid and help in any way they could be used by it and again expressed his very profound thanks for the reception that had been given to him by the society.

#### THE SOCIETY AND THE NATIONAL ELECTRIC LIGHT ASSOCIATION

Mr. T. Commerford Martin, executive secretary of the National Electric Light Association, then read a paper in which he pointed out wherein the Society for Electrical Development and the National Electric Light Association had a common ground to work upon. The National Electric Light Association, Mr. Martin said, had indorsed the society because both of them have commercial development as their sphere. The central-station industry, Mr. Martin stated, is now doubling itself every five years, and anything that the Society for Electrical Development can do to make the industry double at a more rapid rate would be of mutual interest. Both societies, Mr. Martin went on, wanted to augment the electrical industry in every possible way and therefore had a common mission. He spoke also of the continual decrease in the cost of electrical energy to the consumer, thus helping to reduce the cost of living.

#### VIEWS OF THE PRESIDENT OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION

Following Mr. Martin's paper, Mr. Doherty said that Mr. Frank M. Tait, president of the National Electric Light Association, was in the room and asked him to make a few remarks.

Mr. Tait said that he had been chairman of the meeting at Association Island, New York, last summer when the committee which had organized the Society for Electrical Development had been appointed, and that while he had been a little skeptical at that time as to the success of the entire plan, because he had felt that the personal feelings of the various groups of the proposed society would outweigh any good that the society might do, his enthusiasm had been growing rapidly.

He expressed some wonderment as to just how the central-station companies were going to regard the work of the Society for Electrical Development and was somewhat surprised, he said, to see so few representatives of the central-station companies at the conference. He thought that they should have come forward in greater number and that they were losing a great deal by not being present. For their benefit he suggested that the society send a record of the meeting to each of the central-station managers.

Mr. Doherty thanked him for the promise of co-operation from the National Electric Light Association and said that he felt Mr. Tait would not be disappointed in the outcome. He then asked if Mr. E. W. Lloyd, chairman of the Commercial Section of the National Electric Light Association, was in the room, and if so if he would not come forward and tell those present some of the work which was being done by that section.

Mr. Lloyd, however, was not in the room at the time, so Mr. Doherty went on to tell of some of the splendid work which the Commercial Section is doing. This section, Mr. Doherty said, had had a marvelous growth. He spoke of the attempts which he had made to conduct a commercial meeting of the National Electric Light Association in 1902, when he was its president, and how at that time he was unable to get enough commercial material and interest together for a three-hour session. He had then predicted that the interest in commercial progress would outweigh that in the technical and scientific sessions within five years, and he had been gratified, he said, when at the convention in Chicago in 1908 he had found the biggest hall that the association had been able to obtain crowded to overflowing at the meetings of the Commercial Section, whereas hardly anyone attended the meetings of the technical sections.

Mr. Doherty felt that co-operation between the Commercial Section and the Society for Electrical Development has great possibilities for stimulating expansion along commercial lines.

#### EFFICIENCY IN LOCAL ADVERTISING

Mr. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company, next read a paper on "Efficiency in Local Advertising." He first gave a vivid picture of electrical conditions ten years hence as seen in a dream. The luxuries of to-day, he found, were the necessities of that period. Everyone spoke of electrical equipment with the same familiarity with which one now speaks of the ordinary household devices such as faucets, etc. The streets, he said, were illuminated, not merely lighted. The homes were electric homes, and all work around the house was done electrically. Devices in shop windows were plainly marked with the name of the device, its uses, cost and the cost of operating it. Electric vehicles were in common use. Questions concerning jobbers, dealers, contractors and central-station companies were discussed in harmony and selfish feelings were submerged. He found the newspapers replete with electrical news and recipes for use with electrical devices were given in the domestic-science department of the newspapers. Moving pictures portraying all branches of the electrical industry were being shown.

All of these things are possible, said Mr. McQuiston, and all of them will eventually be. The society can help to do this, he said, in many ways. Efficiency in local advertising, he continued, can be obtained only by real co-operation. Advertising in the local paper was formerly regarded as a necessary evil, and when once a contract for advertising had been placed it seldom received attention afterward. He mentioned a case which had come to his personal attention where a central-station company had paid so little attention to its advertising copy in the local paper that in the month of June it was advertising its service for thawing frozen water pipes. The copy had been given to the paper in the winter time and the company had never bothered to change it.

When the manufacturer advertises on a broad scale the local dealer should follow this up with an advertisement in his local paper.

#### THE PEOPLE'S PAGE

Mr. McQuiston said that he was opposed to the electrical page as it is now carried on. He said that the electrical page is ignored by thousands of people in just the same way as is the financial page, because they are indifferent to the matter on it and turn to something else from force of habit, after a mere glance at it. It generally contains, he said, many items which are of no local interest and is not prepared in an attractive form for the layman. It often quotes technical questions and answers in which the general public has no interest.

What should be done is to secure all advertising absolutely on its own merits as such. This would instill the wonders of electricity into people's minds far better than it is now done by the "people's page" in its present form. The objects of the "people's page" would be accomplished in a far better way if the items were scattered throughout the paper rather than grouped on one page as is now the case.

Manufacturers offer many aids to the dealers. They will furnish copy for local newspapers, street cars and billboard advertisements, he said, and also furnish to the dealer the service of experts on window dressing, etc.

#### SOURCES OF PROFITABLE ADVERTISING

Window-dressing, said Mr. McQuiston, cannot be over-estimated as a source of profitable advertising. An excellent idea, he said, is to place on each appliance a tag showing the purpose, name, uses, cost and cost of operation of the appliances. Women demonstrators are also useful in stimulating the sale of electric appliances, and when such demonstrators are employed newspaper notices of their work are highly desirable.

Another way in which the local fields can be improved is by arranging for talks by well-known women on electric cooking, and talks by competent men before clubs, with lantern slides and moving pictures, on electrical subjects. Schools are a very fertile source for stimulating an interest in the application of electricity.

#### MOVING PICTURES AS AN AID

Moving pictures, thought Mr. McQuiston, offer a very desirable form in which to stimulate the public's interest in the electrical industry. The leading film producers, he said, are now making many industrial films which show the methods of manufacturing and the use of many products. Moving pictures are presented in the evening after the day's work is done and the audiences are in the most receptive mood. An interesting scenario dealing with the generation or utilization of electricity, followed by one showing the method of manufacturing appliances for using the energy itself, would be a forcible method of showing the advantages of electricity.

#### BENEFITS OF CO-OPERATION WITH CITY OFFICIALS

Another good method in which to obtain efficiency in a local way is to have regular meetings between the jobbers, contractors, dealers and central-station sales agents and advertising men and to have the work that is being done along advertising lines by the central-station company explained to them. City officials should be cultivated. Oftentimes good results are obtained through the loan of apparatus to the city. The loan of pulmotors by the Commonwealth Edison Company to the city of Chicago received a great deal of publicity, Mr. McQuiston said, and helped to improve the relations between the electrical service company of that city and the latter's officials. The New York Edison Company loans fans in the summer months to hospitals and certain charitable institutions, and this, he pointed out, furnished a desirable kind of publicity. The methods of the Edison Electric Illuminating Company of Brooklyn for co-operating with contractors in the lighting and dressing of the latter's windows (*Electrical World*, Jan. 11, 1913, page 99) he also recommended highly as a means of improving local conditions.

Electric signs are an ever prevalent aid for promoting sales of appliances and electrical energy.

#### A TRAVELING ELECTRICAL SHOW

One thing that appealed very much to Mr. McQuiston was the economy that might be obtained from having a traveling electrical show instead of conducting the electric show along its present lines. The building of new shows is very costly and wasteful, he claimed, and the sentiment

of manufacturers has been somewhat antagonistic to them. A moving electrical show, to travel all over the country, with advance advertisements of its coming, will, he thought, give fully as good results as the present expensive methods in use, at far less cost.

#### DISCUSSION

Mr. W. E. Robertson, in discussing Mr. McQuiston's paper, said that he had once been the proud, but is now the unhappy, father of the electrical page. Before the electrical page was introduced dealers and contractors did not advertise, the speaker said. Only the central station and the telephone companies used advertising in the local papers. The greatest trouble with the electrical page in his opinion is that it has never been properly edited. The Society for Electrical Development might do something along the lines of editing the electrical pages in a proper manner. Everything considered, he thought possibly the best plan was to buy advertising space in the daily papers. Mr. Dodd said that the ultimate in efficient local advertising would be reached when the Society for Electrical Development was fully represented all over the country. The time would come, he thought, when all four groups of the electrical industry in the society will co-operate in local advertising campaigns.

Mr. H. B. Woodill, president of Woodill & Hulse, contractors and dealers, Los Angeles, Cal., said that what the dealers want is co-operation from the manufacturer. Mr. Woodill does not look upon the electrical page as of any service to the dealer, and he thinks that it would be a shame and a sin to publish in the State of California anything of the description of the page now published in Cleveland.

Mr. Wakeman said to Mr. Goodill that the promoting of local harmony was one of the objects of the Society of Electrical Development. Lack of harmony, he admitted, often occurred when the central-station company sold appliances at prices with which the local man could not compete. The idea of the society, he explained, is to bring these interests together so that all can make a good living in the electrical field. It would be a very good thing, he thought, if the society could get the local dealer to place his stock in the windows instead of on the shelves, and to encourage him to get a store in a prominent location instead of on the side streets.

Mr. Frederick Bissell said that the electrical page had been tried out in Toledo, but it seemed to him that it really killed more business than it brought in. A good electrical page would be welcomed in Toledo, and anyone who could work up an efficient page would be gladly received.

#### SUMMARY

Mr. McQuiston, summarizing, said that the great thing to keep in mind is "Are your advertisements read?" He again suggested that electrical news should be distributed throughout the newspaper so that it would be read, as it would then have a higher efficiency than it secured on a single page, conducted in the present way.

#### EVENING SESSION

The session of Tuesday evening was given over to a condensed discussion of ideas and suggestions received from various individuals, electrical associations and luncheon clubs, proposing lines along which the activities of the Society for Electrical Development may best be directed. The large amount of discussion material thus received prior to the meeting was quickly summarized and reported before the society by Mr. T. Commerford Martin, executive secretary of the National Electric Light Association.

Mr. Martin read first a communication from the president of the National Electric Light Association, Mr. F. M. Tait, president and general manager of the Dayton (Ohio) Elec-



tric Light & Power Company, in which the aims and purposes of the Society for Electrical Development were strongly commended and central stations urged to join in supporting its activities.

A telegram from Mr. C. R. Huntley, president and general manager of the Buffalo General Electric Company, offered the substantial co-operation of the Buffalo General Electric Company, the Cataract Power & Conduit Company and other subsidiary Niagara Falls corporations in furthering the Development Society's campaigns.

#### ABSTRACT OF SUGGESTIONS OFFERED

Mr. Martin enumerated briefly the various heads under which he had divided the large amount of submitted material, citing such diversified classifications as general publicity, publicity within the industry, educational work, traveling shows, traveling representatives, campaigns of education for the public and for the electrical industry, books on commercial development and commercial practice, the unification of water-power laws, co-operation with civic bodies, relations with the general press, education of young men for the central-station industry, stimulation of electrical merchandising, etc.

A communication from Mr. J. C. Parker, abstracted by Mr. Martin, urged the unification of the water-power laws of the country, both state and federal. In their present condition the injustice of some of these legal enactments affects everyone in the industry, declared Mr. Parker. It is therefore to the common interest of all members of the electrical fraternity, insisted the writer, that these trammels and restrictions on the development of our national resources be reduced to their lowest limit and denomination.

#### CO-OPERATION OF CIVIC BODIES

Mr. S. L. Coles recommended closer co-operation with local chambers of commerce, boards of trade and other civic organizations. He cited an instance in which he had secured the installation of an ornamental system of street lighting in a small town, in addition to the construction of a power building for the use of small manufacturers. From both of these developments, he pointed out, the local central station will profit substantially, as well as the community.

Mr. T. C. Martin himself recommended the appointment by the Electrical Development Society of a promotion committee, whose members might be drawn from other collateral organizations in the electrical field. This committee would serve as a clearing house for the introduction and distribution of ideas. Each organization represented should also appoint its own standing committee to co-operate with the joint committee of the Electrical Development Society.

#### GENERAL AND TECHNICAL PUBLICITY

Dr. A. S. McAllister, senior associate editor of the *Electrical World*, pointed out the need of greater publicity concerning the objects and aims of the Society for Electrical Development. He also outlined methods by which further co-operation might be secured within the society and the industry, and urged the preparation and distribution of pamphlets showing the general public what use can be made of electricity, how to use it and what the cost will be.

A communication from Mr. O. H. Caldwell, also of the *Electrical World*, as abstracted by Mr. Martin, pointed out the value of publicity both in the general field and within the industry itself. The correspondent referred to the need of effective work to get old houses wired, and suggested the appointment of several traveling representatives to study and adjust local differences between central-station companies and contractors.

Mr. Frank B. Rae, Jr., editor of *Electrical Merchandising*, recommended that the society put a limit on its own publishing activities, avoiding the plan of any such co-operative effort which might be regarded as similar in na-

ture to the "municipal ownership" ideas which its individual members are combating in their own fields. The quality and vigor of the present publications in the field are maintained by the principles of fair competition which now prevail. The introduction of co-operative effort, however, would be likely to drive independent publishers from the field.

#### CENTRAL-STATION SALES TRAINING

Mr. Sydney W. Ashe, of the General Electric Company, Harrison, N. J., pointed out that while the sum of money available for the society's use is not large, it can be applied to accomplish much effective educational work. Mr. Ashe suggested spreading the idea of central-station institutes throughout the country, similar in plan to the school already organized by Mr. Samuel Insull and his associates of the Commonwealth Edison Company, Chicago. It would be of the utmost value to the industry, he declared, to have schools of this kind for the training of candidates for central-station commercial work. Such an opportunity for preparation should attract picked young men, who should be good mixers, earnest students and well capable of taking punishment.

#### ELECTRICITY IN AGRICULTURE

A report from a joint committee of electrical men and Jovians of San Francisco, Cal., next read by Mr. Martin, pointed out the "A B C's" of commercial effort, which they expressed in the alliterative motto: "Attract attention; bring buyers; create confidence." This report urged the further development of electricity especially in the home and on the farm and recommended the education of both architects and farmers concerning the uses of electric lighting and motor applications. The usefulness of county fairs and other public welfare exhibitions was also mentioned among the methods for creating rural interest in electricity. Sales campaigns, it was shown, can be made more effective, for example, if they are preceded by practical articles in the farm journals supplementing and enlarging the arguments later to be presented by the salesmen. One suburban company has arranged an electric truck which has been equipped with all sorts of lighting and motor appliances. This truck can be sent out through the countryside for the local demonstration of the comforts and conveniences of electricity and central-station service.

The Boston Edison Company, added Mr. Martin, makes use of a traveling electrical exhibit, with two circus tents. One tent is put up before the first one is taken down, and in this way the exhibition material can be transferred from one location to another without possibility of injury from weather, etc. The test exhibit includes a complete display of farm apparatus adapted to be driven by electric motors, methods of illumination, etc.

#### ELECTRICAL MERCHANDISING

Mr. Max Lowenthal declared that increased attention should be given to the subject of electrical merchandising, and to this end he recommended the establishment of an electrical merchandising department or clearing house by the Electrical Development Society. One way in which such a bureau might prove useful would be in the compilation and distribution of suggestions for window displays and window trimming. The exchange bureau, for example, might collect hundreds of photographs of good window displays, and then, at the request of individual subscribers who found themselves in need of suggestions, a number of appropriate pictures could be forwarded for inspection.

Moving window displays might also be listed, and even routed from place to place as used by successive central stations. Price cards could also be prepared by the bureau's sign writers, at a price merely enough to cover the cost of production. The bureau might also act as a "brain brokerage" office for high-class central-station employees, salesmen, commercial men and others. By co-operating



with the advertising departments of the various large manufacturing and central-station companies much effort could be saved, and advertising material and cuts might be filed for co-operative use. Instructions could be furnished dealers concerning improved merchandising methods. Printed forms might also with advantage be furnished for shop use.

The Electrical Development Society, continued Mr. Lowenthal, should exercise a rigid censorship over unsafe electrical appliances, a delinquency in which the department stores, with their cheap apparatus, are the principal offenders. Clippings might also be collected from various commercial and trade press sources for the further dissemination of such practical ideas where they might do the greatest good. The good offices of the society could be used to advantage, too, in the adjustment of sales policies.

#### THE APPLIANCE SALES OPPORTUNITY

In one of the most elaborate discussions among those received by Mr. Martin, Mr. Frank Seaman called attention to the development of both the existent market and the latent market for electrical utilities. Conditions in the electrical industry, he pointed out, have not reached the severe competitive degree found in the older and more saturated fields, as in the drug and dry-goods trades, where sales campaigns are sometimes undertaken with forlorn hopes of reaching an already full market. The overstocked condition which prevails in the older markets does not yet affect the commercial efforts of central-station activity; but the future, predicted Mr. Seaman, will require in the central-station field an intensity of effort that has been hitherto unknown. The correspondent suggested methods of getting into the latent market, and pointed out that the thought of cost is one of the dominant negatives tending to hold back development in this field.

As an example, citing the lack of saturation to which electrical merchandising has been carried at the present time, the writer reported on the replies from 673 women subscribers to a woman's magazine, scattered throughout twenty-six cities of the country. Of the 673 answers received, 526, or 78 per cent, of the women reported that they already use electric light in their homes. In answer to the question "Would you welcome the general use of all kinds of electrical appliances in your own household?" 497 replied "Yes," indicating their lively interest in electrical labor-saving devices and conveniences. Seventy-five per cent of the number reported using electric irons, 31 per cent vacuum cleaners, 27 per cent toasters, 23 per cent fans, and 14 per cent percolators. Of all the other appliances on the market none reached a greater proportion than 6 per cent in use by these 497 women. These figures illustrate, said the correspondent, that, despite the large number of women greatly interested in electrical devices, the total number of sales accomplished to date still leaves an enormous unsatisfied and latent market. The whole question of electrical development, he concluded, is that of the cost to the user, a problem which, he added, has not yet been successfully solved by the manufacturer, central station or dealer.

#### EDUCATING BUILDERS AND THE PUBLIC

Mr. S. G. Hibben referred to the necessity of educating the contractor and the architect on the proper use of light, and recommended the broadcast distribution of the Illuminating Engineering Society's "Primer," as already suggested by a previous correspondent.

Mr. W. A. Wadsworth recommended the appointment of traveling representative to exchange ideas and bring about better local co-operation.

Mr. M. A. Edson suggested the organization of traveling electrical shows and exhibits, which might be drawn upon by various subscribers for exhibition in their own neighborhoods.

#### A TRAVELING CENTRAL-STATION EXHIBIT

Mr. John F. Gilchrist, assistant to the president Commonwealth Edison Company, Chicago, described some of the suburban plans of the Middle West Utilities Company, an Insull subsidiary. This company has purchased a new railway car, which is to be equipped with electrical devices as a moving exhibition capable of being transported from town to town along the syndicate's transmission system. The advent of the car in each community will be preceded by an advance agent, who will arrange striking advertising in circus style, preparing the local community for the coming event, and stimulating interest in the central-station exhibit. The car will also be equipped with a moving-picture machine, to provide entertainment as well as instruction by means of special central-station films posed by the Chicago company's representatives. In closing, Mr. Gilchrist recommended that central stations "take their own medicine," to a greater degree, in the use of outdoor advertising by means of electrical signs in their own communities.

Mr. S. L. Coles recommended the standardization and formulation of uniform electrical ordinances and the improvement in existing legislation. Particular objection was raised by him to the cards sometimes found in hotel rooms warning guests against the use of electric irons or devices as a source of danger or fire. Such signs suggest the existence of a fire hazard with electric devices, which is not present.

#### SUGGESTIONS FOR COMMERCIAL DEVELOPMENT

Mr. F. B. Rae, Jr., pointed out that the barrier which now most interferes with the development of the industry is the inertia found in various branches of the field. To counteract this, he declared, there must be an aggressive publicity campaign applied to and supported by the entire industry. Such a campaign is needed to educate and stimulate central stations, contractors and dealers. In furthering this result, he insisted that suggestions of all kinds be accepted on their merits, regardless of source or authorship.

Mr. Rae declared that there exists a need for more business books on the commercial side of electrical merchandising and sales. Some of the subjects for which he recommended more adequate treatment are business methods for contractors, store arrangement, bookkeeping, merchandising, window trimming, etc. He also suggested the establishment of an advisory council, whose assistance individual companies might call upon in deciding upon expenditures in publicity campaigns, sales undertakings, etc. Another useful department would be one for compiling research and statistical data. This information should then be furnished to professional writers, he proposed, to arrange in attractive form for distribution to the popular press.

Mr. Dana Pierce, of the Underwriters' Laboratories, urged that the Society for Electrical Development advocate the use of approved electrical devices.

#### INTERESTING OTHER INDUSTRIES

In opening the discussion, President Doherty explained that with the wealth of suggestions that have been offered the problem becomes chiefly one of selecting the material of most value. While the problems of selling can be discussed learnedly and in academic fashion, "it often takes a roughneck," said Mr. Doherty, "to go out and sell!" The speaker then cited a number of interesting and profitable plans and methods by which central stations can improve their local business.

#### MANUFACTURERS WHO SHOULD USE ELECTRICITY

Mr. Doherty also proposed that the society urge upon those manufacturers who do their chief business with electric-service companies the advantages and advisability of electrifying their own shops and installing electric service

throughout their own plants. The assistance of the automobile interests, he also suggested, might be enlisted to secure more adequate lighting of country roads, thus obtaining the light for the automobilists and valuable revenue for local central stations. This is but an example, said Mr. Doherty, of the useful principle of letting other people help do for you things which will be to their mutual advantage.

One hotel, for example, completely equipped with electricity, at once becomes the basis or standard of local hotel construction, and thereafter it is simply a matter of routine salesmanship to equip similarly other new hotels as they are built from time to time. Mr. Doherty referred to the desire of the popular magazines for interesting news stories and proposed that a press-clipping bureau be patronized to provide hints from which professional writers might prepare attractive accounts of electrical devices, undertakings, etc.

Cities which legislate against electric signs, declared Mr. Doherty, are legislating against their own attractiveness. Many municipalities spend large amounts upon beautifying their parks and boulevards, yet fail to recognize that the illumination of their downtown streets is even a larger factor in bringing visitors and business and making their community attractive. Light brings a crowd, and a traveled street means business.

#### TECHNICAL ASSISTANCE FROM OUTSIDE

The Electrical Development Society, continued the speaker, will get valuable assistance from the government bureaus, especially along the lines of electricity on the farm. Much valuable and useful work might also be done by college students in the preparation of these, if proper subjects were suggested by some practical body such as the society. College seniors would welcome the opportunity to do useful work of this kind, and without cost to the industry they could render valuable service in attacking the solutions of both commercial and technical problems.

Mr. Doherty had a good word for the Jovian Order, commending its aims and declaring that the men who belonged to the organization "can do things." He also spoke with approval of the plan for a training school for commercial employees, declaring that in his own organization the value of this scheme had already been many times proved.

One way in which the local central station can reach many of the local manufacturing companies who are prospects for electric service, as pointed out by Mr. Doherty, is through the electric company's own board of directors, men in most cases allied with the various local industries. In almost every central-station community the membership of the electric company's board of directors reaches practically every local line, affording useful avenues of approach to securing profitable power and lighting business.

#### ELECTRICITY AND THE AUTOMOBILE

Even the gasoline automobile, said Mr. Doherty, is being equipped with electrical appliances which have hitherto been overlooked by the manufacturers of electrical machines. The maker of one prominent gasoline car, for instance, is experimenting with no less than thirty new applications of electricity on his gasoline vehicles. Among these are hand projection lamps, useful in reading roadside signs and direction bulletins, and automatic electric lamps arranged to illuminate the sidewalk and step when the car door is opened. Possible applications thus outlined in the automobile industry alone should be worth \$2,500,000 each year, estimated the speaker.

Gasoline continues to go up, making the cost of operating internal-combustion engines almost prohibitive. Indeed it is predicted that within a year or so the price will reach 40 cents a gallon, a development which cannot but work to the advantage of the electric vehicle. The need of the hour in the field of the electric car, however, declared Mr. Doherty, is a less costly vehicle, and he urged that unless some manufacturer soon supplies this demand

the society itself encourage the production of such a car, going outside the electrical industry if necessary.

#### GETTING THE OLD HOUSES WIRED

Mr. T. F. Bludworth, of the Public Service Corporation of New Jersey, referred to the difficulty in getting old houses wired and urged that more attention be paid to demonstrating to prospective customers that with present construction methods house-wiring can be installed without injury or disarrangement of walls, furniture or household effects. Mr. Bludworth also insisted on the necessity of having men of suitable information, education and caliber visit customers and prospective customers, and declared that unless proper confidence is inspired by such calls it will be difficult to close desirable business. Moving pictures have been employed by the Public Service Corporation to demonstrate the conveniences and comforts of electricity to prospective customers.

Mr. Converse D. Marsh called attention to the value of general publicity campaigns in supplementing the work of salesmen by presenting his arguments in advance.

Mr. C. G. Durfee, of the Rochester Railway & Light Company, Rochester, N. Y., reported that his city has 1200 to 1300 industries, and that his company will co-operate in every way possible with the efforts of the Electrical Development Society.

Mr. Robert Ely, of Philadelphia, suggested that when educative lectures are given to promote central-station development these be held in unwired churches and buildings, the charge for admission being devoted to wiring the structure and thus securing additional customers for the local central station.

#### REACHING THE COMING GENERATION

Mr. Edward L. Bailey proposed that lecturers shall receive salary and expenses to travel among rural high schools and lecture to the high-school students, in this way reaching future farmers and citizens with instructive information concerning the uses of electricity in agriculture and the industries.

Mr. Burton Emmet said that the average family becomes a user of electric light, toilet soap, pianos, automobiles and other so-called luxuries as soon as it has reached a degree of affluence where these can be afforded. No criticism is ever made of the cost. Of the 10,000,000 houses in this country, said Mr. Emmet, only one-fifth are equipped with electric lamps.

Mr. G. H. Barbour recommended that the society take recognition of new inventions brought out, especially those of foreign origin.

Mr. Norman Macbeth, editor of *The Lighting Journal*, pointed out the necessity of salesmanship in commercial relations between manufacturer and consumer, and urged upon the society the necessity of properly looking after the interests of "the man between."

Mr. G. A. Stickney closed the discussion with a brief reference to the necessity of safety precautions.

#### MORNING SESSION, MARCH 5

The morning session on Wednesday, March 5, was called to order at 10:15 a. m., with Mr. A. W. Burchard, of the General Electric Company, New York, in the chair. The first paper to be read was entitled "Co-operation in the Electrical Industry," by Mr. J. Robert Crouse, National Quality Lamp Division, General Electric Company, Cleveland, Ohio. In view of the detention of Mr. Crouse the chairman called upon Mr. F. E. Watts to read Mr. Crouse's paper.

#### CO-OPERATION IN THE ELECTRICAL INDUSTRY

The author stated that during 1905, 1906 and 1907 it had been his mission to raise the entire question of co-operative market developments in the electrical business as a trade and economic issue.

At the St. Louis convention in 1910 Mr. E. A. Sperry, in



reviewing the work of the association, remarked that it was on the threshold of advances during the approaching quarter century as great as those which had taken place in the quarter century then just elapsed. He indicated that future developments were destined to follow commercial lines very strongly.

The author predicted that engineering matters will be radically subordinated within the next few years to purely commercial questions and especially to the problem of developing salesmanship. Improvements in the economy of operation viewed from the standpoint of increased revenues are not to be compared with the possibilities in the direction of increasing the market for the sale of electrical appliances and electrical energy. Here the interests of the central station and the manufacturers are oftentimes identical, and co-operation is highly essential.

#### CO-OPERATION A RECOGNIZED FACTOR IN INCREASING DISTRIBUTION

Commercial co-operation, said the author, is a thoroughly accepted principle and a recognized factor in increasing the efficiency of production and distribution. In other words, men can accomplish more through collective effort than by segregated or individual effort inevitably accompanied by wasteful conflicts and opposite purposes. Within a comparatively brief period business has passed consecutively through the period of individualism, co-partnership, corporations, consolidations, syndicates and associations. Each advance has been in reality a recognition of the co-operative principle and has tended to restrain such competitive effort as inherently tends to defeat its own objects. In the field of manufacture or production there has been an enormous gain in efficiency as a result of specialization, co-ordination and co-operation. On the other hand, selling and distribution have made little gain in efficiency, notwithstanding steady progress in the refinement and perfection of organization. Production has been subject to the advantage of the economic law of increasing returns, while distribution has been subject to the law of diminishing returns. Some plan of co-operative commercialism which will place distribution under the economic law of increasing returns will unquestionably appeal to all.

The author next considered several propositions, the first being whether the \$18,000,000,000 of wealth annually produced in this country is not unduly diverted from the purchase of electrical appliances and electrical service to the attainment of mere luxury and the purchase of such things as automobiles, pianos, phonographs, etc.; second, the question whether a practical plan cannot be devised to alter this condition, and lastly whether these plans, per unit of money and effort expended, will not yield a better return than it is now possible to secure.

#### HOW TO PROMOTE CO-OPERATION

Manufacturer, jobber, dealer and central station are therefore all equally interested in educating the public to the advantages of electrical service. Among the agencies proposed by the author for securing this result are a national campaign of advertising, a national electrical press bureau, the use of advertising service through agencies, the creation of new business departments in the technical press, the establishment of schools of electrical salesmanship, sending out field men among lighting companies and electrical contractors and allied trades, the distribution of a suitable commercial literature to the different trades, and, finally, the offering of special prizes for excellence in commercial work such as those which resulted, for instance, in the "Solicitors' Handbook" of the N. E. L. A. Local electrical leagues, such as the one that has existed for several years in Cleveland and was recently consolidated with the local Jovian League, have done much to spread popular knowledge of the advantages of electrical service. One of the tangible outcomes of this work is the so-called "People's Electrical Page," which appears twice

each week in certain leading newspapers. This page is supported by the local central-station company and the various jobbers and contractors. The author said that similar leagues have been formed in fifty cities and "people's pages" started in fifty newspapers, with an aggregate annual circulation of 50,000,000 copies. These instruments of co-operation offer an excellent opportunity for increasing the general good-will of the public toward the electrical business as a whole, he thought.

The organization of Past-Jupiters of the Jovian Order has created a fund of about \$3,500, and has an annual income now exceeding \$1,500. A movement is also under way in Cleveland to establish a two-thousand-dollar fund in connection with the Jovian League, the income of which will be used to promote the objects of the order. An association of Past-Presidents of the Society for Electrical Development is also proposed, and Mr. Crouse offered to pledge himself personally in the sum of \$5,000 as part of a minimum fund of \$50,000 to be used in promoting the work of the society.

#### Discussion.

The chairman called on Mr. E. W. Lloyd, of the Commonwealth Edison Company, Chicago, and also chairman of the Commercial Section of the N. E. L. A., to discuss the paper. Mr. Lloyd stated that the Commercial Section was founded at the St. Louis convention in 1910 through the efforts of Mr. George Williams. At that time those interested in this new section were not clear as to exactly what work it should undertake, but the leading men in the central-station industry were unanimous in their opinion that the commercial side of the business was undeveloped and needed serious attention. The commercial section now has between 1200 and 1500 members and has devoted itself mainly to the distribution of up-to-date information and data which will help central-station salesmen in securing new business. Substantially nothing has been accomplished in the direction of developing salesmen or teaching salesmanship. The officers of the section have devoted their limited income to such work as seemed to promise the largest immediate returns. Data are now distributed by the section four times a year. Mr. Lloyd stated that real salesmen with technical knowledge and central-station experience are much in demand. He emphasized, also, the fact that there are altogether too few good books on central-station salesmanship, there being less than a half dozen which can be recommended. He also stated that those who have charge of advertising do not publish the right kind or enough data. In closing the speaker announced that the program for the Commercial Section at the Chicago convention will be short in order to devote as much time as possible to discussion.

#### THE SALES END

The author of a paper entitled "The Sales End," Mr. James H. Collins, of New York, opened his discourse in a humorous vein and traced the descent of the present-day electrical salesman from the lightning-rod agent of a couple of generations ago. The father of all salesmen, said the author, was the book agent. The lightning-rod agent was undoubtedly deficient in technical knowledge, but well equipped in the psychology of salesmanship, and understood how to "put it over." The modern electrical salesman essentially needs instruction in the art of salesmanship. Successful selling methods differ with each industry, but in all cases the education of the proper attitude on the part of the salesman is fundamental. In referring to the frequent lack of alertness on the part of central-station salesmen, Mr. Collins mentioned a man who used a laundry machine for performing an operation styled "wet-washing," which he said is likely to become an important supplement to the electric firm in building up the central-station business. This is a washing machine which turns out the washed materials just dingy enough for ironing.



In referring to the objections advanced by some central-station companies against the distribution of electrical appliances through retail dealers, the author stated that this, nevertheless, is the modern method of distribution. The merchant, said he, must always stand behind the quality of his goods, just as the contractor should stand behind his installation or the central station behind the quality of its service. The jobber, who is a middleman, fills a real want and is virtually a clearing house. Electrical appliances, the author emphasized, must become universally known by the public, and to this end the co-operation of all interests, each in his proper sphere, is essential.

President Henry L. Doherty took the chair and asked that discussion of the preceding paper be postponed until the presentation of Mr. Robertson's paper, an abstract of which follows.

#### MERCHANDISING CO-OPERATION

Mr. W. E. Robertson, vice-president of the Robertson-Cataract Company, discussed the subject of "Merchandising Co-operation," and by way of introduction remarked that many of the points which he wished to make had already been covered. While having no quarrel with the selling methods of the past for the development of the electrical industry, the speaker voiced the opinion that in the merchandising of electrical appliances a new day has arrived. The retail dealer, he stated, could make a very handsome net profit if the central-station company would charge up to merchandising cost all of the elements of expense such as rent, light, heat, general expense and depreciation. The speaker stated that he had investigated the comparative number of business failures among jobbing concerns and among manufacturers and found to his surprise that failures among the former class are almost unknown, whereas they are comparatively frequent among manufacturers.

#### A GOOD BUSINESS LOCATION ESSENTIAL

Mr. Robertson explained that his concern makes a very careful study of its points of distribution and notes especially the factors which make for the success of the dealer and the contractor. His concern also keeps in close touch with merchants, associations and organizations. Location, he explained, has more to do with a dealer's success than any other one factor, as proved repeatedly by the experience of the Woolworth five and ten-cent stores and the United Cigar Stores. Experience shows that people as a whole will not go out of their way to satisfy their desires or wants, unless compelled to, and the successful dealer must offer his goods to the public at a location which suits its convenience. If the goods are brought to the people, so to speak, they can be marketed at a very low cost.

#### RETAIL COMPETITION NECESSARY TO STIMULATE MERCHANTS

Retail competition, in the speaker's opinion, is a good thing and necessary to the development of keen, alert merchants. Under a state of monopoly in retail trade, stagnation is likely to result. Retail competition is preferable to monopoly which puts prices so low as practically to exclude competition. The development of keen, responsive, intelligent merchants and the wide and effective distribution of merchandise require retail competition. Among the important factors in retail merchandising are location, window display, courtesy, newspaper advertising and direct appeals from the counters of the shop or store. In selected locations retail stores to-day are justified for electrical merchandising in communities where the central-station company is not retailing appliances at cost or below and recovering the margin of profit in the price charged for electrical energy.

#### DEALER CAN GAIN CONFIDENCE MORE EASILY THAN CENTRAL STATION

Under equal conditions, declared Mr. Robertson, a retail dealer can outsell a central-station company. It is also

easier, the speaker stated, for a local dealer to obtain the public confidence than for the central-station company to acquire it. The sales of his concern to large industrial concerns are so much larger than sales to retail dealers that the latter are really only incidental. In concluding his remarks, the speaker repeated his conviction that retail stores for merchandising electrical appliances can be started and successfully maintained in many localities if there is substantial and effective co-operation among all the interests involved.

#### Discussion

Mr. W. H. Johnson, assistant to the president Philadelphia Electric Company, Philadelphia, Pa., took the chair, and Mr. Henry L. Doherty then opened the discussion on the group of papers just presented. He agreed with many of the statements made by Messrs. Collins and Robertson but said they had not completely stated the central-station problem. Mr. Doherty agreed that every article of trade should be sold at a price which would net a profit. Speaking of jobbers and middlemen generally, he called attention to the public antagonism toward corporations, which commenced to assume serious proportions some years ago, and the more recent antagonism toward the middleman, who is supposed to be responsible in some degree for high prices. However, the public is coming to realize, according to Mr. Doherty, that the middleman is a necessary factor, and antagonism toward him will probably diminish hereafter.

#### FIXED RETAIL PRICES ADVANTAGEOUS

The speaker also voiced his sentiments in favor of placing trade articles on the market under fixed retail prices and referred to the situation in Congress, where a bill is pending which would take away the patentee's right to fix the re-sale price on his patented article. The advantages of price-fixing in retail trade were pointed out, the speaker using the well-known Ingersoll dollar watches as an example. The fixing of the retail price prevents other concerns, said Mr. Doherty, from capitalizing unfairly and profiting by the large expenditures of the Ingersoll company for advertising. If such articles as dollar watches are to be successfully marketed they must be turned out and sold in immense quantities, in order to make the cost of production low enough.

Turning to the subject of retail competition in electrical appliances between the central station and the local supply dealer, Mr. Doherty differed with Mr. Robertson, and stated that some of the dealers who compete with his companies do not obtain more than 10 per cent of the total retail trade. He also expressed his belief that the public as a whole has more confidence in devices marketed by central-station companies than in those offered by dealers.

#### LOW PRICES DO NOT COMPENSATE FOR POOR SERVICE

The great public cry for low prices is based, in the speaker's opinion, on an economic fallacy, and low prices do not and can never compensate for the poor service which is their inevitable accompaniment. The speaker then said that Mr. Robertson had overlooked one of the most important features of merchandising, which is systematic canvassing. The Doherty companies carry on such canvassing according to a well-developed plan and call upon every house, store and business or industrial concern. Much business is secured by this method and by means of a follow-up system. Those who do not take the service at once are often secured later. This practice, declared the speaker, helps to gain public confidence and makes it easy to get new business. Among other things, it is a distinct factor in making sales of electrical appliances. Such campaigns are generally supported by indirect appeals through the advertising columns of the newspapers. This is a source of expense to which contractors and dealers are rather reluctant to contribute their share, although this is not the invariable rule.

### THE QUESTION OF LAMP SUPPLY

The most critical problem in merchandising which the central station has had to solve is a question of lamp supply. When the tungsten lamp came into commercial use the local dealers were induced to offer these lamps to purchasers on the basis of more light for the same expenditure. It was found, however, that many dealers soon broke away from this policy and advocated the same light for a less expenditure, which has a tendency to cut down the central-station company's sales of electrical energy. In order to meet this situation, Mr. Doherty explained that he adopted the policy of cutting the price on tungsten lamps to so low a point that the dealers could not continue to handle them in competition at a profit. In speaking of the effect of introducing defective appliances Mr. Doherty referred to his own efforts, some years ago, for the introduction of electric flatirons in a certain city before they had been thoroughly perfected. The resulting failures made the public so skeptical that this particular city was afterward found to be the most difficult of all in which to introduce electric irons when their commercial success had been established beyond question by general experience. He also referred to the fact that the central station has a decided interest in keeping its customers' appliances in efficient working order and in this respect is in a different position from the local dealer. In closing his remarks Mr. Doherty said that he had many times expressed his wish that some one would devise a scheme for co-operation which in its application would benefit all and injure none, but he had yet to learn of such a plan. He is still hopeful, however, that the problem can be solved.

### INSURING DEALERS A LIVING PROFIT

Mr. W. H. Johnson then took the floor and stated that the co-operation problem had been solved with respect to the local conditions which are found in Philadelphia. The lamp problem has presented the greatest difficulty, and it is found essential to retain control, if possible, of the sales of lamps which will be used by customers. The commercial policy adopted by the Philadelphia company in retailing electrical merchandise has been to "live and let live," and in general it has fixed retail prices on a scale which will permit the local dealers and department stores to do business at a net profit and make a decent living. It still has occasional sales at cut prices in order to stimulate the introduction of some particular appliance when this seems to be warranted. The Philadelphia company attempts to compete with local contractors only in the cases of emergency work on a large scale which the contractor is not usually equipped to handle. In support of his company's policy not to relinquish control of the lamp question with respect to the lamps which will be used on customers' circuits, Mr. Johnson cited the case of the gas companies, which quite generally left the sale of gas mantles to retail distributors. The companies have found through experience that this is a very poor policy and are now coming around to the practice of the central-station companies, having learned that by this means the customer receives better treatment and much superior service. In referring to salesmanship, the speaker said that the most common failing of central-station solicitors is to talk too much, thereby in some instances incurring the customer's distrust. Salesmanship is a fine art, and one of its most important attributes is the ability to size up the human characteristics of the prospective customer.

Adjournment was then taken until 2 p. m.

### AFTERNOON SESSION

When the conference was called to order at 2 p. m. discussion of Mr. Robertson's paper was continued. Mr. C. W. Stone, of the General Electric Company, was the first speaker.

He said that the manufacturer is naturally anxious for

all the co-operation he can get as a means of pushing his product. He expressed himself as greatly in favor of specialized effort. While those in the central-station business are usually a highly specialized class as regards the manufacture and sale of electrical energy, it does not follow, he thought, that they are necessarily merchants. The dealers and jobbers, therefore, have a very distinct part in the development of the central station's business.

With the central-station company, however, the interest centers in filling up the valleys in its load curve and diversifying the load, and the profits from the sale of appliances are therefore of secondary interest. The dealer, on the other hand, is dependent on the profits in his sales, so that his interest is large.

Nevertheless, the central station has had to take the lead in many cases in creating a market for appliances. On account of these efforts taken by the central stations, manufacturers have been glad to get their help in introducing new equipment.

### HIGH FIRST COST RETARDS SALES

Some appliances, the speaker pointed out, are frequently difficult to sell, owing to their high first cost. To show how this difficulty may be offset to some extent, the speaker related the experiences in his household after the introduction of an electric washing machine costing \$100. This machine had great self-advertising powers, as it had proved to be a source of intense interest to the women visitors and had also been an excellent labor-saving appliance.

### LACK OF FOLLOW-UP METHODS

Lack of a follow-up system to see if appliances are properly installed or are in working order was next discussed by Mr. Stone. Oftentimes small devices are neglected and then fail to give satisfaction. It was hard to say, he thought, who could do the following up to best advantage. The manufacturer could hardly be expected to do it, and, moreover, he doesn't even know the customers. The dealer, he felt, was particularly remiss along this line. An automobile dealer, the speaker continued, does follow up his sales by keeping in touch with his customer and using every effort to see that he is satisfied with his purchase.

With the electrical dealer such interest and attention are felt and given only occasionally. In other words, they do not characterize his work as a regular thing. The central-station company, he continued, might do the work. A plan to do the work and divide the expense might be effected by the jobbers, dealers and central-station companies. Such a plan would be a great help to all concerned.

The manufacturer, the speaker explained, needs a great deal of help from all sides in carrying on his research work and wants to know what demand can be created for new products. Some information along this line is given by central-station companies, but there was not, the speaker said, a concerted effort made in this direction by the industry.

In conclusion, he stated his belief that the society can help the manufacturer to develop along lines which will be of the greatest benefit to the central-station company, the dealers and all concerned in the advancement of the industry.

### "DECENT BUSINESS CONDITIONS" FOR DEALERS ONLY

Mr. J. R. Strong, of New York, was the second speaker. He stated that Mr. Ernest Freeman, of Chicago, president of the National Electrical Contractors' Association, was to have been present to discuss the paper, and that his remarks would, therefore, be impromptu.

Regardless of whether concerns were engaged in business solely as a jobber, or a contractor, or a dealer, or in all of these lines, they are all middlemen. It might be possible, he thought, to create some plan, through the "home money department" of the society, that would bring about the sale of electrical merchandise at a profit to all.



The establishment of merchandising conditions, however, would help most. Co-operation, according to Mr. Strong, generally means treating with the other fellow as long as he does what you want.

The central-station company, he said, co-operates only in so far as it suits its convenience. It sells lamps because the dealer does not sell them fast enough to suit it and holds special sales of appliances at prices to suit itself.

All that the contractor asks of the central-station company, he continued, is decent business conditions. He referred to Mr. Doherty's criticism that the contractor doesn't push. This, the speaker said, was because the central-station company is a monopoly in each place and can spend, say, \$100,000 in advertising which does not come out of profits from appliance sales. Such practices prevent the middleman from making much profit, because he has to deal in a small way.

#### MANUFACTURER OFTEN UNDERSELLS LOCAL DEALER

The manufacturer, he maintained, is as much at fault as the central-station company. He sells directly to the customer time and time again, and often quotes to a large customer lower prices than to the men legitimately engaged in the electrical business. In other words, Mr. Strong said, the manufacturer will simply cut prices at random to make a sale.

The establishment of a price schedule he did not consider to be any concern of the society; he did think, however, that the society can help to establish more harmonious conditions.

#### SOMEONE MUST CONCEDE A POINT

Whenever, Mr. Stone asserted, the central-station company maintains a price that is fair to the dealers and contractors the latter invariably get the business. The middlemen throughout the country are prepared to spend money to get business, provided there is sufficient profit to be made from this. Someone, therefore, has got to concede something, and the middleman, he claimed, cannot be the one to do this. The bulk of business which he does, as compared with that of the central-station companies and the manufacturers, was exceedingly small as far as gross sales are concerned. He again expressed the hope that through the society such troubles can be eliminated.

Harmony work, Mr. Strong believes, cannot be done on a national scale, but can be accomplished best by work in each locality.

The jobbers and dealers can grow as soon as conditions permit, and these conditions should be brought about, the speaker felt, by the extensive interests represented in the society. Much improvement has resulted from the work of the National Electric Light Association since he presented some of the facts to it, but, the speaker felt, there is yet room for a great deal more.

#### DOHERTY COMPANIES AID MIDDLEMEN

Mr. Doherty stated that the central-station companies in which he is interested have conceded a great deal to the middlemen and had turned over much wiring work to the local contractors whenever the latter were able to do the work. The solution of the problem, he held, cannot be reached by harsh methods and must be arrived at through careful consideration.

#### THINKS GROUPS CAN NEVER AGREE

Mr. Max Lowenthal stated that he was greatly out of harmony with all that had been said. By heredity, he said, he was enabled to see merchandising in its true light. The diversity of opinion that had been expressed was pleasing to him, but, he insisted, the various groups will never agree; it would not be consistent with human nature for them to do so. Electrical men, he said, have never been merchants, in the sense that the word is used in other lines. He doubted whether electrical men were the right sort of men to merchant their own products.

The whole, he felt, is a personal, human problem. "It is nobody's business how you do your business," he said, "as long as it is done honorably." It is impossible, therefore, to try to harmonize. He then told of his experiences when, some ten years ago, he established an electrical shop in one of the New York department stores. He wanted to sell the appliances to women, so he had naturally established it where women go to shop. There had been a great protest against this from local dealers, but he had gone ahead and the venture had been successful. Department stores, he claimed, will conduct their affairs as they see fit, and will not ask price schedules for appliances from local central-station companies. In other words, they adopt an independent policy, in which, he stated, they were successful. They will cut prices if they think they can stimulate sales, so that even if harmony is established between the jobbers, the dealers and the central-station companies, the latter will still have the department stores, with their appliance departments, to compete with.

Despite their aggressive or merchandising methods, the department stores, he said, do not sell appliances intelligently. Oftentimes those placed in charge of the appliance departments in such stores are entirely lacking in knowledge of the devices and the cost of operating them. What the society should do, instead of decrying these practices, is to teach department store methods to electrical men, who could then compete with the stores on their own level. The whole question, he felt, is a local one. In a small place the central-station company will always sell appliances because there is usually no other concern or individual competent or interested enough to handle them.

#### A FOLLOW-UP SYSTEM USED ON PACIFIC COAST

Mr. H. E. Woodill, Los Angeles, said, in answer to Mr. Stone's statement that there is no follow-up system in general use by dealers, that his concern paid particular attention to this desirable practice. In their advertisements in the daily press, they say: "Buy your goods from an electrical store; we will take care of them for you." He added that of several of the lighting companies that operate in his territory one of them sells appliances at prices far below those at which the dealer can profitably handle them. The other two companies give the dealers lists of names from which they try to pick up business. Mr. Moore said that, prices being equal, the dealer will usually get the greater part of the business; hence if such price levels were maintained, the dealers would have no grievance.

#### CO-OPERATION THE KEYNOTE

Mr. C. G. Durfee, Rochester, said that co-operation is the keynote of the whole question. The great majority of electrical men, he thought, do not know how to co-operate. He stated that his company had tried to co-operate with the electrical contractors in Rochester; a practice of holding monthly dinners with contractors had been instituted, and since then about 80 per cent of the old troubles have disappeared, as a result of the satisfactory talks which took place at the dinners and the co-operative spirit that had been fostered. Many of the contractors have also joined the Jovian Order, he said, and, all in all, the situation has been wonderfully improved.

#### AN EXAMPLE OF "CO-OPERATION."

Mr. W. H. Weekes asked for a definition of co-operation. He told of a Southern central-station company which would not buy lamps from him because it wanted to buy from the contractor and thereby co-operate with him. It had developed later on that contractors were buying 16-cp carbon lamps from free-renewal customers and selling the lamps back to the central-station company.

Mr. Ayer stated that the general tenor of the remarks had taken his thoughts back some twenty years to the time when he was in business in St. Louis and had brought



twenty local electrical men together at a luncheon for the first time, and had thus paved the way for an electric club from which splendid co-operative results had been obtained. Prolonged discussion of policies and methods, he thought, was merely incidental.

#### BOSTON EDISON'S SHOWROOM POLICY

Mr. Ayer also spoke of the opening of an electrical showroom by the Edison Electric Illuminating Company of Boston, some ten years ago, at an expense of \$20,000 a year. At that time the company sold only electrical energy. It was planned merely to show goods and to direct prospective customers to the dealers. The latter, however, did not carry full lines, so that the manager of the showroom was authorized to sell appliances on his own account. Several thousand dollars' worth of appliances were sold in a year in this way, and the showroom was enlarged. The policy, however, has been, he said, to sell at retail prices with which the dealers can compete, and this policy, he stated, has had a successful outcome. Now that the demand has been created, the dealers are encouraged to sell on a larger scale. At present, Mr. Ayer said, the Boston company sells only one-third of the appliances purchased

and make prices to suit themselves in their respective fields. They have their own associations at which prices, etc., are discussed. The whole idea of the society, he said, is to make a greater market for electrical merchandise, and there is a greater opportunity for all on the platform of co-operation.

He agreed with the statements that no set rule to be used nationally can be made, and that the work must be done locally.

The dealer does not ask the central station company to stop selling equipment, Mr. Robertson said; but only to make merchandising conditions in which all can share.

He said also that through lack of attention or thought, men of too radical a nature in any of the four groups represented in the society might inject a note of bitterness that would be foreign to the society's purpose and death-dealing in its effect on local co-operation. He hoped that would not be the case.

#### AN ELECTRICAL ADVERTISING CAMPAIGN

Mr. Doherty next introduced Mr. William D. McJunkin, of Chicago, who read an exhaustive paper in which he suggested a plan for an electrical advertising campaign



THE BANQUETERS AT DELMONICO'S WEDNESDAY NIGHT

in its territory. He commended the policy to those present as an excellent one to pursue.

Owing to lack of time, the discussion was closed by the chair after Mr. Ayer's remarks. Mr. Doherty then said Miss Harriet Billings, assistant secretary of the National Electric Light Association, was in the hall, and paid a warm tribute to her untiring efforts in behalf of the electrical industry.

#### SUMMARY

Mr. Robertson, summing up, said that he had found that his subject had opened much valuable discussion and that he believed the success of the entire movement rested wholly on its application to local conditions. Conditions in Philadelphia, he said, are harmonious; in Cleveland, ideal, and in Boston, splendid.

He thought that merchandising prices should prevail. The middleman, he asserted, is one of the most stable institutions of the country. Referring again to the methods of selling Ingersoll watches he stated that it is absolutely essential to maintain the price of them in order that the selling methods shall be successful.

The middleman, Mr. Robertson said, cannot realize on the capitalization of his earnings as the central-station companies can, but must make his profits on his actual sales. He did not agree, he said, with Mr. Lowenthal's statement that department store merchants act indepen-

to be carried out by the society. Mr. McJunkin said that the idea of the society had first seemed to him to be baffling in its magnitude, but that he had finally been able to lay out a definite course that might be pursued.

In connection with his paper, he had prepared a large chart showing in a concrete form the work to be done by the society. Copies of this were given out to all present. On this he had classified the work under three heads: "Extensive," "intensive" and "follow-up."

After telling the purposes of the chart, Mr. McJunkin took up his plan for a comprehensive advertising campaign for doing the work under these three heads. Going into great detail, he told of the class of copy that should be used for developing the use of electrical energy and of appliances using light, heat and power for services in the home, office, store, shop, factory, public and some public buildings, for municipal purposes and for festivals.

In each case he named the magazines or other advertising mediums which should be used and the kind of copy that should be used in each case, giving his reasons. He spoke of the large amount of advertising that is being done by telephone and telegraph companies, and said that, in his opinion, the society need not give any publicity

to these fields, as they are already very well exploited.

In the same way, the Electric Vehicle Association of America is carrying on a sufficiently vigorous campaign, so that the society need not spend any money for advertising that field. He thought, however, that it would become an important factor in the society's affairs in time.

#### N. E. L. A. COMMERCIAL SECTION BOOKLETS VALUABLE AIDS

Mr. McJunkin stated that the booklets that have been prepared by the Commercial Section of the National Electric Light Association were doing an excellent work and could be used to advantage by the society in carrying out its publicity campaign. He advocated a monthly booklet to be sent to homes.

He also spoke of the value of moving-pictures as a productive advertising medium for the electrical industry and suggested that the society adopt insignia or a trade-mark.

Mr. W. H. Johnson, the temporary chairman, said he considered Mr. McJunkin's paper in the light of a guide for the executive officers and executive committee.

Mr. W. J. Clark, of the General Electric Company, stated that he wished to call attention to one thing that had not been mentioned, one of the greatest features in the electrical industry of the present day, namely, the electric railway load. This, he said, is rapidly coming closer to the central stations owing to the rapidly growing policy of electrification of steam roads.

Mr. Wakeman announced that the executive committee would begin on March 6 to digest all that had been proposed and discussed at the conference.

Owing to the lateness of the hour, further discussion was stopped and several reels of moving pictures depicting the uses of electricity were shown. These were given through the courtesy of Mr. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company.

#### WEDNESDAY EVENING'S BANQUET

Wednesday evening about 125 of the men who had attended the two days' sessions of the society, together with a number of guests, dined at Delmonico's. At the speakers' table were Messrs. Gerard Swope, W. A. Layman, F. E. Wallis, W. E. Robertson, Frank E. Watts, P. S. Dodd, Frank M. Tait, A. W. Burchard, T. C. Martin, J. H. McGraw, Don Seitz, H. L. Doherty, J. M. Wakeman, Guy E. Tripp, W. H. Johnson, C. W. Price, Louis Wiley, James H. Collins and J. E. Montague.

When the speaking began President Doherty surrendered the toastmaster's chair to Mr. T. C. Martin, who characterized the meeting and the society it inaugurated as "a great force for the co-ordination and synthesis of all forces working for the progress of the electrical art and industry." The first speaker was Mr. Seitz, of the *New York World*, who as one explanation of his presence stated that his newspaper paid to the New York Edison Company \$96,000 every year and was, he believed, the next to the largest customer on the books of the company.

By resolution, congratulatory telegrams were sent to Messrs. Thomas A. Edison, Charles F. Brush and J. Robert Crouse.

#### VIEWS OF ELECTRICAL MANUFACTURERS

Following the reading of a letter from Mr. Charles A. Coffin, president of the General Electric Company, expressing the interest of his company in the work of the society and assuring it of his support, Vice-president Burchard reiterated Mr. Coffin's sentiments and, after outlining the trend of industrial consolidation during the last fifteen years, stated that the plan of the society indicated a means by which the results and efficiencies of concentration might be accomplished without antagonizing the public. He stated that he believed that the best way to do business was on the basis of equity and good-fellowship, and that the most potent influence of the society would be in promulgating this idea.

Similar views were voiced by Mr. Tripp, chairman of the Westinghouse board, and by Mr. W. A. Layman, president of the Wagner Electric Company. The latter gave assurance of the support of the "Central Western contingent," not only morally but in the form of substantial contributions.

#### AIMS OF THE JOVIAN ORDER

Mr. F. E. Watts, Jupiter of the Jovian Order, pointed out that his organization was already trying to carry out the objects of the Society for Electrical Development, and that the Jovians had grown not only in numbers but in character, in serious purpose and in ability and determination to accomplish practical things. Mr. Watts said that the first step in co-operation was to make friends; this was the basis of harmony, and harmony was the best foundation for co-operation. He believed that the society would find that its most effective work must be done locally, and that wherever there was a Jovian league the society would find enthusiastic co-operators. "We are with you," Mr. Watts concluded; "use us as a means of accomplishing your great aims."

#### CO-OPERATION FROM THE N. E. L. A.

Following brief remarks by Mr. Wiley, of the *New York Times*, President Tait of the National Electric Light Association voiced on behalf of his organization hearty approval and support of the society and its plans and said that he hoped to be able in some way to convey to the N. E. L. A. members some part of the enthusiasm which had characterized this week's meetings.

#### AID FROM THE TECHNICAL PRESS

On behalf of the technical press, Mr. Hugh M. Wilson, vice-president of the McGraw Publishing Company, said: "You have got under way a scheme to educate the public, but don't forget that a good teacher must be well taught. That is where the technical press can be of great assistance to you. In a large measure, our electrical papers must become not less technical but more commercial, for whatever else they do they must represent the spirit of the times, and this spirit shows the constantly increasing predominance of the commercial element. What we have accomplished as technical papers is largely due to the assistance of technical men. On the commercial side we must develop in the same way—by your aid. Give us a chance to interpret your aims to yourselves and to the outside world. Give us your confidence; let us know what you are thinking and doing. I was greatly impressed by something that Mr. Doherty said about equipping representative industries 'to the last gasp.' In your first gasps and your last gasps, let us gasp with you!"

#### THE FUTURE OF AMERICAN INDUSTRY

Concluding the speaking, Mr. Doherty said: "I believe in my business, I believe in the corporations, and I believe that we occupy a position of importance in bringing prosperity and comfort to others. In working to develop electricity, we are working toward a higher and better civilization. Consolidations formed for good reasons and honestly conducted are bound to result in public good, but these consolidations are now under fire, and we are told that they are a menace to the people. I believe we have now hit upon a plan to get the benefits of co-operation, a plan that can harm no one and must bring good to all in the electrical business. It may be that the example we are setting here will mark the introduction of a new method for advancing supremacy, not only in the electrical but other industries. German industrial progress is due to the policy of business encouragement, not discouragement. Here we have antagonism and discouragement, and I fear the story of our future may not be as pleasant as the story of recent German industrial advance. To do what we can to correct this situation is one of the many important duties of this society."



## Electric Railway in the French Pyrénées

**Double-current generators utilized for supplying energy simultaneously to an 850-volt direct-current railway and a 20,000-volt, three-phase transmission system**

SEVERAL unusual features are embodied in the equipment installed for the electrical operation of a standard-gage railway by the Southern Railway Company in the French Pyrénées. Use is made of the direct-current traction system rather than the three-phase system, and direct-current energy for traction and 25-cycle, six-phase energy for transmission are obtained from common generating units.

The generators are of the so-called "double-current" type, each being provided with a bar-wound armature connected at one end to a commutator of the usual type and at the other to six collector rings. They are compound-wound machines so proportioned that the commutator emf rises from 800 volts to 850 volts when the load varies from the no-load to the full-load value. The machine is provided with eight commutating poles, to eliminate sparking and allow the brushes to be kept in one position.

Each machine forms a unit with a step-up transformer, the primary circuit of which receives energy at 600 volts, six-phase, while the secondary end delivers it at 20,000 volts, three-phase. Each transformer has three vertical cores and is mounted in an oil tank, which is cooled by water circulation. Since each transformer on the lower floor is directly connected by a cable with the generator no busbars are necessary for these circuits. The advantage in using the double-current machine is the reduction in first cost, owing to the fact that no special direct-current generators are needed. This plan saves one generator set, since otherwise the station would require three alternators and two direct-current generators, one extra generator being held as a reserve unit.

Each generator, of which there are four, is a 650-kw machine driven by a 1500-hp Pelton waterwheel, to which it is connected through an elastic coupling. Each turbo-generator set is provided with a 5-ton flywheel 6.5 ft. in diameter, with a Minette speed governor of the oil-pressure

type, and with regulators for guarding against the effect of water hammer. The turbines are operated under a head of 1375 ft. From a dam on the Tet River, an open flume 14,500 ft. in length brings the water to the settling basin, and from there a set of four penstocks lead to the turbine house, a distance of 3380 ft. At the station all four penstocks connect with a common pipe, which is laid below the floor of the building and has a branch pipe running up to each of the turbine-dynamo units in the floor above. The plant is located at La Cassagne, about 12 miles from Villefranche, which is the terminal of the steam railroad. From this place the electric railway extends up-grade to the mountain pass of La Perche at an altitude of 5220 ft. above sea level. After crossing the pass, the line proceeds upon a high plateau to the Rigat Pass and then descends into the Cerdagne plain, ending at the terminal station of Bourg-Madame, which lies near Spanish frontier, with an altitude of 3750 ft. The total length of the electric road is 35 miles, and the maximum gradient is approximately 6 per cent.

At five points along the road are located rotary-converter substations for feeding direct-current energy to the third-rail at 850 volts. All of the substations are similar in design. A step-down transformer of the air-cooled type receives energy at 20,000 volts from the three-phase line and delivers it at 600 volts, six-phase, to a rotary converter, which furnishes direct-current energy for the third-rail and is of the eight-pole type. These machines are built on the same lines as the generators in the main station. The rotary converters are started as direct-current motors with energy taken from the third-rail through an oil rheostat, which is operated from the switchboard panels.

The three-phase transmission line connecting the main plant and each of the substations had to be constructed near the railroad to facilitate inspection and repairs owing to the heavy snowfalls which are so common in the mountain region. A double line of six wires is mounted on pine

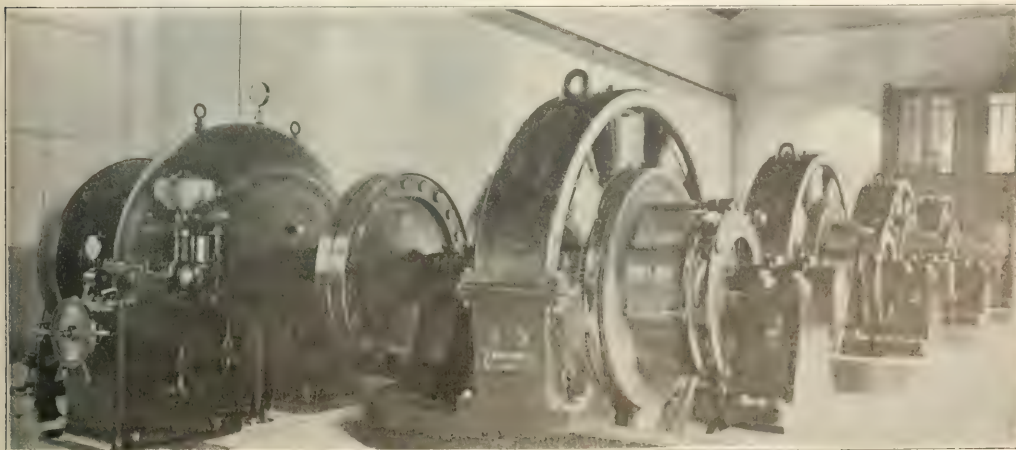


FIG. 1.—INTERIOR OF TURBINE PLANT AT LA CASSAGNE



poles, which have been impregnated with copper sulphate and are spaced from 115 ft. to 140 ft. apart. Two cross-arms of creosoted oak are used, fitted with large porcelain pin-type insulators. In the tunnels, of which there are eighteen, having a total length of 7800 ft., two underground cables of three wires each are mounted along the vaulting

The passenger and freight cars which are used on this line are mounted on double-bogie trucks, and the electrical equipment is the same for each. Each passenger car is fitted with a motorman's cab at each end, a first-class compartment with eight seats, a second-class compartment with thirty-two seats, and a baggage compartment. The freight

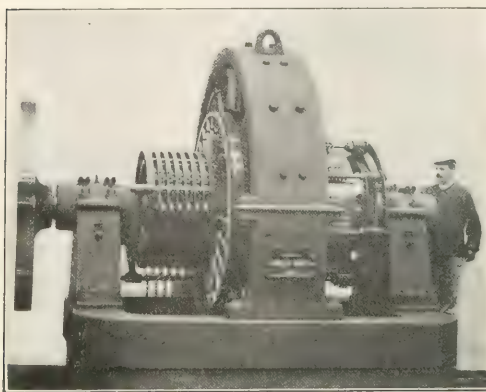


FIG. 2—DOUBLE-CURRENT SIX-PHASE GENERATOR IN STATION AT LA CASSAGNE



FIG. 4—HIGH-TENSION SWITCHING APPARATUS IN 20,000-VOLT CIRCUIT

and are protected at each end by lightning arresters. A junction box is provided for connecting the cables to the overhead lines.

Between the main station and the Villefranche junction

cars have a clear floor space with a motorman's position at each end. The motor equipment of each car consists of four 50-hp, 400-volt motors using a gear reduction of 1 to 4.3. The two motors of each truck are permanently

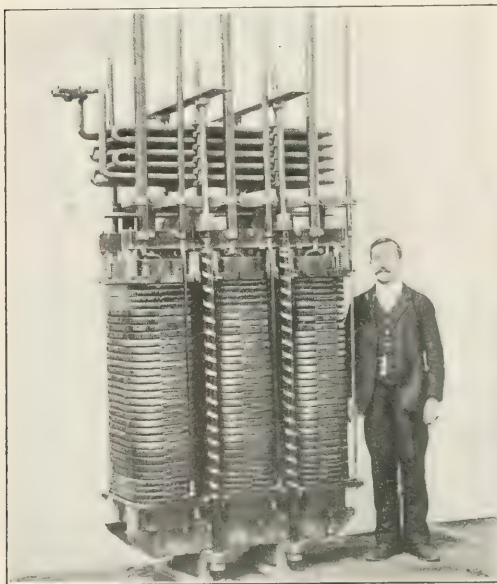


FIG. 3—TRANSFORMER DETAIL

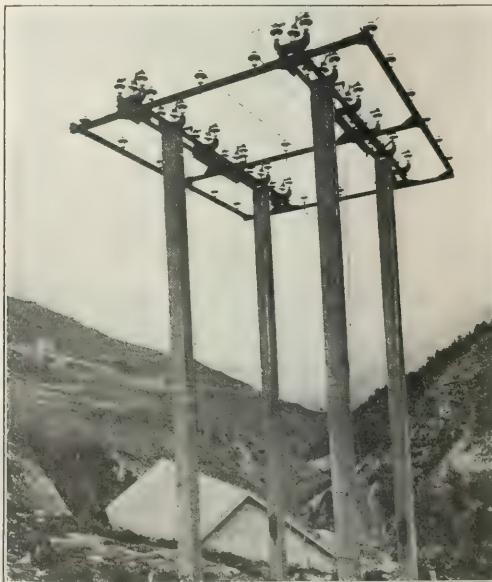


FIG. 5—CONCRETE POLES AT SECTION POINT ON LINE

a special construction was used. It consisted of concrete poles carrying aluminum cables, of which two types were tried. Those on one line were 30 sq. mm (No. 2 B. & S.) in section and were made up of three conductors, while on the other line a single stranded conductor of 70 sq. mm (No. 00 B. & S.) was used.

connected in series so that they may operate at from 800 volts to 850 volts. All cars are equipped with the Sprague multiple-unit control in order to facilitate the handling of trains. Use is made of three braking systems, to avoid trouble on the many steep grades encountered. The main system is the ordinary Westinghouse air brake of the

"straight-air" type. The controller is provided with three extra points for connecting the motor across a resistor carried under the car, and this type of brake is used on steep down grades. In addition to these two systems hand brakes are provided for use in any possible emergency that may arise.



FIG. 6—POLE-LINE CONSTRUCTION FOR 20,000-VOLT CIRCUITS

The rolling stock of the railway, as well as the electrical equipment of the main plant and that of the substations, was furnished by the Société Alsacienne de Constructions Mécaniques, Belfort, France.

### The Coking of Coal at Low Temperatures

The subject of coking of coal at low temperatures is treated in Bulletin No. 60, which was issued by the Engineering Experiment Station at the University of Illinois. This bulletin was prepared by Messrs. S. W. Pau and H. L. Olin and contains an account of their experiments along this line and the results which they have been able to obtain. It was found that Illinois coals could be coked at a temperature approximately 400 deg. or 450 deg. C. The by-products consist of (1) gases of high candle-power and specific heat value and (2) oils containing the minimum amount of tar and free carbon and which are suitable for carbureting water gas and other specific uses. The coke residue has special characteristics which seem to make it of value as a concentrated fuel, capable of combustion without the formation of smoke and suitable for storing without the possibility of spontaneous combustion. The paper states that certain facts have been developed concerning the principles involved in the formation of coke which may open the way to the production of a kind of coke of such texture and strength as to make it acceptable for uses that are not now possible with the coke that is made from similar coal according to present methods.

### The Acetylene-Electric Flame

By C. F. LORENZ

That flames exhibit certain peculiarities under electrical influences has been known since the earliest days of electrical science, and their behavior in this respect has been the subject of a very large number of investigations. These cover the following classes of phenomena: the conduction of currents of electricity by flames, the yielding of currents by a flame when wires leading to a galvanometer are unsymmetrically placed in it; the distortions that a flame may be made to undergo when brought into various relations with charged bodies. The more modern work has been confined to the first of these subjects, and in particular to the conduction of currents that are very small, usually of the order of several micro-amperes, both in flames modified in their conducting properties by the addition of various salts and in so-called "pure flames," that is, flames not containing salt vapors. The experiments described in the present article relate to the more old-fashioned topic of electrically caused flame distortions, together with an associated phenomenon, namely, an increase of luminosity that may be obtained by sending current through carbon-containing flames. Attention has already been called to the latter effect by the writer,<sup>1</sup> the first experiments having been performed with alternating current, with which the requisite high voltage is readily obtained by means of a transformer. Opportunity has since occurred of extending these experiments in the physical laboratory of the Johns Hopkins University, where a source of direct current at 4000 volts or 5000 volts became available.

This source consisted of a set of five small generators having their armatures in series. Besides facilitating the electrical measurements, direct current has the important advantage that its use avoids the confusion of the effects at the two electrodes which necessarily occurs with alternating current.



FIGS. 1 AND 2—SHORTENING OF FLAME DUE TO HEAVY CURRENT

#### DEFLECTION OF A FLAME TOWARD A CATHODE

The results obtained by the early investigators who examined the distortions which a flame undergoes in an electric field are somewhat complicated. The most prominent phenomenon observed was an apparent attraction of at least part of the flame by a negatively charged body. Various hypotheses have been proposed to account for this—for example, one of the possibilities suggested by J. J. Thomson<sup>2</sup> is that perhaps "corpuscles" are given off by the molecules of the hot gases, leaving the latter positively charged. The following experiment suggests an explanation entirely different from this and from any that has heretofore been advanced.

#### DESCRIPTION OF THE PHENOMENON

The flame used was a simple cylindrical jet burning from a pin-hole burner. The gas used was acetylene, though this particular phenomenon can be observed just as well with coal gas or hydrogen. An important part of a simple cylindrical flame is the invisible mantle of those which envelops the visible part and extends far up above it, and which shows when a shadow of the flame is thrown upon a screen by means of a beam of sunlight or arc light. Such a shadow picture was formed, and by watching the latter the electrodes could have given them any desired position with respect to the mantle. Instead of using a static ma-

<sup>1</sup> *Elect. Eng.*, Vol. 32, page 20, 1907.

<sup>2</sup> "Conduction of Electricity Through Gases," Chapter IX.

chine to charge the conductors brought near the flame, as has been done in the past, use was made of the generators; a high resistance was put in series to prevent a short-circuit in case the terminals were brought too close together.

When the machines are run at 2000 volts or 3000 volts and the negative terminal is brought near the flame—say at a height half-way between the base and the tip—no deflection whatever of the flame is observed, provided everything is well insulated, and this is so even if the negative terminal is brought well within the flame's mantle of hot vapor. On bringing the positive terminal of the machines up on the opposite side, but not touching the invisible mantle, a very slight deflection of the flame toward the cathode is observed. The moment the positive terminal is brought close enough to touch the mantle as observed in the shadow picture the flame is strongly deflected toward the cathode and may even come in contact with it. A galvanometer inserted in the circuit, showing no current so long as the positive terminal is outside the mantle, suddenly indicates a current as soon as the mantle is touched by the electrode. The deflection occurs no matter what part of the mantle is touched by the positive terminal, and occurs even if the latter is placed alongside of the negative terminal only a few millimeters from it. If the phenomenon were purely an electrostatic one, the effects of the two electrodes would

produced by combustion or temperature. In the light of what is now known in regard to the nature of conduction of electricity through gases the explanation seems clear. We have only to remember the high resistance at a cathode owing to the scarcity of ions at the surface of the latter, this scarcity itself being caused by the fact that the solid electrode does not furnish carriers to replace those swept out of the region adjacent to the cathode in the act of conduction. For minute currents there is a fall of potential at the cathode which is proportional to the current, and which is of the same nature as that which occurs at those electrodes of a mercury-arc rectifier which are anodes for the passed half-waves but cathodes for the reverse half-waves. There is, similarly, a scarcity of positive carriers at the surface of the anode in the flame, but the "cathode drop" is much greater than the "anode drop" because of the greater mobility of the negative carriers. On account of this high cathode resistance the flame is prevented from acquiring the potential of the cathode, but it does take on approximately the potential of the positive electrode. Consequently attraction occurs between the cathode and the flame-gas near it, causing motion of the latter along the cathode and a consequent local diminution of pneumatic pressure which results in a deflection of flame and mantle. The fact that for minute currents the drop at the cathode



FIG. 3—DEFLECTION OF FLAME TOWARD A CATHODE

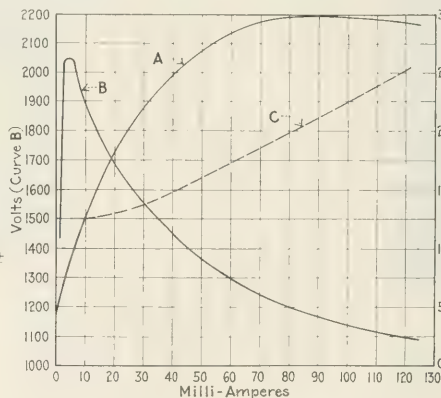


FIG. 4—CANDLE-POWER-CURRENT, CURRENT-VOLTAGE AND CURRENT-WATTS-PER-GAINED-CANDLE-POWER RELATIONS

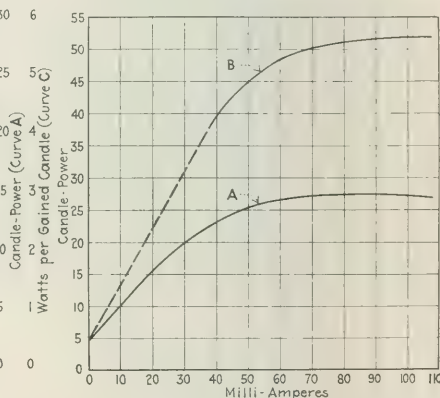


FIG. 5—CANDLE-POWER-CURRENT RELATIONS AT DIFFERENT GAS PRESSURES

in this case have to neutralize each other. As the positive terminal is brought closer and closer to the negative one the deflection of the flame is increased until the electrode distance is so short that a visible discharge forms, when the flame resumes its normal position. As soon as a visible discharge appears only a minute spot on the cathode forms the base of the discharge, while in the conduction of a very small current the whole cathode surface immersed in the mantle presumably takes part. By observing the shadow picture it is seen that the deflection of the flame proper is accompanied by a movement of the mantle in the same sense, and also that the flame gases seem to move along the negative wire away from the tip. The deflection effect can be imitated perfectly by sucking through a glass tube the open end of which replaces the cathode. It is surprising how strongly the air must be drawn through the tube to give the same result as that produced electrically.

#### EXPLANATION OF THE DEFLECTION

From the observations just described it seems evident that the deflection effect depends in some way upon the flow of current, instead of being a purely electrostatic interaction between a negatively charged body and charges

is proportional to the current agrees with the observation that the deflection increases as the anode is brought closer and closer to the cathode. The observed ceasing of the deflection as soon as a visible discharge appears at a spot on the cathode is to be expected since the copious supply of ions at the locally heated spot would end the existence of the high cathode resistance.

#### SHORTENING OF A FLAME UNDER HEAVY DISCHARGE

Another very striking distortion of a simple cylindrical flame is a shortening which occurs when it is traversed by currents larger than those which give the deflection toward the cathode. As soon as the current is made great enough to give a visible discharge a shortening is observable; as the current is increased the flame continues to shorten down to say one-half or one-third its original length. The effect is shown by the halftones Figs. 1 and 2, the former being an uninfluenced acetylene flame and the latter the same flame when traversed by a current of 1/10 amp. This shortening is doubtless to be ascribed to the increased rate at which combustion takes place when the temperature of the flame is raised by the discharge—the size of a flame being always determined by the condi-



tion that its surface must be just great enough for the rate of combustion of the gas to equal the rate of supply.

INCREASE OF LUMINOSITY

The light emitted by a flame, luminous owing to the presence of free carbon, can be increased both in quantity and whiteness by the passage through the flame of an arc-like discharge such as that given by an induction coil when the primary is supplied with alternating current. If the flame is one that has but little "stiffness," such as any flame burning from a wick or a gas flame operating at low pressure, then the flame will be so much distorted by

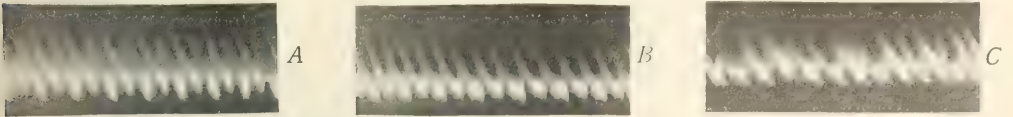


FIG. 6—PHOTOGRAPHIC REPRODUCTIONS OF FLAME SUPPLIED WITH ALTERNATING CURRENT

the discharge that it would be hopeless to try to make any measurements. On the other hand, if a cylindrical gas jet issues at considerable pressure from a burner of fine bore it will burn quite steadily even while the discharge is passing through it, provided there be a suitable disposition of the electrodes, as described below.

CHOICE OF GAS

When illuminating gas is used the increase of luminosity owing to the discharge, though easily perceptible, is not very striking, but in the case of a gas containing a greater percentage of carbon the increase may amount to several times the original value. The most suitable gas is acetylene,  $C_2H_2$ , on account of its high carbon content together with its high temperature, the latter making it capable of being burned in a sufficiently "stiff" flame. The vapor of benzene,  $C_6H_6$ , has the same percentage of carbon, and its use would be very convenient, but it cannot be burned under sufficient pressure. The velocity of the issuing jet, if great enough to give the required stiffness, is greater than the velocity with which the ignition is propagated toward the burner, this velocity being rather small on account of the comparatively low temperature of the benzene flame. The same is true of the vapors of other carbon compounds which are liquid at ordinary temperatures and capable of being readily vaporized, such as amyl-acetate, pentane, xylene, etc. These were vaporized in a small closed brass vessel into which the thimble-like burner tube was directly soldered, the vessel being electrically heated so that the flame could be readily controlled by a rheostat. To use such fuels at all for the purpose in question it is



FIG. 7—PHOTOGRAPHIC REPRODUCTIONS OF FLAME WHEN SHUNTED BY INDUCTANCE AND CAPACITY

necessary to start the discharge with the flame burning low; on then increasing the pressure, the flame, though no longer reaching down to the burner, continues to burn between and above the electrodes, where the temperature is raised by the discharge. To the benzene flame there is also the objection that it is very smoky. With acetylene none of these troubles exist. All the measurements of candle-power given below refer to this gas.

DEPOSIT OF SOOT

In order to have a flame that contains suspended carbon burn satisfactorily while carrying a current it is necessary

to avoid the deposit of soot upon the electrodes. If an electrode touches the luminous part of the flame a surprisingly large amount of soot will build itself upon it, sometimes forming a tree-like growth that may reach from one electrode to the other. For this reason the burner cannot be used for one electrode, as the soot would interfere with the flow of gas. Heating the electrodes is ineffectual in preventing this deposit of soot. The deposit is, doubtless, due to electrostatic attraction. This would account for the tree-like character of the deposit, as the electric force would always be strongest at the tips of the branches. The trouble from the soot may be entirely avoided by keeping the elec-

trodes out of the luminous part of the flame, having it only in the invisible mantle of hot gases surrounding the flame. The best arrangement is to have one electrode near the base of the flame and the other on the other side about one-third or one-half way up to the tip. In spite of this unsymmetrical arrangement the flame does not lose its appearance of symmetry. There is not merely an arc through the flame from one electrode to the other, but the whole flame seems to take part in the discharge. If the current is very strong the arc can be traced; it is blown by the flame past the upper electrode and curves down to meet the electrode. The steadiness obtainable depends very much on the proper shape and adjustment of the electrodes as the base of the discharge has a tendency to shift about on the electrode. It is best to give the electrodes, consisting of bluntly pointed wires, an upward slant at the end.

ELECTRICAL AND PHOTOMETRIC MEASUREMENTS

It seemed worth while to obtain some quantitative data in regard to the conduction of current by the flame and in regard to the candle-power changes, and to this end apparatus was arranged so that sets of simultaneous readings of current, difference of potential between electrodes, and candle-power could be made. The current through the flame was read on a Weston instrument and difference of potential between flame electrodes on a Kelvin electrostatic voltmeter. In series with the flame it was, of course, necessary to have a certain amount of resistance to preserve the equilibrium. For the photometric measurements a simple flicker photometer was used, because the variation

in whiteness of the flame with variation of current made it impossible to make reliable settings with a Lummer-Brodhun or Bunsen photometer. In all cases given the horizontal candle-power of the flame was measured in terms of the candle-power of a standardized incandescent lamp.

RELATION BETWEEN CANDLE-POWER AND CURRENT AND BETWEEN CURRENT AND VOLTAGE

The curves in Fig 4 show the result of a set of such readings. In this run the voltage at the generators' terminals was left unchanged at 3300 volts, the current being varied by means of the series resistance. The flame height

was 40 mm, the gas-pressure at the burners 67 mm of water, and the rate of flow of gas was given by a rate-meter as 0.23 cu. ft. per hour. The vertical distance between the electrodes, which were made of copper, was 11 mm.

It will be observed that there is a gradual increase of candle-power with current up to a limiting value, which in the present example is approximately five times that of the uninfluenced flame. With very large currents there is a slight falling off of candle-power. The points near the beginning of the two curves show that the increase of candle-power begins while the discharge is still in the "glimm-strom" stage, before a true arc is formed. The dotted line shows the variation of the "specific consumption" in watts per candle as the current is varied, the lowest value on the curve corresponding to 2.5 watts per gained candle. This may be materially reduced by operating the flame at a lower gas-pressure, for the reason given in the next paragraph.

#### COMPARISON OF OPERATION AT DIFFERENT GAS PRESSURES IN REGARD TO HIGHEST CANDLE-POWERS ATTAINABLE

It seemed probable that with burners of different bore, operated respectively at such pressures that the rate of flow of gas was the same for all, the candle-power attainable would be the same for all, but the following experiment shows that this is by no means the case. Candle-powers and currents were measured for two burners in succession, leaving the electrodes undisturbed but changing the burners. With the aid of a simple gas-flow indicator of the kind described by Tufts,<sup>3</sup> the rate of flow for the two burners was made the same, this being about 0.25 cu. ft. per hour. The results are shown in the curves given



FIG. 8—PHOTOGRAPHIC REPRODUCTIONS OF FLAME UNDER ACTION OF DIRECT CURRENT

in Fig. 5. It is seen that, though for the flame without the discharge the candle-power is approximately the same for both pressures, the candle-power attained with current is greater the less the pressure needed to give the same rate of flow. Therefore it is advantageous, when using a current-carrying acetylene flame as a source of light, to choose a jet that will give a flame only just stiff enough not to be distorted by the discharge. The explanation may lie in the fact that the greater the velocity of the jet the more air is dragged along by the flame, and consequently the more rapid the combustion and thus the less the amount of free carbon present.

#### COMPARISON OF CANDLE-POWER ATTAINABLE WITH DIRECT CURRENT AND ALTERNATING CURRENT

From the fact that with alternating current the discharge is practically zero during a considerable fraction of the period (since the difference of potential at the terminals has to rise to a certain value before the discharge begins), combined with the fact that the highest candle-power attainable is limited no matter how heavy the discharge, one would expect that the value to which the candle-power could be pushed would be higher with direct current than with alternating current. This is shown to be the case by the following comparison; the direct and alternating currents were each made great enough to give the limiting value of the candle-power: Flame without current, 5.3 cp; flame with alternating current, 28.8 cp; flame with direct current, 44.2 cp.

#### EFFECT OF MATERIAL OF ELECTRODES

Using direct current, it is only the cathode that is heated to any extent by a current sufficient to give the limiting value of the candle-power. A platinum cathode will become white hot and melt; if coated with calcium-oxide it will remain comparatively cool (only red hot) until the oxide is all volatilized, which soon occurs if it is only a thin coating. A piece of metallic calcium serves very well as a cathode, the base of the discharge then being a minute spot on the oxidized surface. To determine the effect of the material of the cathode upon the candle-power attainable a direct comparison was made of the following: copper, iron, titanium, magnesium, manganese, cadmium, silver, platinum, calcium and carbon. It was found that except for slight discrepancies caused by the position of the cathode, the same photometer reading gave a balance for all, the current being made great enough to give the limiting value of the candle-power.

#### PHOTOGRAPHS ON A MOVING PLATE

The increase of luminosity caused by the discharge is shown by photographs taken on a moving plate when the flame is operated on alternating or intermittent current. In Fig. 6, page 501, *A* and *B* show the result of supplying the flame with ordinary 60-cycle alternating current, the current strengths being 3 and 10 centi-amperes respectively. The discharge begins and ceases each time the potential difference rises and falls to certain critical values, and in that part of the period during which the potential difference lies below this value the flame regains nearly its original height. In *C* is shown the effect of shunting the flame (supplied with alternating current) with a condenser; the discharge is then irregular and emits a crackling sound.

the same as with a much higher difference of potential in air. If the flame is shunted by inductance and capacity in series, the discharge is much more regular, as is shown by *D* and *E* in Fig. 7.

The remaining photographs show the results obtained with direct-current supply. In *F* the capacity was large compared with the inductance and the note emitted not agreeable. Increasing the inductance gives the effects in Fig. 8 (*G* and *H*), and *I* was taken while the cathode (upper electrode) was of calcium. In the last three cases the note emitted was of considerable purity. By suitable adjustment of inductance and capacity it was easy to vary the frequency of discharge from values too low to give an audible note up to values that were too high.

#### COLOR OF THE FLAME

The high temperature to which the carbon is raised by the discharge makes the light emitted much whiter than that of a flame without discharge, as can be most readily shown by allowing the two sources to cast adjacent shadows of a pencil on a white screen. The shadow receiving light only from the current-carrying flame appears blue compared with the other. On the other hand, the light is yellower than that from the crater of a carbon arc.

#### THE CURRENT-CARRYING ACETYLENE FLAME AS AN ILLUMINANT

This combination of acetylene flame with small-current, high-potential arc is worth some attention as an illuminant, though the high voltage required and the rather high spe-

<sup>3</sup>E. L. Tufts, *Phys. Rev.*, Vol. XXII, page 193; 1906.



cific consumption detract from its interest in this respect. The "radiant efficiency" is large, owing to the high temperature of the carbon particles, but the specific consumption is high on account of a high conduction-convection loss. The combination may from one standpoint be looked upon as a carbon-incandescent lamp having the filament material continually renewed, and from another as a small-unit flaming arc in which the electrodes are not consumed and the luminous material is the carbon supplied by the acetylene

#### ITS USE IN PHOTOGRAPHY AND SPECTROSCOPY

Owing to the high temperature attained by the carbon particles the current-carrying acetylene flame compares with other continuous-spectrum illuminants (with the exception of the arc) much more favorably in photographic efficiency than in candles-per-watt output. It may also be useful in spectroscopic work as a source of radiation when strength in the violet and ultra-violet of a continuous spectrum is needed. Although its intrinsic brilliancy is less than that of the crater of a carbon arc, it has the advantage that it presents a larger radiating area than the hottest part of the arc, which is only a spot, and also of running indefinitely without attention. Spectral reference lines can be conveniently obtained by shunting the flame with a condenser during a part of the exposure when lines corresponding to the material of the electrode are superposed on the continuous spectrum.

The writer takes pleasure in acknowledging the helpful suggestions received from Prof. J. S. Ames during the course of these experiments.

### Smallest Japanese Generating Station

By M. KAWARA

That Japan may not be far behind other parts of the world in the utilization of electricity can be inferred from the tiny power house illustrated herewith having an equipment rated at only 1.5 kw. The fact is that many streams in the country are harnessed to supply energy for electric lamps to take the place of oil lamps and wooden torches in villages scattered along their routes. The plant here shown is located in the village of Tamagawa, about 60 miles west of Tokyo. It is owned and operated by one of the villagers for his house lighting and also for fan motors in the summer and radiators in the winter. The wooden house in the front is the generating station, in which is installed the 1.5-kw direct-current generator designed for



SMALL GENERATING STATION IN TAMAGAWA, JAPAN

100 volts and 15 amp, driven by a 2-hp waterwheel having a runner diameter of 13 in. and operating under a water head of only 9 ft. The thatched shack at the rear is a rice mill operated from the same source of water.

The transmission line is 1066 ft. long and is supported on five poles. For lightning protection use is made of a telephone arrester. Arrangement is made for regulating the voltage from the end of the line by means of a field rheostat.

The plant has been in operation for over two years and has given no trouble whatsoever thus far. The total cost of the plant including the line was a little less than \$500. The owner states that the lighting service is much more economical, convenient and safe than that obtainable from oil lamps.

### Midwinter Convention, A. I. E. E.

The preceding issue contained a report of the midwinter convention of the American Institute of Electrical Engineers, held at New York Feb. 26 to 28, including abstracts of the papers and discussions presented at the morning and afternoon sessions of the first day. The meeting of Wednesday evening was given over to the presentation and discussion of fourteen papers on the subjects of heating, heat measurements and rating by heat. Abstracts of these papers and of those on the following days now appear, together with an account of the general discussion they provoked.

#### INTERNAL HEATING OF STATOR COILS

Mr. R. B. Williamson's paper takes up the problem of the internal heating of the coils of alternator stators, espe-

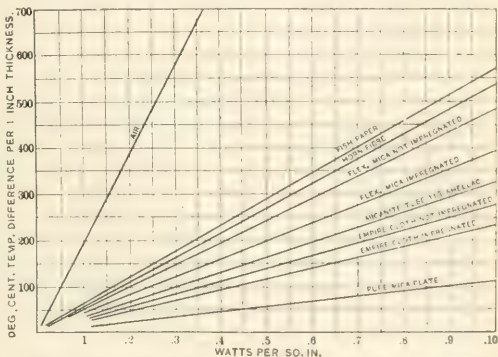


FIG. 1—RELATIVE TRANSMISSION OF VARIOUS INSULATORS

cially long-core machines in which the direct heat path is long. Accordingly, much of the heat transfer must then occur through the insulation and iron, so that the probable temperature difference between the two sides of the insulation should be known. The paper concludes with the report of some tests made to determine this difference. Tables of thermal-conductivity coefficients are also included, and the method of calculating temperature gradient is outlined. Fig. 1 shows the heat transmission of various insulators.

#### TEMPERATURE MEASUREMENTS IN ROTATING MACHINES

In discussing the features of standard test methods, Messrs. L. W. Chubb, E. I. Chute and W. A. Oetting point out the indefiniteness of certain of the present Standardization Rules which result in measurements of iron and copper temperatures, instead of insulation temperature, although it is the latter, of course, that is of importance. Thermocouple and exploring-coil methods are discussed, together with their limitations, and a convenient arrangement of a thermocouple with a potentiometer is described (see Fig. 2, page 504). Exploring coils are expensive and laborious to use, thermocouples being much preferable. For internal temperatures in revolving parts, one should await shut-down and use thermocouples, since brush con-



tacts and collector rings are unreliable. A thermocouple can often be used to take temperatures quickly that would be affected by continued presence of a thermometer. Full-field excitation should be used in bringing machines to rest quickly after heat runs, thus maintaining their temperatures.

#### TEMPERATURE MEASUREMENTS OF ALTERNATORS AND MOTORS

In discussing methods of obtaining room temperatures and internal temperatures in generators and motors, the authors, Messrs. H. G. Reist and T. S. Eden, recommend standard putty coverings for thermometer bulbs. Their own experiments show that such a form of covering will indicate higher temperatures than coverings of cotton waste, felt, wool, etc., besides being convenient to handle and of such compact form that the covering does not impede natural circulation over a large area of the surface under examination. Resistance measurements to determine internal temperatures often disagree widely, the cold reading usually being the principal source of error. Such resistance methods should be limited to revolving parts, for they become particularly erroneous applied to stators, etc. For room temperature readings a metal cylinder inclosing

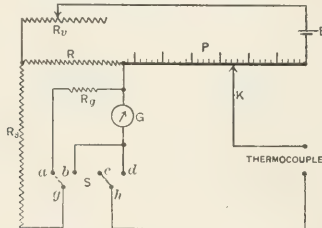


FIG. 2—POTENTIOMETER CONNECTION FOR THERMOCOUPLE

the thermometer bulb is recommended. The actual method of determination, however, should depend on the kind of ventilation used.

#### THERMOCOUPLES AND RESISTANCE COILS FOR MEASURING LOCAL TEMPERATURES

The paper by J. A. Capp and L. T. Robinson discusses devices for measuring temperatures in electrical machines and their sources of error, especially the limitations of mercury and alcohol thermometers, thermocouples and resistance coils. Fluid thermometers generally measure only surface temperatures. Rotating parts must therefore be measured after they come to rest, introducing large chances of error due to changes of temperature, slow indication of thermometers, small bulb contact, emergent steam, etc. Where internal coils of fine copper are used, highly accurate measurements are possible, as the coefficient of temperature of the wire may be accurately known. The extent of the coil determines the extent to which the measurement is local. For accurate determinations, some sort of bridge is required. The thermocouple is the most accurate device for measuring local temperatures, as the emf generated is a function of the difference in temperature between the junction of the wires of the couple and their free ends, and the temperature of the free ends can be accurately controlled. Thermocouples require precision meters for reading their indications, and potentiometer arrangements may be applied to obtain any desired degree of accuracy. Ordinary thermometry is the simplest, quickest and least accurate method of temperature measurement and usually applies only to surface conditions. The choice between the electrical methods is determined by the ease of application. The thermocouple will give the most rapid indications, although the resistance method is almost as rapid if the coil is of right proportions and is intimately applied to the parts whose temperature is to be measured.

#### DETERMINING TEMPERATURES OF TRANSFORMERS AND COOLING MEDIUM

Messrs. S. E. Johannesen and G. W. Wade, the authors, call attention to the errors resulting from variation in air temperatures during a heat run on a self-cooled, oil-immersed transformer, because of the tardiness with which the large mass follows the temperature changes in the sur-

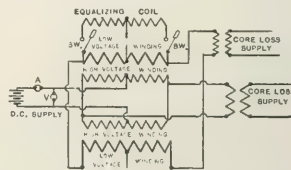


FIG. 3—METHOD OF MEASURING RESISTANCE WITHOUT CUTTING OFF LOAD

rounding medium. The effective temperature of the cooling medium is really that of a duplicate transformer under similar conditions and without load and such an actual value should be used in calculating rises. The paper recites actual tests showing the advantages of using such an idle transformer for comparison of temperatures and recommends that this form of test be prescribed in the rules. Fig. 3 illustrates a method of measuring resistance.

#### DETERMINING TRANSFORMER TEMPERATURES

Each part of a piece of electrical apparatus should be ventilated in accordance with its individual requirements, as pointed out by Messrs. W. M. McConahey and C. Fortesque, in their discussion of methods of measuring the temperature of transformers. Tests of cooling efficiency are reproduced and standard methods for loading transformers described. Theoretical proof of the method of alternate open-circuit and short-circuit testing is given. This scheme is useful in saving energy when a single transformer is on test. Investigations using this method with both self-cooled and water-cooled transformers gave results which agreed closely with those obtained with standard tests. Balanced loading is shown in Fig. 4.

#### CORRECTION OF TRANSFORMER TEMPERATURES FOR ROOM CONDITIONS

Mr. C. Fortesque first assumes a body of copper and, considering that loss of heat takes place only by convection, computes its corrected temperature rise for any arbitrary room temperature. Next similar formulas are derived for

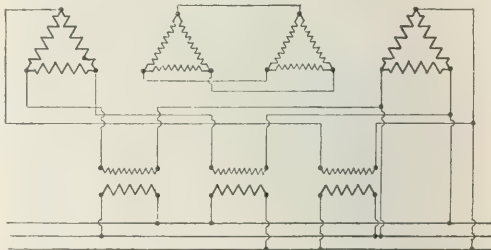


FIG. 4—THREE-PHASE BALANCED LOADING OF TRANSFORMERS.

bodies of both iron and copper. When the iron and copper losses are taken into account it is found that the difference between the observed temperature rise and that for the standard room temperature is, as a rule, negligible. The average temperature rise of the oil is proportional to the total heat dissipated if the convection currents in the oil were constant in flow. But with rise of temperature the

oil flows faster and its viscosity also decreases so that the correction factor assumed will be too great. If the increased radiation is also included, the factor may reduce to zero, even sometimes becoming negative.

#### TEMPERATURE RISE OF STATIONARY INDUCTION APPARATUS

Messrs. J. J. Frank and W. O. Dwyer suggest directions in which revision is needed in applying correction for the effects of temperature, atmospheric pressure, humidity, etc., of the cooling medium, in arriving at the temperature rise of stationary induction apparatus. It was expected that humidity might have considerable effect, but except for fog-laden air, the possible effect is very small, as shown by a theoretical study. Actual tests, reported in the second part of the paper, check these observations. Apparatus should be tested, it is recommended, under conditions approaching, as nearly as possible, those under which it is to operate. Where these requirements cannot be maintained, suggestions are given for applying correction factors for room temperature and atmospheric pressure.

#### EFFECT OF ROOM TEMPERATURE ON TEMPERATURE RISE OF MACHINES

Messrs. Maxwell W. Day and R. A. Beekman report the results of special tests on motors and generators to determine the effect of room temperature on machine temperature rise. In part of these experiments the room temperature could be varied at will. A general tendency was noted toward higher rise at the cold-room temperature, but the inconsistency of other results makes an accurate rule or statement inadvisable. However, from the curves and data presented in the paper, it is concluded that the present correction rule is wrong and should be corrected. The tests revealed the difficulty of formulating a rule to include all types of machines or even all parts of the same machine. Ultimate temperature reached is of greater importance than the rise noted, although further tests are desirable to fix a general statement to apply to temperature corrections.

#### EFFECT OF TEMPERATURE, PRESSURE AND HUMIDITY ON TEMPERATURE RISE

Besides the rise in copper resistance with temperature, the authors, Messrs. C. E. Skinner, L. W. Chubb and Phillips Thomas, point out that other factors affected are the variation in iron loss with temperature; increased iron resistance, reducing eddy-current losses, variation in quantity of heat radiated at different temperatures, change in viscosity of cooling medium, change in thermal conductivity of air, variation in barometric pressure, change due to humidity, variation in windage and brush and bearing friction, etc. The tests which the authors report show that within commercial limits the temperature rise is independent of air temperature, provided nearby objects are at air temperature. In conclusion the authors recommend that, contrary to the provision specified by the Standardization Rules, no correction be made for variation in air temperatures with the usual testing limits. As above enumerated, some of the variables are positive, some negative, and others either negative or positive depending upon contemporary operating conditions.

#### TEMPERATURE RISE AND ATMOSPHERIC CONDITIONS

In reporting their laboratory investigation of temperature rise as a function of pressure, temperature and humidity, Messrs. C. R. Blanchard and C. T. Anderson describe in detail the apparatus and methods used, although expressing regret for the incompleteness of the observations due to unforeseen difficulties. The data collected include values for temperature rise with varying air pressure, humidity and temperature. Curves are given showing the relation of temperature rise to watts input, pressure, temperature, etc. The authors express confidence in the results thus far obtained, although they plan to report later on a more thorough and careful investigation now being made.

#### LAWS OF HEAT TRANSMISSION

Mr. Irving Langmuir points out that the laws of heat transmission in electrical machinery depend upon three modes of thermal transfer—conduction, convection and radiation. A useful collection of reliable data on thermal conductivities and resistivities of various metals and materials is included under the discussion of the first subject, heat conduction. These data are also supplemented by figures on emissivities of various bodies for use in calculating radiation losses by the Stefan Boltzman fourth-power law. Experimental results, it is said, confirm the film theory of convection, which affords an easy analysis of the changes occurring with temperature and pressure. Viscosity is one of a number of important factors in the convection of heat in liquids. Radiation and convection are usually about equally effective in carrying heat away from a surface, but a distinction must be carefully drawn when the walls of the room are of a different temperature from the air.

#### CURRENT RATING OF ELECTRIC CABLES

Messrs. R. W. Atkinson and H. W. Fisher point out that the rating of an electric cable depends entirely upon its allowable heating, and this in turn is limited more by the external conditions than by particular features of the cable itself. Variability in these external conditions may reduce the rating to one-half, one-third or even a smaller fraction of its normal value. The paper discusses limiting temperatures, for both long-hour and intermittent operation, and presents methods of calculating temperature rise of cables in free air. Tables are given showing overload carrying capacities of various cables and the time necessary for the cable to reach 90 per cent of its final temperature, etc. It will require 50 per cent longer to attain 97 per cent of final temperature and 50 per cent less time to attain 68 per cent of final temperature. For nearly all conditions the carrying capacity of stranded cables varies as the 1.3 power of the diameter of the equivalent solid section.

#### THE HEATING OF CABLES CARRYING CURRENT

In this paper Mr. Saul Dushman points out that the carrying capacity of a cable may be computed with fair accuracy from observed data on the thermal resistivity of the insulation and the surface. In his experiments the following heat-transmission values (in degrees Centigrade per watt per inch cube) have been found: Rubber and cotton braid cover, 250; varnished cambric and cotton braid, 400; varnished cambric, lead-covered cables, 300. For surface resistivities (degrees Centigrade per watt per square inch): painted-steel braided armor, 100; cotton covering, 120; lead, ordinary, 190; lead, dull black, 140. Results show that the effect on carrying capacity of surface resistance is much greater in general than the internal thermal resistance of the insulation. The surface losses thus become of great importance in determining cable-carrying capacities.

#### Discussion on Heating and Heat Measurements

In a written discussion Mr. C. P. Randolph pointed out the complexity of calculations of temperature in stator coils and the large effects which slight differences in air-film thickness may introduce. Tests of a machine even before and after painting may show differences in the higher heat emissivity of the painted surfaces.

Mr. E. D. Edmonston reported some effects observed in cable burn-outs at Baltimore where succeeding break-downs in adjacent cables at the same point were caused by globules of water distilled from the paper insulation at the time of the first break-down. Mr. Edmonston expressed hope that a more uniform set of cable specifications might be formulated through agreement of manufacturers and users.

Among those who took part in the oral discussion Wednesday evening were Messrs. C. W. Burrows, C. A. Adams, S. O. Dushman, W. F. Dawson, Leo Schüler,

H. M. Hobart, C. O. Mailloux, C. P. Steinmetz, W. A. Durgin, B. G. Lamme, M. Leeds, L. W. Chubb, L. T. Robinson, R. F. Schuchardt, A. E. Kennelly, James Burke, Robert Landell, F. D. Newbury, Alexander Gray, R. B. Williamson, C. J. Fechheimer, Ralph D. Mershon and S. Haar.

In reply to a question by the German delegate, Mr. Schüler, Mr. Hobart declared his opinion that fog-laden or moist air offers a practical means of reducing the air volume to be circulated for cooling certain electrical machinery. There are, however, he cautioned, several practical details and problems which must be understood and solved before this use of moist air can be successful.

Mr. W. A. Durgin referred to the successful use of temperature or exploring coils on generators of from 5000 to 20,000 kw rating in Chicago. Close record is kept of internal temperatures and advance warning is given of clogging of the slots, indicating when cleaning is necessary.

Mr. L. W. Chubb reported that while nickel is an excellent material for temperature coils from the standpoint of its temperature coefficient, specific resistance, etc., it has the objectionable property of changing its electrical resistance when magnetized. One such exploring coil showed 2 per cent rise in resistance with its turbine field excited.

#### THE "MYRIAWATT" AS A UNIT OF BOILER POWER

Mr. H. G. Stott opened Thursday morning's session with a discussion of the proposed use of the "myriawatt" and the "myriawatt-hour" as ratings of boiler power and performance. The speaker pointed out that the criticism to which this proposed unit has been subject is in general due to a misconception. At the present time the units of boiler power are not only arbitrary but based on many different definitions, including evaporation, heating surface, quantity of steam delivered, etc. It is a happy coincidence, said Mr. Stott, that one boiler horse-power equals 10,000 watts or 10 kw, hence the name "myriawatt." The intention, he said, was not to introduce a new unit, but simply to add a multiple prefix to the familiar unit of power, thus making a convenient measure of the proper order of magnitude, corresponding in application to the kilowatt.

Dr. C. P. Steinmetz called attention to the heterogeneous and incompatible units employed in modern power-plant nomenclature, and the difficulty of making calculations or conversions through the various systems of units employed.

Prof. C. A. Adams pointed out the inconsistency of such present engineering calculations and declared that the average engineer wastes at least one year of his career in struggling with the present system of units.

Dr. A. E. Kennelly said that in Germany the difficulty in getting the mechanical engineers to adopt the kilowatt as a unit of power was finally overcome by proposing to call this unit the "neupherd," or "new horse."

Mr. Leo Schüler, of Berlin, declared that the prefix "myria" is a term that has little use in engineering nomenclature in America or abroad. The Verband Deutscher Electrotechniker, he said, now rates motors in kilowatts.

Mr. H. M. Hobart declared that the use of the ton is one of the chief difficulties in transferring American units to metric equivalents. The English ton is, however, almost exactly equivalent to the metric ton.

#### INDUCTION-MOTOR LOAD LOSSES

In their paper on load losses of induction motors, Messrs. H. G. Reist and A. E. Averrett recommend measurement of the losses themselves, rather than entire energy quantities, as introducing fewer uncertainties. Load losses may be largely in the form of excess core loss due to teeth saturation and excess copper loss in both primary and secondary. Results of twenty-nine input-output tests quoted show an average of 0.75 per cent lower efficiency by direct measurements than by the method of losses. The authors

conclude that load losses will not occur without saturation and that excess copper losses need not be allowed for with wire-wound stators.

#### STRAY LOSSES IN INDUCTION MOTORS

The author, Mr. A. M. Dudley, calls attention to the fact that the "load losses" referred to in the present Standardization Rules include certain losses not actually present when the motor is running under normal conditions. After pointing out means for segregating the real load losses from other losses observed in the power input to the motor at standstill, Mr. Dudley concludes that small wire-wound motors have no load losses, although such losses appear in larger sizes and with certain types of conductors. He recommends taking these facts into recognition in revising Rule 167.

#### INDUCTION-MOTOR LOSSES

Mr. R. W. Davis recommends that the true fixed loss be taken as the power input when the motor is running at rated voltage and without load, minus the stator-copper loss produced by the magnetizing current. In slow-speed motors this loss is appreciable. The stray or eddy-current loss in the stator copper is proportional to the stator-copper loss, the percentage depending on the degree of lamination employed. Six per cent is an average commercial value for 25-cycle and 60-cycle machines. As no commercial method of determining the average value of the stray loss is available, the author proposes that an average value in terms of the stator-copper loss be adopted. In squirrel-cage and small wound-rotor motors having slips greater than 2 per cent the total rotor loss should be taken from the slip reading when operating at full-load.

#### Discussion on Motor Losses

Among those taking part in the discussion on induction-motor losses were Messrs. B. G. Lamme, A. E. Averrett, B. A. Behrend, C. P. Steinmetz, James Burke, H. M. Hobart, Leo Schüler, R. E. Hellmund, C. J. Fechheimer, C. A. Adams, Alexander M. Gray, L. T. Robinson and M. G. Lloyd.

#### TRANSFORMER LOSSES

Mr. W. W. Lewis proposes to divide transformer losses into no-load losses, including core and dielectric losses, and load losses, made up of resistance and stray losses. From a study of impedance watts and load losses it is concluded that they are practically the same in value. The paper presents results of practical tests on commercial machines, giving stray losses, dielectric losses, etc. The author recommends revision of the Institute rules to agree with the definition and division of losses above given, and he further suggests that all losses be measured at the operating temperature.

#### STRAY LOSSES IN TRANSFORMERS

From a theoretical standpoint, Messrs. C. Fortesque and W. M. McConahey show that the copper loss and regulation of a transformer, considered as a pair of mutually inductive circuits, may be derived from its short-circuit loss and impedance voltage. With proper design the effects of frequency, wave-form, dissymmetry of winding, permeability of iron, etc., should be almost negligible in the copper losses of the transformer. Even taking into account the physical characteristics of iron, the theoretical determinations based on the mutual-inductance theory need not be modified in order to come within the limits of practical accuracy. Formulas are given for obtaining the equivalent short-circuit loss under full-load conditions, and practical examples of the use of these equations are compared with results of tests.

#### Discussion on Transformer Losses

Messrs. J. M. Weed, C. Fortesque, James Burke, E. A. Wagner, C. P. Steinmetz, Leo Schüler, B. G. Lamme and



C. F. Scott took part in the discussion on methods of determining losses in transformers.

LOAD LOSSES IN ROTATING MACHINES

The paper describes tests made by the authors, Messrs. E. M. Olin and S. L. Henderson, to determine the load losses occurring in rotating machines. The proposed correction factors are not to be applied to the sum of the separate losses but to the sum of the calculated armature

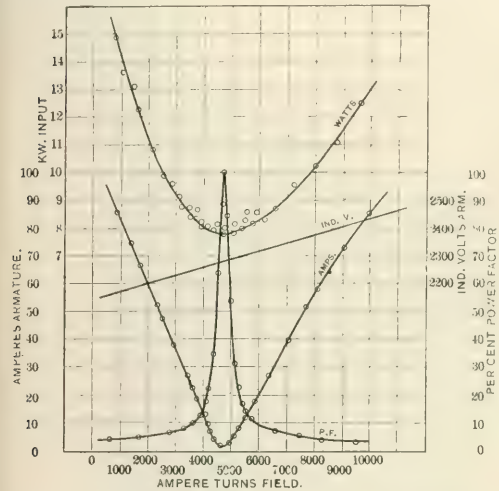


FIG. 5.—PHASE CHARACTERISTIC OF 300-KW ALTERNATOR

copper losses and the no-load core loss. The laboratory tests indicated fairly uniform ratios between the sum of these losses under actual load conditions and their sum as determined by no-load measurements. The authors therefore recommend the following correction factors as checking closely with commercial tests:

	FRACTIONAL LOADS			
	0.5	0.75	1.00	1.25
Direct-current motor	1.10	1.20	1.30	1.40
Alternator	1.01	1.03	1.10	1.20
Synchronous motor	1.04	1.07	1.10	1.20
Synchronous converter, 60 cycles	1.00	1.00	1.00	1.00
Synchronous converters, 25 cycles	1.00	1.00	1.00	1.00

LOAD LOSSES OF ALTERNATING-CURRENT GENERATORS

The accurate determination of load losses in well-designed generators is difficult, for the losses are themselves small, according to the authors, Messrs. W. J. Foster and Edgar Knowlton. The circulating-energy method is recommended where duplicate machines are available, since this scheme measures the losses of both machines, enabling variations of any size to be detected. From a study made with three machines to find a method of accurately measuring load loss when but one machine is available, the authors observed that load loss is approximately equal to short-circuit core loss, although the present meagerness of data does not justify establishing this statement as a general rule. Fig. 5 shows characteristic curves of a 300-kw unit.

STRAY LOSSES IN SYNCHRONOUS MACHINES

From an analysis of a variety of machines, Mr. F. K. Brainard insists that provision of the present Institute rule

allowing for stray loss as one-third of the short-circuit core-loss is entirely too small. When well built, modern moderate-speed machines show little short-circuit loss in the armature core, the armature resistance loss plus eddy-current loss accounting for practically all losses observed. In high-speed turbine-generators, however, a large loss appears on short-circuit, and this remains unexplainable by the eddy currents in the conductors. There is probably an appreciable additional loss with actual load, on account of the increased magnetic leakage from the field resulting from the increased excitation required. Mr. Brainard recommends a larger allowance for stray loss than is at present approved.

STRAY LOSSES IN COMMUTATING MACHINES

Messrs. H. F. T. Erben and H. S. Page undertake selection of empirical factors for estimating stray-loss values in direct-current apparatus, without the necessity for actual tests. The paper discusses the two elements of stray loss—commutation loss and loss due to flux distortion—and describes methods of testing for stray losses, giving results of actual tests. Curves presented show the values for stray loss on commercial machines, affording a basis for suggestions concerning multiplying factors.

STRAY-LOSS MEASUREMENTS FROM INPUT-OUTPUT TESTS

With careful input-output tests, declares Mr. L. T. Robinson, certain direct-connected sets can be tested with an error less than 0.2 per cent, a degree of precision smaller than the limits within which the efficiency is likely to remain constant. Where the no-load losses fail to remain constant the efficiency sometimes becomes indefinite within 0.5 per cent. Without checks by determination of the smaller losses direct methods are seldom conclusive, since they do not include all sources of loss or realize operating conditions completely. Accurate input-output tests require too much time and labor for regular commercial use, although they are valuable as a basis of final reference. The paper closes with a number of comparisons of efficiency determinations made by input-output and loss-segregation methods.

EFFICIENCY DETERMINATIONS OF ROTATING MACHINES

When the efficiency of a machine is determined by the method of summation of separate losses the effect of possible errors, as pointed out by Messrs. E. I. Chute and William Bradshaw, will be much less than when the measurement is made by the input-output method, since in the latter all determinations enter directly into the final result. Errors likely to arise are those of the instruments themselves, incorrect observations and changes in operating conditions. Swinging of instrument pointers may introduce considerable error unless prevented. The efficiency as determined by the loss method, while not the true operating efficiency, can be so modified by certain factors depending on the type of machine as to approach closer to the actual value than the results obtained with the average input-output method. In view of laboratory limitations in commercial plants and the equivocal results usually attained, the authors do not recommend the input-output method.

Discussion on Generator Tests

Discussion of the subjects of alternating-current and direct-current generators and errors of tests was postponed to the evening session of Thursday. Among those taking part were Messrs. Edgar Knowlton, G. F. Brown, E. F. Collins, R. E. Hellmund, W. J. Foster, F. D. Newbury, B. G. Lammie, H. F. T. Erben, B. A. Behrend, James Burke, C. P. Steinmetz, E. M. Olin, L. T. Robinson, C. J. Fechheimer, John L. Harper, E. I. Chute, M. G. Lloyd, H. M. Hobart, W. F. Dawson and R. D. Mershon.

BRUSH FRICTION AND CONTACT LOSSES

Messrs. H. T. Erben and A. H. Freeman call attention to the present insufficiency of A. I. E. E. rules on brush-loss

determinations. These losses include both sliding friction and brush-contact drop, but the quantities involved are often too small for ordinary means of measurement. To observe the effect of wide temperature ranges on brush friction, a commutator was operated in an asbestos-lined box heated by grids to temperatures between 40 deg. and 100 deg. C., but the variation in power required to drive the commutator at different temperatures was found to be negligible. The paper includes a number of curves presenting values for friction, contact drop, etc., for various commercial brushes at different speeds. The authors propose that brush friction be hereafter calculated from data and by methods having Institute approval, instead of using present inaccurate test methods.

#### CONTACT AND FRICTION BRUSH LOSSES

The resistance of the contact beneath the brush varies with brush composition, pressure, temperature, humidity, current density, etc., according to Messrs. H. R. Edgecomb and W. A. Dick. Their present investigation studied two surface variations which may cause large errors: (1) Large momentary fluctuations in contact-voltage loss, caused by changes in brush surface. (2) Decrease in voltage loss by formation of a thin carbon coating on the commutator which provides a conducting medium between the brush and the commutator. The power required to overcome brush friction depends upon brush composition, angle of setting, surface, pressure, speed, etc. The authors advocate data tests under ideal conditions on which to base loss determinations superseding the present commercial tests.

#### COMMUTATION AND BRUSH LOSS

Great variations are found in brush-loss tests, even when made on slip-rings or special commutators, and such tests as usually carried out are virtually worthless for practical use. There is difficulty, adds Mr. C. E. Wilson, in separating actual brush loss from commutation loss. In parts of the brush current densities are found of three times the apparent average density. If local currents be eliminated by using narrower brushes, resistance leads or interpoles, higher average densities are permissible. Brush resistance decreases with increasing current, although at present no way of calculating or measuring the actual loss at the brushes is known. The increase actually occurring is to be regarded as a commutation or load loss, being considered one of the stray losses of the machine.

#### *Discussion on Brush Losses*

Among those who took part in the discussion of brush losses were Messrs. T. M. McNiece, L. R. Berkeley, E. H. Martindale, H. F. T. Erben, Leo Schüler, B. A. Behrend, Alexander M. Gray, C. A. Adams, A. H. Freeman, B. G. Lamme, R. B. Treat, R. B. Williamson, John L. Harper, L. T. Robinson, W. H. Powell, F. D. Newbury and L. E. Underwood.

Mr. Lamme said that in testing a 2000-kw homopolar generator fitted with one set of iron collecting rings and one set of bronze rings the losses in the iron rings due to magnetic action were found to be 200 kw greater than those in the bronze rings. The use of iron rings, he pointed out, must depend upon local conditions, presence of magnetic fields, etc.

Mr. R. B. Treat said that the period of seasoning of commutators depends upon the characteristics of individual machines. One source of chattering, he pointed out, is caused by loose collector rings, although the degree of looseness may be so small as to be quite imperceptible to the hand when the machine is at a standstill.

#### METHODS OF LOADING LARGE MACHINES FOR TEMPERATURE TESTS

Mr. F. D. Newbury's paper compares various methods of loading larger alternating-current and direct-current gen-

erators and rotary converters for factory temperature tests. The tests discussed are those of separate open-circuit and short-circuit loading, alternate open-circuit and short-circuit loading, direct-current open-delta loading, and zero-power-factor loading. The first two are declared unreliable, although the first method named requires least testing equipment. The third method checks well with actual operation, while the fourth approaches most nearly to actual conditions, exactly corresponding to service operations in all respects except power-factor and imposing even severer conditions in this regard. Mr. Newbury recommends Institute adoption of the zero-power-factor method and suggests the loading-back method for tests of direct-current generators and rotary converters.

#### LOAD-TEST METHODS FOR ALTERNATORS AND FOR INDUCTION MOTORS

In comparing the methods of making load tests on alternating-current generators and induction motors, Messrs. E. F. Collins and W. E. Holcombe describe the most practical methods adapted for load-temperature runs using a limited amount of power. For alternators approved methods are: (1) zero-power-factor method; (2) open-circuit and short-circuit method; (3) open-delta method, and (4) phase-displacement method. For induction motors: feeding back; reduced voltage, and reversed rotation. Actual test data cited show the close agreement between temperature-rise results by the equivalent-load and actual-load methods. The paper includes a full discussion of the advantages and drawbacks of the various methods described and recommends the special application of each.

#### LOAD TESTS ON LARGE INDUCTION MOTORS

Complete factory tests of induction motors, as enumerated by Mr. A. M. Dudley, include checks on the efficiency, power-factor, torque, heating, noise, mechanical balance and temperature. It is usually necessary and desirable, however, to make compromise tests of temperature, and the author describes some methods employed. From five examples in which actual test results are compared with compromise tests on the same machines, the close agreement of the results is shown. The methods outlined in the paper, the author gives assurance, afford results which are always safe, although approximating closely to actual test conditions. In concluding the author recommends that the Institute recognize the various methods of conducting compromise tests, with their reliability and limitations.

#### *Discussion on Generators and Motors*

Among those taking part in the discussion of methods of testing generators and induction motors for performance were Messrs. F. D. Newbury, A. E. Averett, R. B. Williamson, R. E. Hellmund, B. G. Lamme, Leo Schüler, E. I. Chute, P. M. Lincoln, Alexander M. Gray, B. A. Behrend, H. M. Hobart, S. L. Henderson, J. K. G. Madden, C. P. Steinmetz, W. J. Foster and S. S. Seyfert.

Mr. Leo Schüler urged upon the Institute consideration of the undesirable results which might follow from making equivalent tests a part of the Standardization Rules, suggesting instead the incorporation of these tests in an appendix, if necessary.

Mr. E. I. Chute declared that the simpler the tests the better, and he urged careful consideration of the matter of duplicating results.

Mr. P. M. Lincoln explained that the manufacturer's facilities for applying power tests are often limited. The zero-power-factor test he declared is even more severe than normal load and is the most satisfactory of the test methods.

Mr. F. D. Newbury assigned the direct-current circulating test a place next to the zero-power-factor test in

point of satisfactory results, putting this circulating test ahead of the intermittent test.

#### LOAD TESTS ON TRANSFORMERS

When only a single transformer is available for a test in which actual load is not to be applied, Mr. J. J. K. Madden describes how heat runs may be made by applying intermittently an over-voltage core-loss with an over-current impedance loss. Approximate temperature results can be obtained by combining an ultimate open-circuit heat run with an ultimate short-circuit heat run. The intermittent-run method is recommended for tests of a single single-phase transformer, and although this method may be modified to obtain closer refinement, sets of figures presented in the paper compare the results of these test methods with the dead-load and motor-generator methods. The over-voltage and over-current to be employed must depend, however, upon the individual transformer's characteristics, lest injury be done to its windings.

#### SOURCES OF ERROR IN TRANSFORMER TESTS

Messrs. W. M. McConahey and C. Fortesque discuss precautions to be observed, mentioning proper selection of instruments, care in reading scale deflections, attention to ratio and polarity determinations, etc. Among the topics treated are tests for copper loss and impedance, iron loss and magnetizing current, manner of making heat runs, testing of insulation and over-potential tests.

#### RATING OF OIL CIRCUIT-BREAKERS

Mr. G. A. Burnham advocates a universal method of rating oil circuit-breakers with reference to their instantaneous rupturing capacity, thus eliminating many variables. All reference might then be omitted to non-automatic, cell-mounted, pipe-frame, time-limit-tripping and other oil-switch qualifications, by rating the rupturing capacity on a "maximum instantaneous" basis, since the oil switch itself is the essential factor and the addition of various accessory apparatus leaves the rupturing capacity unchanged.

Messrs. P. M. Lincoln, M. G. Lloyd, F. D. Newbury, R. F. Schuchardt and C. A. Adams took part in the brief discussion on the subject of circuit-breaker ratings.

#### THE SPHERE SPARK-GAP

Messrs. S. W. Farnsworth and C. L. Fortesque point out the limitations of the needle spark-gap and recommend in-

stead the use of a gap with two equal spheres. If the latter are used with a separation less than their diameter, corona and resultant inconsistencies do not appear. Large spheres, of course, will be required for high voltages. Such gaps have already proved successful in commercial test work. They are reliable, convenient, portable and compact. For standards, the use of spheres 25 cm, 37.5 cm and 50 cm in diameter is proposed, covering ranges of 50,000 to 275,000, 50,000 to 412,500 and 50,000 to 550,000 volts effective values. For pressures below 50,000 volts a smaller size of sphere should be used, although the authors as yet offer no recommendations. The sphere-gap affords more consistent results than the needle-point method, since its break-down is

little affected by air pressure, humidity, proximity of neighboring bodies, etc.

#### CALIBRATION OF SPHERE-GAP VOLTMETER

Mr. C. Fortesque and Mr. L. W. Chubb report that the surface intensity at break-down and ratio of separation to diameter observed with sphere-gaps show the ultimate strength of air to vary from 3 kilovolts to 3.6 kilovolts per centimeter within the working range. Extraneous objects, however, may prevent the theoretical proportion between voltage, separation and diameter from holding throughout the range. The paper presents tables of direct calibrations for pairs of 25-cm, 37.5-cm and 50-cm spheres, taken up to a maximum pressure of 400,000 volts. The test results show break-down to be independent of wave-shape and frequency when expressed in terms of the maximum value of the voltage wave. Calibration curves were also obtained for the spheres, at separations from low-voltage up to diameter distance. As the curves are expressed in effective values of voltage, they assume a sine-wave shape.

#### Discussion on Spark-Gaps

Mr. F. W. Peek pointed out that the results obtained with needle-gaps may vary as much as 20 per cent, depending on the humidity, although sphere-gaps are practically independent of moisture if the spacing be small with respect to the diameter.

Mr. C. E. Skinner declared that the accuracy of the sphere-gap method is proved by the close agreement of the observations of many experimenters during several years' work. On no other subject brought before the present standardization meeting, Mr. Skinner pointed out, was there such general approval and unanimity as with respect to the superiority of the sphere-gap over the older method. Some little difficulty, he said, has been experienced in obtaining accurate spheres of the required diameters.

Mr. G. H. Sanford pointed out that with the sphere-gap the observer can make adjustments with the voltage on the test piece, moving the electrodes gradually closer together until the break-down point is reached. Considerable time is thus saved over the needle-gap method, which required stationary settings for each piece.

Mr. James Lynan reported some earlier experiments of his own in which sphere-gaps had shown wide variations in break-down voltage, the discrepancy ranging between 20 and 25 per cent. In order to obtain the best results, he found it necessary to amalgamate the brass spheres after each discharge in order to secure perfect spherical surfaces.

Mr. L. W. Chubb urged that amalgamating brass spheres might reduce their accuracy since the mercury attacks the zinc in the brass, causing distortion of the entire mass.

Dr. Percy Thomas pointed out that the sphere spark-gap has a comparatively high electrostatic capacity and may hence require a certain charging current not involved with the needle-gap. If a series resistance be inserted in series with the sphere-gap, the drop measured will be indefinite. While these effects may not introduce discrepancies at low frequencies, care must be observed at higher frequencies lest accurate results be interfered with.

Dr. C. P. Steinmetz cited his own earlier experiments in which he found time lags of the order of 0.0001 of a second. This lag, as he pointed out, is really an error lag, due to the fact that it is necessary to accumulate energy at a potential high enough to break down the gap. For comparatively low pressures, those up to say 20,000 volts, the needle-gap may continue to be standard. Others who took part in the discussion were Messrs. A. Adams, S. W. Farnsworth, C. Fortesque and W. S. Franklin.

#### POTENTIAL WAVES OF ALTERNATING CURRENT GENERATORS

In stating at the outset his purposes in preparing this paper the author, Mr. W. J. Foster, sets down the following threefold aim: (1) to show potential waves closely re-

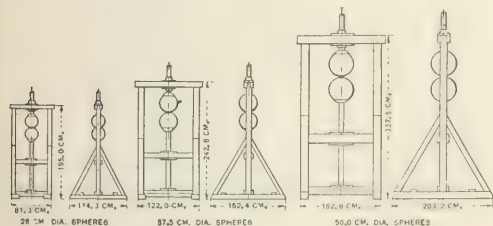


FIG. 6—STANDARD SPHERE SPARK-GAPS

stead the use of a gap with two equal spheres. If the latter are used with a separation less than their diameter, corona and resultant inconsistencies do not appear. Large spheres, of course, will be required for high voltages. Such gaps have already proved successful in commercial test work. They are reliable, convenient, portable and compact. For standards, the use of spheres 25 cm, 37.5 cm and 50 cm in diameter is proposed, covering ranges of 50,000 to 275,000, 50,000 to 412,500 and 50,000 to 550,000 volts effective values. For pressures below 50,000 volts a smaller size of sphere should be used, although the authors as yet offer no recommendations. The sphere-gap affords more consistent results than the needle-point method, since its break-down is



lated to the evolution of alternators; (2) to exhibit the effect of load and other conditions on the no-load and open-circuit wave; (3) to give illustrations of commercial wave-forms, good, bad and indifferent, as actually employed in service. The paper is illustrated with nearly 100 wave illustrations. The general effect of load is slightly to broaden the top of the wave, bending it to the left and making it somewhat unsymmetrical. An inductive loads tends to smooth out the harmonics, a condenser load to emphasize them. Among the conditions for obtaining proper wave-shape is the proper shading of magnetic flux by shaping the poles or distributing the windings, and an irregular though prime relation between the number of slots in the armature and the number of poles.

#### EFFECTS OF WAVE DISTORTIONS

Mr. P. M. Lincoln observes that the present A. I. E. E. rule in regard to wave-form is not satisfactory in that it fails to penalize adequately the higher-frequency harmonics. The author discusses various conditions, among them the situation involved where two differing wave-forms are connected in parallel, showing the resultant effect on the current wave. In some cases very great current-wave distortion may occur, or large exchange currents may flow between machines. The paper concludes with a discussion of wave-form errors in power-factor meters and other instruments.

#### PROPOSED WAVE-SHAPE STANDARD

The wave-shape standard proposed by Mr. Cassius M. Davis would make use of the principle of change in effective reactance of a condenser with change of wave-form.

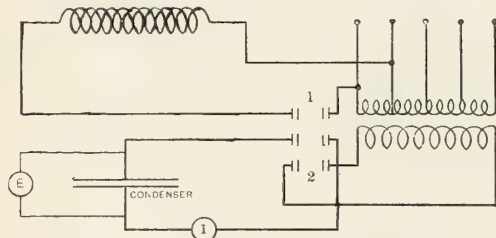


FIG. 7—CONDENSER CONNECTION FOR MEASURING STANDARD WAVE-FORM

Among its advantages over the present standard (which has objections in its use of the oscillograph, length of calculations and tendency toward higher harmonics) would be the following: Wave distortion could be determined quickly; distortion would depend upon the order and magnitude of harmonics present; the apparatus is simple and the tests require little technique. The ratio of the condenser reactance on a sine wave to the condenser reactance on a distorted wave is called the distortion ratio. It is measured by first impressing the wave on a condenser in series with large inductive reactance, and then across the condenser alone. The distortion ratio of generators should be tested at no load, since under load the wave length is indefinite.

#### Discussion on Wave-Form

Among those who took part in the discussion of wave-form and determination of wave-shape standards were Messrs. G. B. Smith, W. L. Waters, F. M. Farmer, T. Reed, C. P. Steinmetz, B. G. Lamme, A. E. Kennelly, M. G. Lloyd, L. W. Chubb, D. C. Jackson, C. A. Adams, P. M. Lincoln, L. T. Robinson and C. M. Davis.

#### REGULATION OF ALTERNATORS

At low power-factors, according to Mr. A. B. Field, the method of determining the regulation of an alternator as set down in the Standardization Rules is inaccurate, taking

no cognizance of varying pole leakage or of the ratio of armature reaction to reactive voltage drop. These effects are marked at zero power-factor. Since this is the usual condition for taking regulation curves, it is advocated that regulation be based upon the saturation at zero power-factor and the no-load saturation. The author suggests revision of the present rules in accordance with suggestions submitted by him in a paper ten years before, drawing attention to the importance of the zero-power-factor curve.

#### REGULATION OF DEFINITE-POLE ALTERNATORS

Mr. Soren H. Mortensen suggests that the triangle method be used for obtaining the regulation of alternators, instead of the scheme now recommended, which is based on the use of the no-load saturation short-circuit curve and armature resistance. The latter method he asserts, often gives incorrect results. The tests required are the same as with the present A. I. E. E. method, the regulation being derived, however, from the Kapp diagram based on estimated full-load zero-power-factor saturation curve, in turn determined by aid of Potier's triangle. Tables presented by the author, comparing the triangle and A. I. E. E. methods with the results of actual tests, show the superior accuracy of the proposed triangle method.

#### GENERATOR AND PRIME-MOVER CAPACITIES

In their paper on generator and prime-mover capacities Messrs. D. B. Rushmore and Eric A. Lof pointed out the desirability of considering turbo-generators as units. Turbo-sets are in operation in which the output is limited by a discrepancy in the ratings, the prime mover being either too small or too large for the generator. Units are now being rated on a maximum or constant continuous rating, which should not be exceeded except during momentary peaks. Steam-turbine units have been thus rated with entirely satisfactory results. It is also becoming quite common with waterwheel-driven units. For the sake of standardization it seems desirable to give all generators a maximum constant continuous rating at a certain specified temperature.

Among those taking part in the discussion of the papers on machine regulation and prime-mover capacities were Messrs. F. D. Newbury, S. S. Seyfert, B. G. Lamme, C. A. Adams and Alexander M. Gray.

#### CLOSE OF THE CONVENTION

In summing up the work of the convention, Mr. B. G. Lamme, member of the standards sub-committee, pointed out the difficulty of making accurate measurements, loading machines, etc. Certain losses which were discussed by the convention, he reminded the Institute, are after all small quantities in themselves and often quite negligible. The results of the discussion and the divergence of opinion expressed, said Mr. Lamme, are both discouraging and encouraging; especially, however, the latter, since the attention of the industry is thus being called to matters in which it has been lacking. Taking load losses as an example, since, said the speaker, it is often too costly to measure them accurately, they should be eliminated or provisions made for protection against them. The manufacturers are now acquiring that exact knowledge in which they have been lacking. The present convention, said Mr. Lamme, has set a pace hard to follow.

Retaking the chair from Dr. A. E. Kennelly, who presided during the technical sessions, President Ralph D. Mershon congratulated the Institute on having completed one of the most successful gatherings in its history and predicted that a mid-winter meeting, devoted strictly to business discussion, would become a regular feature of the annual program. After brief remarks by Mr. C. F. Scott, on behalf of the standards committee, and Mr. Leo Schuler, delegate from the Verband Deutscher Elektrotechniker, of Berlin, the convention adjourned.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Minneapolis Electrical Board

As a result of the dinner given recently by the Minneapolis General Electric Company to the electrical contractors and representatives of other electrical interests in that city, noted on page 300 of the Feb. 8 issue of the *Electrical World*, an organization styled the "Minneapolis Electrical Board" has been formed. This board consists of seven members, there being a representative of the wholesale houses, the retail dealers, the sign manufacturers, the contractors, the fixture dealers, the municipal inspectors' department and the central station. The board will meet once a month for the discussion of matters of common interest, and every effort will be made to further the electrical development of Minneapolis.

## Wholesale Disposition of Ice Output

One of the comparatively large combination ice-electric plants of the country supplies a Western city of 30,000 inhabitants. The 60-ton steam-driven compressor equipment and freezing tank cost approximately \$1,000 per ton of rating and operates for from six to eight months during the year.

Under these conditions it is estimated that the ice manufacturing cost averages about \$1 per ton. The entire output is disposed of at wholesale, bringing \$3.60 per ton, so that a substantial income is added to the earnings of the electrical equipment. Distilled water reclaimed from the engines driving the electrical generators is used for freezing purposes. Ice storage capacity up to several hundred tons enables the refrigerating machinery to be uniformly loaded without respect to the varying demands of the local consumption.

## Successful Central-Station Lecture Service

The lecture division of the Boston Edison Electric Illuminating Company's advertising department has been carrying forward important work this winter in popularizing the use of electric service in many parts of eastern Massachusetts. Up to the middle of February more than thirty-five lectures had been given by representatives of the company before men's and women's clubs, classes of children and young people in the graded, trade and evening schools and church societies and lodges. Over 4000 persons have attended the lectures so far this season. The work has been handled by Mr. L. D. Gibbs, superintendent of advertising, with the assistance of Messrs. La Rue Vredenburg and F. C. Hard.

In connection with the lecture service a special program of entertainment and instruction has been arranged for the demonstration of electric cooking and heating. A kitchen table, of the "knock-down" type, with a special crate for easy shipment, has been equipped with outlets and a cable which can be connected in service wherever the appliances are to be used. Other crates have compartments for appliances and for the small supply of dishes used in places where no other means for furnishing refreshments are available. The entire equipment can thus be shipped promptly and easily by express to the place where the lecture and exhibition are to be given, and there assembled and dismantled with speed and convenience.

## Referring Appliance Purchasers to Dealers

The relation of a public-service company with the electrical contractors of its community, so far as the sale of electric utensils or supplies is concerned, should be clearly defined in order to promote good feeling between everyone involved. Care is taken to make this a feature of the policy of the Louisville (Ky.) Lighting Company.

Although itself exhibiting for sale a wide range of electric equipment for home, office and store—a stock, in fact, much more comprehensive than any but the largest dealers could afford to carry—the Louisville company makes a point of soliciting appliance business by sample demonstration of the utensil, in the end directing the purchaser to the nearest supply house. Of course, if a customer insists on buying from the central-station company and no one else, the company is naturally prepared to meet the demand. But wherever possible the business is turned over to the specialist in this line.

## Miniature Distribution System in Window Display

To afford a better popular understanding of the methods of producing and distributing electrical energy, the Worcester (Mass.) Electric Light Company recently installed in one of its main-office show windows a model depicting the various steps, from coal mine to home, in the production and supply of electric service. A miniature mine shaft and colliery are connected by a railroad track with the coal pocket of a tiny power station. This generating plant contains boiler, engine and dynamo equipment, and its outgoing pole lines lead to a small substation from which local distribution circuits run to a doll house. The little dwelling is wired complete with miniature lamps and is equipped with tiny models of an electric flatiron and sewing machine. En route to the house, taps from the overhead distribution circuits at various points are taken to miniature street lamps, and in the model substation a practical lilliputian switchboard controls the service to these lines. Energy to operate the display comes from the company's office circuit, but the sequence of operations from coal mine to household lamp is clearly shown and the exhibit has earned much favorable local comment.

## Quick-Service Connection in an Emergency

At 11 o'clock on a recent Saturday morning the commercial department of the Baltimore Gas & Electric Company received a telephone call from a local physician who explained that it was absolutely necessary that service be furnished a certain residence for operating an X-ray machine in connection with an operation about to be performed. Investigation showed that no electricity had ever been supplied to this building, so that it was necessary to arrange not only for the outside service run but also the interior wiring.

A man from the wiring department was at once dispatched to the premises to reconnoiter. After finding what was needed he telephoned the distribution department, with which arrangement had already been made for quick handling of the service order. This order came through at

12 o'clock noon, and at 1:15 p. m. the distribution department had the service installed and working. It was needed for only an hour, as had been explained by the physician beforehand, and after serving its purpose the wires were removed.

### Electric Ice Making "Farthest North"

The Consumers' Ice Company, Ltd., of Winnipeg, Manitoba, Canada, is installing a 100-ton motor-driven raw-water ice factory which will be operated by central-station energy purchased at an advantageous rate from the Winnipeg Electric Railway Company. The 100-ton refrigerating equipment is divided into two duplicate sets, each comprising a 150-hp, 2200-volt, 60-cycle Lincoln motor driving a 50-ton compressor made by the Arctic Ice Machine Company of Canton, Ohio.

Auxiliary equipment for the ice factory includes two 5-hp air-compressor motors, two 7.5-hp brine-pump motors, two 5-hp thaw-pump motors and one 20-hp deep-well pump motor. In addition to the main ice machines there is an auxiliary 5-ton compressor, driven by a 10-hp motor, this set having been provided for use in holding temperature when the principal units are shut down.

This electric ice factory is expected to operate at nearly full rated output throughout the entire year, despite the extremely low winter temperatures for which Winnipeg is famous. Besides the hotel and club customers whose ice consumption continues uniform during the winter season, it is estimated that the domestic consumption during the cold months approximates 60 per cent of the summer demand. This is explained, paradoxically enough, by the very great cold itself. This low temperature, it is declared, makes it impossible for the housewife to put provisions outdoors lest they be completely frozen. In consequence many homes make use of their refrigerators all the year around.

### Lighting a Large Sign at Low Cost

The advent of the tungsten sign lamp has given a new impetus to billboard lighting. When such lamps are combined with proper reflectors surfaces of unusual size may be illuminated at low cost. The accompanying illustration shows a billboard in Providence, R. I., which is about 25 ft. high and 50 ft. long. The illumination is furnished by six 100-watt tungsten lamps carried in suspended reflectors at



ADVERTISING AT LOW COST

the front of the board. The cost of operation is only about 6 cents per hour, but by night the sign is one of the most striking objects seen from the street below. The lamps and reflectors are hung by strong wires and are notable for their inconspicuous appearance. The reflector area is so small in relation to the size of the board that the light sources do not appreciably interfere with the advertisement.

### Annual Profits of \$5,950 from \$10,000 Ice-Plant Investment

In a Western plains city of 3500 population, on the same line of latitude with Omaha, the electric company several years ago invested \$10,000 in a 10-ton ice plant to be operated in conjunction with its electrical equipment. This ice machinery now produces 1200 tons annually at a net cost of \$1.28 per ton under full-load operating conditions, netting its owners a profit of nearly \$6,000 per year, or about 60 per cent return on their outlay. The ice-making season lasts but four months in this climate, so that the ice equipment earns this income in about 120 days.

The compressor plant, freezing tank, etc., cost \$9,000, to which must be added \$500 for teams and wagons and \$500 for miscellaneous equipment, making the total investment \$10,000. Locally the domestic price for ice, delivered, is 45 cents per 100 lb., although a quantity of the product is sold wholesale from the platform for \$4 per ton. A cold-storage room provides space for holding 75 tons of ice under artificial refrigeration.

Last year the 1200-ton output brought a gross income of \$7,500. Plant expenses chargeable to ice making were \$1,500, as follows:

Gross income from ice business.....	\$7,500
Expenses, including depreciation, interest, etc.....	1,500
Net profit from ice making.....	\$5,950

In general, this company finds its wholesale business much more satisfactory than selling ice by retail to domestic users. The annoyances and misunderstandings of delivery are avoided, and while the net return per ton are diminished, much wear and tear is saved for the management. In seasons when the natural-ice crop is light, the plant ships thirty-five to forty carloads of ice per season to nearby towns, receiving \$3.50 per ton f.o.b. in car-load lots.

### The Central Station and the Consulting Engineer

In its treatment of consulting engineers the central station often overlooks important opportunities open to it for increasing its industrial motor load. At the present time few consulting engineers are enthusiastic about central-station service. It is quite natural that they should not be, for the central station is their competitor in doing the engineering work, and even though an engineer is retained on a motor installation the fee is much less than where a steam plant is installed.

Now, the consulting engineer is the logical arbiter of the question "central station versus isolated plant," and if the central station is to get the business which is rightfully its own, then its attitude toward the consulting engineer should be such that he will consider the question impartially. The first step in bringing about such impartial consideration is in having central-station salesmen recommend to customers that they retain an engineer to decide the power question. In spite of what disappointed salesmen have to say, established consulting engineers are almost without exception both honest and fair. They can weigh the motor-service salesman's arguments much better than the plant owner, and the central station will have a better chance of getting the business to which it is fairly entitled.

It is self-evident that the central station's recommendation will be appreciated by the consulting engineer and that he will give the company's statements and view of the conditions ample consideration. A report from his own consulting engineer will carry much more weight with the customer than the central station's report. The engineer's statement will not be discounted as would a partisan report, or be subject to possible prejudice against the central station.

He himself being qualified to judge of the accuracy of



every claim, either steam or electrical, the consulting engineer would gladly have the central station's case presented by a fully competent power engineer. Then if the facts in a particular case favored the isolated plant, such an industrial service engineer could be shown the conditions and the reason for the decision, and the consulting engineer would feel no fear of discrimination against him by the central station on future work. In fact, the graceful acceptance of his decision in such a case would be the best kind of salesmanship.

Another important point in getting on a friendly basis with the consulting engineers is to let them understand that the central station is glad to help them secure the engineering on motor installation and, furthermore, this must be the sincere practice of the central station.

The argument that the purchase of central-station service would save consulting engineers' fees would have to be dropped. However, that argument has opened the door for one of the most pernicious forms of selling ever practised. The buyer considering a source of power for his new factory would like to compare the concise proposal of the central station with the jumble of opinions and proposals submitted by the steam-equipment men. He would like to have a definite guarantee of his electrical and heating costs. But the central-station salesman has rubbed in the argument that a consulting engineer's fee is money wasted, and that the engineer will decide in favor of the steam plant anyway. So the door is open for the agent of several lines of steam apparatus or the manufacturer of major equipment, such as engines, to step in with a proposal on a complete plant for a definite sum, guaranteeing to deliver electrical and heating service for a given cost per unit. This cost is reduced to the minimum by using the cheapest equipment throughout and by basing the guarantees on fixed prices for labor, repairs, fuel, and especially depreciation, which will not stand inspection by a competent judge. On the trial test the economy may be shown, but the buyer will appreciate his bargain at its real value in a very few years when the inferior equipment begins to fall apart. Such misrepresentation could be eliminated by the retention of a consulting engineer.

## Ice-Plant Investment and Returns in Town of 2300

During its four months' ice-making season, the 15-ton steam-driven compression plant operating in a Kansas town of 2300 inhabitants turns out 2800 tons of ice. Distilled water regained from the condensation of the various plant engines, including the ammonia compressor, is used for freezing. The \$16,700 investment in the ice-plant department is apportioned as follows:

Ice-plant addition to building.....	\$2,000
15-ton steam-driven compressor.....	13,000
Freezing-tank equipment.....	1,000
Waxons.....	500
Total ice-making investment.....	\$16,500

In addition to the refrigerating equipment proper, the company recently installed cold-storage capacity for 1000 tons of ice, thus enabling it to hold and conserve its product to meet the variations in demand. This 1000-ton ice storage cost \$6,000, bringing the total outlay for the ice department to \$22,700.

To produce a ton of ice at the station platform, the factory cost is estimated at \$1.35. The several charges entering into this manufacturing expense are, per ton of ice made:

Fuel.....	\$0.75
Labor, including office salaries.....	0.30
Water.....	0.10
Supplies and miscellaneous.....	0.15
Total factory cost per ton.....	\$1.35

Wholesale this product brings \$2.75 per ton. The local retail price is 35 cents per 100 lb., or \$7 per ton. Delivery of the ice to retail customers adds, however, a blanket charge of approximately \$1.30 per ton, according to the company's cost sheets. Following is the corporation's report on last season's earnings:

Yearly gross income from ice business.....	\$12,000
Expenses for year, including depreciation, etc.....	9,420
Net earnings from ice business.....	\$2,580

In offering a word of advice to electric companies which contemplate combination ice manufacture, this operator urges wholesale disposition of the product at the plant, warning the uninitiated against the annoyances of handling retail local delivery.

## Simplified Contract Forms for Motor Service

In many cases there is a chance for much improvement in the forms and phraseology of contracts for industrial motor service. Too many central stations take a "high and mighty" position regarding any deviation from their long detailed contract form, which apparently does nothing and guarantees nothing for the purchaser but protects the seller at every turn. The company's attorney may say it is perfect and protects the company completely, but usually it is not the kind of document a business man wants to sign.

A clever sales manager recently did much to remedy this by putting the company's service rules on the back of the contract, leaving on its face a simple agreement to furnish a given quantity of energy at a given price per unit, "subject to the company's regular rules for such service (printed on back of contract)."

No company is so big and mighty that it can dictate every detail in a sale of motor service, and still get all the profitable business it should have. There must be some "give and take." A little more elasticity in contracts will do a lot to increase business for many central stations.

## Advertising a Town Electrically

The use of illuminated billboards for advertising to passengers on passing trains the manufacturing and educational resources of a town is growing in favor among local boards of trade alert to improve their opportunities.



ELECTRICALLY ILLUMINATED SIGNBOARD IN MANSFIELD, MASS.

representative signboard of this sort at Mansfield, Mass., is shown herewith. It is about 10 ft. high and 30 ft. long and is wired for six lamps through brackets at the top of the panel. Two boards of the kind, mounted on opposite sides of the railroad tracks of the principal trunk line passing through the town, form an effective means of attracting the attention of travelers.

## Illumination and Wiring

### Bracket-Cluster Lighting at Portsmouth, Va.

High Street, the principal business thoroughfare of Portsmouth, Va., was until recently lighted by flaming-arc lamps hung at 100-ft. intervals on both sides of the street, but



FIG. 1—NIGHT SCENE ON HIGH STREET, PORTSMOUTH, VA.

these have now made way for special bracket clusters, each carrying five 75-watt tungsten lamps, as shown in the accompanying illustrations. The brackets are mounted on the tubular iron trolley poles at heights approximately 20 ft. above the pavement, affording excellent distribution over the 97-ft. roadway.

The lamps used are of the 75-watt series type, but are connected in series multiple across the regular lighting secondaries, in order to avoid bringing high-voltage series circuits onto the iron poles. The Philadelphia Electrical & Manufacturing Company, Philadelphia, built the five-lamp bracket clusters from designs suggested by Mr. R. H. Palmer, general superintendent for the Virginia Railway & Light Company, which supplies energy to operate the installation. Each unit is inclosed in a 10-in. Haskins-Lucida ball.

The 75-watt lamp used in the High Street illumination

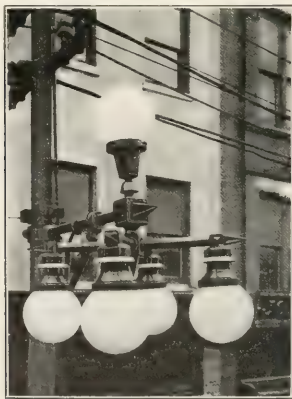


FIG. 2—SPECIAL BRACKET-CLUSTER FIXTURE WITH FIVE 75-WATT LAMPS

has proved to be very popular locally, according to Mr. E. R. Sutherland, commercial manager at Norfolk, nearly 1600 of these units having been already installed in this vicinity.

Attaching bracket clusters to the iron poles used for carrying the distributing circuits has eliminated the necessity of placing more poles on the curb line.

### Lighting a Store Window from Outside

The accompanying picture shows the method employed in lighting the windows of a Boston post-card and souvenir store, in addition to the usual interior illumination. The proprietors desired to make full use of the window panes for displaying illustrated cards within a few inches of the spectators' eyes, so that reliance upon interior lighting was



LAMP REFLECTORS OUTSIDE SHOW WINDOW

out of the question. The problem was finally solved by installing two 16-cp lamps in each of two metal reflectors hung in front of and above the window panes by pipe framing. The reflectors are semi-cylindrical in shape and about 18 in. long, with dull exterior finish and polished inside surfaces. At the entrance to the store is an ordinary electric sign as shown in the photograph, while flanking it on either side are the reflectors. The latter work entirely without glare, were inexpensive to build and provide ample illumination over the entire front of each window.

### Colorado Theater Installation

The Burns Theater, recently completed in Colorado Springs, Col., furnishes an interesting example of theater installation. The connected load aggregates 85 hp in motors and 4500 60-watt incandescent lamps. Service for the installation is brought over a three-phase, 2200-volt circuit controlled by an oil switch and passing through an alley adjacent to the theater. For a distance of 160 ft. the service is brought in lead cable through iron conduit to the basement, where a reinforced-concrete transformer room with iron safe door is provided. An auxiliary service over a two-wire No. 6 lead-covered circuit is also brought into the same room, where the potential is stepped down for distribution throughout the house. Three 40-kw transformers are used for feeding the lamp circuits and three 25-kw transformers feed the power house. Furthermore, there is an additional auxiliary 10-kw transformer for lighting circuits. The secondaries of the lighting transformers are wound for 110 volts, while the secondaries of the motor-circuit transformers are wound for 440 volts. The three-phase secondaries of the lighting circuits are split at the service board and the building load is balanced as nearly as possible among them. The feeders from the transformers to the service switchboard comprise six 1,600,000-circ. mil conductors inclosed in 6-in. conduit. Two pairs of 1,300,000-circ. mil feeders inclosed in 6-in. conduit carry the energy from the service board to the stage switchboard. The trans-



former room, which is 7 ft. x 12 ft. x 8 ft., is ventilated to the outside of the building only, and recording thermometers show that the maximum room temperature reached is 92 deg. Fahr.

The switchboards used throughout are of the Crouse-Hinds manufacture. The smallest switch is rated at 100 amp and the largest switch at 1800 amp. The main

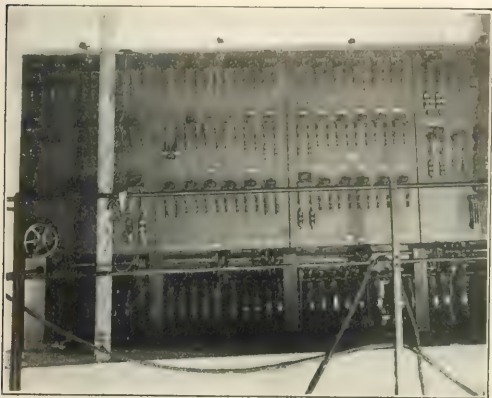


FIG. 1—STAGE SWITCHBOARD AT BURNS THEATER, COLORADO SPRINGS, COL.

motor and lamp circuit switches on the service board are of the double-throw pattern so as to be serviceable in case a private plant should eventually be installed. The dimmers are of the Cutler-Hammer wheel-drive type and control the lamps in the borders, foots and strips, in addition to two 25-amp, two 35-amp and two 50-amp stage plugs and all the lamps in the auditorium excepting the emergency lamps and those over in the exits. The circuits from the switchboard pass through a sectional pull box located behind the dimmers. Red, blue and white lamps are used in the borders, strips and foots, there being twice as many white lamps as

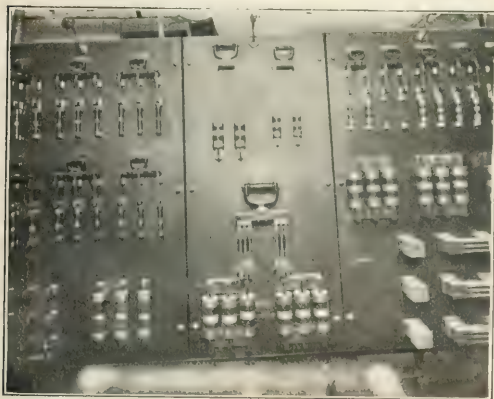


FIG. 2—SERVICE SWITCHBOARD

blue or red. Westinghouse tungsten lamps are used throughout.

The electrical installation follows the best standards, the wires being placed in conduit without any loose wires back of the switchboard and with curtain and fan motors completely inclosed. All material used was passed by the Underwriters' Laboratories, and the details of the electrical construction were worked out in conjunction with the city

electrician. Messrs. Douglass & Hetherington were the architects and the New York Electric Company, Colorado Springs, Col., was the electrical contractor.

## Removing Nails from Trim in Old-House Wiring

BY GEORGE M. TALBOT

Before replacing finished trim that has been removed to permit the running of wires the nails in the trim should be cut off flush with the back of the trim with a pair of pliers



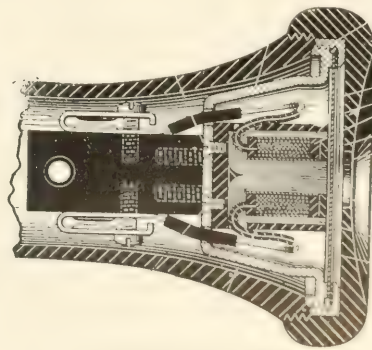
FIGS. 1 AND 2—CORRECT AND INCORRECT METHODS

or a cold chisel (Fig. 1), or should be broken off with a hammer. If an attempt is made to drive them out, they will almost invariably chip out slivers of the trim, as indicated in Fig. 2. New finishing nails of small diameter should be used for refastening the trim.

## Recent Telephone Patents

Mr. W. W. Dean, of Elyria, Ohio, has patented an improved receiver, which is shown in section herewith. The object is to expose a large surface of the diaphragm to the magnetic action of the coil, and to this end the core of the coil is formed of fine wires, which are threaded through the bore and turned back over the outer surface. Both core and coil are then impregnated with a liquid insulating material which is allowed to harden, then the exposed core wires are brought down to a plane surface.

A transmitter for aiding deaf persons has been patented by Mr. H. Tideman, of Menominee, Mich. It is the particular object to make a transmitter which shall be equally sensitive to sounds striking it at an obtuse angle and those striking it at right angles. To this end a double conical mouthpiece is arranged, one cone lying within the other.



SECTION THROUGH RECEIVER

so that sound obtains access to the diaphragm through a number of small apertures, leaving the diaphragm partly shielded. Sound enters the outer cone through somewhat larger holes. The angles of the walls of the outer and inner cones are so adjusted that sound coming perpendicularly into the outer cone will be reflected from the walls and away from the diaphragm, while sound coming at a considerable angle will be reflected toward the diaphragm.



# Letters to the Editors

## Co-operation with Employees in Budapest

*To the Editors of the Electrical World:*

SIRS:—Your editorial in the issue of Feb. 1, 1913, pertaining to aid for the unfortunate leads me to believe that your readers might be interested in the system inaugurated many years ago by the director-general of the Budapest General Electric Company, Mr. Etienne de Fodor. It has always been his desire to obtain a model staff of workers for the company, and since assuming charge of the company's operations he has found that by taking an interest in the private and social life of his men he has obtained the best results as regards efficiency and permanency, which mean a great deal in the running of a central station.

After being in the company's service for a year, every good workman is transferred and listed on the pay-roll as an *employee*, and he then receives a monthly salary which is increased periodically. Thus all the linemen, metermen and emergency men have the title of an employee and not that of a workman, while from their monthly salaries nothing is deducted in case of sickness, vacations or other kinds of holidays. Every employee also receives without cost the services of a doctor and free medicine in case he or any member of his family becomes sick. In serious cases Mr. de Fodor engages a specialist, and if necessary the sick man is sent to a private sanatorium, or to some bathing place in another part of the country where recovery may be hoped for. In case of a death in his family an employee (or in case of his own death his widow) receives a lump sum to defray funeral expenses. In many other cases of a sudden and exceptional need Mr. de Fodor comes forward with a helping hand, and his men understand that what he gives is not charity but well-directed help. It is noteworthy that at the present time several men of the engineer's staff are reserve officers of the army and have been called to the front for the last three months, and that their families are receiving their regular monthly salaries from the company.

When Mr. de Fodor took charge of the company's affairs he started an "aid fund," out of which all of the above-mentioned expenses are now defrayed by the company. Every employee can obtain a loan of money that may exceed his salary by from 100 to 250 per cent according to circumstances, and this loan is repaid without interest in monthly instalments in amounts that vary to from 5 to 10 per cent of the sum borrowed; the instalment can be postponed, if desired, when the quarter arrives during which rent is due.

Last, but not least, Mr. de Fodor has had issued in the name of each employee who receives a monthly salary an insurance policy which will give him a pension after he has served the company for forty years; in case of disablement or death he or his widow receives a pension immediately. To-day several widows are drawing pensions from the insurance company. In case an employee leaves the company after he has served several years, the company presents him with the policy if his conduct has been satisfactory. Obviously such a policy is a far better present than the testimonial or gold watch and chain which are often given to a man after he has served a company a lifetime. The Budapest General Electric Company pays the taxes that the state levies on the income which its employees receive from the company.

It will be seen from what is stated above that such a handling of the workmen on the part of a private concern produces not only the very best of impressions and co-operation, but brings together a staff of workers who are not only devoted to their duties but take a sincere interest in the welfare of the company by which they are employed. The company is immune from all kinds of strikes or other labor disturbances, since the men appreciate that they would lose too much, as they forfeit future privileges that

gradually increase in worth the longer they remain in service.

Mr. de Fodor believes in meeting all his men from time to time personally in a social way, and hence invites them to dinners now and then where all forms of business are cast aside and all the men are placed on an equal footing in the enjoyment of the occasion.

It will be seen from the above outline of results obtained by the Budapest General Electric Company that the plan being introduced by the Union Electric Light & Power Company, St. Louis, is worthy of imitation by other concerns. It is a creditable action which should be commended by the entire press of the United States.

*Budapest, Hungary.*

FRANCIS JEHL.

## American and European Wiring Practice

*To the Editors of the Electrical World:*

SIRS:—In regard to Mr. L. Lustig's letter in your issue of Feb. 15 commenting on my contribution printed in the Jan. 11 issue under the title "American and European Wiring Practice" a few words of explanation should be given. Although the title as printed may have been somewhat general, it is distinctly stated in the beginning of my article that the wiring methods described are those of French and Italian—in fact, mainly of French—practice.

I know well that a more advanced standard is adhered to in Germany and Switzerland (in both of which countries, for instance, as Mr. Lustig states, the use of wooden molding has been discontinued), but as I am mainly familiar with the systems in use in the more southern European countries, I confined myself to a description of the methods used there, beginning with the flexible-cord system mentioned in the article published on Jan. 11.

However, even in Germany, present practice in conduit work sanctions the use of asphaltic paper tube armored with sheet brass, sheet iron or sheet aluminum, with an occasional use of thin-steel threaded-joint insulated pipe where a more durable job is required. No unlined pipe similar to that used in the United States can be obtained in Germany or in any other part of the continent of Europe, nor can any stamped-steel outlet and switch boxes be had there; at least, my efforts to obtain them from German conduit manufacturers, who supply most of this material used in Europe, were unsuccessful, and I was obliged to use American conduit fittings for my work on the Riviera, notwithstanding the high cost of transportation and duty, which was almost prohibitive of their use.

Regarding the steel suspension cable, in addition to the two copper conductors, in flexible cords, which Mr. Lustig mentions as being used in Germany and Austria, I might mention that a German electrical engineer informed me recently that this is not in as general use as formerly, and that if ceiling rosettes and lamp sockets were constructed with a space for tying a good knot in the flexible cord, as is the case with American sockets, the use of a supplementary suspension strand would cease.

In conclusion, I would state that my reason for contributing the descriptions of foreign wiring methods is that, while I am convinced that prevailing American practice in conduit work—which is necessary for the best installations where permanence and reliability are prime requisites—is far in advance of European practice, yet I believe a great deal can be learned from Europe with regard to the more simple and inexpensive forms of wiring which will be necessary for the introduction of electric lighting into the cheaper grades of dwellings and apartment houses which are already built, and where there is no possibility of the tenants enjoying the advantages of electric service so long as present costly and over-standardized wiring methods are insisted upon in this country.

*Brooklyn, N. Y.*

ALBERT H. BERNHARD.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Locating Faults on Series Lighting Circuits

BY VERNE JAMES

Grounds on series arc or incandescent lighting circuits frequently reveal their locations automatically. If there are two good grounds on the circuit, the lamps connected in the line between the grounds will not burn because the grounds will shunt them out. For example, in Fig. 1, with a good ground at 1 and 11, the lamps Nos. 2 and 10 would be shunted out. Sometimes there may be two grounds on a circuit, but they may not be "good" enough to shunt out the lamps.

The presence of but one ground on a circuit, irrespective of how "good" it is, will not reveal itself automatically, and the proper operation of the circuit will not be affected by one ground. However, where there is one ground it constitutes a menace to the lives of the station operators and troublemen. Furthermore, another ground may occur at any time that may cause the shunting out of lamps or possibly a fire or destruction of equipment. Hence it is very desirable to maintain the circuits entirely clear of grounds. It is the practice in all well-maintained stations to test each series circuit for grounds some time during every afternoon, and if a ground is discovered a troubleman is sent out to locate and clear it before the circuit is thrown into service for the night.

The usual method of testing dead series circuits for grounds is to disconnect the circuit from all station apparatus

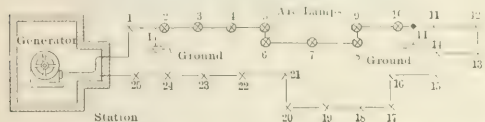


FIG. 1—EFFECT OF TWO GROUNDS ON AN ARC-LAMP CIRCUIT

and then to connect one terminal of a magneto test set to the circuit and the other to ground. If the bell rings vigorously when the crank is turned, the circuit is grounded. If it does not, the circuit is clear. If the circuit is very long or in cable for a considerable portion of its length, the bell may ring even if the circuit be clear of grounds.

The method of locating a ground on a dead arc circuit is illustrated in Fig. 2. Disconnect all station apparatus and temporarily ground one side of the circuit as at B (Fig. 2). Proceed out along the line and connect some testing instrument (a magneto test set is most frequently used) in series with the circuit at some point. If when the crank is turned the magneto bell rings, indicating closed circuit, the tester is between the station ground and the ground on the circuit. If the magneto "rings open," the tester is between the circuit ground and the ungrounded station end of the circuit. If, in Fig. 2, the test set is inserted at lamps 1, 2 or 3, the magneto should ring "closed," while if inserted at any of the other lamps it should ring "open."

In locating either a ground or a break on a series circuit, unless the tester has an idea as to the location of the trouble, he should proceed to the middle point of the circuit and there make his first test. This first test will indicate on which side of the middle point the trouble is. He should then proceed to the middle point of the half of the circuit that shows trouble and there make another test. This will

localize the trouble to one quarter of the circuit. This "halving" of the sections of the circuit should be continued until the trouble is finally found.

A ground on a series circuit can sometimes be located with the current from the arc generator or rectifier by placing a temporary ground on the circuit at the station. For example, if in Fig. 2 a temporary ground is connected to

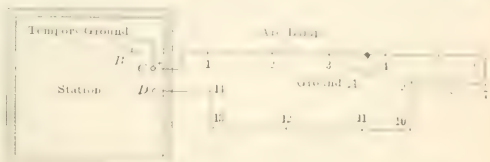


FIG. 2—LOCATING A GROUND ON A DEAD CIRCUIT

terminal B and the device that supplies the operating current to the circuit is connected to terminals C and D and normal operating current thrown out on the circuit, the lamps 1, 2 and 3 will not burn, indicating that the ground is between lamps 3 and 4. The use of this method is attended by some fire risk; hence the method should be used with caution.

A method of locating a ground on a series circuit with lamp bank is suggested in Fig. 3. A bank of 110-volt incandescent lamps, each of the same candle-power, is connected in series as indicated and one end of the bank is permanently grounded. There should be a sufficient number of lamps in the bank so that the sum of the voltages of all of the lamps is at least equal to the voltage impressed on the series circuit by the arc generator or the regulator. For instance, if the voltage impressed on the series circuit is 6600, there should be at least sixty 110-volt incandescent lamps in the bank.

In locating a ground the flexible cord which is connected to the center point of the double-throw switch is successively placed on different points on the conductor that connects the incandescent lamps in series, the switch being thrown to one or the other of the circuit terminals C or D. Move the flexible cord along until the incandescent lamps in the bank between the point of connection of the cord and

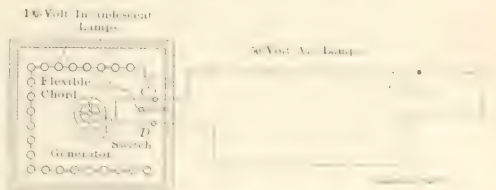


FIG. 3—USE OF LAMP BANK IN LOCATING A GROUND ON A CIRCUIT

the permanent ground burn at about full brilliancy. When this condition obtains the voltage impressed across the lamps that are burning is full brilliancy, approximately equal to the voltage impressed on the portion of the arc circuit to which the switch connects between the station and the ground. The voltage required across each lamp of the outside circuit being known, the number of lamps

between the station and the ground can be readily computed, and thereby the ground is located.

For example, consider Fig. 3. There is a ground on the circuit at *G*. It is found that two of the incandescent lamps of the bank burn at full brilliancy between the flexible cord connector and the lamp-bank ground. Since 110-volt lamps are used in the bank, the voltage across these two is 220. This means that the voltage on the arc circuit between points *C* and *G* is about 220. Since the arc lamps each require about 50 volts, there must be  $220 \div 50 = 4.4$ , or in round numbers 4, arc lamps between *C* and the ground *G*. After making a test with the switch point on *C*, it should be thrown over to *D* and a check test made from the other end of the circuit. The method is the same in each case.

To locate a break in a series circuit, ground one end of the circuit at the station, as in Fig. 2. Then make tests at different points out on the circuit with the magneto connected in between line and ground. So long as the magneto bell indicates a closed circuit, the open is on the line side of the tester. When the magneto indicates an open circuit the open is toward the station from the tester.

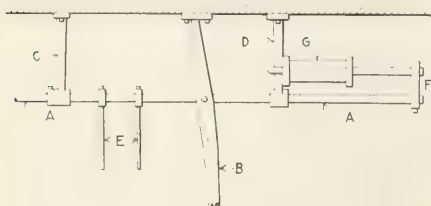
### Dash-Pot Belt Shifter

By JAMES F. HOBART

A double emery wheel driven by a 3-hp, 220-volt direct-current motor is belted to a common line shaft with a small pump and a light screw-cutting lathe. It was not intended to operate the lathe while the grinder was working, but men sometimes shift the belt of the emery grinder without looking to see whether the pump and lathe are running or not. After several recurrences of this unnecessary overload which nearly burned out the motor it was determined to put a stop to the sudden shifting of the grinder load to the small motor. To this end, an arrangement was added to the belt shifter which made it impossible to throw the belt over quickly. The operation of this device required a little of the workman's time—probably three or four seconds—but it also prevented a sudden load being thrown upon the motor.

The method shown in the drawing insures a slow, steady movement to the belt shifter. The sliding bar of the overhead hanger is shown at *AA*, the shifter-handle at *B*, the shifter hangers at *CD*, and the belt fork at *E*. One end of bar *A* was extended to the right to receive the double collar *F*. To the hanger *D* was clamped a portion of a door check which was found among the scrap metal. The spring was dispensed with, and only the cylinder, rod and piston were retained. The piston rod was attached to bar *A* by means of the double collar *F*.

This apparatus, although very simple, has given satisfac-



HOME-MADE BELT-SHIFTER

tory service. When a man tries to move the belt shifter in a hurry it will not go, and the hiss of escaping air from the door check reminds him that he is moving the belt shifter faster than he should. The adjusting screw, which is part of each door check, permits the apparatus to be set so that it will move at any required speed. When the belt is to be shifted in the reverse direction air passes

through the piston freely and offers no appreciable resistance to movement of the belt shifter. The workman may shut off the grinder as quickly as he pleases, but must start it slowly.

### Wire Clearance with Buck-Arm Construction

The method of buck-arm construction of junction poles employed at Fairmont, W. Va., is illustrated in the accompanying reproduction. Double arms are used for the main leads, buck-arms being fixed to each end of the double arms by through-bolts. The pins in the buck-arms are mounted on the under side in order to give good clearance. These inverted insulators are then filled with tar cement to keep out water. All cross-arms used on the local lighting system are of Washington fir and are previously soaked in dead oil of coal tar for nearly one month.

This buck-arm construction, according to Mr. D. L.



BUCK-ARM CONSTRUCTION AT FAIRMONT, W. VA.

Evans, line superintendent of the Fairmont & Clarksburg Traction Company, gives good clearance for linemen and makes it cheaper to renew arms when required. With the cross-arm construction formerly employed at this location it was impossible for linemen to get up between the wires to the top of pole.

### Adjustment of Exciter Voltage

The field of an alternator is supplied with energy from a 1.5-kw, 110-volt shunt-wound exciter. One rheostat is connected in the field circuit of the exciter and another is inserted between the exciter armature and the field circuit of the alternator. Should the exciter be worked at full rated voltage with regulation by the alternator field-circuit rheostat, or should the regulation preferably come in part from the exciter field-circuit rheostat? The present load does not require the use of both. If the exciter is worked at low voltage output, it operates at poor efficiency, while if worked at full voltage, energy will be wasted in the alternator field resistance.

F. E. S.

In supplying excitation current to any alternator the best arrangement will be one, of course, in which the losses become a minimum. Therefore the field coils of the alternator should be used without extra resistance and the voltage of the small exciting generator should be kept at a value just large enough to supply the required amount of current to the field coils of the alternator. In some cases such a voltage might be too low on account of the tendency of the direct-current generator to fluctuate too widely in voltage with slight changes in speed. If this condition exists in your station, it would be better to operate the exciter generator at a slightly higher voltage and to make use of a small amount of resistance in series with the field coils of the alternators.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Parallel Operation.**—In connection with the parallel operation of alternators it is well known that serious trouble from hunting may occur unless the system has such characteristics as to prevent the natural oscillating frequency from approaching resonance with the frequency of the engine impulses. The author discusses formulas for determining the natural frequency from the alternator characteristics and the weight of flywheel needed to give the system a predetermined natural frequency. The results of actual practice sometimes differ seriously from those indicated by the formulas. The author discusses the importance of the corrections which must be applied and shows how to apply them. Notes are added upon the effect of load, the calculation of combinations of dissimilar sets, and the general specification of requirements to be met by the flywheel. —*London Electrician*, Feb. 14, 1913.

**Sparkless Commutation of a Rotary Converter Mechanically Coupled to an Alternating-Current Booster.**—A note on a recent British patent (No. 23,285, 1912) of the Siemens-Schuckert company. The compensating windings are energized by a current varying with the load on the booster, as well as by the direct current from the converter. This extra exciting current may be derived from extra brushes on an auxiliary commutator on the booster and lying in the direction of the main poles; auxiliary poles midway between the main poles are energized by the direct current from the converter. Auxiliary windings on the booster armature may be used, or else an auxiliary dynamo with constant field driven by a direct-current motor whose armature is connected to the field coils of the booster. These two machines may be combined into one, having two commutators and operating in conjunction with fields of different numbers of poles. —*London Elec. Eng'g*, Feb. 6, 1913.

**Speed Control of Cascade Induction Motors.**—A note on a recent (British) patent (No. 1979, 1912) of E. Rosenberg. The rotor of the first motor is connected to a starting resistor through the stator of the second motor, which has a short-circuiting switch whereby the resistor can be connected directly to the rotor of the first motor. Mechanically connected to the short-circuiting switch is a pole-changing switch. The resistance is always connected to the rotor of the first motor. —*London Elec. Eng'g*, Feb. 13, 1913.

**Excitation of Direct-Current Machines.**—E. J. BRUNSWICK.—A long mathematical paper illustrated by diagrams and read before the International Society of Electricians in Paris. After reviewing the known methods for pre-determining the excitation of direct-current machines the author gives a new method which is specially intended for practical use. —*La Revue Elec.*, Feb. 7, 1913.

**Commutation.**—A. MAXDIT.—The first part of a paper illustrated by diagrams and read before the International Society of Electricians in Paris. The author gives an account of experimental and theoretical researches on commutation in direct-current machines. —*La Revue Elec.*, Feb. 7, 1913.

**Resistance of Contacts.**—L. BINDER.—An illustrated translation of his recent German article on the resistance of such contacts as are formed by brushes on slip-rings and commutators. —*London Electrician*, Feb. 14, 1913.

**High Angular Speeds.**—MAURICE LEBLANC.—The conclusion of his long paper on the realization of high angular

speeds. In this instalment the author outlines his methods of automatically maintaining the equilibrium. —*La Revue Elec.*, Feb. 7, 1913.

### Lamps and Lighting

**Chemical Production of Light.**—WILDER D. BANCROFT.—A Franklin Institute paper in which the author shows that photoluminescence, thermoluminescence, pyroluminescence, electroluminescence, cathodoluminescence, anodoluminescence, crystalloluminescence, triboluminescence and organoluminescence are all cases of chemiluminescence, or luminescence due to and accompanied by chemical action. In some cases of cathodoluminescence it is possible to give the chemical reactions taking place. One should speak of the spectrum of a reaction and not of the spectrum of a substance. Any marked change in a spectrum indicates the occurrence of another reaction. The same bluish light is emitted when sodium burns slowly in chlorine, when sodium chloride is fused, when sodium chloride is placed in the surface separating the oxidizing and the reducing zones of the Bunsen flame, when hydrochloric acid gas is fed into a sodium flame, when sodium chloride is precipitated from an aqueous solution by alcohol or by hydrochloric acid, and when sodium crystals are crushed. All reactions tend to emit light, and all reactions do emit light if the reaction velocity is sufficiently high. The critical reaction velocity necessary to the emission of light visible to the eye may be very different with two different reactions. The intensity of the emitted light increases with increasing reaction velocity. The quality of the emitted light varies only slightly with the reaction velocity. —*Jour. Franklin Inst.*, February, 1913.

### Generation, Transmission and Distribution

**Powdered Coal as Fuel.**—H. R. BARNHURST.—An illustrated article discussing concisely the specific requirements for the use of powdered coal as fuel, namely, dry coal, fine grinding, hot chamber or firebox, and proper air supply. The quality of the coal is not of supreme importance with this method. Its great value in the developments of the future may be in the efficiencies obtainable from low-class or refractory fuels heretofore unavailable. —*Metall. and Chem. Eng'g*, March, 1913.

**Water-Power Development by the Prussian State.**—An account of a bill before the parliament of Prussia proposing the development of water-powers of the Weser River by the Prussian state in connection with the canal system of Prussia. It is proposed to build three power stations which will be able to develop 41,000,000 kw-hr. per year. This energy is to be distributed over the surrounding district, which includes the cities of Göttingen, Münden, Cassel and Waldeck. Some details of the plan of the stations are given. —*Elek. Zeit.*, Feb. 13, 1913.

**Dangerous Rise of Voltage.**—W. PETERSEN.—The first part of a paper in which the author discusses the general subject of dangerous rises of voltages in networks and protection of the networks. He points out that the object of the protective apparatus should be the prevention of dangerous rises of voltages. The network used is not designed that quantities of energy cannot be transformed in portions of the network of bounded extension. It is wrong to compare the network with a circuit having a single inductance and single capacity, as it is a circuit with distributed inductance and capacity, and the dangerous rises of voltages

must be explained by the theory of waves traveling along circuits of this kind. The author outlines the theory of traveling waves. The article is to be continued.—*Elek. Zeit.*, Feb. 13, 1913.

**Starting Squirrel-Cage Induction Motors.**—C. MACMILLEN.—An article giving a comparison of three methods of starting squirrel-cage induction motors, by means of an auto-transformer, a balanced rheostat or an unbalanced rheostat. The relative magnitude of the disturbances produced on the distribution system by any one of these three methods is analyzed. Since the balanced rheostat permits the terminal voltage on the motor to rise as the current decreases with increase of speed, while the auto-transformer maintains practically a constant voltage during acceleration, the rheostat might appear to give the more desirable results, but a consideration of the starting characteristics of the induction motor shows these advantages to be largely superficial. From a number of tests, the results of which are plotted in curves, it was found that the auto-transformer gives the most satisfactory starting conditions, both as regards the amount of current necessary for a given value of torque and the actual power taken from the line.—*Gen. Elec. Rev.*, March, 1913.

**Electric Power in Breweries.**—G. BACHMANN.—The first part of an illustrated article on the use of electricity in breweries. In case energy is bought from a transmission system three-phase current may be used, but if the brewery has its own generating plant, direct current is far preferable. The three-wire direct-current system of  $2 \times 110$  volts is recommended with the lamps operated at 110 volts and the motors connected across the outer wires. Individual motor drive is preferable to group drive. The drive of the various machines used in breweries is discussed. The article is to be concluded.—*Elek. Zeit.*, Feb. 13, 1913.

**Explosion-Proof Motors.**—H. H. CLARK.—The author discusses the theory of explosion-proof protection; the method of testing is explained, and the types of device tested are described. The test results are discussed for each type and a general review of the whole is given, with some conclusions as to design deduced from the tests.—*London Electrician*, Feb. 14, 1913.

### Traction

**Tramways in Industrial District.**—G. PETRI.—An article giving a review of the system of tramways and light railways in the Bergischeland, including the textile industry of the Wuppertal and the steel industry of Solingen. It is a district of 1100 sq. km with 411 km of light railways. The different lines are all operated by the trolley system, although in other respects the equipment is quite different. Direct current is used at voltages varying between 500 and 750.—*Elek. Zeit.*, Feb. 13, 1913.

**Railway Electrification.**—Some notes on the extensive electrification scheme which the North Eastern Railway in Great Britain has under consideration, on the high-tension, direct-current system. From a power station three-phase currents at a frequency of 40 cycles will be transmitted at 20,000 volts to two substations situated on the railway and there converted to direct current at 1500 volts. The ordinary track rails will be bonded for the return circuit, and at places where overhead equipment is difficult a protected conductor rail will be erected on the track sleepers.—*London Electrician*, Feb. 14, 1913.

### Installations, Systems and Appliances

**Control of Meters, Public Lamps, Etc., from the Central Station.**—W. DUDELL, A. H. DYKES AND H. W. HANDCOCK.—A paper read before the (British) Institution of Electrical Engineers. The author describes a new method of remote control. The underlying principle is to control relays, which may be inserted anywhere on the general system of mains, by means of a superposed current impressed on the main current in the system. If the main current be continuous, then the control current may be alternating of

any desired frequency. If the main current be alternating, then the impressed current must be of a different frequency, the relay in either case being so designed that while it instantly responds to the impressed current it is unaffected by any alteration of the main current or pressure. In the case of an alternating-current system one may superpose a direct current—that is, move the zero line of the wave-

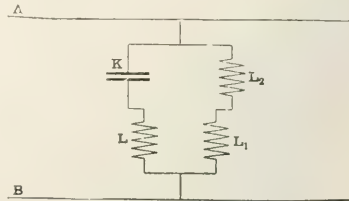


FIG. 1—COMPENSATED RELAY CIRCUIT

form a little away from the symmetrical position. Obviously the addition of a small alternating-current emf of, say, 10 volts, will not affect the lamps on the mains. The chief problem is the design of a reliable relay. On a direct-current system the solution is as follows: A condenser and a coil, to be used as a relay, are connected in series across the mains. This will not be affected by the continuous current, but will respond to an alternating current. On an alternating-current system the relay must be made "selective" so that it will operate only when a current of the selected frequency is impressed on the line. This can be done by making use of the phenomenon of resonance. The authors so choose the self-induction of the relay  $L$  and the capacity of the condenser  $K$  that at the frequency  $F'$ , at which the relay is intended to operate, they are in resonance, while at the normal frequency  $F$  they are not. That is to say, neglecting resistance, the following relation is established:  $LK(2\pi F')^2 = 1$ . This simple resonance circuit works perfectly in the case of a direct-current supply system and has many advantages over the non-resonant relay; but in the case of an alternating-current supply, unless the resonance be made unduly sharp or there be a large difference between frequencies, the condenser  $K$  and relay  $L$  will let through sufficient current at the lower or supply frequency to attract the armature of the relay. For instance, with a supply circuit of 100 volts at 50 cycles it seems impracticable to build commercially a plain resonance relay to work with 5 volts superposed. To get over this difficulty the authors add an additional or compensating circuit to the relay, as illustrated in Fig. 1.  $L$  is the relay coil, the armature and core being omitted for the sake of clearness. On top of this coil is wound a

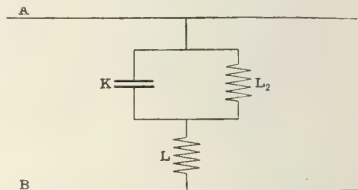


FIG. 2—SIMILAR CIRCUIT FOR COMPENSATED RELAY

second coil  $L_1$ , which may have roughly the same number of turns, and this coil is connected in series with a choking coil  $L_2$ , having a high self-induction. The current through the condenser  $K$  and relay coil due to the supply frequency, say, 50, leads almost 90 deg. the applied potential difference. The current through the choking coil  $L_2$  and compensating winding  $L_1$  is made to lag about 90 deg.

If these two currents be adjusted to approximate equality, their action on the core of the relay can be made very small. It cannot be completely eliminated, because the two currents are not exactly at 180 deg. to one another, but it is sufficient for practical purposes. By making the choking coil  $L_2$  with an adjustable air-gap in its magnetic circuit it is very easy to adjust the compensation. A compensated

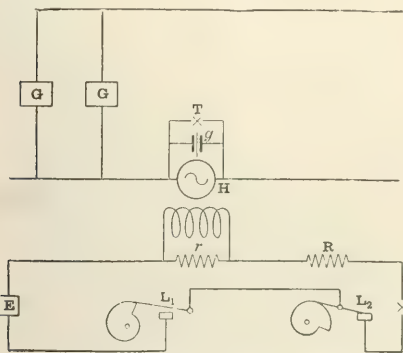


FIG. 3—CONNECTIONS OF RIPLE GENERATOR

resonance relay of this sort will work with certainty at 5 volts, 200 cycles, and will consume zero volts at 50 cycles. The arrangement in Fig. 2, although electrically identical with that in Fig. 1, may be looked upon as functioning in a different way. Owing to the supply pressure a certain current flows at the lower frequency through the condenser  $K$ . The greater part of this current may be supplied without taking it from the mains by placing a choking coil in parallel and adjusting the choke coil so that its self-induction and the capacity of the condenser are practically in resonance for the supply frequency. In this case the only current taken from the supply mains is the small current to supply the losses, and this small current is the only current due to the supply frequency, which flows through the relay coil  $L$ . At the high frequency of the superposed current,  $K$  and  $L$  are no longer in resonance, and consequently a considerable current will flow through  $K$  and  $L$ , which may be further enhanced by making  $K$  and  $L$  also in resonance. To superpose the ripple on the supply an alternator or the secondary of a transformer can be put in series with the main generators. The connections of the ripple generator are shown in Fig. 3. In this diagram  $G$ ,  $G$  are the main generators and  $H$  the high-frequency alternator to supply the ripple, the whole of the main current passing through  $H$  when in use.  $E$  is the exciter,  $R$  a regulating resistor,  $T$  a short-circuiting switch, and  $G$  is a spark-gap to prevent an interruption of the main current if  $H$  should break down. The two cams are mounted on one shaft and rotate together. They can be adjusted to give any length of contact desired. The relays on an alternating-current system being always connected across the mains absorb a little power, but this is more than counterbalanced by the saving in meter-shunt losses due to the shunts being cut out of circuit. In a direct-current system the relays consume no energy, except when the ripple is on, when the loss is 0.7 watt per relay. For ordinary incandescent street lighting a relay is fixed in the base of the lamp-post, operating a switch by a step-by-step movement. On switching on the high-frequency current the armature of the relay is attracted and then released, causing the switch to be released. When next the current is switched on, the armature is again attracted and released, causing the switch to open. In the case of the larger switches for motors, transformers, etc., the relay closes or opens the circuit of a local solenoid operated directly off the mains.—*London Electrician*, Feb. 17, 1913.

## Electrophysics and Magnetism

**Electric Resistivity of Metals in a Wide Range of Temperature.**—E. F. NORTHROP AND V. A. SUYDAN.—A paper giving a preliminary report of an extended investigation which had a twofold object: First, to perfect a method whereby the resistivities of metals and alloys may be measured with ease, precision and rapidity through a range of temperature between that of liquid air and a point a little below the boiling point of the substance in question; the same method to be applicable to molten salts. Second, to use this method for obtaining data on metals, alloys and molten salts which boil under 1500 deg. C., for plotting sets of curves showing the resistivity and temperature over a range of temperature of from 20 deg. C. to near the boiling point of the substance in question. In this paper the results are given for the following metals: mercury, lead, cadmium, zinc, tin, bismuth and antimony, at different temperatures between 200 deg. and 900 deg. C.—*Jour. Franklin Inst.*, February, 1913.

**Form-Factor of Waves.**—TAYLOR READ.—The sine wave is the form recognized as standard by the A. I. E. E., and in its Standardization Rules limits are set for the allowable deviation from the equivalent sine wave of peaked and flat-top waves. The effective values of voltage or current as read on indicating instruments do not give a correct representation of the average, or mean, values. Some important engineering factors depend upon the average values. For instance, the flux density and consequent hysteresis loss and heating in transformer cores is a function of the average voltage, not of the effective, and for a given voltmeter reading may be too low if tested on a peaked wave. Hence the necessity for keeping within certain well-defined limits. In this article the author has calculated and plotted the limiting peaked and flat-top waves that comply with the above-mentioned rules.—*Gen. Elec. Rev.*, March, 1913.

## Electrochemistry and Batteries

**Cheaper Alumina.**—A symposium of papers on methods for producing cheaper alumina. If any of these methods prove successful, it will have a great effect on the price of aluminum, as at present the controlling factor is the cost of the starting material, the alumina. Two papers, by J. W. Richards and Sam A. Tucker, deal with the Serpek process, in which alumina and ammonia are produced simultaneously, this process being also one for the fixation of atmospheric nitrogen. A paper by A. H. Cowles describes his new process for producing alumina and numerous by-products from mineral silicates and deals with recent advances made at the plant at Sewaren. A paper by L. E. Saunders deals with the uses of aluminum as an abrasive and refractory.—*Metal. and Chem. Eng'g*, March, 1913.

## Units, Measurements and Instruments

**Variations of the Loading-Back Test.**—F. S. ROBERTSON AND R. E. SHAWCROSS.—The difficulty with the original Hopkinson method of testing two machines and Kapp's modification is the difference in the fields of the two machines. The later variations are improvements in this respect, the magnet windings being adjusted so as to have equal ampere turns. Special attention was paid to this matter by Field, who by putting the magnet winding in series produced practically identical field strengths. Modern machines with commutating poles do not appear, however, to give this desirable effect. From tests the present writers carried out on two tramway motors, fitted with commutating poles, they found that the fields were very dissimilar on load when the magnet ampere turns were equal, and that the generator magnet windings had to be shunted to a considerable extent in order to obtain the emfs, and therefore the field strengths, into equality. The author gives the results of tests first with the field windings in series and secondly with the generator field shunted as in Fig. 4. In the first case the emfs of the motor and the



generator were 440.8 and 467.6 volts respectively. In the second case they were 435.2 and 436.2. If the object of the test is merely to determine the efficiency of the machines, then, as pointed out by Hopkinson, a considerable error in the energy supplied will only slightly affect the result. The test is, however, capable of giving accurate information on the core loss under load. In this case it is necessary to

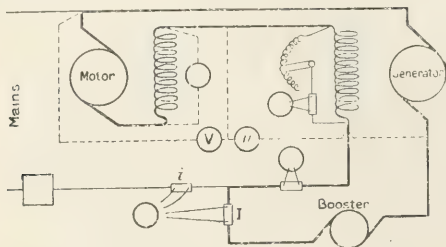


FIG. 4—CONNECTIONS FOR LOADING-BACK TEST

take every precaution to keep the fields equal to insure equal core loss in the two machines. The total friction and core loss is most readily obtained as a contribution from the mains  $iE_m$  and one from the booster  $I(E_m - E_g)$ . This later vanishes when the fields are truly equal, and may become negative as in the tests before mentioned.—*London Electrician*, Feb. 14, 1913.

**Testing Insulation.**—M. E. TRESSLER.—An article illustrated by diagrams on methods of testing electric insulating materials. Methods of measuring insulation resistance and disruptive strength are described, followed by a discussion of the effect on disruptive voltage of such factors as thickness of insulation, size and shape of insulating material, temperature, time of application of voltage, and frequency. Permissivity is defined, means of its measurement described, and its values for common insulating materials given. The concluding section deals with energy losses in insulation.—*Gen. Elec. Rev.*, March, 1913.

**Resistance Measurements.**—In a continuation of the serial on shop testing of electrical apparatus the various methods for measuring resistances are reviewed.—*Elec. Jour.*, February, 1913.

### Telegraphy, Telephony and Signals

**Disturbances of Telephone Lines Due to Three-Phase Transmission Lines.**—O. BRAUNS.—A conclusion of his long article. The author gives a long series of oscillograms. His final conclusion is that three-phase lines produce in adjoining telephone lines disturbances due to influence and induction. The higher harmonics of the voltage and the current waves in the three-phase line are much more important in this respect than the fundamental wave. In star-connected systems the triple higher harmonics are the chief disturbing factors if the neutral point of the generator is earthed. In this case dangerous voltages may be produced by induction in the telephone line. This is confirmed by the oscillograms taken in the high-tension district of the Eberswald electricity station. For this reason the earthing of the neutral point of the generator is disadvantageous.—*Elek. Zeit.*, Feb. 13, 1913.

**Signaling Thunderstorms.**—An illustrated description of the storm indicator of the Telefunken company. A spark-gap  $F$  and a coil  $S$  connected up to the earth conductor  $E$  are inserted into the aerial wire  $L$ , as shown in Fig. 5. The coherer  $Fr$  and a blocking condenser  $C$  are arranged in parallel with the coil, the relay circuit, which comprises the cell and the relay coils  $Sr$ , being branched off, as usual, from the condenser. The secondary circuit of the relay contains a battery  $B$ , which, when the relay contact is completed, actuates a tapper  $K$  and a recording apparatus (in the present case a single-stroke bell  $G$ ). The spark-gap

having been adjusted to a spark distance of a few tenths of a millimeter, a series of sparks will pass, thus exciting the coherer and sounding the bell as soon as there are any changing phenomena in the atmosphere. Feeble atmospheric accumulations—that is to say, far distant thunderstorms—will result in a slow charging of the aerial wire, and accordingly in the passage of sparks at considerable

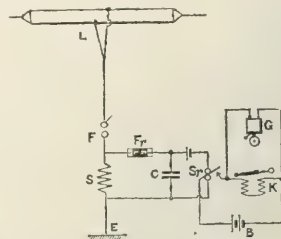


FIG. 5—CONNECTIONS FOR STORM INDICATOR

intervals. Since the signal bell is sounded in the very rhythm of spark discharges, the sequence of sound allows the distance of the thunderstorm from the recording apparatus to be gaged. In the place of the single-stroke bell, a Morse recorder with self-disengaging paper tape can be connected up to the apparatus, thus marking each passage of a spark by a point on the tape. If the speed at which the paper is unwound be known, the distance of the thunderstorm can be gaged by measuring up the paper tape and counting the number of points recorded thereon.—*London Elec. Review*, Feb. 14, 1913.

## Book Reviews

**WECHSELSTROMTECHNIK.** By Dr. G. Roessler. Part I. Berlin, Germany: Julius Springer. 304 pages. 185 illus. Price, 9 marks.

Dr. Roessler's writings have always interested the electrical engineer. The author is a man of great erudition and is possessed of the pedagogic faculty of presenting a complex subject in a thoroughly scientific manner with the utmost clearness and lucidity. The book treats, first, of general definitions; second, of general principles; third, of alternating-current transformers; fourth, of generators for single-phase and polyphase currents; fifth, of polyphase currents and rotating fields; sixth, of non-synchronous polyphase motors without commutators. It can be heartily recommended to students who are familiar with the German language and who wish to study a most readable elementary treatise.

**ALLGEMEINE ELEKTROTECHNIK HOCHSCHUL-VORLESUNGEN.** By P. Janet. Vol. I. Leipzig, Germany: B. G. Teubner. 280 pages, illus. Price, 7 marks.

This book is a German translation of Prof. Paul Janet's work. It is rather difficult to do justice in a review to a book of this nature which to the reviewer has passed through a double translation. As a class book for students of elementary electricity it seems interesting and suggestive. In reviewing a book of this character by a French author one can never help indulging in a comparison between it and the master treatise of Mascart and Joubert, which is so well known and clear. There can be no question that M. Janet's book in its translation will be of great interest to German readers, but it can hardly be expected that the American reader will take the trouble to study the German translation while the French original is accessible.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Two-Circuit Pendant Switch

For controlling two circuits, two chandeliers, two clusters or lamps and a fan from one location a two-circuit arrangement is the most convenient. A porcelain-type, brass-shell two-circuit pendant has been added by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., to its standard line of supplies. The small quick-break twin mechanisms are inclosed in the base, each mechanism being operated by its own push-bar. The switch is rated at 6 amp. 125 volts, or 3 amp. 250 volts.

By means of this switch a large chandelier or cluster of lamps may be divided into two groups controlled separately, as is often done in large stores where some artificial lighting is desired during daytime. Also for fan electroliers where the fan and lamps may be used at different times, the two-circuit pendant affords convenient control. Various other combinations in which it will be found useful will readily suggest themselves. The switch has been approved by the Underwriters' Laboratories.



PENDANT SWITCH FOR TWO-CIRCUIT CONTROL

### An Electric Flashlight "Pistol"

An electric-flashlight "pistol," which is a close copy of a small Colt automatic revolver, has been brought out by the Interstate Electric Novelty Company, of New York. The case, which is made of stamped metal with gun metal finish, is 4 in. long. Complete with lamp and battery the whole device weighs only 4 ounces. In the muzzle of the toy gun is a miniature tungsten lamp, which is supplied with electricity from a small battery located in the handle of the pistol. The switch controlling the lamp is operated by pressing the trigger. A continuous light may be obtained by sliding a button which locks the trigger. The top of the magazine is removable, allowing for replacement of

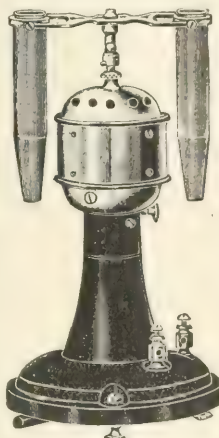


TOY PISTOL CONTAINING TUNGSTEN LAMP

the battery, which merely slides into place without the necessity of connecting any wires. This harmless novelty, besides being useful in looking for street numbers and keyholes, may serve in some measure as a protection, particularly for women and children, as it looks very much like a real weapon.

### Physician's Electric Centrifuge

The illustration presented herewith shows a physician's electric centrifuge which is being introduced by the Lindstrom, Smith Company, 281 South Wabash Avenue, Chicago, Ill. It is claimed that this outfit covers the entire



CENTRIFUGAL MACHINE FOR MEDICINAL USE

centrifugal field in so far as it relates to therapeutic work. The machine is equipped with two aluminum tube shields and two glass tubes, one of which is graduated and the other plain. It is claimed that this apparatus permits the estimation of albumen, chlorides, phosphates and sulphates or precipitates, casts, crystals and the like in about one and one-half minutes. It will precipitate bacilli in sputum or will give the correct percentage of blood corpuscles in two minutes. The motor is capable of a high speed and is so finely adjusted that it is not necessary to have the apparatus fastened in position. The motor will operate smoothly at any speed between 1000 and 5000 r.p.m.

The acceleration and deceleration are gradual to avoid any possible loss of the contents of the tubes which might be brought about owing to a sudden jerk on starting or stopping.

### Electric Drills for Direct-Current and Alternating-Current Service

The accompanying illustration represents the type of high-power 2-in. portable electric drill made by the Standard Electric Tool Company, of Cincinnati, Ohio, for both direct-current and alternating-current operation, the latter either for two-phase or three-phase. As will be seen, the tool illustrated is fitted with screw feed. The drills are made in 2 in., 3 in., 4 in., 5 in., 6 in., 7 in., 8 in., 9 in. and 10 in. sizes. Ball bearings are used throughout and rigid construction and high power are special features. Series motors are employed on all direct-current types. The mechanical construction is simple and it is said that these drills are "fool-proof." Motors having ample overload range are provided and are guaranteed not to run hot under the hardest continuous service. This drill is similar in many respects to the tool described in the Jan. 11, 1913, issue of the *Electrical World*.



DRILL

## Safety Cut-Out Tungsten Hanger for Industrial Use

By means of the safety cut-out hanger illustrated herewith large multiple tungsten lighting units used for industrial illumination may be automatically cut out of circuit



SAFETY CUT-OUT HANGER FOR  
TUNGSTEN LAMP

and lowered to the ground for cleaning, trimming or renewing. The device, which is manufactured by the Thompson Electric Company, 337 Superior Avenue, N. W., Cleveland, Ohio, is similar in principle and operation to the larger arc-lamp hanger made by the same company.

As the illustration shows, the sheave arrangement effects the positive alignment of the contacts, while perfect connection is assured by the construction, which spreads the contacts by the weight of the lamp. These contacts are wiped clean each time the lamp is lowered. The hanger contains no delicate or complicated parts, and all mechanism is fully protected against dirt and weather by an inclosing metal sleeve.

For use in mills, factories, railway shops and sheds, and industrial plants of all kinds, the hanger makes it possible to clean and renew lamps from the ground, without danger of the trimmer's falling. Hanging loops of wire are avoided, and the trimmer runs no risk of shock, for the lamp is disconnected when lowered. Cranes or ladders are not needed, and the work is done in half the time otherwise required. Lamps can be located wherever most effective, without regard to accessibility, for this is assured by the hanger in any position. The hanger has the approval of the National Board of Underwriters.

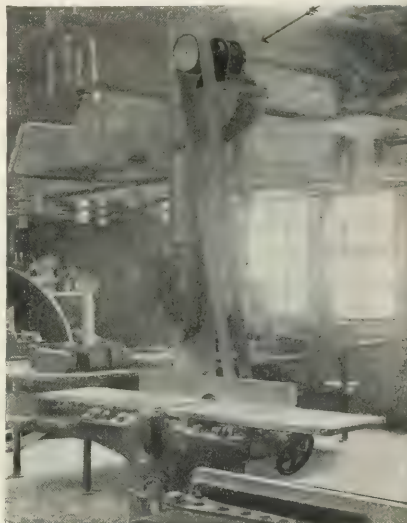
## Motor Drive in Pattern Works

The pattern works of Charles Jurack, Milwaukee, Wis., have recently been equipped for electric motor drive by the Mechanical Appliance Company of Milwaukee. There is a total of twenty-two machines operated by ten motors, seven

Number of Motors	Rating in Hp	Speed, R P M	Application
1	1	1,800	Belted to 6-in. jointer.
1	1	1,800	Belted to 12-in. jointer.
1	1	1,800	Belted to 16-in. jointer.
2	2	1,800	Belted by short belt to band saws.
1	3	1,800	Belted by short belt to 16-in. circular saw.
1	3	1,800	Belted to 24-in. planer.
1	3	1,800	Belted to 16-ft. line shaft, driving two speed lathes, one drill press, two post lathes and one slotter.
1	3	1,800	Belted to 12-ft. line shaft, driving four wood speed lathes and one entry wheel.
1	3	1,800	Belted to 16-ft. line shaft, driving a double-disk grinder, one fan, one core box machine and one gear cutter.

of the motors being used for individual drive, while the other three drive groups of machines. One motor driving a circular saw is mounted on the floor within a wooden inclosure. Two motors operating band saws are hung on brackets on the floor below and all other motors are mounted on brackets 11 ft. above the floor. The accompanying table gives a list of the motors employed and

their application. It will be noted that the 16-in. jointer and the 24-in. planer, each rated at 7.5 hp, and the group consisting of drill press, slotter, two speed lathes, 8-ft. post lathe and 12-ft. post lathe are driven by 3-hp motors, all the machines not being used at the same time.

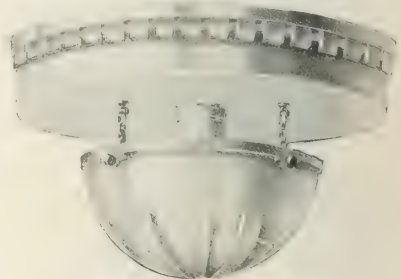


MOTOR-DRIVEN PLANER

The wiring in this plant is mostly open knob and tube work, except between motors and starting switches, where iron conduit is used with a conduit fitting at each end. Watson three-phase, 220-volt squirrel-cage motors are used. The average energy consumption per month is about 1500 kw-hr.

## Semi-Indirect Lighting Fixture

The so-called "Brascolite luminous unit" is a semi-indirect lighting fixture constructed almost entirely of glass. The canopy or reflector is made of dense white opal glass depolished on the outside. The suspended bowl is made of "Alba" glass which is said to have excellent diffusing qualities and very little absorption. A tripod in



FIXTURE FOR SEMI-INDIRECT LIGHTING

the reflector for attachment to the ceiling is of cast malleable iron, to which is attached a porcelain flexible-tongue, center-contact socket. The loops below the reflector are of cast brass and screwed into the tripod, thereby carrying the bowl independently of the reflector. The three aluminum chains have hooks on the lower end so that the bowl



can be easily removed for cleaning and replacing of the lamp. The tripod makes it possible to install the unit to a stud or to the side holes in the standard 4-in. junction box, or to use wood screws. Insulating joints or canopy insulators are not required, as the building wires are connected directly to the brass terminals of the sockets and the reflector is a non-conductor. The socket is placed high in the reflector to obscure the skirt of the lamp. The unit is made in four sizes: For 60-watt or 100-watt lamp, 12-in. diameter reflector; for 150-watt lamp, 14-in. diameter reflector; for 250-watt lamp, 18-in. diameter reflector; for 400-watt or 500-watt lamp, 22-in. diameter reflector.

A photometric test made in a typical office room with the 150-watt unit indicated an average of 3.5 ft.-candles at a 30-in. plane. The fixture is said to be non-corrosive and to retain its efficiency indefinitely. It is made by the St. Louis Brass Manufacturing Company, Jefferson and Washington Avenues, St. Louis, Mo.

### Portable Ozonizer

The ozonizer shown herewith consists of a step-up transformer, tubes for generating the ozone and a regulating switch, all contained in a portable case. The tubes are of glass with an outer coating of metal. The inner walls are lined with a metal mesh. The outer coating is connected to one terminal of the high-tension winding of the transformer, and the inner coating is connected to the other high-tension terminal. The uneven distribution of potential by the metal mesh on the inside of the tubes produces many small brush discharges which generate ozone.

The generating cylinders are placed above the transformer and are vertical, so that the warm air rising from the transformer and from the inside of the generating tubes causes an upward draft. On top of the case is a knob connected to the regulating switch inside the case, which is connected to the generating tubes in such a manner that by turning the knob to the positions indicated on the dial the number of tubes in operation may be regulated from one to four.

The cylindrical part of the case is of heavy sheet metal



OZONIZER FOR GENERAL USE

and the top and bottom of wood. This wood is thoroughly seasoned and heavy enough to prevent warping. It is finished in either white enamel or polished mahogany for the wooden parts and dull black for the remainder of the case.

The ozonizer is designed for connection directly to a lamp socket and takes only 18 watts at maximum produc-

tion. The operation is practically noiseless, so that it can be left running in the sleeping room without disturbance. Although the voltage is stepped to a high value, the circuits are so thoroughly insulated and all exposed metal parts are electrically so connected together that no difference of potential can exist between them even if a part of the circuit should become grounded to the case. This ozonizer is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

### Small Refrigerating Machine

A small refrigerating equipment known as the Audifren-Singrun machine is being imported into this country from France and placed on the market by the H. W. Johns-Manville Company, New York.

The machine is of notably simple construction and can be operated by any one without any knowledge of the

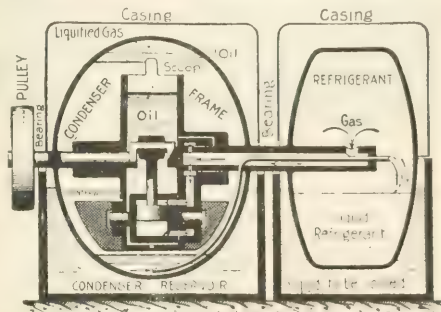


FIG. 1. SECTIONAL VIEW OF REFRIGERATING MACHINE

machine proper. It is claimed that all that is required is to close and open the switch, the unit being self-contained and practically fool-proof. It is operated on the compression system using sulphur dioxide as the refrigerating agent. Externally the machine is similar to a large dumb-bell consisting of two drums or globes on a hollow shaft. When these drums are revolved the machinery within is set in motion, producing the cooling effect. There are no joints, valves, gages or stuffing boxes requiring attention. The machine is delivered complete and hermetically sealed

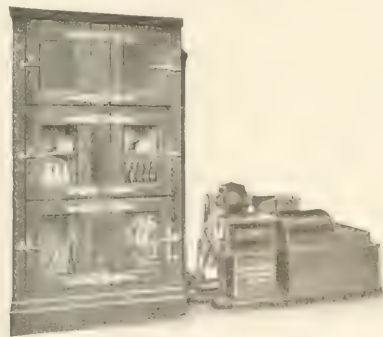
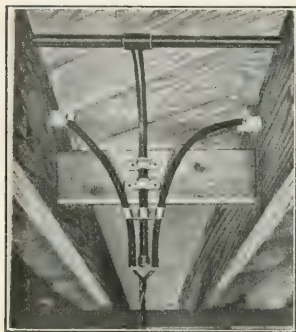


FIG. 2. REFRIGERATING MACHINE

ready to place on bearings and start. Advantages claimed for this machine are the small quantity of condensing water required and its ability to operate with much warmer condensing water than other machines. The space required is very small, an important consideration particularly in private houses, apartments, clubs, cafes, etc.

### Clamp for Gas and Electric Outlets

A clamp for holding electric wiring and gas pipes in position at outlets has been placed on the market by the T. & W. Manufacturing Company, Milwaukee, Wis. Nails and staples bent over looms have proved unsafe as they generally damage the insulating quality of the material. The old method of binding the looms to the pipe outlets



OUTLET CLAMPS INSTALLED

with friction tape does not produce a good mechanical result. It is stated that with clamps of the type illustrated neither of these difficulties is encountered. The clamp is punched from strap steel and is rounded at the edges to eliminate the possible danger of cutting the loom should it be necessary to bend it at an angle with the clamp. These clamps are made for gas outlets alone, for electric outlets, or for combination gas and electric outlets. The illustration presented herewith shows a combination gas and electric outlet installed with these clamps.

### Belt Clamp

For placing new belts and to facilitate quick lacing a belt clamp of unusual design has been put on the market by the Higgins Machinery Company, Seattle, Wash. The clamp consists of two arms in V-shaped arrangement, provided at the upper ends with clamps to be tightened on to the belt ends. Between the two arms is a toothed segment, which is engaged by a ratchet wheel turned by means of a crank. This when turned draws together the ends of the belt. It is claimed that by means of this device a belt can be made ready for lacing in three minutes.

### Large Feed-Water Meters

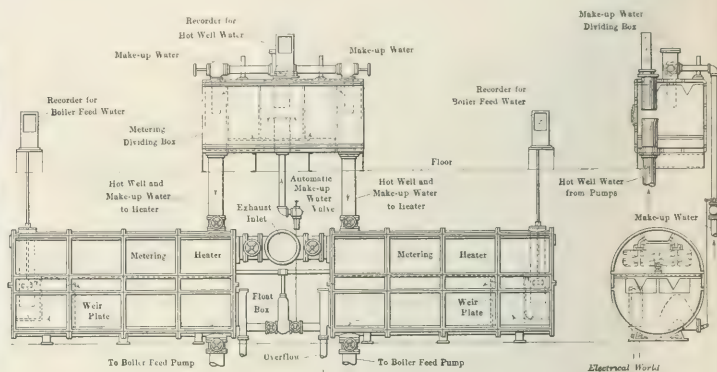
The largest boiler-feed water meters so far ordered are now under construction in the shops of the Harrison Safety Boiler Works, of Philadelphia. This equipment has a capacity of 1,200,000 lb. of water per hour, which is equivalent to about 30,000 boiler-hp, or 100,000 turbine hp.

The combined apparatus is more than a meter, however, since it also serves as a hot-well for the condensed turbine returns, as a make-up water regulator for supplementing these returns, and as a boiler-feed water heater, utilizing the steam exhausted by circulating pumps, boiler-feed pumps, etc., to heat the total boiler-feed supply up to 210 deg. Fahr.

Besides measuring the total boiler-feed supply, from which may be determined the amount of water evaporated per pound of coal used, as well as the efficiency and capacity of the boilers, the outfit also measures the condensate from

the main turbines separately, so that by comparison with the machine watt-hour meters the daily average steam economy of the turbines can be checked.

The metering device employed is the V-notch weir, which was selected because of its accuracy at small flows as well as at the rated flow. It was incorporated in the Cochran feed-water heater because the total boiler-feed supply, in-



APPARATUS FOR METERING 1,200,000 LB. OF BOILER FEED

cluding raw make-up water and drips and returns, is here brought together before being fed to the boiler. Inclosing the notch within the meter also avoids all annoyance and loss of heat through escape of vapor.

A great advantage of the notched-weir method is that by reading the head on the weir and calculating the flow therefrom according to carefully verified formulas the indication of the recording instrument can be checked at any time. To obtain the same verification with other forms of meters involves weighing or measuring tests which often cause no little expense.

Referring to the illustration, the condensed returns will be seen to flow into the central compartment of the combined meter and dividing box, located on the turbine floor. From this central chamber the water passes under horizontal baffles, one on either side, into the still-water chambers, from which it overflows through two V-notches to the outflow chambers.

The raw make-up water enters a dividing box located above the hot-well and meter chamber just described, where it is separated into two equal parts, each flowing into the corresponding outflow compartment of the meter chamber. From the outflow compartments the water descends to the two metering heaters, operated as a single heater on the multiple-unit system. Provision is made for cutting either heater out of service for cleaning or inspection while the other continues in operation.

From the cold-water trough of the heaters the water overflows upon the trays and is heated to 210 deg. Fahr., after which it travels to the end of the heater and passes downward under a baffle, and then up into a "still-water chamber." From the latter it overflows through two V-notch weirs into a large storage and pump-supply chamber that occupies nearly the whole lower half of the heater shell.

The large size of these pump-supply chambers is of considerable importance, since it insures a fairly uniform flow through the meter proper, without fluctuation, independently of racing of feed pumps or other disturbances in the boiler-feed line.

The level of the water in the still-water chamber is recorded by a simple mechanical device, which also gages the flow from instant to instant throughout the day, besides giving the total flow taking place in any given period of time.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**The Increase in the Number of Holding Companies.**—In our issue for Dec. 28, 1912, page 1353, we presented the results of an analysis which was made to determine the extent to which centralization of ownership, as shown in the number of holding companies, had progressed in this country in cities of 5000 or more population. This analysis showed that as of Sept. 30, 1912, in 1159 such cities there were 528 syndicate or holding company plants, 524 independent plants and 205 municipal plants, there being included in these ninety-eight cities in which there is competition between two or more of these three classes of service. In *Moody's Magazine* for February, 1912, Mr. Edward B. Lee makes the following observation upon the results of our analysis: "It does not follow because the electric light and power plants of more than 45 per cent of the cities of 5000 population or more in the United States have ceased to be independent properties that no more successful holding companies for this kind of property can be organized. It does most certainly follow, however, that greater caution and judgment than ever before must be used in the acquisition of electric light and power properties for holding company purposes, as much of the cream has been skimmed off and as there is more competitive buying of properties and as the owners of the properties still independent are apt to hold them for prices much higher than were paid for properties now a part of successful holding companies organized a few years ago. It would not be surprising if in the eager search for properties now so manifest prices were paid which even the advantages from holding company management cannot entirely overcome. Accordingly, investors would do well to use as much care and discrimination in purchasing the securities of holding companies as in purchasing securities of any individual company."

**Will Tie in Its Ohio Properties.**—With more economical operation as the object in view, the American Gas & Electric Company, 30 Church Street, New York, is planning to shut down the small generating stations now supplying energy to a number of Ohio communities in which it has purchased the public-utility properties, to divide these communities into groups and to supply each group with electrical energy from a large central station. Four groups are to be arranged at this time. One of these will be composed of the small towns near Newark, Ohio; the second of the towns near Canton, the third of those near Tiffin, and the fourth of the communities around Wheeling, W. Va. As part of the plan, a transmission line is to be built from Newark to Lancaster, and this will be eventually tied in with a line from Wheeling, W. Va. A 10,000-kw station has just been completed in the last-named place and will be enlarged later on to possibly 40,000 kw. A 5000-kw station is in course of erection at Newark, and this will be enlarged to 15,000 kw later on. Among the Ohio properties of the American Gas & Electric Company are the Canton Electric Company, Licking Light & Power Company, Newark; Fremont Yaryan Company, Fremont; Ohio Light & Power Company, Tiffin; Lancaster Electric Light Company, and Mount Vernon Electric Company.

**Kings County Electric Light & Power Meeting.**—At a meeting of the stockholders of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn on Feb. 24, the following board of directors for both companies was elected for the ensuing year: Frank Bailey, William Berri, Anthony N. Brady, Nicholas F. Brady, Horace C. DuVal, Walton Ferguson, Bernard Gallagher, William W. Hester, Seth L. Keeney, Thomas E. Murray, W. F. Sheehan, James N. Wallace and W. F. Wells. All of these were re-elected with the exception of W. F. Wells, who is now general manager of both companies and takes the place of W. W. Freeman, who

was formerly general manager, vice-president and director of both companies. The combined annual report of the two companies for the year ended Dec. 31, 1912, shows gross operating revenue of \$5,167,669, as compared with \$4,707,914 in 1911. Operating expenses, including taxes and depreciation charges, were \$3,379,343, as against \$2,928,450 in the preceding year, and the balance to credit of profit and loss, after all deductions, was \$101,408, as compared with \$178,888 in 1911.

**Annual Statement of Northern States Power Company.**—For the year ended Jan. 31, 1913, the Northern States Power Company reports for itself and constituent companies gross earnings of \$3,035,723. It is to be noted, however, that this includes the results from the operation of the Minneapolis General Electric Company for only the eight months from June 1, 1912, to Jan. 31, 1913. The net earnings were \$1,504,573 and from these were paid fixed charges amounting to \$920,484 and preferred-stock dividends of \$447,698. The Northern States Power Company has \$5,975,000 of common stock outstanding, \$8,386,700 of preferred stock and \$5,000,000 of 6 per cent notes. The item of constituent companies' bonds, etc., amounted to \$17,465,000. This includes seventy shares of Minneapolis General Electric Company 6 per cent preferred stock, which is not yet acquired, although dividends on it are included in the item of fixed charges.

**Johns-Manville Company Reported as Interested in Chicago Factory Site.**—Daily newspapers publish a report that the H. W. Johns-Manville Company has purchased a large site at Riverdale, on the southern limits of Chicago, on which to erect a manufacturing plant to cost several million dollars and to employ several thousand hands. No official confirmation of the story has been authorized, although it is believed that the company has obtained options on land in the outskirts of Chicago. If a factory should be built in or near Chicago, it would probably be devoted to the company's asbestos and pipe-covering products rather than its various electrical specialties.

**Defeat Municipal Ownership Plan for Sharon (Pa.).**—The city of Sharon, Pa., at a referendum election held recently, rejected a proposition to erect a municipal lighting plant. The plan was defeated by a majority of 80 in a vote of 1193. In May, 1912, a proposition to bond the city for the construction of the plant was carried, but as a reduction took place subsequently in the rates of the central station company, this proposition was again referred to the voters, with the result stated above. A five-year contract for all the municipal lighting requirements will be signed by the City Council with the Mahoning & Shenandoah Railway & Light Company.

**Sell Property of Allis-Chalmers Company.**—In accordance with the reorganization plan, the personal property of the Allis-Chalmers Company was sold on Feb. 21 for \$1,000,000, in Milwaukee, to representatives of the reorganization committee, who were the only bidders. The sale included stocks, bonds, mortgages, raw material, accounts and orders. The net cash received was \$1,000,000, \$2,250,000, as noted in these columns.

**Growth of Tungstolier Business.**—Owing to the rapid growth of its business in the past few years, the Tungstolier Works or General Electric Company have found it necessary to build a new factory in Chicago, Ill. The new plant will be one of the greatest manufacturing institutions in the country.

**Increases Its Capital Stock.**—The Tampa (Fla.) Electric Company has increased its capital stock from \$1,800,000 to \$2,214,000.



**Detroit Edison's Year.**—The annual report of President Alexander Dow of the Detroit Edison Company, Detroit, indicates a very rapid growth of the business in that city. A 15,000-kw generator has been ordered for delivery early in the summer, and it will be installed in the No. 2 station. Improvements begun in 1912 will almost double the capacity of Station No. 1 as compared with 1909 by the end of this year, when the combined capacity of the two stations will be 93,000 kw. Mr. Dow, however, says this will be no more than the company will need if the city continues its growth, and it will be insufficient for 1914. To provide for the early future the directors have been engaged in making provision for the construction of a power station on the river front about 8 miles above Delray. Concerning the operation of the Detroit Edison Company and its constituent companies in 1912, President Dow says: "The gross earnings for the year were \$4,385,615.17, as compared with \$3,598,994.11 for the year 1911, an increase of \$787,521.06, or 21.8 per cent, and the net earnings were \$1,858,434.85, as compared with \$1,536,904.22, an increase of \$321,530.63, or 20.9 per cent, and the surplus after interest charges paid and accrued was \$1,145,569.20, as compared with \$853,174.90, an increase of \$292,334.30, or 34.2 per cent. The business of the Eastern Michigan Edison Company included in the foregoing—that is to say, the business of the territory beyond the city of Detroit and its immediate vicinity—is \$431,071.99 gross earnings and \$181,570.52 net earnings, increases of 23.3 and 19.9 per cent respectively. The number of general light and motor-service customers connected increased from 55,407 to 70,763. Our business in Detroit was very good in 1912 and the prospects for 1913 are equally good."

**New Plan for Doherty Companies.**—The directors of the Cities Service Company, the Consolidated Cities Light, Power & Traction Company and the Utilities Improvement Company have approved a plan by which an exchange of underlying companies has been effected by these three corporations, and additional companies have been taken over. Henry L. Doherty & Company, organizers and managers of the three corporations, state that under the rearrangement and by the taking over of the new properties the net earnings of the Cities Service Company will be increased from \$1,113,732 for the year ended Dec. 31, 1912, to a basis of \$1,757,798 for the year, and the amount earned for the common stock increased from a little over 9 per cent to more than 12 per cent, even on the large capitalization under the new plan. The net earnings of the Consolidated Cities Light, Power & Traction Company, which were \$308,288 for the year ended May 31, 1912, will be increased, they state, to a basis of \$715,232, with an earning power for the stock of 5.16, as compared with a little more than 2.16 per cent. The net earnings of the Utilities Improvement Company, which were \$1,083,000 for the year ended Dec. 31, 1912, are estimated at \$1,720,400, which will give 5.18 per cent on the outstanding common stock.

**Long Acre Electric Light & Power Progress.**—The Public Service Commission for the First New York District, by a vote of three to two, has adopted a resolution directing its counsel to prepare a certificate approving the construction of an electric-light plant by the Long Acre Electric Light & Power Company, New York. As has been recorded previously in these columns, the Long Acre company applied in 1908 to the commission for permission to issue \$50,000,000 in bonds and \$10,000,000 in stock. This application was denied, and the company took the matter to court. The Appellate Division decided against the commission, and directed it to permit the company to issue stocks and bonds in an amount sufficient for its legitimate needs. Acting under that decision, the commission subsequently let the company issue about \$2,000,000 in stock and \$2,000,000 in bonds. The New York Edison Company appealed from this order to the court. The Appellate Division again upheld the order granting the Long Acre company permission to issue securities. The case was taken to the Court of Appeals, which a few months ago reversed the decision and upheld the original decision of the commission.

**Public Service Company of Northern Illinois Absorbs Gas Company.**—The stockholders of the Public Service Company of Northern Illinois, at the annual meeting in

Chicago on Feb. 24, approved the proposition to absorb the Northwestern Gas Light & Coke Company, and the merger is now an accomplished fact. The Northwestern Gas Light & Coke Company is said to control the sale of gas in forty-four suburbs north and west of Chicago, serving a population of 200,000. It has plants in Oak Park, Blue Island and Evanston, Ill. Control of the Northwestern company recently passed to Samuel Insull personally and now is again transferred to the Public Service Company of Northern Illinois. The stockholders of the latter company authorized the issuance of 20,000 shares of common stock to be given to the stockholders of the Northwestern company in exchange for their stock. It was announced that the Public Service Company of Northern Illinois will soon go out of the street-railway business, as it has decided to sell the one small line which the corporation now owns and operates in Streator, Ill. The old directors of the company were re-elected.

**Crocker-Wheeler Company on Business Outlook.**—An official of the Crocker-Wheeler Company, Ampere, N. J., was quoted this week as follows on the outlook in the electrical business: "The Crocker-Wheeler Company is employing 25 per cent more men at its factories than in February, 1912, but many orders for materials placed last August with steel companies have not yet been delivered. This delay in delivery applies to steel products in general and deliveries are now at five or six months. The copper market, on the other hand, has eased off to some extent. The general tendency of the electrical business shows a slackening, but the majority of the companies report that they have booked more business so far this year than in the corresponding period of a year ago. Prices of material have held very firm, except pig-iron, which has gone down. The chief congestion is in sheet steel, which is essential for all sorts of electrical machinery."

**New Central Colorado Reorganization Plan.**—The reorganization committee of the Central Colorado Power Company has filed with the Columbia-Knickerbocker Trust Company, New York, and the Commonwealth Trust Company, of Boston, a revised plan of reorganization, in place of that dated Nov. 25, 1912, and referred to in these columns Dec. 7, 1912. Under the new plan, bondholders of the Central Colorado company will receive 90 per cent of their principal in common stock of the new company instead of the 75 per cent provided in the former plan. The committee states that under the new plan it sees an excellent future for the new company in furnishing electrical energy for operating the mountain divisions of railroads and in the acquisition of new properties.

**New Owners for Hornell (N. Y.) Company.**—The Hornell Electric Company, which furnishes electric light and steam heat for the city of Hornell, N. Y., has changed ownership, the new owners taking the property on Feb. 28. Harvey L. Elkins, of Philadelphia, was elected president; Eugene F. McCabe, of Titusville, Pa., vice-president and general manager; William Maul Measey, of Philadelphia, treasurer, and William J. Seltzer, of Philadelphia, secretary. These gentlemen, with Samuel T. Beatty, of Dansville, N. Y., form the board of directors. L. T. Mason, of Hornell, is the superintendent in charge. This syndicate owns and operates plants in Dansville, N. Y.; Titusville, Pa., and Morbely, Mo.

**Diesel Engines for Arizona Mining Plants.**—The Usine Carels Frères, Ghent, Belgium, of which W. R. Haynie, 30 Church Street, New York, is United States representative, is contracting with Phelps, Dodge & Company, 99 John Street, New York, for two 1000-hp, two-cycle, four-cylinder Diesel-type engines for use at one of its Arizona mining plants. These engines will be direct-connected to 60-cycle alternators. This, it is said, is the first sale of stationary-type Diesel engines as large as these in this country.

**Goulds Manufacturing Company's Annual Meeting.**—The annual meeting of the stockholders of the Goulds Manufacturing Company was held at Seneca Falls, N. Y., Feb. 24. No change was made in the board of directors, and the following officers were re-elected: President, N. J. Gould; vice-presidents, D. V. Colby, W. D. Pomeroy, W. E. Davis, W. E. Dickey; secretary, H. S. Fredenburg; treasurer, B. R. Wells, and assistant treasurer, E. W. Medden.

# Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Feb. 26	Mar. 4
Allis-Chalmers, t. r., 3d pd...	\$15,501,800			21*	
Allis-Chal., pf., t. r., 3d pd...	14,105,500			91*	92*
Amalgamated Copper.....	153,887,900	1 1/2	O	67 1/2	72 1/2
American Tel. & Tel.....	335,001,000	2	O	132	132 1/2
Electric Storage Battery, c.	16,074,425	1	O	51 1/2	52
General Electric.....	101,203,500	2	O	137 1/2	139
Mackay Cos., c.....	41,380,400	1 1/2	O	83*	83*
Mackay Cos., pf.....	50,000,000	1	O	67 1/2	67
Western Union Tel.....	99,745,400	1	O	68 1/2	68*
Westinghouse E. & M., c.....	33,821,200	1 1/2	O	69 1/2	70 1/2
Westinghouse E. & M., pf.....	3,998,700	1 1/2	O	117 1/2	118

\*Last price quoted.

## NEW YORK METAL MARKET PRICES.

Copper:	Feb. 25		March 4	
	Bid	Asked	Bid	Asked
Standard, spot.....	14.07 1/2		14.37 1/2	14.75
London, standard, spot	64	0 0	66	0 0
Prime Lake.....	14.75 to 14.85		14.87 1/2 to 15.00	
Electrolytic.....	14.70 to 14.80		14.85 to 14.95	
Casting.....	14.60 to 14.65		14.70 to 14.80	
Copper wire, base.....	16.25		16.00 to 16.25	
Lead.....	4.35		4.35	
Nickel.....	40.00 to 45.00		40.00 to 45.00	
Sheet zinc, f. o. b. smelter.....	9.00		8.25	
Spelter, spot.....	6.37 1/2		6.35 to 6.45	
Fin. spot.....	47 1/2		47 1/2	
Aluminum:				
Prompt delivery.....	25.50 to 26.00		25.50 to 26.00	
Future.....	35.50 to 26.00		35.50 to 26.00	

## OLD METALS.

Heavy copper and wire.....	13.37 1/2	13.50
Brass, heavy.....	8.75	9.00
Brass, light.....	7.75	7.75
Lead, heavy.....	4.15	4.15
Zinc, scrap.....	5.37 1/2	5.12 1/2

## COPPER EXPORTS IN MARCH.

Total tons to March 5..... 6,105

# Personal

**Mr. George Ostrander** has been appointed superintendent of power and light at Brampton, Ontario.

**General George H. Harries** was appointed a delegate to the Lakes-to-Gulf Good Roads Association, which met in Washington March 6.

**Mr. W. A. Brothwell** has been elected treasurer of the Essex (Conn.) Light & Power Company, succeeding Mr. W. G. Seeley, who becomes vice-president.

**Mr. Albert Mohr**, vice-president of John Mohr & Sons, boiler manufacturers, Chicago, has been appointed one of the South Park Commissioners of that city.

**Mr. T. H. Hogg**, formerly managing editor of *The Canadian Engineer*, has resigned to become associated with the Hydro-Electric Power Commission of Ontario.

**Mr. L. A. McArthur**, former assistant manager of the Pacific Power & Light Company, of Portland, Ore., is now stationed at North Yakima, Wash., as local agent for the same corporation.

**Mr. R. W. Clark**, for the last five years assistant commercial manager of the Minneapolis General Electric Company, has joined the staff of the Puget Sound Light & Power Company at Seattle, Wash.

**Mr. F. J. Forbes** has resigned as superintendent and chief electrician of the Portage (Wis.) Electric Light Company to remove to Racine, Wis., where he will have charge of outside plant construction.

**Mr. Eugene F. McCabe**, vice-president and manager of the Titusville (Pa.) Light & Power Company, has been appointed vice-president and general manager of the Hornell (N. Y.) Electric Company.

**Mr. Arthur H. Hull**, for the past three and a half years associated with the engineering department of Smith, Kerry & Chase, has recently joined the designing engineering staff of the Hydro-Electric Power Commission of Ontario.

**Mr. L. M. Page**, formerly in charge of the Madison (Wis.) sales office of the Fort Wayne Electric Works, has succeeded Mr. T. J. Ryan as district manager of the Fort Wayne Electric Works in Cincinnati.

**Mr. Thomas F. Kelly**, formerly contract agent for the Dominion Power & Transmission Company of Hamilton, Ont., has been appointed sales manager of the Dayton Power & Light Company, of Dayton, Ohio.

**Mr. Samuel Insull**, president of the Commonwealth Edison Company, Middle West Utilities Company and other electric-service companies, returned to his desk in Chicago last week after an extended tour in Europe.

**Mr. William G. Merowitz** has severed his connection with the Holtzer Cabot Electric Company to become power apparatus sales specialist for the Northern Electrical & Manufacturing Company of Montreal, Canada.

**Mr. F. A. Creighton**, for several years city engineer of Prince Albert, Saskatchewan, Canada, has been appointed manager of the civil hydroelectric development work at La Colle Falls, 12 miles distant from Prince Albert.

**Mr. T. J. Collins** has been appointed contract agent for the Amesbury Electric Light Company, of Amesbury, Mass. Mr. Collins was formerly connected with the Central Massachusetts Electric Company at Palmer, Mass.

**Prof. George Goldman**, of the electrical engineering department of Syracuse University, recently addressed the Cleveland Section of the American Institute of Electrical Engineers, on the subject of transformers for multiple frequency operation.

**Mr. W. W. Cole** has been appointed general manager of the Citizens' Light & Power Company, of Oil City, Pa., succeeding Mr. F. D. Shaffer. Mr. Cole has for several years been associated with the public utilities department of the Day & Zimmerman Company.

**Mr. W. J. Richardson** has become superintendent of the Radford Light & Power Company, of Radford, Va. Mr. Richardson, formerly of Ann Arbor, Mich., was until recently superintendent of the Carlisle Electric Light & Power Company, of Carlisle, Ky.

**Prof. C. R. Moore**, who has been in charge of electrical design at Purdue University, plans to devote a portion of his time hereafter as engineer for the Lafayette Electric & Manufacturing Company, of Lafayette, Ind. Prof. Moore will continue his course of lectures on design at the university.

**Mr. W. J. McCorkindale** has resigned as vice-president and manager of the Marquette County Gas & Electric Company, of Ishpeming, Mich., to become manager of the Wilmington (Del.) Gas Company. Mr. McCorkindale will also become a member of the executive board of the C. H. Geist Company, of Philadelphia, which controls the Wilmington gas property.

**Mr. Albert W. Childs** has been appointed superintendent of sales for the Southern California Edison Company, of Los Angeles, Cal., in which position he has general charge of all lighting and motor-service salesmen, supervision of contracts, etc.

For several years past Mr. Childs has held the position of assistant general agent. He entered the service of the Edison Electric Company some months ago and has since held the position of assistant general agent. Mr. Childs is a native of Chicago and received his education at the Northwestern University and the Dakota Agricultural College. He entered the field of business as a small agent and later as a district agent.

Mr. Childs is a member of the Pacific Northwest and Middle West electrical engineers' association in Redlands, Cal., resulting in his removal to that State, where in 1902 he joined the staff of the Edison Electric Company.





**Mr. E. J. Phillip**, who has been superintendent of the Berlin (Ont.) gas and electric plants for eight years, has resigned to accept the position of manager of the water and light department at Brockville, Ont. He succeeds Mr. C. T. Wilkinson, who retires to go into business. Mr. Phillips had been connected with the Berlin plant since 1904.

**Mr. E. A. Sessions** has retired as a member of the firm of Woodmansee, Davidson & Sessions, consulting engineers, Chicago. Mr. Sessions is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Mechanical Engineers, a member of the Illuminating Society, and an associate member of the American Society of Civil Engineers.

**Mr. R. J. Hiller**, of Montreal, Que., has severed his connection with the Canadian General Electric Company, to become sales manager of the Engineering Equipment & Supply Company, St. James Street, Montreal. Mr. Hiller has been identified with the Canadian electrical industry since 1886, when he entered the employ of the Royal Electrical Company of Montreal.

**Mr. Ralph W. E. Donjes**, of Camden, N. J., was appointed a member of the New Jersey Board of Public Utility Commissioners by Governor Wilson, to succeed Mr. Robert Williams, of Paterson, N. J. The appointment has been confirmed by the Senate. Mr. Donjes is an attorney and has served as captain in the Third Regiment and on the military staff of the Governor.

**Mr. Leo Schüler**, general secretary of the Elektrotechnische Verein, Berlin, Germany, attended the mid-winter convention of the American Institute of Electrical Engineers, Feb. 26 to 28, as the special delegate of the Verband Deutscher Elektrotechniker. On the evening of Feb. 27 the standards committee of the American Institute tendered an informal dinner to Mr. Schüler.

**Mr. John Gilmartin** has resigned as foreman of the meter department of the Toledo Railway & Light Company, Toledo, Ohio, to take charge of the meter department of the Detroit Edison Company. Mr. Gilmartin, who began his service with the Toledo company twenty years ago, has served on several technical committees of both the National Electric Light Association and the Ohio Electric Light Association.

**Mr. Thomas J. Ryan**, recently made sales manager of the General Electric Company for the Cincinnati district, has been in charge of the Cincinnati office of the Fort Wayne Electric Works for the last fourteen years. Mr. Ryan began his electrical experience with the old Thomson-Houston Electric Company, and when that organization was succeeded by the General Electric Company he was retained by the latter. Later he was placed in charge of the Cincinnati territory by the old Fort Wayne Electric Corporation, and five years later, at the reorganization of that company, he retained the same position for the Fort Wayne Electric Works, being in charge of the Cincinnati office until his recent advancement. Mr. Ryan is a member of the Jovian Order and is greatly esteemed for his engaging personality.

**Mr. Frank W. Frueauff**, first vice-president and general manager of the Denver Gas & Electric Light Company, who has been spending a few weeks in Colorado in connection with the completion of several large irrigation projects now being developed by H. L. Doherty & Company, addressed 600 Colorado business men at a recent luncheon of the Denver Chamber of Commerce. During the course of his talk Mr. Frueauff decried the present tendency toward repressive legislation against corporations, advocating instead measures which through reasonable regulation and intelligent protection in the conduct of business will encourage capital investment. The speaker's comments were received with much enthusiasm and approval, both by his auditors and by the general public as reflected through the newspapers.

**Mr. H. W. Eales** has assumed the duties of assistant superintendent of distribution and assistant chief electrical engineer of the Union Electric Light & Power Company of St. Louis. Mr. Eales, who is a native of England, has recently been connected with the sales office of the General Electric Company in St. Louis. He came to this country at

an early age and was graduated from Yale University in 1904. From 1904 to 1907 Mr. Eales took post-graduate work in engineering at the Sheffield Scientific School. He then entered the employment of the General Electric Company, continuing with it in various capacities until his connection with the Union Electric company. He is a member of the Sigma Xi and Phi Beta Kappa fraternities. The increase in the Union company's business and the new work made necessary by the forthcoming distribution of hydroelectric energy from Keokuk, it is explained, have made necessary Mr. Eales' addition to the staff.

**Mr. Emile Berliner**, to whom has been awarded one of the Elliott Cresson gold medals bestowed by the Franklin Institute for important contributions to telephony and to the



EMILE BERLINER

science and art of sound reproduction, as noted in our columns last week, was born in Hanover, Germany, on May 20, 1851. He was educated in the public schools of that city and in the Samson High School, Wolfenbüttel, graduating from the latter in 1865. Five years later he came to America and while engaged in a mercantile pursuit took up the study of the electric transmission of speech. In 1877 he invented the loose-contact telephone transmitter bearing his name and which brought Bell's great invention of the preceding

year within the range of commercial application and practical use. In the same year he effected another great advance in the telephone art by an application of the induction coil to step up the low-tension variable current through the loose-contact transmitter to a current of higher tension better capable of overcoming the impedance of long lines. These inventions were of fundamental importance to the telephone art and promise to be useful for many years to come. In 1878, on the formation of the Bell Telephone Company, Mr. Berliner accepted the position of chief inspector of instruments at its works in Boston, and in that capacity the first 20,000 transmitters that went into use passed through his hands. In 1881 Mr. Berliner, retaining his connection with the Bell Telephone Company as consulting expert, removed to Washington and, besides bringing out a number of other inventions relating to telephony, devoted his attention to the improvement of the talking machine. In 1887 he invented the gramophone, the first talking machine which utilized a record having a groove of even depth and varying direction and in which the record groove not only vibrates the recording stylus but also propels it. This invention he exhibited before the Franklin Institute in 1882, and a John Scott medal was subsequently awarded to it by the city of Philadelphia, on the recommendation of the Institute. The Berliner gramophone, now known in America as the "Victor" talking machine and throughout the world under various other trade names, has become the basis of a great and growing industry and an important agency of education and culture. Its popularization has been largely due to the system invented by Mr. Berliner for accurately and cheaply duplicating the original records. Mr. Berliner has latterly extended his inventive efforts into the field of aviation and has made notable progress toward perfecting a multi-cylinder motor of the internal-combustion type. His engine of this type, produced in 1907-8, with a rating of 35 hp, weighed only 97 lb. These were the first revolving cylinder motors successfully applied in aeronautical work and led the way to the extensive adoption of this type of motor for aeroplanes in Europe. In addition to his activity as an inventor, Mr. Berliner has given largely of his time to the study of the pathology of milk. His campaign of education on this subject led to the Washington Milk Conference of 1907, and his efforts have been fruitful of beneficial results. In this department of hygiene, as well as in his immediate field of research and invention, Mr. Berliner has made numerous contributions to scientific and technical literature.



## Construction

TEMPE, ARIZ.—Bids are being received by the board of governors of the Salt River Water Users' Association, of Phoenix, for the construction of one-half mile of reinforced concrete tubing for part of the penstock of the new power plant at Tempe, Ariz. Work will soon start on the proposed plant.

**YUMA, ARIZ.**—The proposition to issue \$300,000 in bonds for a water system, sewer system and electric-light plant and distributing system is under consideration. Plans are being prepared by Frank Brooks, city engineer.

LITTLE ROCK, ARK.—The State Board of Incorporators has granted B. J. Hamlin a franchise to develop water-power on Ten Mile Creek.

**SULPHUR SPRINGS, ARK.**—Bids will be received at the office of the Improvement Board, Sulphur Springs, until March 20 for furnishing material and constructing complete water-works and lighting plant, including power house, pump house, machinery and electrical equipment, water pipe, valves and a standpipe of 100,000 gal. capacity. Plans and specifications are on file at the office of the Improvement Board, Sulphur Springs, and at the office of A. C. Moore, Independence Building, Joplin, Mo. C. J. Williams is chairman of board.

BELDEN, CAL.—The Oro El. Corp., of Oroville, is building a railway from Belden to Humbug Valley, a distance of about 9 miles, to transport material for its power project in the latter place.

**BERKELEY, CAL.**—The City Council has adopted a resolution providing for the installation of electroliters to be erected on both sides of University Avenue from Shattuck Avenue to Grove Street.

**COLUSA, CAL.**—In amended articles of incorporation of the Northern El. Ry. Co. the company has announced the construction of three lines in the immediate future as follows: Sacramento to Hamilton, Chico to Redding and Sacramento to Folsom, a total distance of 204 miles.

GLENDAL, CAL.—The Glendale & Eagle Rock Ry. Co., of Glendale, is planning to build an electric railway from the terminus of its present line in Verdugo Canyon to Montrose and to Los Angeles Avenue in La Crescenta, a distance of about 10 miles. F. D. Goode is president of the company.

GREENVILLE, C.M.—The Indian Valley Lt. & Pwr. Co., it is under-  
stood, will install a 1000-hp unit immediately at its plant on the North  
Fork of the Feather River, near Seneca. The remainder of the ultimate  
capacity of 30,000 hp will be developed gradually.

**LOS ANGELES, CAL.**—The Pacific Lt. & Pwr. Corp., of Los Angeles, has a force of men in the San Gabriel Canyon doing development work in connection with a 6000-kw hydroelectric power plant. About 5 miles of tunnels will be built. The proposed plant will have a pressure head of approximately 1700 ft.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Co. has purchased the property of the Oak Forest Land & Wtr. Co. The property adjoins Eagle Rock Park and embraces the upper end of Eagle Rock Canyon. The Pacific Lt. & Pwr. Co. has commenced the erection of a large transformer station on a portion of the property, which when completed will transform energy transmitted over the high-tension lines from the Big Creek plant.

PORTERSVILLE, CAL.—Work will soon begin on the erection of an additional transmission line for the San Joaquin Lt. & Pwr. Co. of Fresno, to connect the Strathmore substation with the substation at Famosa. The new line will be connected with the Tule River plant

**SPRINGVILLE, CAL.**—Plans are being considered by the Sequoia Camp Meeting Association for making improvements to its property on Tule River. It is proposed to complete the water system for the ground and install electric lamps at once. J. H. Turner, of Lindsay, is president of the association.

WASHINGTON, D. C.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 3 for the construction complete, including the electrical protection conduit and wiring, lighting fixtures, plumbing, heating and ventilating equipment, of vaults, except vault doors, for the new building for the Bureau of Engraving and Printing, Washington, D. C. Drawings and specifications may be obtained at the above office. O. Wenderoth is supervising architect.

CHIPLEY, FLA.—Arrangements have been made by the Chipley L. & Pwr. Co. for installing electric lamps. Bids will be asked for installing machinery, etc., as soon as surveys are completed.

ST. PETERSBURG, FLA.—The St. Petersburg El. Lt. & Pwr. Co. is planning to build a 15,000 kw steampower plant, for which bids for construction will be received March 10. R. E. Ludwig is designing engineer and H. C. Case general superintendent, both of St. Petersburg.

**TAMPA, FLA.**—Extensions and improvements are contemplated by the Tampa El. Co. during the year involving an expenditure of about \$400,000. The company proposes to enlarge its main power house and plan at the foot of Jackson Street on the river front. The output of the plant will be increased 125 per cent.

CONYERS, GA.—The Panola Lt. & Pwr. Co., of Conyers, has applied to the State Railroad Commission for permission to increase its capital stock to \$200,000. The company proposes to rebuild and enlarge its dam on the South River, 8 miles from Conyers, and increase the service. It also plans to build a steam plant at Lithonia to turn

electricity for lamps and motors there and to extend its service to Covington, where it has already applied for a franchise.

DALTON, GA.—The City Council has granted the Georgia Ry. & Pwr. Co. a franchise to supply electricity in Dalton for a period of 99 years. Under the terms of the franchise the company is to furnish energy to factories and industrial plants using 50 hp or more. Those using under 50 hp are to be supplied by the municipal plant.

GRACE, IDAHO.—The Last Chance Canal Co. advises us that it does not contemplate the construction of a hydroelectric power plant at present, but may take up the project in the future. Reported in the issue of Feb. 8 to be contemplating the installation of a power plant, George Telford is secretary and treasurer.

ASHLAND, ILL.—The Village Board has decided to dispose of the municipal electric light plant and an ordinance offering it for sale has been ordered prepared.

AURORA, ILL.—The Interstate Tel. Co. has applied to the City Council for an extension of its franchise as it wishes to make improvements to its system, involving an expenditure of over \$75,000. The proposed work includes the installation of a new switchboard, etc.

CAMBRIDGE, ILL.—Bids will be received by E. E. Fitch, county clerk, until April 22 for wiring the new Henry County Infirmary.

CHICAGO, ILL.—In his last annual report the general superintendent of police asks for rehabilitation of the police, telephone and patrol-box system, at an estimated cost of from \$100,000 to \$300,000.

DE KALB, ILL.—The City Council has closed a contract with the Illinois Northern Utilities Co., of Chicago, for the installation of 60 concrete lamp posts and lamps.

ELGIN, ILL.—The annual budget of the City Council provides for an appropriation of \$700 for an expert report upon the feasibility of establishing a municipal electric-light plant. The West Side Chamber of Commerce has appointed a committee to investigate street lighting conditions. Dr. J. R. Tobin is president.

ELKVILLE, ILL. — C. T. Bass & Son have been granted a franchise to erect transmission line to distribute electricity for lamps and motors here.

ELMWOOD, ILL.—The Elmwood El. Lt. Co. has sold its property to

R. S. Wallace, of Peoria, representing Eastern capitalists, who also operate the People's El. Service Co., of Farmington. The local plant supplies electricity in Elmwood, Yates City, Douglas, Maquon, Brimfield, Milledgeville and Princeville. The transmission lines will be connected with the plants at Farmington and Cuba, so that power may be furnished from either plant in case of emergency.

ERIE, ILL.—The Illinois Northern Utilities Co., of Chicago, has asked the Village Board for a 90-day extension in which to complete a transmission line to Erie. In consideration of this grant the company offers to furnish electricity for lighting school buildings up to 400 kw per year. A 10-year contract for street lighting is asked.

HILLSBORO, ILL.—The electric railway company, which is financed by the Hillsboro El. Lt. & Pwr. Co., it is reported, has made arrangements to build this summer an interurban railway east from Hills to the city of Schram City, Irving and Witt to Nokomis. Negotiations for a franchise in Schram City have begun. The cost of the proposed railway is estimated at \$400,000. I. J. Frey, of Hillsboro, is president.

JACKSONVILLE, ILL.—At an election to be held April 15 the proposition to issue \$50,000 in bonds for the installation of a complete municipal electric-light plant will be submitted to a vote. Joseph F. Brennan is commissioner of Department of Public Property.

LEWISTON, ILL.—The Lewiston El. Co. has increased its capital stock from \$5,000 to \$50,000.

**MOLINE, ILL.**—The Central Union Tel. Co. contemplates improvements to its lines in Moline and Watertown, involving an expenditure of about \$70,000. A new exchange will be built in Moline and a new one erected in Watertown.

MORRISONVILLE, ILL.—The Hillsboro El. Lt. & Pwr. Co. is installing a 200-hp turbo-generator set at its plant here to supply power during the winter in Morrisonville, Palmyra, Harvard and Morris. In the summer months the power will be supplied from the Hillsboro and the local power house closed down.

MOUNT PULASKI, ILL. The Missouri Planters' Co. & Co. asked the City Council for a 3-year franchise to occupy and use the public plant, the old tram line, for a road. If granted, the company will prove its plant. The company is now in the process of extending its lines to Chester, Kenton, and Leitch, and is also in the process of extending its lines to farmhouses along the present road.

PONTIAC, ILL.—The Public Service Co. of Northern Ill. has been authorized by the Federal Public Utilities Commission to purchase the property of the Chicago & North Western Ry. Co. in the city of Pontiac, Ill. The purchase will include the right of way, tracks, bridges, and other facilities. The commission has also authorized the company to acquire the right of way for a new line of street cars to be operated between Pontiac and Chicago. The new line will be operated by the Chicago & North Western Ry. Co. and will be a part of the Chicago & North Western Ry. Co. railway system.

SPRINGFIELD, Ill.—The Springfield Journal, No. 100, will be published at the Springfield station and an edition will be furnished to the post office at Springfield, Mo., at the Springfield station, Springfield, Mo.

TISKILWA, ILL.—The Spring Valley Lt. & Pwr. Co., of Spring Valley, has applied to the Village Board for a franchise to supply electricity.

for lamps and motors in Tiskilwa. Energy will be supplied from a transmission line which will be erected from Spring Valley to Buda and Neponset. The company asks for a 20-year contract for lighting the streets of the village at \$15 per lamp per year. It also proposes to erect transmission lines from Spring Valley to Bureau and Depue.

**WARREN, ILL.**—The Village Board has accepted the proposition of F. F. Morrison, of Dixon, Ill., to establish an electric light plant here.

**GOSHEN, IND.**—The City Council has voted to install ornamental street lamps in the business district.

**INDIANAPOLIS, IND.**—The Indianapolis Lt. & Ht. Co. has voted to increase its capital stock from \$1,000,000 to \$2,000,000, the proceeds to be used for improvements and extensions to its system. The company proposes to install a storage battery at the Wabash Street station and enlarge its Mill Street power house.

**LOGOOTEET, IND.**—Application has been made to the City Council by George E. King, representing F. J. Burger & Co., of Petersburg, for a 20-year franchise to erect and operate an electric-light plant here. The company also asks for a street-lighting contract, to become effective at the expiration of the present contract, the amount to be not less than \$1,800 per year for public lighting.

**AUDUBON, IA.**—R. G. Wieland, of Walnut, Ill., is negotiating for the purchase of the local electric-light plant. Mr. Wieland proposes to extend a transmission line to Exira to furnish electrical service there. If the deal goes through a 24-hour service will be established.

**CHARLES CITY, IA.**—The City Council has appointed a committee to look into the proposition submitted by George E. May, of the Charles City Wtr. Pwr. Co. The company offers to sell its entire property and business to the city for \$75,000.

**HAWKEYE, IA.**—The proposition to grant a franchise to C. Miller & Sons, of Clermont, has been approved by the voters.

**KEOKUK, IA.**—Plans are being considered to change the entire street-lighting system, and to install a boulevard lighting system, covering the city. The Keokuk El. Co. has the contract for street lighting.

**LEON, IA.**—The Leon El. Co., of Leon, is erecting a transmission line to Garden Grove. The company has franchises to furnish electricity in Humeston, Leroy, Weldon and Van Wert.

**OSSIAN, IA.**—The installation of an electric-light plant in Ossian is under consideration. The cost of the plant is estimated at about \$8,000.

**PETERSEN, IA.**—The equipment of the power plant of the Petersen Power & Milling Co. includes two Trump waterwheels equipped with Woodward governors, instead of two Woodward waterwheels, as stated in the issue of March 1.

**VINTON, IA.**—John Redmond, of Cedar Rapids, has transferred his property interests near site of proposed dam to William C. Dows, president of the Iowa Ry. & Lt. Co. The company, it is said, is making preparations to build a power dam.

**ZEARING, IA.**—The Village Board has called a special election to be held March 21 to vote on the proposition to grant a franchise to the Iowa River Lt. & Pwr. Co., of Eldora, to distribute electricity in the village.

**AUGUSTA, KAN.**—At an election held Feb. 24 the proposition to construct a municipal electric-light plant was carried. Work will begin on the proposed plant as soon as arrangements can be made. J. R. Switzer is city engineer.

**CANTON, KAN.**—Bids, it is reported, are being asked by the city officials, of Canton for the installation of a municipal electric-light plant, bonds for which have been authorized.

**DOUGLASS, KAN.**—The installation of an electric-light plant in Douglass is under consideration. Local business men are said to be interested in the project.

**SALINA, KAN.**—The Salina Lt., Pwr. & Gas Co. has submitted a proposition to the City Council for the installation of an ornamental street-lighting system. The plans provide for the erection of fifty-seven ornamental standards, to cost about \$4,300.

**TURON, KAN.**—At an election held recently the proposition to issue \$20,000 in bonds for the installation of a municipal electric-light plant was carried.

**LEXINGTON, KY.**—The Lexington Utilities Co. has applied to the city commissioners for a 20-year franchise. The old franchise has still three years to run. The company asks for the new franchise to enable it to issue bonds to pay for improvements contemplated.

**NAPOLEONVILLE, LA.**—Bids will be received by the Mayor of Napoleonville until March 17 for furnishing material and installing a complete electric-light plant and system. Oil is to be used as fuel.

**BELFAST, MAINE.**—The Penobscot Bay El. Co., of Belfast, has secured the contract for wiring and lighting the residence of Ira M. Cone, of Chicago, Ill., now being constructed in Northport. Work will begin on the extension of the transmission line early in the spring. The company will probably furnish electricity for lighting the cottages on the North Shore at Northport.

**BALTIMORE, MD.**—Plans are being considered by Ezra B. Whitman, city water engineer, and Robert J. McCuen, superintendent lamps and lighting, for utilizing the overflow from the dam at Loch Raven to generate electricity for lamps.

**CHESAPEAKE CITY, MD.**—The Elkton Lt. & Pwr. Co., of Elkton, has submitted a proposition to the town to furnish electricity for lamps and motors.

**HAGERSTOWN, MD.**—Arrangements are being made for the installation of an ornamental street-lighting system here. The cost of the standards is estimated at about \$30 each, to be paid by property owners. The city will maintain the lamps.

**CHHOPE, MASS.**—Plans have been announced by the Amherst Pwr. Co. for enlarging its substation in Chhoepe to enable it to supply 1500 kw additional power contracted for by the Springfield St. Ry. Co. The Amherst company will duplicate the present equipment of the plant. The contract will take effect as soon as the installation is completed.

**CLINTON, MASS.**—The Selectmen and the Clinton Gas Lt. Co. have reached an agreement on the new street-lighting contract. Under the terms of the new contract the company will furnish 100 tungsten lamps of 80 cp and 577 tungsten lamps of 40 cp. At present there are 33 tungsten lamps of 40 cp and 304 tungsten lamps of 32 cp.

**EAST MATTAPoisett, MASS.**—The New Bedford Gas & Edison Lt. Co., of New Bedford, has submitted a proposition to the owners of the cottages on Crescent Beach offering to extend its electric-lighting service to that colony.

**GREENFIELD, MASS.**—The Greenfield El. Lt. & Pwr. Co. has sold all its rights in the Deerfield River, except Gardner Falls power rights, to the New England Pwr. Co., of Maine. The sale includes real estate and flowage rights along the river at the site of the dam construction near West Deerfield.

**LYNNFIELD, MASS.**—Committees representing the Lynnfield Public Improvement Society and the Lynnfield Center Civic League have decided to put an article in the town warrant providing for lighting the town with fifty lamps in each village for a period of five years, the placing of the contract to be left with the committee to be appointed by a vote of the town.

**SANDWICH, MASS.**—The Buzzards Bay El. Co., of Falmouth, has submitted a proposition offering to extend its transmission lines to Sandwich, providing sufficient patronage is guaranteed the company.

**SPRINGFIELD, MASS.**—The Springfield St. Ry. Co. has contracted with the Amherst Pwr. Co. for additional power to operate the city lines when the Margaret Street plant is overtaxed. The contract calls for 1500 kw.

**SPRINGFIELD, MASS.**—Plans are under consideration for improvements to the power plant and shops of the United States Army at Springfield. Two new boilers will be installed this spring, and it is hoped to install a second pair in the early summer. Col. W. S. Peirce, commandant, is planning to abolish the present system of mechanical drive from a Corliss steam engine as soon as the appropriation can be secured and to substitute electric motors in the gun-making factory and other portions of the plant. A turbo-generator installation will probably replace the existing equipment.

**WARE, MASS.**—The Selectmen have authorized the Ware El. Co. to replace the southern circuit of street lamps with cluster lamps similar to those now in use on the northern circuit. H. M. Parsons is superintendent of the Ware El. Co.

**WORCESTER, MASS.**—The Wright Wire Co. has entered into a 10-year contract with the Connecticut River Transmission Co., Fitchburg, to supply energy to operate both its Worcester and Palmer plants. The wire company will abandon its own plants.

**FLINT, MICH.**—The lighting committee of the Council is considering the installation of cluster lamps.

**HOUGHTON, MICH.**—Work has been begun on the construction of the power house for the new hydroelectric power plant of the Oliver Milling Co. The building will be 55 ft. by 61 ft., three stories high. Work will soon start on the new concrete dam. G. H. Robey has charge of the work.

**MONROE, MICH.**—The Toledo, Ottawa Beach & Northern Ry. Co., of Toledo, it is reported, will extend its railway from Toledo Beach to Monroe Piers, a distance of 7 miles.

**MOUNT MORRIS, MICH.**—An election will be held March 10 to submit the proposition of granting a franchise to furnish electricity for lamps and motors for both the business and residential district.

**STEPHENSON, MICH.**—The Menominee & Marinette Lt. & Trac. Co. has been granted a franchise to erect transmission lines to distribute electricity here. The residents of Daggett, 3 miles distant, are negotiating with the company for extension of the line to that place.

**DULUTH, MINN.**—The Great Northern Pwr. Co., of Duluth, has decided to install an additional motor-generator set at its Thompson plant, increasing the output of the plant from 48,000 hp to 62,000 hp. The cost of the work is estimated at about \$300,000.

**MANKATO, MINN.**—A committee has been appointed by the Mankato Commercial Club to investigate the advisability of installing an ornamental street-lighting system on Front Street. The Consumers' Pwr. Co. has the contract for street lighting.

**ROSEAU, MINN.**—The proposition to issue \$14,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters on March 11. P. H. Buran is clerk.

**WYOMING, MINN.**—The Village Council has asked the St. Croix El. Lt. Co. to extend its transmission line from Chicago City to Wyoming to furnish electricity here.

**CRANE, MO.**—J. R. Woodfill, representing the Aurora El. Lt. Co., of Aurora, and W. N. Castle, of Lancaster, Pa., representing Eastern capi-



talists, have submitted a proposition to install an electric-light system in Crane.

**GALENA, MO.**—Work has begun on the construction of a dam and hydroelectric power plant on the James River at Virgin Rock, near Galena. General William H. Standish, of Aurora, and associates are interested in the project.

**ROLLA, MO.**—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 1, for the construction, including plumbing, heating apparatus, gas piping, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Rolla, Mo. Drawings and specifications may be obtained at the above office or from the custodian of site. O. Wenderoth is supervising architect.

**SPRINGFIELD, MO.**—Steps have been taken by local business men to organize a company with a capital stock of \$200,000 to build a private plant here. The proposed plant is to be sold to the city any time it wants to try municipal ownership.

**WEBB CITY, MO.**—Plans are being considered by the City Council for the installation of a new street-lighting system here. Cluster lamps and arc lamps are both under consideration.

**HAYRE, MONT.**—The committee appointed to make investigations relative to the installation of a municipal electric-light plant has reported in favor of the project and recommends that the proposition to issue \$50,000 in bonds for this purpose be submitted to the voters at the coming spring election.

**PLAINS, MONT.**—The Thompson Falls Pwr. Co. contemplates extending its transmission lines to furnish electricity in Iron Mountain, St. Regis, Paradise, Plains and Eddy.

**FREMONT, NEB.**—Work, it is reported, will soon begin on the construction of a hydroelectric power plant at Fremont. Electricity generated at the plant will be transmitted to Omaha and distributed by the Omaha El. Lt. & Pwr. Co.

**HASTINGS, NEB.**—The City Council has instructed the light commissioner to purchase 60 arc lamps to be erected in outlying portions of the city.

**HILDRETH, NEB.**—The proposition to issue \$4,000 in bonds for an electric-light system and \$6,000 in bonds for water-works has been approved by the voters.

**LINCOLN, NEB.**—George Steinmeyer, of Holmesville, has filed application with the state engineer asking for water rights on the Blue River to be developed for power purposes. One of the plants will be located at Hoag, where 218 hp. will be developed, and the other at Barneston, developing 670 hp. A dam 20 ft. high will be built at each place.

**OREANA, NEV.**—Surveys have been made for the site of the power plant in Oreama to be erected by the Nenzel El. Co., which will supply electricity for lamps and motors for mines and towns of Rochester and Oreama. Bids have been received for machinery, and work will begin at once on construction of power plant and erection of transmission lines. The initial installation will provide for about 200 hp., which will be increased as the demand increases.

**GREENFIELD, N. H.**—The Keene Gas & El. Co., of Keene, and the Ashuelot Gas & El. Co., of Ashuelot, have filed a joint petition with the Public Service Commission asking permission to extend their transmission lines into the town of Greenfield.

**LACONIA, N. H.**—The Laconia Gas & El. Co. has petitioned the Public Service Commission for permission to extend its transmission lines into the town of Tilton.

**NEW BOSTON, N. H.**—The Manchester Traction, Lt. & Pwr. Co., of Manchester, is contemplating extending its transmission lines to New Boston for the purpose of supplying electricity for lamps and motors.

**MORRISTOWN, N. J.**—The Morris & Somerset El. Co. has been granted permission by the Board of Public Utility Commissioners to issue \$50,000 in bonds, the proceeds to be used for extensions and improvements to its plant and distributing system.

**MORRISTOWN, N. J.**—The Morris & Somerset El. Co. has entered into a contract with the Newark Conference Camp Meeting Association for lighting the streets of the village of Mount Eden for ten years. The contract provides for eighty-six street lamps also to light about 150 private residences during the summer.

**TRENTON, N. J.**—Plans are being considered for establishing a municipal electric-light plant to supply electricity for lighting the streets and public buildings in the city. It is expected that the proposed plant will be located at the pumping station. William I. Back and George R. La Barre are city commissioners.

**TRENTON, N. J.**—An appropriation of \$30,000 has been asked for the erection of a central power plant at the New Jersey State Hospital for the Insane. The present plants are in need of repairs and with the erection of the proposed building for the criminal insane additional power will be required.

**TRENTON JUNCTION, N. J.**—The Fwing township committee is negotiating with the Public Service El. Co. for the installation of an electric-lighting system in Trenton Junction.

**BINGHAMTON, N. Y.**—The Council has passed a new boulevard extension bond issue ordinance, which includes two Court Street Bridge Main Street to Front and Water Street, from Court to Henry, on the

original plans, decreasing the bond issue to \$85,000, and raising the lot amount to be voted at the election to be held March 25.

**CHATHAM, N. Y.**—The Public Service Commission, Second District, has authorized the Chatham El. Lt. & Pwr. Co. to extend transmission to the towns of Ghent and Pultney and the village of Pultney. The application was supported by the Board of Trustees of Pultney.

**ELTON, N. Y.**—The proposition to issue \$25,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant will be submitted to the voters at the next village election. The improvements contemplated include the purchase and installation of a 600-hp steam turbine, a 200-hp boiler and a 500-kw generator.

**NEW YORK, N. Y.**—The Public Service Commission has adopted a resolution directing the company to prepare a certificate approving the construction of the plant of the Long Acre El. Lt. & Pwr. Co. and authorizing the exercise of its franchise.

**POUGHKEEPSIE, N. Y.**—The Board of Supervisors of Dutchess County is considering the question of installing an electric plant to light the county court house. B. Frank Green, of Matinecock, is chairman of the board.

**DURHAM, N. C.**—The Board of Aldermen has awarded the contract for street lighting to the Durham Traction Co. The contract is for a period of ten years and provides for 600 arc lamps at a cost of \$60 each per year. The company agrees to install new street lamps throughout the city.

**HENDERSON, N. C.**—Attiensburgh, N. C., has contracted with the Manufacturers' Pwr. Co. for a hydroelectric development on Green River, in Henderson County, North Carolina. Plans provide for a concrete dam, 164 ft. high, at the mouth of the Thomas River, 7 miles from Henderson. The proposed power plant will develop about 5,000 hp and will involve an expenditure of about \$1,000,000. W. S. Montanary, of Spartanburg, is president and Luke A. Lark, of Henderson, is treasurer.

**BERTHOLD, N. D.**—The installation of an electric-light plant at the poor farm south of the city is contemplated by the Board of County Commissioners.

**DEVIL'S LAKE, N. D.**—The contract for the installation of the municipal street lighting system has been awarded to Roberts & Pichard, of Minneapolis, Minn., for \$12,995.

**NEW SALEM, N. D.**—W. G. Woodruff, of Bismarck, is negotiating with local business men with regard to selling the town for transmitting electricity for lighting purposes.

**BENTON RIDGE, OHIO.**—The Western Ohio Ry. Co., of Lima, contemplates extending its electric-lighting service to Benton Ridge. A transmission line will be erected from here to Ravenna. It is proposed to furnish electricity to farmers along the line between Benton Ridge and Ravenna.

**COLUMBUS, OHIO.**—The Columbus, Delaware & Marion Ry. Co. contemplates the purchase of one 600-hp turbine and three 200-hp boilers for its power plant in Marion during the year.

**DAYTON, OHIO.**—Negotiations are being made by the Rubber Works Co., of Dayton, with a view of erecting a transmission, condenser, steam plant. It is expected that the proposed building will also supply water accommodations for other concerns.

**DELAWARE, OHIO.**—The City Council has granted the Delaware El. Lt. & Pwr. Co. permission to replace the incandescent lamps with incandescent lamps. The company proposes to install an entire new equipment, except boilers, in its plant during the summer.

**FAIRFAXVILLE, OHIO.**—The Cleveland, Painesville & Western R. R. Co., of Willoughby, has purchased the property at the Lake El. & Pwr. Co., of Painesville, which furnishes electricity to Fairport, and other towns and rural sections of Lake and Ashland Counties. J. W. Moore, of Cleveland, is president of the Cleveland, Painesville & Western R. R. Co.; J. E. Latimer, of Cleveland, is president of the Lake El. & Pwr. Co.

**CLEVELAND, OHIO.**—The Cleveland, Painesville & Western R. R. Co. has been authorized by the Board of Public Utility Commissioners to issue \$50,000 in bonds for the purpose of extending its transmission lines to the city of Cleveland.

**ELGIN, ILL.**—The Elgin El. Ry. Co. is negotiating with the Elgin & Rockford El. Ry. Co. for the purchase of the Elgin & Rockford El. Ry. Co. and will eventually extend to North Elgin and Rockford, Ill., and will do the same to St. Louis.

**PORTLAND, ORE.**—The Portland El. Ry. Co. is negotiating with the Portland El. Ry. Co. for the purchase of the Portland El. Ry. Co. and will eventually extend to North Elgin and Rockford, Ill., and will do the same to St. Louis.

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appropriating \$25,000 for the survey of the Celilo water-power project. The project is to be carried out in conjunction with the State of Washington.

**PANAMA.**—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until March 26 for furnishing electric traveling cranes, steel rail, angle bars, truck bolts, switches, track frogs, tie plates, track chisel, etc. Blanks and general information relating to this circular (No. 764) may be obtained from the above office or from the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

**CENTER SQUARE, PA.**—The Citizens' Improvement Association of Center Square has decided to take steps to get an electric-lighting system for the township. Petitions are being circulated to secure the signature of property holders. It is proposed to install 60 lamps, at a cost of \$60 each per year, the service to be furnished by the Counties Gas & El. Co., of Norristown.

**MAHANOEY CITY, PA.**—The Harwood El. Co. expects to make improvements to its system at Mahanoy City and Shenandoah soon, involving an expenditure of about \$100,000. The new substation at the old plant of the People's Lt., Ht. & Pwr. Co. is well under way. John S. Wise, Jr., of Hazelton, is manager.

**READING, PA.**—The City Council has appointed a committee to make investigations and secure estimates of the cost of installing a municipal electric-light plant.

**READING, PA.**—The Metropolitan El. Co., of Reading, has decided to rebuild on the Schuylkill River below Reading. The plant will have an output of 4000 hp. The Reading Transit Co. is closing a contract at Phoenixville for developing power on the Schuylkill at the point. The plant will have a generating capacity of 3200 hp. A contract for developing power at the Norristown dam is about closed, where over 3200 hp will be developed.

**GALVESTON, TEX.**—Sealed proposals will be received by John M. Murch, county auditor, Galveston, until March 11, for installing an ornamental lighting system on Galveston Seawall Boulevard, between Nineteenth and Twenty-seventh Streets, consisting of 57 ornamental standards carrying five-lamp clusters and eight ornamental arc lamp standards, together with all cable, lamps and other material necessary to make the installation complete as per plans and specifications, copies of which may be had on application.

**RIVIERA, TEX.**—The Riviera Beach Interurban Ry. Co. is preparing to construct an extension of its railway from Riviera to Fallfurias, a distance of about 15 miles.

**OGDEN, UTAH.**—The city commissioners and the Weber Club have ratified the joint contract for the installation and maintenance of an ornamental street-lighting system in the business district. The contract provides that one-half of the cost of the installation is to be paid by the Weber Club. The club is also to be responsible for one-half of the cost of maintenance of the system for the first year. The remaining half is to be paid by the Ogden Rapid Transit Co., which is to have free use of the poles for supporting the trolley wires. The Merchants' Lt. & Pwr. Co., in addition to supplying current, will furnish the arc lamps and keep the poles in repair. The Merchants' company is to receive \$4.75 per lamp per month for furnishing electricity for the system.

**BRISTOL, VA.**—The contract for standards for the proposed ornamental street-lighting system has been awarded to the Union Foundry Co., of Anniston, Ala. The Aldermanic Board of Bristol, Tenn., has made arrangements with the local lighting company for the installation of an ornamental lighting system on the Tennessee side of the city.

**DORCHESTER, VA.**—Preparations are being made by the New York Mining & Manufacturing Co. for the erection of a power plant in Dorchester. The proposed plant will be equipped with four boilers with rating 500 hp each, generator and turbine engine. Contracts have been closed and work will begin immediately. M. S. Kemmerer, 143 Liberty Street, New York, N. Y., is president.

**NORFOLK, VA.**—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 22 for furnishing a three-wire direct-current engine-driven 125-kw generator at the United States Naval Hospital, Norfolk, Va. Estimated cost, \$5,200. Plans and specifications may be obtained on application to the bureau or to the commandant of the navy yard. H. R. Stanford is chief of bureau.

**RICHMOND, VA.**—The Council committee on public buildings, properties and utilities has recommended to the City Council the installation of an ornamental lighting system for the entire downtown business section at a cost of \$26,192 for installation and \$5,438 per year for maintenance.

**ASOTIN, WASH.**—Work will begin at once on the construction of the proposed electric railway between Asotin and Clarkston, a distance of about 10 miles. The cost of the work is estimated at about \$300,000. F. L. Strum, of Lewiston, Idaho, is interested.

**BELLINGHAM, WASH.**—The Stone & Webster Engineering Corp., of Boston, Mass., is investigating the feasibility of building an electric railway north from Bellingham into the Nooksack Valley, and ultimately to Vancouver, B. C. The company also contemplates the construction of a railway from Mount Vernon southward to Everett, thereby closing the only missing link between this city and Tacoma.

**BREMERTON, WASH.**—The City Council has granted the Northwest Gas, El. & Wtr. Co. a 25-year franchise. The company will begin work at once on the construction of a plant to cost about \$75,000.

**CLE ELUM, WASH.**—The Kittitas Ry. & Pwr. Co. is planning to erect a hydroelectric power plant near Salmon La Sac. The company recently purchased 1000 in. of water per second from J. V. Hoeffler.

**ELBERTON, WASH.**—Preparations have been made by the Washington Wtr. Pwr. Co., of Spokane, to connect this city with its main power line east of here.

**EPHRATA, WASH.**—A movement has been started for the installation of a municipal electric-light plant here.

**NORTH YAKIMA, WASH.**—The Yakima Valley Transportation Co. will begin work immediately laying track on the Selah extension of its system.

**OLYMPIA, WASH.**—Governor Lister and a special legislative committee which investigated the Celilo Rapids power project have recommended that the State of Washington appropriate \$15,000 in aid of Oregon in an engineering investigation to determine whether the development of the proposition should be undertaken by the two States.

**ORTING, WASH.**—Plans are being prepared and estimates being received for establishing a municipal electric-light and power plant in Orting.

**PASCO, WASH.**—The City Council has entered into a contract with the Pacific Pwr. & Lt. Co. for the installation of cluster lamps, at \$28 per standard per year.

**TACOMA, WASH.**—The City Council is considering the question of furnishing electricity for heating and cooking purposes at a very low rate. If this policy is adopted, new substation equipment will be required. At present the substation is equipped to handle only about one-half of the output of the La Grande plant. The cost of the new equipment is estimated at about \$33,000.

**TACOMA, WASH.**—Plans are being considered for connecting the municipal electric-light plants of Tacoma and Seattle. The cost of erecting the transmission line is estimated at about \$100,000. If the project is carried through it is proposed to furnish electricity to towns along the route. A. L. Thorn is superintendent of the Tacoma plant, and J. D. Ross is superintendent of the Seattle plant.

**BERKELEY SPRINGS, W. VA.**—The Cacapon Pwr. Co. has sold its power plant in Berkeley Springs and on Cacapon Creek to the Winchester & Washington City Ry. Co. The Cacapon Pwr. Co. furnishes electricity in Berkeley Springs, Great Cacapon and Hancock.

**CHARLESTON, W. VA.**—Sealed proposals will be received until March 28 at the office of the supervising architect, Treasury Department, Washington, D. C., for the installation, complete, of an electric elevator in connection with the extension of the United States post office and court house at Charleston, W. Va., in accordance with drawings and specifications, copies of which may be had at the above office.

**JANESVILLE, WIS.**—The State Street Advancement Association expects to be ready to proceed with the installation of the proposed ornamental street-lighting system on State Street in the spring. Approximately \$7,000 has been raised among the property owners for the new system. It is proposed to erect ornamental standards on each side of the street and eliminate the arc lamps at the intersections.

**LONE ROCK, WIS.**—A special election has been called for April 1 to vote on the proposition to issue \$5,000 in bonds to build an electric-light plant.

**NEENAH, WIS.**—The Wisconsin Trac., Lt., Ht. & Pwr. Co. contemplates installing a new generator in its Neenah plant, increasing the output from 1000 hp to 1500 hp.

**DUNCANS, B. C., CAN.**—Bids will be received by the city clerk until March 13 for water turbines, generators, exciters, transformers and switching equipment. Specifications may be obtained from DuCane, Dutcher & Co., Rogers Building, Vancouver, B. C.

**SOUTH VANCOUVER, B. C., CAN.**—The British Columbia El. Co., of Vancouver, is contemplating extending the Davie street car system through from Twenty-fifth Avenue to the Fraser River Valley. A section of the proposed line will be built at once.

**VANCOUVER, B. C., CAN.**—The Western Canada Pwr. Co., of Vancouver, will extend its transmission lines at once to Millardville to supply electricity for lamps and motors there.

**BERLIN, ONT., CAN.**—The Light Commission is planning extensions and improvements to the gas and electric departments involving an expenditure of about \$70,000. Of this amount \$35,000 will be expended for gas mains, increasing transformer capacity and service extensions in the electrical department.

**BRECHIN, ONT., CAN.**—The ratepayers have approved the by-law to enter into a contract with the Hydro-Electric Power Commission for Niagara power.

**IROQUOIS FALLS, ONT., CAN.**—The Abitibi Pulp & Paper Mills, Ltd., which is building a large paper mill at Iroquois Falls, on the Abitibi River, has obtained a lease of the water-powers of Iroquois Falls and Couchiching Falls, and also has the right to hold and control the waters of Abitibi Lakes for power purposes. Henry Holgate, of Montreal, has reported on the water-powers and estimates the total power available to be 57,193 shaft hp.

LONDON, ONT., CAN.—Announcement has been made by Adam Beck that three new hydroelectric transmission lines will be erected radiating from London this spring. The proposed lines will serve the agricultural districts and a number of small towns and villages. The first will run to Dorchester, Thorndale and Thamesford; the second will serve St. John's, Birr, Masonville, Lucan and other points, and the third will run from Hamilton Road station through Westminster, Lambeth, Delaware, Mount Brydges, Glencoe, Melbourne and Strathroy.

OWEN SOUND, ONT., CAN.—The Hydro-Electric Commission of Ontario has submitted a proposition to the town of Owen Sound, offering to furnish energy at \$29 per hp per year, stepped down to a low voltage. It is expected that the town will contract for 1500 hp. If the offer is accepted, it is understood that work will begin at once on the development of Eugenia Falls and a transmission line erected from Eugenia to Owen Sound. F. F. Espenschied is engineer of the commission. J. R. McEldon is superintendent of the municipal plant.

TILBURY, ONT., CAN.—Steps have been taken to obtain electricity from the Hydro-Electric Power Commission.

WESTBORO, ONT., CAN.—The installation of an electric light system in this village is under consideration.

OUTREMONT (MONTREAL), QUE., CAN.—The Town Council has announced that it proposes to establish a municipal electric light plant. The plans include the building of underground conduits.

REGINA, SASK., CAN.—By-laws authorizing an expenditure of \$2,750,000 were voted by the ratepayers on Feb. 25 for civic improvements, including extensions to street railway system, water mains, sewers, new electric light and power plant, new civic buildings, overhead bridge, etc.

REGINA, SASK., CAN.—Tenders will be received by the City Commissioners of Regina, Sask., until March 29, for electrical department supplies as follows: Section (1)—weather-proof copper wire; (2)—Western cedar poles; (3)—cross arms; (4)—top pins, insulators, etc.; (5)—pole-line hardware; (6)—pole-type transformers; (7)—integrating watt meters, single, polyphase and two-phase; (8)—metal-frame arc lamps and station equipment; (9)—series cut-out mast arms for arc lamps; (10)—underground material; (11)—break-arm boxes and sockets, price to be f.o.b. Regina. Copies of specifications may be had from E. W. Bull, superintendent of light and power.

## New Industrial Companies

THE EDEN SPECIALTIES CORPORATION, of New York, N. Y., has been incorporated by J. B. Kissam and B. Darrah, Jr., and F. F. Hazard, of New York, N. Y. The company is capitalized at \$25,000 and proposes to manufacture and deal in electrical devices.

THE EQUIPMENT IMPROVEMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of \$100,000 for the purpose of manufacturing signaling and safety devices. The incorporators are: Alexander Turner, Robert H. Weatherly and Frank H. Clark, all of 30 Church Street, New York, N. Y.

THE GLOBE ELECTRIC CO., of Philadelphia, Pa., has been incorporated by Casimir Kalderna, Frank Strauss and Howard W. Thomas, all of Philadelphia, Pa. The company is capitalized at \$25,000 and proposes to deal in electric motors, switchboards, etc.

THE HOT SPARK MAGNET COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of \$10,000 by P. Riedele, A. T. Kwajel and Mary Riedele.

THE HURLEY ELECTRIC TOOL COMPANY, of Chicago, Ill., has been incorporated with a capital stock of \$5,000 to manufacture and deal in electric tools, machinery, etc., by Neil C. Hurley, L. E. Brigham and Walter T. Haynie.

## New Incorporations

LOS ANGELES, CAL.—The Inyo County Wtr. & Pwr. Co. has been incorporated with a capital stock of \$200,000 by Louis Luckel, L. A. Gork and J. E. Pettijohn.

LAPORTE, IND.—The Laporte, Logansport & Southern Ry. Co. has been incorporated with a capital stock of \$100,000 to construct and operate an electric railway from Laporte to Logansport. The company also proposes to supply electricity to lamps and motors through towers and communities along the proposed railway. The directors are: Warren W. Travis, P. O. Small, C. J. Loetz, R. N. Smith and Ora Bosserman.

FRANKFORT, KY.—The McKinney El. Co. has been incorporated with a capital stock of \$2,000 by M. McKinney, Eugene Hoge and W. H. Hoge.

DENMARK, MAINE.—The Denmark Lt. & Pwr. Co. has been incorporated with a capital stock of \$5,000. The officers are: Henry M. Cobb, president; Alfred P. Cobb, treasurer, and E. S. Cobb, clerk, all of Denmark.

FOSTORIA, OHIO.—The Fostoria El. Co. has been incorporated with a capital stock of \$100,000 by Frank Espy, H. H. Henzy, James F. Loftus, Ralph A. Burgess and William N. Dore.

## Trade Publications

CIRCUIT-BREAKERS FOR RAILWAY SERVICE.—Bulletin No. A4086 of the General Electric Company is devoted to the subject of circuit-breakers for railway service.

BELT DRESSING.—The new standard "Belt Dressing" is the title of a bulletin just published by the Clegg-Surface Company, Buffalo, N. Y. It shows a number of interesting examples of treated rope drives and gives accurate technical data.

AUTOMOBILE ACCESSORIES.—Catalog 1, new issue, issued by the Superior Lamp Manufacturing Company, 124th Street and First Avenue, New York. It contains brief illustrations and captions of its electric head lamps, tail lamps, dashboard and other automobile accessories.

FIXTURES.—In the "Furniture", issued by the Tinsmith Works of the General Electric Company, Cincinnati, Ohio, is given much information on the latest developments in the fixture industry. The publication contains many suggestions that should prove of value to the fixture dealer.

SIGN RECEPTACLES.—Bulletin No. 760, issued by Pass & Saxe, Inc., Solvay, N. Y., contains sixteen pages devoted to lead in descriptions and miniature illustrations of sign and outlet box receptacles and gives views of a number of prominent signs in various parts of the country using these devices.

WATT-HOUR METERS.—The Sargamo Electric Company, Springfield, Ill., is distributing Bulletin No. 34, descriptive of its complete line of single-phase and polyphase induction watt-hour meters. This bulletin has been arranged with particular reference to use by central-station meter superintendents desiring complete information on the latest metering developments.

REVERSING MOTORS FOR PLANERS, SLOTTERS, ETC.—In Bulletin No. A4081, issued by the General Electric Company, reversing motors for planers, slotters, etc., are treated in detail. The publication contains various curves which show the advantage of direct drive over belt drive and, therefore, the advantage of reversing motors. Various auxiliary appliances are also illustrated.

LIGHTNING ARRESTERS.—The Electric Supply Company, Seventeenth and Cambria Streets, Philadelphia, Pa., has issued a well-printed and excellently illustrated sixty-eight-page pamphlet of Barton Daniels lightning arresters. It contains information on lightning phenomena, the construction, installation and operation of alternating-current and direct-current arresters, and the grading and spacing of arresters.

PORTABLE LAMP WITH "EYE COMFORT" SYSTEM.—A novel variation of the "Eye Comfort" lighting system, is the title of the Curtis portable lamp, is the subject of a bulletin issued by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill. Some beautiful designs of table and floor pedestals for use with the "Eye Comfort" system are shown. These are especially suitable for libraries, drawing or music rooms.

PORTABLE ELECTRIC DRILLS.—The Standard Electric Tool Company, of Cincinnati, Ohio, has recently issued Bulletin P-1, describing the Standard high-power direct-current portable electric drills, and Bulletin B-2, performing a similar service for the Standard high-power alternating-current portable electric drills for two-phase and three-phase.

REVOLUTORS.—The New York Revolving Platform Elevator Company, Jersey City, N. J., has recently issued Bulletin No. 1, in which its motor-driven revolvers for table turning are shown with a revolving base) are described and fully illustrated. The use of this apparatus increases the storage capacity of one's shelves and stock racks by from 20 to 50 per cent, as the revolvers rotate on their own wheels and store material near the ceiling, thereby saving the space usually lost to its inaccessibility.

BOILERS.—The illustrated bulletin, "Boilers," is a new 16-page booklet of the United States Army & Navy Engineering Corps, 10 Broadway, New York, of great interest to naval architects. It possesses an entirely new feature of being the only publication that will allow the naval architect to compare the relative merits of the steam, the hot oil and the hot water boiler, and to select the one on the head of the matter. It is a most valuable reference for the constructor.

AUTOMOBILE LIGHTING.—A new 16-page booklet, "Automobile Lighting," is a new 16-page booklet of the United States Army & Navy Engineering Corps, 10 Broadway, New York, of great interest to naval architects. It possesses an entirely new feature of being the only publication that will allow the naval architect to compare the relative merits of the steam, the hot oil and the hot water boiler, and to select the one on the head of the matter. It is a most valuable reference for the constructor.

WIRING CALCULATIONS.—The new 16-page booklet, "Wiring Calculations," is a new 16-page booklet of the United States Army & Navy Engineering Corps, 10 Broadway, New York, of great interest to naval architects. It possesses an entirely new feature of being the only publication that will allow the naval architect to compare the relative merits of the steam, the hot oil and the hot water boiler, and to select the one on the head of the matter. It is a most valuable reference for the constructor.

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## Indiana Public Utilities Law

The State of Indiana has just adopted a public utilities law, abstracted elsewhere, which is a model of its kind and ranks with the Wisconsin act as one of the fairest and most effective instruments of regulation on record. The pitfalls into which legislators in some other states were led have been avoided, and the decks are clear for state-wide administration of the new act under conditions which hold forth the promise of a square deal for all and favoritism for none. The Wisconsin plan of indeterminate permits in lieu of franchises having a definite term has been adopted outright, and to every public utility company a strong inducement is held out to relinquish its old franchise and accept such a permit, with the strong protection against needless or wasteful competition which it insures. The days of political bickering for franchises in the Hoosier State are therefore numbered, and in their place has come a saner era of public-utility regulation under which, judging from the results elsewhere, the stability of public-service corporations will be increased and their development stimulated. So much for the opportunities under the new law. The next question, and one of the gravest importance, is the selection of a thoroughly competent commission to administer the law. Here is an opportunity to duplicate the brilliant achievement of placing so effective and just a measure on the statute books. It is to be hoped that this progressive community will break away from precedent and appoint at least two members out of the five on the new commission on the basis of their technical qualifications. We cannot urge too strongly that one member be an engineer of eminent qualifications and one an expert accountant. If to this there be added an economist of repute, a lawyer of broad experience and a fifth member with a special knowledge of transportation questions, the balance will be exceedingly satisfactory and much superior to a commission overbalanced with members from the legal profession.

## Getting Ready for Moving Day

A tenant serves notice on the electric company that he intends to vacate his present quarters and asks that his meter be removed and a bill rendered. A man from the storeroom goes out, pulls down the meter and takes it to the shop. Next day the new tenant calls up the office and orders electric service, insisting that he must have it that same evening. Half an hour later tenant No. 1 sends in an agonized appeal from his new quarters, explaining that he had thought the premises were supplied with electricity but that service has in some way been disconnected. Of course, he too wants his meter in by nightfall. Notwithstanding the fact that the company removed its connections from the latter location less than twenty-four hours be-

fore, it will have to send out its metermen and replace the same meters, or other ones in their stead, on the identical hooks from which they were just pulled down. Of course, such a wasteful system is expensive for the company, and it is hard on the metermen and hard on the meters. In one Central Western city where the semi-annual hegira of dissatisfied renters numbers several hundred the local manager has arranged the blank form reproduced on another page, by means of which record is kept of each prospective removal, date, name and address of the new tenant, etc. In this way, with the aid of the clearing-house principle, all the effort and expense of changing meters is saved and customers are spared the annoyance of being without light during the trying ordeal of "moving."

## The Supply Dealer as a Business Man

Statistics show that barely one merchant out of twenty who engage in retail business in this country makes even a living success of his undertaking. The other nineteen, because they overlook the simple precautions of determining their selling costs and profits, are inevitably pushed to the wall. Nowhere is this sad condition more forcibly illustrated than among the ranks of the small contractors and dealers in electrical supplies. Usually good workmen of excellent mechanical instincts, they are notoriously poor business men, and this failure to recognize the rules that govern grocery and dry-goods merchants has led to their own lack of success and the embarrassment of those with whom they deal. In retail selling the fundamental requirement is to provide a profit, either on the individual articles or the annual sales, sufficient to cover the direct charges, "overhead" contingencies and a reasonable surplus. Ascertainable overhead expenses include rent, light, heat, wages, advertising, insurance and freight. Reasonable interest must next be allowed on the capital invested. The third charge is for contingencies, and here is found the source of much trouble, because contingencies are unforeseen and impossible of exact calculation but are annual occurrences and must be provided for. They may be detailed in part as follows: Natural depreciation of stock, depreciation through mistakes in buying or commission, fire losses, employees, losses by individual bad debts, special sales or extra advertising in backward seasons. A simple plan for calculating selling price based on earning a given gross profit above the cost price is contained in a bulletin recently issued by the National Association of Cash Merchants. From 100 per cent subtract the percentages of operating expenses and net profit. Divide the cost of the article by the difference; the result will be the necessary sales price. Such a simple rule will place the dealer's business on a substantial basis, for which stability there is often sore need.

### A Startling Hydroelectric Undertaking

We commend to the attention of all cautious and conservative hydraulic engineers the description we print this week of a hydroelectric station that pumps part of the supply for its own wheels by electrical energy. To the first thought of the uninitiated it seems a bit like lifting one's self by one's boot straps, or carrying to a triumphant conclusion the favorite scheme of perpetual motion. On the contrary, it is a singularly clever and ingenious method of conserving water supply in a territory where water is precious and the available amount limited. The situation is briefly this: A plant working on the somewhat scant and variable supply of a mountain stream, fortunately rendering available a head of over 1000 ft., at certain seasons of the year found itself painfully short of water. Had there been a second stream available, it would have paid to go to considerable expense to add its flow to that of the primary source of power. This has often been done to meet the exigencies of increasing load and stationary water supply. In the present case no such auxiliary stream was available at or near the level of the main supply. A group of springs, however, at a lower level gave hope of additional water in paying amount, and the bold expedient was adopted of pumping this water supply to the level of the main head-works by electric power. And a cubic foot of water which one can drop more than 1000 ft. on to the wheels below by pumping it less than 150 ft. is not a source of energy to be held in contempt.

The project as actually carried out involves an automatic pumping station driven by the simplest form of induction motor directly coupled to a centrifugal pump capable of delivering 3.5 cu. ft. of water per second against a head, including friction, of 138 ft. The little pumping plant requires no attention. The result is very interesting. Except in May and June, when the primary water supply outruns the capacity of the pipe line, it pays to pump the spring water. At normal load it takes 67 kw to deliver the 3.5 cu. ft. per second at the upper level, and this quantity of water represents 237 kw at the generators below. There is, therefore, obtainable at the expense of the pumping plant 170 additional kw for ten months in the year, rising to a yearly output of nearly 1,250,000 kw-hr. It is sufficiently obvious that this additional supply, as large as that delivered by the central station in many a small Eastern city, is a valuable asset. In point of fact, the saving would be more than enough to pay for the pumping plant in a single year. Altogether this installation is a startling example of the resourcefulness of the Western hydraulic engineer when he is really face to face with difficulties.

### Magnetism and Elasticity

Many investigations have been made at different times into the varied interrelations of magnetism and mechanics. Thus, when a bar of soft steel is magnetized longitudinally its dimensions are found to be slightly altered. The magnetization in the steel sets up of itself a condition of stress in the metal. Is the alteration in the dimensions accompanying magnetization due to this associated stress or is it due to some independent molecular change in structure

which is merely modified by the stress? These and many other questions have been propounded by physicists, who have sought for experimental answers in the laboratory. The answers have been in some cases clear and easily understood. In other cases they have been difficult to interpret and seem to be affected by a variety of complexly associated influences. It is fair to say that many of the phenomena connecting the mechanics and magnetics of iron and steel are still very obscure.

It cannot be said, however, that all of the questions propounded by physicists are of merely theoretical or speculative interest. Some of them are already of vital practical interest to the industry, and others are rapidly assuming such interest. In dynamo-electric machinery magnetic stresses are often in excess of a ton-weight per pole, while the mechanical stresses involved, both tangentially during acceleration and radially at steady speeds, due to centrifugal forces, may be very considerable. It is necessary that the designer of dynamo machines involving large mechanical stresses per unit of cross-section shall be informed concerning the tensile strength of the steel and structure he employs in his design. The tests of tensile strength are ordinarily conducted on sample prisms, or test pieces, of the material, in an unmagnetized state. Does any appreciable correction need to be made for the effects of magnetization, seeing that in actual operation many of the rotating parts are powerfully magnetized? Is the elasticity of these parts increased or decreased by the magnetization?

In the article by Mr. F. J. Kean which appears in this issue some measurements are described of the elasticity (Young's modulus) in steel bars before and after being longitudinally magnetized. Young's modulus of elasticity may be described as the tensile stress per unit cross-section which would have to be applied to the material considered in order to double its original length, as inferred from actual stresses involving very small stretching, on the assumption that proportionality between stress and stretch continued throughout so great and ordinarily unattainable a range. Consequently, the greater Young's modulus for any material the stiffer and stouter the material is, at least within the observed limits of stress and stretch. The results given in the article go to show that when strongly magnetized the steel bars tested increased, on the average, some 2 per cent in Young's modulus of elasticity, and consequently it would take some 2 per cent more stress to stretch them, say, 0.1 per cent after being magnetized than before. In other words, these test bars were strengthened slightly in tensile elasticity after being magnetized.

Although the results here reported are satisfactory from the designer's standpoint, as indicating a gain rather than a loss in structural strength of dynamo steel under magnetization, yet it would manifestly be unsafe to assume that the whole question is thus settled from the designer's viewpoint. In a dynamo machine the steel employed is by no means always of identical quality and composition. The magnetic stress is not continually applied. Some vibration tends, moreover, to be set up in the pole pieces during their rotation. Further information is, therefore, desirable as to the influence of each of these variables, both singly and conjointly. It might be possible to have the elasticity re-

duced in some brands of steel while it was increased in others. An effect might be found for the influence of duration of magnetization, or of alterations and intermissions of magnetization, with or without vibrations or changes of temperature. It becomes evident, after such reflections, how deep and thirsty is the vacuum of engineering and industrial uncertainty into which we pour, year by year, an endless stream of new knowledge derived by the labors of exact scientists.

### Popularizing Electric Service

The Society for Electrical Development, Inc., of whose first notable conference a full report was given in our last issue, has for its frankly expressed purpose thorough, efficient and extensive "boosting" of the electrical industries. The time of dog-in-the-manger competition in electrical affairs has fortunately long passed, and the organization of a society for united effort in helping the growth of all branches of the electrical business is significant evidence that an era of team work has opened. The men at the head of the new society are of long experience and keen judgment. They know not only what has been done in electrical industries but what infinite room there is for still further progress, and they are getting together to accomplish definite results. The chief difficulty in carrying through such work as the leaders have in mind lies in the great diversity of electrical interests and a natural feeling of uncertainty as to the proper place to begin in efficient "boosting." The consumption of electrical goods and electrical energy in this country has already risen to a prodigious amount, probably in excess of two billion dollars a year, and yet it is a fact of which every alert man is aware that electrical goods and electrical energy have not yet come fully into their own in the popular life of the country. The general function of the society is to bring this general public into close touch with what is being done in the electrical field. Enormous as the advances in electricity have been and greatly as the output of energy has increased all over the country, it is yet a fact which admits of no doubt that electrical service has not thoroughly passed from the stage where it is a luxury to the stage where it is a necessity. It is still looked upon as belonging in the category of luxuries in spite of lowered prices and industrious exploitation.

It is a fact that must not be forgotten that while through the past decade the prices of everything which has to do with living expenses of the individual or the family have risen to an astounding degree, through this same period the average price of electrical energy has steadily and greatly declined. It is the one necessity of modern life which has suited itself to the necessities of the wage-earner during a period of rapidly rising prices. Nevertheless, a statement of this fact always brings a touch of surprise to the average man to whom it is made, and in his daily life he does not act as though electrical service were a commonplace necessity. Despite the fact that to-day most Americans have become dwellers in cities and large towns, and despite the fact that electrical networks are ramified all over the country, it is still a fact that of about ten million or so buildings in which men dwell hardly one in five is supplied with electrical service. It is still a fact, also, that in large

cities, where electrical energy is relatively cheap and accessible, this meager ratio is not materially better. The same condition holds true of the general uses of electricity for motor and miscellaneous service which fall within the practical experience of the ordinary man.

One of the greatest tasks which the new society can accomplish is to break down the limitations of this condition and prove to the man on the street, as the representative of the general public, that electrical service is in his interest and that he must look upon it as a necessity. We are sorry to say that the central stations themselves are not always without blame in this matter. They have too often affected to despise the small consumer and have put him out of the game in making their schedules of prices, without a moment's thought as to the ultimate future of the business. The station that fears to take on the small consumer or believes that it cannot make a profit out of him is in line for decreased business and needs an immediate change in management.

The time has come in the growth of all the electrical arts when universal use is a thing to be sought, not carefully selected employment by a small group of customers whose business can be easily coddled. If the huge investment in electrical things in this country is to be vindicated in the future, it must be by proving to the public at large that electricity is to become a part of the daily life of the whole people. A tremendous amount of missionary work of every kind is needed to this end; but in such particulars actions speak louder than words, and no amount of skilful publicity will build up increased consumption against the handicap of poor service or high prices or schedules arranged so that the few gain and the many lose.

We are just beginning to come within view of the great general uses of electrical energy. The whole field of electrical heating and cooking and the minor miscellaneous uses of a similar sort has barely been touched. We say this advisedly in spite of all the excellent work which has been done in the exploitation of some few heating appliances. Looking at the matter in the large, most companies have eliminated by their price schedules all business of this kind below a certain limit. That limit is not an impassable one. Below it business can increase to almost an indefinite extent. Above it business will merely drag along as it has dragged in the past. One cannot sell energy for large motors for general industrial purposes on a 10 cents per kw-hr. basis, and he cannot cultivate the larger field successfully at even half this price.

The expansion of the electrical business is the object of the new society. It is in deadly earnest and has ample resources and enthusiasm. The finest and most effective piece of work it can do is to try to give some of this enthusiasm to the man on the street, to make him understand how much to his advantage electrical energy is, and how thoroughly it can and will actually keep in touch with his needs. The society must devote its energies to that kind of missionary work which shall make electricity appear to the public mind as a necessity, the production of which is to be encouraged and the application of which is to be welcomed as part of daily life.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Minnesota Electrical Association

(By Telegraph)

About fifty central-station and supply men attended the sessions of the first day of the sixth annual convention of the Minnesota Electrical Association, held at the Hotel Saint Paul, St. Paul, Minn., March 11, 12 and 13.

In his opening address President Eugene Holcomb, of St. Paul, referred with regret to the lack of interest shown in the association by members between conventions. He urged all-the-year-round work. The membership is now about equally divided, he said, between privately owned and municipal plants. It might be well, he suggested, if divisions were made of these classes. Continuous performance of association work is needed, and to that end he proposed that the executive committee should be a continuing body and should appoint the secretary. The recommendations contained in President Holcomb's address were referred to a committee consisting of Messrs. H. J. Gille, of St. Paul; R. E. Brown, of Mankato, and T. C. Gordon, of Little Falls. Mr. E. F. Strong, of Chaska, secretary-treasurer of the association, next presented his report.

On Tuesday afternoon papers were read by Mr. D. D. Lescohier, of the Minnesota State Bureau of Labor, St. Paul, on "The Prevention of Accidents," and by Mr. Ludwig Kemper, of Albert Lea, on "The Central-Station Manager." Both papers were well discussed. President Holcomb appointed a nominating committee, consisting of Messrs. B. W. Lynch, of Minneapolis; F. A. Otto, of St. Paul, and E. A. Aspness, of Montevideo.

The matter of organizing a geographic section of the National Electric Light Association did not come up on the opening day.

Others papers scheduled to be presented before the Minnesota convention on the following days of the session were: "Increasing Boiler Plant Efficiency," by a representative of the General Electric Company; "Central Station Sales Methods," by Mr. C. E. Van Bergen, Duluth, Minn.; "The University and the Central Station," by Prof. George Shepardson, Minneapolis, and "Report of a Diesel Oil-Engine Test," by Mr. E. A. Aspness, of Montevideo.

Several manufacturers made exhibits of their products.

### New York Law Authorizing Lighting Districts

Governor Sulzer of the State of New York has signed the bill introduced by Assemblyman Schwartz granting to second-class cities of the State the right to establish, alter or extend special lighting districts for ornamental street-lighting purposes.

### Los Angeles Section, A. I. E. E.

At a meeting of the Los Angeles Section of the American Institute of Electrical Engineers held at the Hollenbeck Hotel, Los Angeles, Cal., March 5, several papers presented at the New York midwinter convention of the Institute were abstracted and discussed, as follows: "Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity," abstracted by Mr. F. W. Harris; "The Temperature Rise of Stationary Induction Apparatus as Influenced by the Effects of Temperature, Barometric Pressure and Humid-

ity," abstracted by Mr. R. W. Sorensen; "Current Rating of Electric Cables," abstracted by Mr. Edward Woodbury. The papers were discussed by Messrs. E. R. Northmore, A. W. Nye, C. G. Pyle and O. C. Miller. Nearly sixty members and visitors attended the meeting, over which Mr. George A. Damon, section chairman, presided.

### Arlington "Wireless" Received 2400 Miles Away in Daylight

The United States scout vessel *Salem*, which has been cruising in the North Atlantic Ocean testing the transmitting range of the new government wireless-telegraph station at Arlington, near Washington, reached Gibraltar last week. Despite the difficult sending conditions usually imposed by full daylight, the *Salem* was able to receive complete messages from the Arlington 70-kw station when at a distance of 2400 miles. Night transmission distances were considerably greater. With its own 10-kw set the cruiser returned messages to Arlington at 1300 miles. Both the Arlington and the *Salem* equipments are of the Fessenden type. The *Salem* reports an extremely rough eastward crossing. It has started on its homeward trip, during which the wireless experiments will be continued.

### New York-Boston 310-Mile Run of Storage-Battery Car

A run of 310 miles from New York to Boston over the Hudson River and Boston & Albany routes was successfully made on March 6 by a new Beach-Edison storage-battery car. The trip was particularly interesting in that it demonstrated to representatives of steam roads for which the run was made that this type of self-propelled car can maintain high average speeds for distances considerably in excess of 100 miles.

Mr. Ralph H. Beach, of the Federal Storage Battery Car Company, was in charge of the experimental run, which was made with a party of representative railroad and electrical men. The car used is 50 ft. long over all, 12 ft. 6 in. high and 8 ft. 11 in. wide, and weighs complete with load 34.6 tons. Seats are provided for fifty passengers, although on the trial run the car carried a combined load equivalent to eighty-four passengers. The electrical equipment of the car includes four 20-hp, 220-volt Diehl motors and two sets of 230 cells, each of Edison A-8-H storage battery, delivering energy to the motors at approximately 240 volts.

The route followed provided a variety of track conditions, including a long run at level grade, several climbs and considerable curved track. The batteries were fully charged when the car left New York at 9 a. m., and the run of 114 miles to Hudson was made at an average schedule speed of 35 miles per hour. On arrival at Hudson the car climbed  $1\frac{1}{2}$  miles of 2 per cent grade before recharging. The energy consumption for the level run of 114 miles was  $37\frac{1}{2}$  watt-hours per ton-mile.

The car arrived at Springfield, Mass., 98 miles distant from Hudson, with about one-third of the full charge left in the batteries, and this after having climbed the Berkshire Hills to an elevation of 1450 ft. and negotiated many grades,

including one continuous up-grade of 1 per cent for 8 miles. At Springfield the battery received a short boosting charge while the party had dinner. The remainder of the run, 98 miles, to Boston was covered without event.

### Spokane Section, A. I. E. E.

The first meeting of the Spokane Section of the American Institute of Electrical Engineers was held in the Hotel Spokane at noon on March 3. There were present fifty men, of whom eighteen were petitioners with the right to vote. Mr. J. B. Fiskien was elected temporary chairman and Mr. H. B. Peirce temporary secretary. Committees on by-laws and on membership were appointed and the meeting adjourned until March 6. At the adjourned meeting, which was held at 8 p.m. in the Washington Water Power Building, the attendance was about forty. By-laws were adopted and officers for the present year elected as follows: Chairman, Mr. J. B. Fiskien; vice-chairman, Mr. J. W. Hungate; secretary-treasurer, Mr. H. B. Peirce; executive committee, Messrs. C. S. MacCalla, C. F. Uhden, Louis N. Rice and H. A. Shearer. After the election of officers a short paper on "Benefits to Be Derived from the Section" was read by Mr. D. F. Henderson. On vote of those present it was decided to hold the next meeting in the evening of March 18, with papers and discussion following a dinner of an informal nature.

### Proposed British Electrical Publicity Scheme

"A general campaign that will set the nation thinking" is being advocated in the interests of the electrical industry of Great Britain by Mr. H. Clifford Palmer, publicity manager of the General Electric Company, Ltd., of London, one of the largest dealers in electrical supplies in the world. In an address which Mr. Palmer delivered last month before the British Institution of Electrical Engineers, Manchester Section, he declared that £30,000 (\$150,000) would be needed to support such a year's publicity campaign as he proposed for the electrical education and instruction of the public.

"Individual efforts, while highly desirable, are not all-sufficient," declared Mr. Palmer. "In such an industry as ours, where all interests blend, results of infinite value might be obtained by co-operation. Local efforts might interest a town, but a general campaign would set the nation thinking.

"The public does not know all we have to offer it, all we can do for it, what advantages we can offer over coal, gas or oil; that the cost for electric light compares more than favorably with the cost for gas lighting; that breakfasts can be cooked on the breakfast table; that seventy-two slices of bread can be toasted for the cost of 1 penny for energy; that electric cooking reduces meat losses to the lowest possible level; that an electric iron provides the only clean, convenient and healthful method of ironing, and that it can be operated from any existing lampholder without the necessity for special wiring. How should it know all this unless it is taught? The public can be educated on extensive lines," insisted Mr. Palmer, "only by systematic, judicious, and practical advertising."

Coming to concrete plans for obtaining this publicity, the speaker suggested the establishment of a general fund to which manufacturers, central-station companies and contractors might contribute. This fund, he added, should be administered under the control of an expert. From £20,000 to £30,000 he estimated as being sufficient for one year's campaign.

Among the mediums for obtaining publicity Mr. Palmer outlined plans to make use of the daily newspapers, bill-boards, a central information bureau, circularizing schemes

and electric signs. For the latter he proposed a system of animated, illuminated night displays which might be taken down after various "runs" in the metropolis and set up for re-display in provincial centers. Supplementing the central information bureau, Mr. Palmer suggested a series of local showrooms in outlying cities.

"Our associations must get to work," concluded Mr. Palmer. "We must make the publicity problem our study for 1913."

### Important Code Change Suggested

In the official bulletin containing suggestions for changes in the National Electric Code, which will be considered at this month's meeting of the electrical committee of the National Fire Protection Association, there occurs this paragraph:

"Rule 68, Section d, second paragraph: Amend by placing a period after the word 'connection' in the third line and omitting the following words, 'and to make it difficult for it to be replaced when melted.'"

The condition in which the code will be left if the amendment should be adopted is shown from an examination of Section d of Rule 68, which is as follows:

"d. Construction.—The fuse casing must be sufficiently dust-tight so that lint and dust cannot collect around the fusible wire and become ignited when the fuse is blown.

"The fusible wire must be attached to the terminals in such a way as to secure a thoroughly good connection and to make it difficult for it to be replaced when melted."

It appears that if amended as proposed the code would tacitly approve the principle of the refillable fuse, or rather would open the way for the approval of suitable refillable fuses submitted for test at the Underwriters' Laboratories. It is understood that this change has been proposed by the advisory board of engineers of the Department of Water Supply, Gas and Electricity of the city of New York. This board consists of Messrs. Charles F. La Combe, chief engineer of light and power for the city of New York; F. J. T. Stewart, superintendent of survey, New York Board of Fire Underwriters; George F. Sever, consulting electrical engineer for the city of New York; J. C. Forsyth, chief inspector electrical department of the New York Board of Fire Underwriters; George E. Bruen, superintendent of the electrical department of the Suburban Fire Insurance Exchange, and Hubert S. Wynkoop, electrical engineer for the city of New York.

#### THE STANDARD INCLOSED FUSE

The advocates of the non-refillable cartridge fuse claim for it the following among other advantages: It was standardized ten years ago, and the fuse of any manufacturer will fit the clips of all other manufacturers. It provides what is believed to be a safe receptacle for a blowing fuse. It can be refilled only by the manufacturer whose reputation is at stake, so that proper workmanship is insured and amateur refilling is prevented.

#### THE REFILLABLE FUSE

The advocates of the refillable cartridge fuse make the following claims, among others, for their product: It enables the operator of a plant to use a relatively large amount of fuses by having the refilling done on his own premises. On account of the cheapness and convenience of refilling on the premises, its use overcomes the objection to fuses of the standard type of non-refillable fuse in order to save the time, trouble and expense of returning cartridges to the manufacturer for refilling or of having new cartridges for replacement.

#### COMMITTEE TO STUDY PROPOSED CHANGES

Mr. Robert C. Cole, electrical engineer of the Johns Pratt Company, has sent a communication to members of the electrical committee of the National Fire Protection

Association, in which he makes the following statements:

"It being physically impossible to design a refillable fuse so that it cannot easily be refilled with an improper fusible element, an exceedingly large element, an unsatisfactory heat-dissipating material, or for that matter without the use of any filling material at all, any or all of which methods of refilling will result in a device constituting a real fire hazard, it is manifest that such devices should not be listed in the code.

"The inclosed fuse of to-day is the result of a standardization effected by a committee of underwriters' and manufacturers' representatives in 1902 and 1903. These fuses were approved after the Underwriters' Laboratories had satisfied themselves that they would, in *just the form that they would appear on the market*, operate satisfactorily. They are now asked to approve a line of devices which will be submitted to them by the manufacturers in one form and which will be installed by the users after they have been refilled in an entirely different form."

#### THE QUESTION OF COST

Mr. H. R. Sargeant, of the General Electric Company, has made the following analysis of the claim that the use of the refillable fuses results in a large saving to the consumer. He takes as a basis of comparison 100 200-amp fuses of the reloadable type, the list price of which is \$4. On 100 fuses he figures the cost at the end of the first year at \$401.50, this sum including 10 per cent of reloads at 15 cents each. At the same rate of reloading, the cost at the end of the second year would be \$403, and at the end of the fourth year the total investment would be \$404.50. For standard inclosed fuses of the same capacity the original cost would be \$200, while 10 per cent of reloads each year at \$1 each would make the investment at the end of the third year \$230, or a saving in full for the inclosed fuse of \$174.50.

#### INCREASING THE FIRE HAZARD

L. W. Downes, of the D. & W. Fuse Company, has prepared a list of seven reasons why a change in the code provision covering inclosed fuses will increase the fire hazard. His first reason is that the proposed change would take the control of reloading of inclosed fuses, and ultimately the entire inclosed-fuse situation, out of the hands of the Underwriters' Laboratories and place it in the hands of people who, through ignorance, indifference or carelessness, are entirely unqualified to undertake the proper reloading of any fuse. A further reason why the proposed change would increase the fire hazard, according to Mr. Downes, is that there would be no possible way in which the Underwriters' inspector could determine whether a fuse had been properly reloaded, unless the device was removed and taken entirely apart. It has been the experience of manufacturers, Mr. Downes asserts, that even those who are supposed to possess a certain amount of technical knowledge will demand that the capacity of a given fuse be increased beyond its normal rating by, for example, putting 400-amp links in a 200-amp casing. The manufacturers of approved inclosed fuses absolutely refuse such demands, but there is no way of checking such practices on the part of the individual user. On account of the patent situation, with many refillable fuses on the market, it would be necessary for dealers to carry a large stock of different makes of links. As they are not likely to do this, Mr. Downes points out, the use of improper links would be increased.

#### THE OPEN-LINK FUSE

The attitude of the division of inspection of the Department of Water Supply, Gas and Electricity, New York City, as set forth in the Electrical Code of the city of New York, can best be summed up by stating that, considering the ever-present tendency to bridge across standard inclosed fuses and to load refillable fuses improperly, it has

gone on record as urging that the cartridge fuse be not used where the open-link fuse can be employed. That is to say, the fire hazard of the open-link fuse is well recognized and can be guarded against by proper inclosing boxes, while the cartridge fuse is sometimes improperly shunted or refilled and then presents an even greater hazard which is neither recognized nor provided for.

### Famous Whitney Development Abandoned by Aluminum Company

(By Telegraph)

The Southern Aluminum Company, a French concern with French capital, has decided to abandon its hydroelectric development on the Yadkin River at Whitney, N. C., and to build a new dam several miles below the present site.

According to the tentative plans, the magnificent masonry structures at Whitney, comprising a solid granite dam of cut stone, 1000 ft. wide and 38 ft. high, the spillway of similar dimensions and material, at right angles to the dam, and the canal leading from the dam, will all be submerged and the entire investment, representing at least \$3,000,000, virtually thrown away.

The new dam will be of concrete, about 1200 ft. long and 150 ft. high. Its construction will involve an expenditure of about \$2,000,000. Notwithstanding reports that have been circulated, it is declared that the contract for building the dam has not yet been signed, although the presumption is that the Hardaway Contracting Company, of Atlanta, Ga., will have the refusal of it. The contract reported made with the General Electric Company some time ago for seven 5000-kw, 250-volt direct-current generators—which would have been the largest of their type in the world had they been built—has also been annulled pending investigations on the new site. Definite information regarding the new development will not be available for some weeks to come.

#### HISTORY OF WHITNEY DEVELOPMENT

The Whitney development as a whole has been watched with some misgivings ever since its inception in 1901. The late George Whitney, of Pittsburgh, was the leading spirit in the movement to establish an electric generating plant on the Yadkin River, and the development bearing his name antedated the hydroelectric developments of the Southern Power Company and of the other great syndicates in the South. Pittsburgh contractors built the dam, spillway and canal on what was said to have been a basis of cost plus 20 per cent. The work was the finest ever undertaken in the South, the granite being cut and set with instruments. Like nearly all subsequent developments in this region, the purpose of the development was to generate ten-hour to twelve-hour power for cotton-mill operation. By construction of 4.5 miles of canal, 40 ft. wide and having a depth of 18 ft., a head of 120 ft. could be obtained and approximately 45,000 hp developed.

In the panic of 1907-1908 the entire enterprise had to be abandoned. At that time the dam, spillway and canal were nearly complete, but nothing whatever had been done on the power house. French capital was heavily interested in the original developments, and since the same financial houses are represented in l'Aluminus Française, the present ownership of the plant is explained.

#### PURCHASE BY SOUTHERN ALUMINUM COMPANY

After the Southern Aluminum Company acquired the property, at a price placed by rumor at \$750,000, it established offices and engineering quarters at Whitney, proposing to undertake its own engineering work. Up to within a few months ago Dr. Heroult, the well-known French engineer, acted in an advisory capacity, but he has since



severed his connection with the company. The Hardaway Contracting Company was engaged to complete the work and to grade the property there, but this work has also been stopped.

To a representative of the *Electrical World* the reason given for abandonment of the Whitney development\* was that the site does not permit sufficient storage of water for twenty-four-hour operation. By locating farther down the stream a higher head is obtainable and water will be backed up the river for a distance of about 9 miles, submerging the top of the masonry dam at Whitney at 2 ft. The exact pondage afforded by the new site and the contemplated dam has not yet been determined, nor has the type of electrical and mechanical generating equipment been settled upon.

#### ELECTRICAL PROBLEMS INVOLVED

There are many interesting engineering questions involved in the development. For manufacturing reasons the company would like to employ direct current at a tension of 250 volts, and while the General Electric Company was willing to build such 20,000-amp machines running at a speed of 170 r.p.m. the Westinghouse Electric & Manufacturing Company is understood to have recommended through Mr. Lamme double 10,000-amp machines. This recommendation, it is understood, was made because of the engineering problems involved in collecting the heavy current and in arranging suitable brush rigging.

The change of site will, of course, necessitate changes in the contemplated generating equipment, depending on the location of the aluminum plant. If 250-volt operation is no longer feasible, the General Electric Company is preparing plans for a 500-volt direct-current layout, using alternating-current generating equipment with rotary converters. To locate the aluminum plant at the power house will require extensive grading of the hillside, costing considerable money. On the other hand, if the aluminum plant is located even a short distance from the generating station the feeder investment, supposing that seven 500-kw, 250-volt units are still retained, will be prohibitive. The company owns 10,000 acres of land along the river and at Whitney, although the nearest bauxite deposits are said to be at Rome, Ga.

#### PLANS FOR THE FUTURE

Offices will be maintained at Whitney, it is declared, where also will be located the residences of the operating heads. If it is finally decided to locate the aluminum plant there also, alternating-current equipment with rotary converters will naturally be selected. No contracts have been placed for any equipment as yet, but a conference of engineers will be held within the next two weeks. The S. Morgan Smith Company and the I. P. Morris Company are at work on tenders for hydraulic equipment and the large electrical companies have had engineers on the site going over electrical details.

The Yaddin River has a number of hydroelectric developments along its banks, although the stream flow varies between wide limits from the floods of winter to low water in summer.

While storage will enable the plant at Whitney to meet certain emergencies, only the natural flow of the river can be depended on should twenty-four-hour operation prevail.

The Southern Aluminum Company has had a large organization at Whitney for about a year, and, inasmuch as it appears to be able to command plenty of money, many believe it is a part of the so-called aluminum trust. A man prominent in engineering and business circles in the South has prophesied, however, that if the tariff is taken off aluminum the development below Whitney will never be completed. Mr. W. P. Marselle, formerly connected with the Electrode Company of America, of Niagara Falls, N. Y., is the general manager of the Southern Aluminum Company.

### The World's Highest-Head Water-Power Plant, 5400 Ft.

Construction has begun on a 15,000-hp water-power plant at Martigny, in the canton of Wallis, Switzerland, to utilize a fall of 5400 ft., making this station the highest-head water-power plant in the world. Special interest attaches to the penstock lines, which are 3 miles in length. The upper section, which will be under comparatively light hydraulic pressure, is being built of welded steel pipe, 23.6 in. in diameter. The lower section, which will withstand a hydrostatic pressure of nearly 2500 lb. per sq. in. or 165 atmospheres, is to employ special ingot-pressed seamless steel pipe. The tube sections vary in wall thickness from 1.24 in. at the top to 1.77 in. at the region of highest pressure. The turbines, which will be of the Pelton type and have a total rating of 15,000 hp, will be furnished by Piccard, Pictet & Company, of Geneva. Of some interest is the fact that with the 5400-ft. head available at this plant only about 30 cu. ft. of water per second will be necessary to develop the full 15,000-hp output of the station.

### Great Falls Power for Sun River Reclamation Project

A contract just executed between the United States Reclamation Service and the Great Falls Power Company of Montana for electrical energy in connection with the construction of the Sun River irrigation project calls for 2500 kw throughout the period of the next six years.

The power company will transmit this energy a distance of 100 miles, delivering it to the Reclamation Service at a number of substations, from which it will be distributed to the several principal parts of the work. Proposals will be advertised for immediately for excavating the main canal, which will be 45 miles long. The diversion dam, 140 ft. high, and the diversion tunnel will both be constructed by government forces.

This use for electrical energy for excavating the Reclamation Service canal is not only a new departure but is believed to mark an epoch in such construction work. Great reductions in cost and time are expected to be accomplished with the new methods. The Great Northern Railroad Company completed the construction of a new line up the Sun River Valley last fall, and the Great Northern Railroad and the Chicago, Milwaukee & St. Paul each have a line under construction crossing the project, thus making four independent lines of railway across and along the irrigable lands.

There are already twelve towns within the limits of the project, and as many more have been planned. The electric service that will thus be already available when the land is opened to entry will be of great advantage in assuring these communities lighting and motor service for manufacturing and allied uses.

### Bills in New York Legislature for State Hydroelectric Schemes

Our readers will recall that in the issue of Jan. 4, page 33, there was presented an analysis of the Rydine bill, which had the support of the New York State Conservation Commission in the last Legislature for the creation under State ownership of a State-wide hydroelectric system, modeled after the provincial system of Ontario. Although this bill did not become a law, the Conservation Commission has been very active in arousing interest in the subject and numerous water-power bills have been put before the Legislature now in session. Several of these are rather comprehensive and of great importance for the public service corporations of the State.

# BILL TO AMEND THE CONSERVATION LAW IN RELATION TO WATER REGULATION

Another bill introduced by Senator Walters to amend the conservation law in relation to water regulation and utilization is quite similar in its general provisions to the preceding bill. Article 6, Chapter 647, of the Laws of 1911 would be repealed by the bill and a new article inserted which confers the following powers upon the Conservation Commission:

In addition to its other functions, the commission is authorized to regulate the flow of water, to acquire and develop sources of water supply, to improve watersheds, construct reservoirs, dams and other works with moneys appropriated by the State or furnished by water-storage corporations, to contract with municipal and other corporations for supplying them with hydroelectric energy or with water, to regulate stream flow, to make examinations and surveys of property required, and to prepare plans, specifications and estimates for all such undertakings.

In general, the commission is clothed with authority to carry out the provisions enumerated in the preceding bill introduced by Senator Walters. Authority is also conferred upon the commission to utilize or to sell all of the waters of the canals of the State, including the diversion rights, not necessarily required for navigation or for the safety of the canals. Canal waters or energy developed therefrom shall be disposed of under public contracts in the name of the State for a period not exceeding fifty years, upon permits and conditions in every case providing adequate compensation to the State.

## BILL FOR THE ESTABLISHMENT OF HYDROELECTRIC PLANTS AND DISTRICTS

The most comprehensive bill yet introduced is that for which Senator Murtaugh is the sponsor, which would amend the conservation law in relation to hydroelectric plants and districts and would establish a hydroelectric plant for the capital district. This bill amends Chapter 647 of the Laws of 1911 by inserting a new Article 6 (a), the chief provisions of which are given in what follows:

At such points as the Legislature shall direct the Conservation Commission shall construct hydroelectric plants. Should the State adopt a state-wide hydroelectric system, the water-power districts already created will become part thereof, the rates being made consistent. For the operation of any such hydroelectric plant the commission may utilize canal waters, subject to the navigation laws and prior regulation.

A hydroelectric division would be created, in charge of a deputy commissioner at \$7,000 per annum, assisted by a division engineer at \$5,000 and such other clerks and assistants as needed. The commission is also to have authority to construct transmission lines and substations and to purchase or lease lines already built.

The general powers conferred upon the commission include the right to acquire property, to erect and maintain structures and works, to prepare plans, specifications and estimates, and to make examinations and surveys. All work shall be done under formal contract. The local authorities of any city or town within the hydroelectric district may apply to the commission for an estimate of the cost at which electric energy can be delivered to their municipality, cost of constructing the distribution system, cost of operation and conditions of proposed contract for service. Such application must specify the population of the municipality, the assessed valuation of property, the existence of any electric or power plant within the municipality, the number and character of industrial establishments and any other information that the commission may require. The commission at will may defer action upon such an application until a sufficient number of municipalities to afford a reasonable basis for making estimates have duly filed their applications. The annual payments must

cover the 4 per cent interest on the State's investment, charges for a sinking fund which at the end of fifty years will completely wipe out the original investment, and an obsolescence charge of 2.5 per cent upon the cost of construction.

If a private plant is already in operation, the local municipality may enter into a contract with the owners to act as its general distributing agents, or it may purchase the existing plant at a price to be agreed upon with the owners thereof, subject to referendum vote, or the municipality may construct a distributing system at its own expense. A special election will be required to authorize or ratify the action of municipal authorities in any of these matters. The bill also provides for the creation in each municipality receiving such electric service of a municipal hydroelectric board consisting of the Mayor and two other members. The municipality may raise money to construct or purchase a distribution system either by direct taxation or by the issuance and sale of municipal bonds.

Every municipal corporation under contract will be required to post its rates for service in some public place and shall under proper regulations offer rates for the following classes of service: (1) Lighting of public streets, highways and buildings; (2) domestic and commercial lighting; (3) motor service for municipal purposes; (4) motor service for manufacturing or private use; (5) wholesale energy for public-service corporations. Municipalities will be required to keep their accounts in such form as the commission shall prescribe.

Any person or corporation located in a hydroelectric district, but in a municipality which has not contracted for electric service, may apply to the commission for a direct contract at rates to be agreed upon. The commission is required to devise a system of accounting for the hydroelectric districts and to make quarterly reports to the State Comptroller.

The final section provides for the creation of the "capital hydroelectric district" for the city of Albany and the construction of plants on the barge canal at Crescent and Vischer's Ferry, together with transmission lines, etc.

## HEARINGS

At the hearings held in Albany by the judiciary committees many prominent officials urged the adoption of the proposed schemes. Among them, Lieutenant-Governor M. H. Glynn declared that the movement has the indorsement of Prime Minister Borden of Canada, who also favors the expansion of the Ontario system to other provinces. Messrs. G. E. Van Kernen and J. D. Moore, members of the State Conservation Commission, indorsed the measures, and several representatives of local business concerns urged their adoption. Others who appeared on behalf of the bills were Mr. W. J. Gloeckner, of the Albany Chamber of Commerce; Mr. G. E. Ward, of the Civic League, and officials of neighboring municipalities.

Among those who opposed the bills were Mr. R. P. Bolton, representing the National Electric Light Association, and Mr. Francis Blossom. Both of these witnesses testified that there is insufficient surplus water at Vischer's Ferry for a substantial development. Mr. Bolton contended that the hydroelectric system of Ontario is constantly losing money and characterized the proposed New York scheme as a socialistic plan of excessive expenditure and favoritism to a few interests in a small section of the State. Mr. George Clinton, of Buffalo, opposed the plan because, in his opinion, it threatened the water supply of the canals. Ex-Senator H. W. Hill, of Buffalo, Mr. N. B. Killmer of Brooklyn, and ex-Senator Edgar T. Brackett were also among those who opposed the plan. Ex-Senator T. Harvey Ferris, of Utica, head of the legislative commission that reported unfavorably on the Ontario plan, spoke briefly, defending the report that his committee made.

Representatives of the Merchants' Association of New

York City and the Citizens' Association of Brooklyn also raised objections on the ground that such legislation favored given localities at the expense of the people of the State as a whole.

### Exhibition Arrangements for N. E. L. A. Convention

The exhibition committee of the National Electric Light Association, Mr. J. C. McQuiston chairman, has announced the arrangement made for Class D members' exhibits in connection with the forthcoming convention of the N. E. L. A. to be held at the Medinah Temple, Chicago, June 2 to 6, inclusive.

In the accompanying diagram is shown the booth plan for the exhibit hall which will occupy the lower floor of the Temple. This room measures approximately 100 ft. by 200 ft., leaving a booth area of 10,930 sq. ft. with sixty-eight booths. The committee will provide signs, railings, decorations, service outlet for electrical connection, telephone, etc., for each booth and has made arrangements with

with a single company. The Pacific Gas & Electric Company now has in operation electric generating stations with a rating exceeding 200,000 hp and is engaged in the construction of additional electric water-power plants with an ultimate rating of 165,000 hp, which, when completed, will give it a total generating rating of 365,000 hp.

### The Indiana Public Utility Law

The Public Utility Bill recently passed by the Indiana Legislature, which becomes a law on and after May 1, is unusually comprehensive and definite and easily ranks among the model laws of this class already enacted by the various states. Its principal features are presented here in abstract.

The term "public utility" is defined in the act as embracing every corporation, company, individual, association of individuals, their lessees, trustees or receivers, and every city or town that owns, operates, manages or controls any

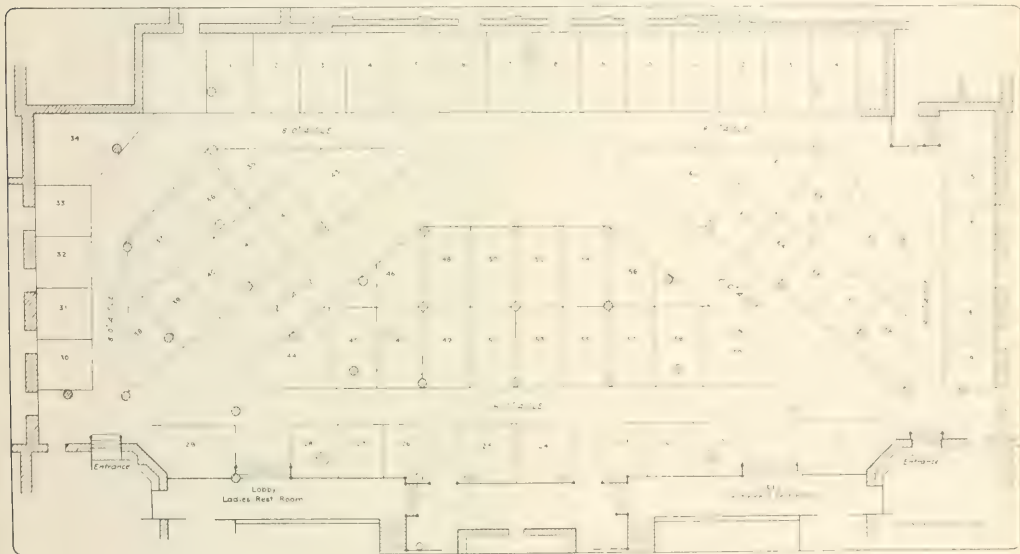


DIAGRAM OF BOOTH PLAN FOR EXHIBIT HALL

local firms for labor of all kinds, floral decorations, rugs, furniture, etc.

Mr. H. G. McConaughy, 299 Broadway, New York City, is secretary-treasurer of the exhibition committee.

### Energy for Panama-Pacific Exposition

A contract has been signed between the Panama-Pacific International Exposition Company and the Pacific Gas & Electric Company under which the latter will supply exclusively during the next three and one-half years the electrical energy required for all purposes during the term of the World's Fair in San Francisco in 1915 and during the period of construction and dismantling. Present estimates are that the exposition will require 20,000 hp. The gross amount of this business is estimated at \$500,000. Simultaneously contracts have been made with the Pacific Gas & Electric Company for all gas and steam required by the exposition.

This is the first time that an exposition of the first magnitude has contracted for all of its requirements for energy

street railway or interurban railway or any telephone or telegraph system, or any heat, light, water or power system, or any elevator or warehouse furnishing service either directly or indirectly to or for the public. The term "service" is employed in its broadest sense and includes not only the use or accommodation afforded to consumers or patrons but also any product or commodity furnished by them and the plant employed in such service. The term "indeterminate permit" is used in the act and means every grant directly or indirectly from the State to any corporation, company, individual, association of individuals, etc., of the power, right or privilege to own, operate, manage or control any plant or part of a plant for the transmission, transmission or furnishing of heat, light, water or power directly or indirectly to or for the public or for the transportation of street or interurban railway passengers or property, or for the furnishing of railroads for the transmission of intelligence between points within the State. Every such permit shall continue in force until such time as a municipality shall exercise its option to purchase the property as provided for in the act, or until the permit shall be otherwise terminated according to law.



The Public Service Commission of Indiana will consist of five members, not more than three of whom are to be members of the same political party. Each member shall be appointed by the Governor for a term of four years. The Governor shall also appoint a general counsel for a term of four years. Under the act the former Railroad Commission is abolished, and its rights, powers and duties are conferred by the act upon the Public Service Commission and continue in full force. The commission is empowered to select one of its own members as chairman. The salary of each member and of the general counsel will be \$6,000 per annum. The secretary will receive \$3,600 per annum and the clerk \$3,000. Each member of the commission will be required to give bonds in the sum of \$10,000 for the faithful performance of his duties. The commission is authorized to employ such attorneys, engineers, examiners, experts, accountants, etc., as it may deem necessary.

#### SUFFICIENCY OF SERVICE

Each public utility will be required to furnish reasonably adequate service and facilities, and the charges made by all public utilities shall be reasonable and just. Every unjust or unreasonable charge for service is prohibited and declared unlawful, provided that nothing in the act shall authorize the charging of a higher rate than is provided by any franchise under which a utility is operating. Every public utility having tracks, conduits, subways or poles along streets or highways shall permit the use of the same by any other public utility for a reasonable compensation whenever public convenience and interest requires it and when such use will not cause irreparable injury to the owners.

#### ACCOUNTS AND REPORTS

Every public utility will be required to keep and render to the commission uniform accounts of all business in such form as may be prescribed. Every public utility engaged directly or indirectly in any other or subsidiary business shall render separate reports thereof to the commission if so ordered. The commission will prepare suitable blanks and forms for carrying out its purposes. No public utility shall keep any other books, accounts or records except those prescribed or approved by the commission, unless required by some other public authority.

Every public utility must have an office in one of the towns or cities of the State in which its property or some part of its property is located and shall there keep its books and records. Every executive and general officer and the majority of the members of the board of directors of any utility company must be bona-fide residents of the State during their term of office. All accounts shall be closed annually on June 30 and a balance sheet taken as of that date.

#### DEPRECIATION ALLOWANCES

Every public utility must carry an adequate and proper depreciation account whenever the commission after investigation shall determine that it can be reasonably required. From time to time the commission shall determine what are the proper and adequate rates of depreciation for the several classes of property on each public utility. The rates shall be such as will provide the necessary amounts over and above expenses of maintenance to keep the property in a state of efficiency corresponding to the progress of the industry.

Depreciation charges shall be set aside out of the earnings and carried in a depreciation fund which either may be expended for new construction extensions or additions to the property or may be invested, and if invested the income from the investment shall also be carried in the fund. This fund and its proceeds shall be used for no other purpose but depreciation, and in no event shall the money expended from the fund for new construction be credited to the capital account, but it shall always be charged against

the depreciation fund. The commission shall keep itself informed of all new construction, extensions and additions to the property of public utilities and shall prescribe the form and manner of keeping the construction accounts, which shall clearly distinguish between operating expenses and construction.

#### STANDARDS OF SERVICE

The commission shall ascertain and fix adequate and serviceable standards for the measurement and quality, pressure, initial voltage or other factors pertaining to the service rendered by any public utility and shall prescribe reasonable regulations for testing the quality of service. Reasonable regulations and standards shall also be established to secure accuracy of all meters and measuring appliances, and the commission shall provide for the examination and testing of any and all such appliances used by a public utility.

#### RATES AND TOLLS

Every public utility must file its rate schedules with the commission and must also keep copies of the same open for public inspection. This applies with full force to the joint rates or charges. After the act takes effect no change shall be made in rate schedule except upon thirty days' notice to the commission and the receipt of approval from the commission, unless the commission shall authorize a shorter period. No utility may charge or receive a greater or less compensation for any service performed by it than is specified in its public schedules.

The commission shall provide for a comprehensive classification of the service rendered by each public utility, which may take into account the quantity used, the time when used, the purpose for which used and other reasonable considerations. The commission shall have authority to inquire into the management of the business of all public utilities and obtain in any case all necessary information to enable it to perform its duties, including the right to inspect books, accounts, papers, records, etc., and to examine under oath any officer, agent or employee of a public utility in relation to its business affairs.

#### STOCK AND BOND ISSUE

The Public Service Commission is to have very complete authority over the issues of stocks, bonds, notes and certificates of indebtedness by public-utility companies. No public utility shall issue any stock or certificate of stock except in consideration of money or of labor or of property at its true money value, as found by the commission, or at such premium as may be approved by the commission.

No public utility shall issue any bonds, notes or other evidences of indebtedness except for money or labor or property actually received and equal to not less than 75 per cent of the value thereof. It is provided, however, that no bonds or notes shall be issued to retire or discharge any discounts incurred after Feb. 1 of the present year in connection with the issuance of bonds, notes or other certificates of indebtedness to be refunded or discharged.

The indebtedness of any public utility shall bear reasonable proportion to the total issue of capital stock, due consideration being given to the nature of the business, its credit, future prospects and earnings. Any public utility may, with the approval of the commission, issue securities or evidences of indebtedness payable at periods of not more than twelve months after the date thereof, when necessary for the acquisition of property, the construction of plant or the improvement of service, or for the lawful refunding of its obligations; or, again, for the reimbursement of money spent from the treasury and obtained from the issue of securities within five years next prior to the filing of application with the commission, assuming that the utility kept its accounts in the manner ordered by the commission. Whenever a public utility desires to make such an issue of securities it must file a full statement of its financial condition with the commission, and no issue will

be lawful unless it bears the approval of the commission.

Moneys received from the sale of securities shall not be applied to any purpose except that which is specified in the approval and order of the commission. The commission has not power, however, to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount actually paid to the State or to any subdivision thereof as the consideration for the grant of such franchise. When two or more corporations are merged the combined capitalization shall not exceed the sum of the capital stock of the corporations consolidated except for additional sums of cash actually paid out. No contract for consolidation or lease or merger shall be capitalized.

The act expressly states that the State of Indiana does not indorse or guarantee in any manner whatsoever any issue of securities of a public utility under the provisions of the bill. No public utility shall transfer or lease its franchise, works or system to any other person or corporation without the consent of the commission. No public utility shall directly or indirectly acquire the stocks or bonds of any other corporation engaged in a similar business unless authorized to do so by the commission. When the commission gives its consent, any two or more public utilities furnishing a similar service in the same locality may enter into contracts with each other which will enable them to operate their systems jointly. Upon the consent of three-fourths of the capital stock outstanding, and with the consent of the commission, any public utility may buy or sell or lease its property or business at a price and on terms fixed by the commission.

#### INDETERMINATE PERMIT

After this act takes effect no license, permit or franchise will be granted to any interest to own, operate, manage or control any public utility by any municipality where there is already in operation a public utility engaged in furnishing similar service under an indeterminate license, franchise or permit, except in the event that the commission has declared, after due public hearing, that public convenience and interest require such a second utility and the resulting competition.

Any existing permit, license or franchise which shall interfere in any way with the existence of a second public utility is declared under the terms of the act to be against public policy and is amended in such manner as to permit the grant of an indeterminate permit to a second utility under the terms of the act. The provision of the act making it mandatory to obtain an indeterminate permit after due public hearing applies with equal force to municipalities which desire to engage in furnishing public service in competition with one or more of the existing parties.

No license or indeterminate permit shall hereafter be granted or transferred except to a corporation duly organized under the laws of the State of Indiana or to a citizen of the State. Every license or franchise hereafter granted to any public utility shall have the effect of an indeterminate permit, subject to the provisions of the act and subject also to revocation by the commission for cause.

Any public utility operating under an existing license or franchise shall, upon filing prior to July 1, 1915, a declaration of surrender with the clerk of the municipality which granted it, receive by operation of law an indeterminate permit with all the rules and privileges thereunder which the act provides.

Every public utility accepting or operating under an indeterminate permit is deemed to have consented to future purchase of its property by the municipality in which the major part of it is situated at the valuation to be fixed by the commission under the terms of the act, without other recourse to law or the courts. The act sets forth the procedure which a municipality must follow in taking over an existing utility which it desires to acquire and operate.

#### PENALTY FOR VIOLATION

The act strictly forbids the furnishing by any public utility of free service, franchises or special privileges to any person, patron or public officer, or to any political committee or candidate for public office. Violation of this provision is punishable by not less than one year's nor more than five years' confinement in the state prison, or by a fine of not less than \$200 or more than \$1,000.

If any public utility charges or receives more than or less than its published rate for service, the act is also punishable by a prison term or a fine. The same applies in case any public utility gives any particular person or corporation any undue or unreasonable preference or subjects any one to any undue or unreasonable prejudice or disadvantage in any respect.

Rebates are expressly forbidden and declared unlawful. Violation of any of the provisions of the act by any officer or agent of a public utility or by any officer of any town or city constituted a public utility is made a misdemeanor and punishable by a fine.

Every public utility will be required when an accident attended with loss of human life takes place upon its premises to give immediate notice thereof to the commission. In such event the commission, if the public interest appears to require it, shall cause an investigation to be made immediately and shall inquire into any neglect or violation of any laws of the State or the ordinances of any city or town by any public utility or its agents or employees.

The commission shall have the power and it shall be its duty to enforce the provisions as well of all other laws relating to public utilities. A sum sufficient to carry out the provisions of the act, not to exceed \$75,000, is appropriated annually out of the state treasury.

### Public Service Commission News

#### MASSACHUSETTS COMMISSION

The Massachusetts Railroad Commission has authorized the Bay State Street Railway Company, operating about 1000 miles of track north and south of Boston, to issue 6600 additional shares of preferred stock at \$115 per share, the proceeds to be used in paying floating indebtedness. The funds raised will be applied in part as follows: New track and line construction or improvement, \$83,178; cars, \$68,476; power stations and equipment, \$283,787; land and buildings, \$63,458. The new preferred stock will be taken by the Massachusetts Electric Companies, under the provisions of the company's by-laws.

The Gas and Electric Light Commission has issued a decision sustaining the appeal of the Buzzards Bay Electric Company from a franchise granted the Barnstable Electric Company by the Selectmen of Barnstable to build and operate lines in that part of Barnstable known as Hyannis. The issue before the board was whether public necessity and convenience called for the admission of the Barnstable company into territory already occupied by another company able and willing to perform its duties. The service proposed at Hyannis and other parts of the Buzzards Bay district includes the supply of electricity to many summer residents. The board points out that to supply such a scattered territory with a maximum of efficiency and economy a single company with a properly located central station is preferable to numerous companies with independently operated stations, each the center of a small area of supply. No superior facilities were shown to exist in cases in the Barnstable company. It appeared that before the controversy arose the Barnstable company had planned and was undertaking in good faith the supply of this territory as rapidly as the growth of its business warranted. Its plans included the supply of other towns and the board points out that while its investment and business in Hyannis



were small, it had irrevocably professed there its public calling and could not thereafter have legally or properly refused to supply electricity throughout the town of Barnstable to all who might reasonably demand its service.

Governor Foss has issued a statement reiterating his determination to advocate a public utilities commission with centralized powers in place of the existing tribunals for the regulation of public service companies. Within the past few days a movement has taken shape in the Legislature to create a transportation commission possessing some of the powers which the Governor has advocated, in place of the present railroad board. The Governor says that it would be particularly unfortunate at this time if a centralized board should not be established, and that a strong public demand exists at present for the creation of a commission with broader powers over a wider field than the proposed transportation commission would have. The present bill of the sub-committee on railroads is a re-draft of the Washburn bill and provides for the enlargement of the Railroad Commission from three to five members, for an increase of the salary of the chairman to \$9,000 and that of the remaining four members to \$8,000, and for mandatory powers, with appeal to the Supreme Court of the State rather than to the federal court, in order to save time in trying appeals. Thus far there appears little popular demand for the centralized commission plan which has been urged by the Governor for several years, and if the re-drafted Washburn bill goes through, it is probable that the regulation of gas and electric companies, with the exception of electric-railway, telephone and telegraph companies, will remain in the hands of the Gas and Electric Light Commission. It is rumored that the Governor will veto any bill other than one providing for a centralized utilities board.

#### NEW YORK COMMISSIONS

With the return of the subway operating contracts from the Board of Estimate and Apportionment to the Public Service Commission for execution, negotiations will be consummated for the building and operation of the dual system of rapid transit which will give to New York City a subway and elevated system having 629 miles of single track and costing, for new work and new equipment, upward of \$300,000,000. The approval of the operating contracts was noted in our issue of March 8. The only contract not included is the certificate for the third-tracking of the elevated railroads in Manhattan and the Bronx. This certificate originally was made out to the Manhattan Railway Company, owner of the elevated roads, which refused to accept it. The commission for the First District thereupon made out a new certificate to the Interborough Rapid Transit Company, as lessee of the roads. A public hearing on this certificate is set for March 15. The commission's vote on the adoption of the contracts was divided three to two, Chairman Edward E. McCall and Commissioners John E. Eustis and George V. S. Williams voting for adoption and Commissioners Milo R. Maltbie and J. Sergeant Cram against. Commissioner Maltbie proposed several amendments to both of the operating contracts, reducing the amount of the proposed preferential payments and making other changes in provisions to which he objected. The amendments were all voted down. Excluding the assignments of contracts Nos. 1 and 2, covering the existing subway, for which the new contracts will be substituted, there are eight different instruments involved in the new agreement. When all these contracts are signed the Public Service Commission will push the work of letting construction contracts on such portions of the new system as have not been already awarded. The most important of these are the extension of the existing subway from Times Square down Seventh Avenue to Park Place and under the East River to Brooklyn, and the Broadway-Fifty-ninth Street subway, running from the Queensboro Bridge to Seventh Avenue and down Seventh Avenue and Broadway

to lower Manhattan and by tunnel under the East River to Brooklyn.

The Colliers Light, Heat & Power Company has been authorized to issue \$25,000 of stock and \$135,000 of mortgage bonds to acquire the property of the Clinton Mills Power Company, which operates in Cooperstown, and the Richfield Springs Electric Light & Power Company, which operates in Richfield Springs, both in the county of Otsego. The property of both companies now taken over by the Colliers company has been entirely rearranged so that the principal source of power supply will be the steam plant just acquired by the Otsego & Herkimer Railroad Company from the Hartwick Power Company. The water-power and steam plant formerly owned by the Clinton Mills Power Company will be used to supplement and as a reserve for the power to be taken from the railroad company.

#### CALIFORNIA COMMISSION

The Pacific Gas & Electric Company has applied for a rehearing of the case involving the reduction of rates of the Northern California Power Company. The applicant stated that the rates were unremunerative to both the Northern California Power Company and itself and asked that the rate order be suspended in so far as it applied to Butte and Colusa Counties.

A supplemental order has been issued allowing the City Electric Company to sell \$83,000 of bonds which had previously been authorized to be pledged as collateral security for a loan.

#### NEW JERSEY COMMISSION

The New Jersey Board of Public Utility Commissioners has dismissed the complaint against the Public Service Electric Company, charging excessive and discriminatory municipal electric-lighting rates in a proposed schedule, brought by Raritan Township Dec. 16, 1911, and later joined in by East Newark, Montclair, Kearny, Harrison, Roselle Park and Jersey City. After inspecting the new rate schedule for street lighting filed by the company and investigating the justice and reasonableness of the increases shown in certain sections, the board holds that these rates will not bring to the company an unreasonable return on a legitimate investment. In the decision the board says that the new schedule shows a total net decrease of \$100,200.98. While increases are made in the charges to some municipalities, the total number of such is small as compared with the total decreases. The board has decided that the increases do not afford sufficient cause for setting aside the schedule and further declares that the investment cost for conduits and pole lines which should be allotted to street-lighting service produces a lower average cost per lamp for a municipality with a large number of lamps as compared with a municipality having a smaller number. The board holds that "a sliding scale rate granting lower rates for larger installations is not unduly discriminatory or preferential, but a uniform price to all municipalities, irrespective of the number of lamps without reference to terms of the contract, would be unduly discriminatory."

The new schedule of the company is as follows: Thirty-one contracts for 890 arc lamps, former charge \$74,539, new charge \$65,886, total reduction \$8,653; forty contracts for 10,768 lamps of 2000 cp, former charge \$834,309, new charge \$773,808, total reduction \$60,501; fifty-five contracts for 1798 incandescent lamps, former charge \$124,899, new charge \$113,510, total reduction \$11,389.

#### OHIO COMMISSION

The application of the Columbus Railway & Light Company for permission to consolidate the railway and lighting interests at Columbus received a hearing before the commission on Feb. 28. President S. G. McMeen of the railway company explained that the consolidation is desired in order that the service of both the railway and lighting plants may be continued at existing rates and that such extensions and improvements may be made as are



needed. This service cannot be continued long under present arrangements, he said, since operating alone, the plants cannot give service on the most economical basis. This fact was realized some years ago, but then the only means available for operating the plants as a unit was the leasing plan. This has, however, proved too costly. Mr. McMeen said that at present it is necessary to keep nine complete sets of accounts, and that a large clerical force is needed. With the plants consolidated much of the clerical work can be eliminated. It was also shown that expenses in other directions are larger than they should be. The desired consolidation, it is declared, is needed in order that the present rates may be maintained and necessary extensions and improvements made. At the hearing no objection was made to the plan or the purpose sought, but Mr. W. A. Henry, the attorney representing the Columbus Light, Heat & Power Company, argued that the stockholders of this company are being treated unfairly in the proposed exchange of their stock. A brief will be filed with the commission setting forth his contention.

#### WISCONSIN COMMISSION

The question of state regulation of water-powers is again before the Wisconsin Legislature. A bill recently introduced provides for the construction and maintenance of dams across navigable rivers for the purpose of improving navigation or developing power under franchises to be issued by the Railroad Commission. No franchise is to be issued by the commission except upon a petition and a public hearing or upon an investigation by the commission upon its own initiative. The bill also authorizes the commission to regulate the level and flow of water, to pass upon and approve all plans and specifications relative to new construction or improvements and, in general, to supervise the construction, maintenance and operation of dams upon all navigable rivers in the State.

At the request of the city of Milwaukee, an investigation of the various phases of the local street-lighting problem has been made by the engineering staff of the commission, which will submit comprehensive recommendations to the city.

## Current News Notes

**WATER-POWER COMPANIES PROHIBITED FROM CONDEMNING SITES OF OTHER COMPANIES.**—The North Carolina Legislature, at present in session at Raleigh, has passed a measure preventing water-power companies within the State from condemning water-powers of other companies under certain conditions. The 1907 act which made that possible has now been amended so as to restrain monopolization.

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**WEIGHT OF ICE-COATED WIRES.**—In the course of an account of the effects of a recent sleet storm, the *Bell Telephone News*, of Chicago, said: "A coating of ice 1 in. in diameter on a telephone wire will weigh 1.75 lb. to the foot. A span between two poles which normally weighs 5 lb. grows to fifty times that weight, and three cross-arms filled with wires thus coated with sleet weigh about 4 tons. Such conditions crush and splinter the stoutest poles."

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**GOVERNMENT FORBIDS USE OF CARBON-FILAMENT LAMPS.**—A recent order from the office of the Supervising Architect of the Treasury Department of the United States government is to the effect that carbon-filament, gem or metalized carbon-filament lamps must not be used in government buildings hereafter. Any such lamps in use at the time of the receipt of the order (which is dated Feb. 1, 1913) must be removed and 25-watt tungsten lamps must be substituted.

**ELECTRIC ZONE TO NEW HAVEN BY JUNE 1.**—The electrified zone of the New York, New Haven & Hartford Railroad is expected to be in operation to New Haven sometime in May. This will more than double the railroad's present electrified trackage, which extends from New York City to Stamford. The New Haven will then have about 35 miles under electric operation, including, besides the single-phase equipment, 12 miles of third-rail terminal tracks entering the Park Avenue tunnel and Grand Central Station. Several miles of overhead construction yet remain to be completed on the new Stamford-New Haven extension.

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**ELECTRICAL EXPOSITION PROCEEDS FOR INDIAN PAGEANT.**—At the midweek luncheon of the Colorado Electric Club, Denver, March 6, it was decided to donate the proceeds of the 1913 Denver Electrical and Industrial Exposition to the Colorado Publicity League for use in preparing the Last Grand Council of the North American Indian, a pageant which will be held in Denver in 1915, contemporaneously with the San Francisco and San Diego expositions. Early Indian life will be represented, and several thousand Indians, cowboys and soldiers will take part. Phonographic and moving-picture records are to be taken for preservation. Nearly 200 attended the meeting of the electric club.

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**NO PERMANENT QUARTERS FOR ELECTRIC CLUB OF CHICAGO AS YET.**—The question of securing permanent quarters was again discussed at the meeting of the Electric Club of Chicago on March 6. Secretary Rosseland gave the result of a postal-card vote on the subject. Out of a membership of about 375, 198 men voted on the question. To the query "Are you in favor of permanent quarters?" 159 answered in the affirmative and 39 in the negative. In relation to the proposal to raise the dues from \$5 to \$12 a year, 156 voted in favor of it and 38 opposed it. The attendance at the meeting of March 6 was 140. There was a good deal of discussion, in which Messrs. W. M. Connelly, O. B. Duncan, H. E. Niesz, W. D. Ray and others took part. A vote was taken on carrying out the recommendations of the special committee recently appointed, of which Mr. H. A. Mott was chairman, favoring the establishment of permanent quarters in the old building of the Hamilton Club. This proposition was voted down. However, the subject may be taken up again.

\* \* \*

**BANQUET OF WESTINGHOUSE MEN.**—The third annual banquet of Westinghouse men in the Pittsburgh district was held at the Hotel Schenley, Pittsburgh, Pa., March 8. About 600 were present at the affair, which was given under the auspices of the Westinghouse Club. Mr. Charles A. Terry, of New York City, vice-president of the Westinghouse Electric & Manufacturing Company, acted as toastmaster and introduced the following speakers representing the Westinghouse interests: Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company; Colonel H. G. Prout, vice-president of the Union Switch & Signal Company, who spoke on "The Young Man and the Nation"; Mr. F. S. McClahan, chief architect, steam and gas department of the Westinghouse Machine Company, "Miscibility"; Mr. F. A. Craig, chief engineer, Westinghouse Air Brake Company; Mr. H. H. Westinghouse, New York City, president of the Westinghouse Air Brake Company, "History," and Mr. Guy E. Tripp, chairman of the board of directors of the Electric Company, "The Public." Mr. Robert Garland, member of the Council of Nine of Pittsburgh and an electrical manufacturer, the guest of the evening, made a forceful address dealing with local questions of government and advocating efficiency in municipal affairs.

**"WIRELESS" TRAIN DISPATCHING ON LACKAWANNA.**—The Lackawanna Railroad is equipping its stations at Scranton, Pa., and Binghamton, N. Y., with wireless-telegraph transmitting apparatus capable of sending messages 65 miles. The trains which pass these points will be fitted with receiving devices so that orders, messages, etc., can be transmitted directly to the train crews while running at full speed. Besides the regular work of train dispatching it is also planned to use the "wireless" to deliver messages to passengers, transmit news, etc. Mr. L. B. Foley is superintendent of telegraph for the Lackawanna. If this initial installation proves satisfactory, wireless apparatus will be installed throughout the system.

\* \* \*

**"ELECTRIC FOOT WARMER" EXONERATED.**—Some attention was attracted among electrical men in Chicago recently by a daily newspaper item to the effect that an "electric foot warmer" in the house of a man in Wilmette, Ill., set fire to bed clothing and caused the house to catch fire. Inquiry reveals the fact that the fire was caused by a defective socket attached to a lamp cord leading to the bed, a lamp being used for reading purposes. It appears that the socket happened to be under the bed covers and a short-circuit occurred, setting fire to the bed clothing. The woman of the house said she knew the socket was defective but had neglected to have it repaired. Since the accident the extension cord and socket have been done away with entirely. Apparently no electric-heating pad was involved in the case in any way.

\* \* \*

**NAUTICAL TRAINING FOR COLLEGE MEN.**—A plan has been proposed whereby the United States Navy in co-operation with the presidents of the universities and colleges of the United States will train a limited number of students on board battleships. According to the draft of the proposed general order students recommended by the proper authorities will be embarked in battleships and armored cruisers in full commission for a training period of two months' duration. No more than twenty students will be assigned to one vessel. All applicants must be over eighteen years of age and must have completed at least two years of their courses. Training will be given to successful candidates in the engineering, electrical, gunnery, navigation and boat departments, besides general regulations and routine of shipboard life. The training is to be thoroughly practical, embracing every opportunity for actual experience. The aim will be to ground each student well in one line of duties rather than give a smattering of several. As far as practicable, the choice of this specialization will be in line with the student's educational course at college.

\* \* \*

#### SOCIETY MEETINGS

**MR. ERICKSON TO SPEAK ON PUBLIC UTILITY LAWS.**—Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, is to address a joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers at the rooms of the former on the evening of March 24.

\* \* \*

**TRI-STATE WATER AND LIGHT ASSOCIATION.**—The second annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia, which was organized at Columbia, S. C., June 28, 1911, will be held at Charlotte, N. C., April 15 and 16. The officers of the association are: President, Mr. W. F. Steiglitz, Columbia, S. C.; first vice-president, Mr. W. E. Vest, Charlotte, N. C.; second vice-president, Mr. George Hubbard, Elberton, Ga.; third vice-president, Mr. B. F. Erwin, Atlanta, Ga.; secretary and treasurer, Mr. J. W. Neave, Salisbury, N. C.

**ANNUAL MEETING OF THE S. P. E. E.**—During the week of June 23 the Society for the Promotion of Engineering Education will hold its annual meeting at Minneapolis, Minn.

\* \* \*

**PLEASURE-VEHICLE PROBLEMS TO BE DISCUSSED.**—Informal luncheons of the Chicago Section of the Electric Vehicle Association are held every Tuesday in the Traffic Club on the eighteenth floor of the Hotel La Salle. On March 18 and 25 and April 1 it is planned to have short talks by representatives of manufacturers of pleasure cars.

\* \* \*

**NEBRASKA ELECTRICAL ASSOCIATION.**—It is probable that the convention of the Nebraska Electrical Association will be held later this year than last, perhaps not until summer or early fall. Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, is president of the association, which is a geographical section of the National Electric Light Association.

\* \* \*

**JOVIAN CHAPTER, ST. LOUIS LEAGUE OF ELECTRICAL INTERESTS.**—At the luncheon of the Jovian Chapter, St. Louis League of Electrical Interests, March 4, President A. C. Einstein presented gold pins to Messrs. Burgess and O'Brien for obtaining the greatest number of new members. Mr. Richard McCulloch, vice-president and assistant general manager of the United Railway Company of St. Louis, read a paper on "Electric Railway Problems," dealing with subjects of track and car construction, scarcity of efficient laborers and supervision of traffic. Figures which he quoted showed that the number of St. Louis passengers who ride on transfers is 46 per cent of the number of revenue passengers, making the average revenue per passenger for the year 1912 3.31 cents.

\* \* \*

**N. E. L. A. ACTIVITIES AT PHILADELPHIA.**—Prof. E. E. F. Creighton, of Union College, Schenectady, N. Y., addressed the Philadelphia Electric Company N. E. L. A. section, Feb. 17, on the subjects of "The Protection of Electrical Circuits" and "Experiments at High Frequencies." The address was illustrated with both charts and actual demonstrations. Mr. J. C. Bartlett discussed electric vehicles before the commercial department branch, Feb. 24, presenting data on operating cost, energy consumption, etc. This branch now has 146 members. The manufacture of watt-hour meters was described before the February meeting of the meter-department branch by Mr. J. B. Mills, of the Fort Wayne Works of the General Electric Company. The newly formed engineering branch of the Philadelphia Section is now organized for work, with Mr. A. L. Atmore as chairman-elect.

\* \* \*

**INSTITUTE OF RADIO ENGINEERS.**—A paper by Dr. L. W. Austin, of the National Bureau of Standards, describing some experimental extensions of his recent work on the variation with frequency of condenser resistances, was read at the regular meeting of the Institute of Radio Engineers, New York, March 5. Although Dr. Austin was unable to deliver the paper in person, the subject matter aroused much interest and brought about a lively discussion. The design of an emblem was submitted to the membership for final criticism, and it is expected that the form agreed upon will be ready for distribution at the next meeting, April 2. The Institute of Radio Engineers, which was formed by the consolidation of the Society of Wireless Telegraph Engineers and the Wireless Institute, is now well on in its second year. The membership is still growing rapidly, and meetings are held on the first Wednesday of each month at Fayerweather Hall, Columbia University, New York, with an average attendance of about fifty.

## Mill Creek Automatic Pumping Station

**Increasing the output of a Utah hydroelectric plant by the use of electrical methods to pump a portion of its water supply. By M. R. Lott**

**I**N laying out hydroelectric systems it is sometimes possible to add appreciably to the output of an existing power station by introducing into the main flow line additional water from some source other than that of the primary supply. In many instances this can be accomplished with an expenditure of money which is small in proportion to the gain in power output of the station. In plants where the supply of power is equal to, or very little in excess of, the demand, the value of the additional capacity thus made available becomes very great, particularly during the low-water period.

Sometimes it is possible to gain the additional water by diverting some small stream or spring whose channel is at a sufficiently high elevation to allow its waters to be carried by gravity through a conduit to the main flow line. If, on the other hand, the source of the spring is at a lower elevation, it will be necessary to use a pump to lift the additional water to the main conduit. The latter method would be profitable only, of course, when the head against which the water must be pumped is small in comparison with the effective head available for use at the plant where the additional supply of water is required.

An example of a profitable development illustrating the latter case is the Mill Creek pumping station of the Knight Consolidated Power Company, whose main offices are at Provo, Utah.

### KNIGHT SYSTEM OF WATER-POWER PLANTS

The Knight Consolidated Power Company has in operation in Utah eight hydroelectric plants all located within a radius of 45 miles of Salt Lake City. These stations feed into a 40,000-volt transmission system, the output being used for lighting a dozen towns and for power purposes in the largest mining camps in the State. The mining load is a large and important one.

Most of the plants depend upon small mountain streams for their water supply and operate under rather high heads. These streams have a large flow during the high-water season (May, June and a part of July), but this later decreases to a fairly small run-off, reaching a minimum during the months of December, January and February. As the plants have to be designed with the fluctuating stream flow in mind, any method which will add to their

available water supply, at the same time involving small installation and operating costs, becomes a valuable consideration.

The two plants of the system most intimately associated with the pumping plant to be described are those in Mill Creek Canyon, southeast of Salt Lake City. The lower plant, known as Mill Creek No. 2, is located at the mouth of the canyon, approximately 7 miles southeast of Salt Lake City (see Fig. 1). The upper station, Mill Creek No. 1, is situated about 5 miles further up the canyon. This rocky valley is one of the many small canyons in the Wasatch mountain range, and is a very narrow defile, having high rock walls which prevent the sunshine from

reaching the stream bed during the greater portion of the day. The little mountain river winds its course down the narrow canyon bed, receiving additional water from various springs as it goes. Its character is similar to that of other mountain streams having the usual fluctuating flow of water. The accompanying table, which shows the amount of water in cubic feet per second available each month at the lower plant, is characteristic and



FIG. 1—LOWER MILL CREEK CANYON PLANT OF KNIGHT CONSOLIDATED POWER COMPANY, SALT LAKE CITY

illustrates in a very clear way the nature of the flow.

The water passing through the upper plant is discharged into the intake reservoir for the lower plant, the diversion works for the latter station being about 650 ft. down the canyon. A small concrete dam, approximately 20 ft. high, backs the water up to the upper plant, thus forming a small reservoir with a storage of approximately 6 acre-ft., an amount of water equivalent to about 560 kw at the lower plant for eight hours.

### PIPE LINE AND LOWER MILL CREEK PLANT

The intake to the pipe line is about 19 ft. below the crest of the spillway, and the pipe line itself leading to the lower plant is laid on a grade of 2 ft. per 1000 ft. The lengths and sizes of the various portions governing the net effective head are as follows: 25,094 ft. of 30-in. continuous wood-stave pipe, 334 ft. of 28-in. riveted steel pipe, 405 ft. of 26-in., 438 ft. of 24-in., 450 ft. of 22-in., 149 ft. of 21-in. and 367 ft. of 20-in. lap-welded steel pipe.

The static head is 1031 ft. An accompanying curve (Fig. 2) shows the net effective head at the power house for any discharge between zero and the maximum dis-



charge capacity of the conduit, 19.3 cu. ft. per second. This curve of effective head was computed by the Hazen Williams slide rule, using as values  $C = 115$  for the wooden-stave and riveted-steel pipes and  $C = 100$  for the lap-welded pipe.

There are two units at the lower plant, each consisting

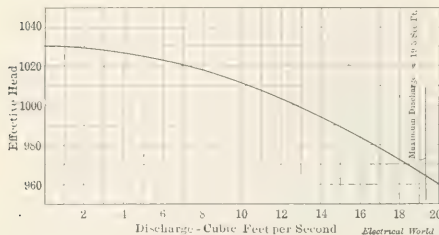


FIG. 2—CURVE OF EFFECTIVE HEAD ON LOWER MILL CREEK PLANT

of a Doble waterwheel direct-connected to a General Electric generator. Each waterwheel is capable of developing 1300 hp at 514 r.p.m. under an effective head of 990 ft. The generators are rated at 700 kva, 60 cycles and 2300 volts.

The curve in Fig. 8 shows the kilowatt output at 100 per cent power-factor for different quantities of water discharged through the wheels. This is a theoretical curve which was checked by actual test, using a water rheostat for load. The Lower Mill Creek plant does most of the governing for the system.

#### SPRINGS AND PUMPING STATION

Approximately half a mile down the canyon from the intake works for the lower plant a number of springs issue from the ground within a limited area. The flow from these springs, by weir measurements, varies from 3 second-ft. to 4.5 second-ft., depending upon the season of the year. By means of a small diversion dam and pumping plant it was possible to collect these waters and pump them into the main 30-in. flow line, thus increasing the available water supply at the lower plant and in consequence its available power output.



FIG. 3—DIVERSION DAM AND PUMP HOUSE

The diversion dam as built is made of concrete and structural steel and is provided with removable wooden gates. The concrete which supports the structural steel extends from the surface of the creek bed down to a solid foundation. One end pier ties into the station building foundation and the other extends 4 ft. into the mountain

slope, thus preventing leakage of the collected waters. The steelwork consists of I-beams with angles riveted to them to form guides and supports for the wooden gates. Wooden gates made with tongue joints were used for damming up the water, so that in time of flood conditions they might be removed to allow the debris carried with the

#### WATER AVAILABLE AT LOWER MILL CREEK PLANT, 1912

	Maximum	Minimum	Average
January	9.36	8.88	9.16
February	9.10	8.43	8.82
March	10.56	8.85	9.30
April	16.44	12.43	14.62
May	51.84	16.61	30.91
June	56.00	24.50	37.00
July	18.99	12.61	16.38
August	17.67	13.47	15.26
September	13.59	12.68	13.11
October	12.57	10.73	12.01
November	12.16	11.09	11.56
December	11.50	10.07	10.90

rushing torrents to be taken down stream without filling the small reservoir which the dam makes available. A platform extends around the station building and across the dam, to facilitate the removal of these gates. The average depth of water at the gates is about 3 ft. 6 in.

The station building has a concrete foundation, brick walls and a shingle roof. It is 12 ft. by 16 ft. in plan and 16 ft. high. On the stream side of the building a weir is placed in the foundation wall to permit making tests. The floors are of concrete. Difficulty was encountered in excavating for the station building on account of numerous small springs which became apparent after the work of excavation had proceeded to a depth of 2 ft. From that point to the required floor elevation, about 6 ft. farther down, the work had to be carried on in mire. Solid foundations of the building walls were secured by sinking water-tight boxes till solid formation was reached, filling these with concrete and reinforcing the entire foundation. To secure dry floors, it was necessary to use two layers of concrete, leaving spaces for drainage between. A rough, thick floor was first laid to keep out most of the water; then forms were built for the drains, which were covered with a solid piece of sheet iron, and on this the top floor was laid.



FIG. 4—DOWNSTREAM SIDE OF DIVERSION DAM, GATES REMOVED

#### PUMP EQUIPMENT AND AUTOMATIC CONTROL

The water flows from the stream channel into a receiving well 6 ft. by 12 ft. and 7 ft. 2 in. in height, made by placing a concrete partition wall across the building. This is topped with a reinforced-concrete cover on which the motor-starting apparatus is placed. The horizontal pumping unit con-

sists of a Worthington single-stage, single-suction 6-in. centrifugal pump, direct-connected to a General Electric three-phase squirrel-cage induction motor, rated at 100 hp, 1800 r.p.m., 2200 volts, 60 cycles. Pump and motor are mounted on the same bedplate, the whole unit being placed so the shaft center line is 2 ft. 7.5 in. below the weir crest.

plant. A check valve is provided on the discharge side of the pump, and provision is made for draining the pipe line.

It was the intention to make the station entirely automatic in its operation, so that no regular attendance would be necessary. To accomplish this automatic motor control

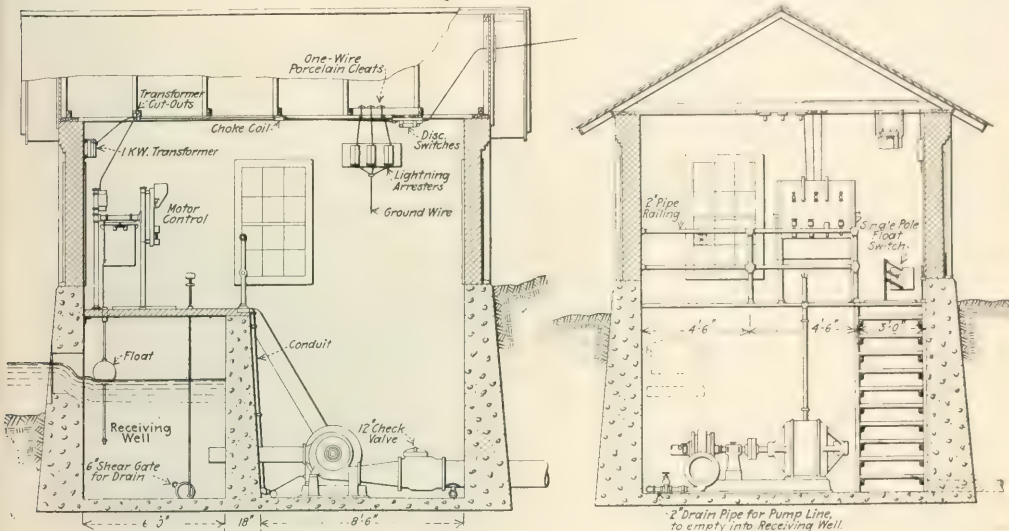


FIG. 5—ELEVATION SECTIONS THROUGH AUTOMATIC MOTOR-DRIVEN PUMP HOUSE

This arrangement does away with the troubles associated with foot valves and priming. Great care was used to secure an efficient pump and motor, for the feature of efficiency becomes of great importance in this type of an installation. Numerous copies of specifications detailing the requirements were sent to the various manufacturers, and from the replies to these the maker guaranteeing the

was required. A float switch operated by the change in level of the water in the receiving well controls through the automatic motor compensator the starting and stopping of the motor at the pumping house. This apparatus is mounted on pipe framework over the receiving well, together with the disconnecting switches, Garton-Daniels lightning arresters, choke coils, and the 1-kw transformer



FIG. 6—T-CONNECTION WITH MAIN PIPE LINE

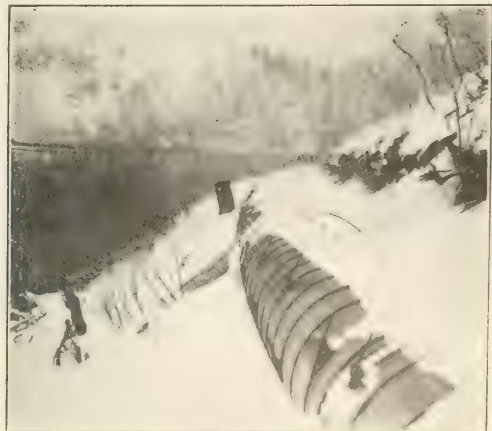


FIG. 7—30 IN. PIPE LINE IN CANYON

most efficient machines, other things being equal, was selected.

The pump is designed to lift 3.5 cu. ft. of water per second in ordinary operation, the normal head against which the water must be pumped being 138 ft., including friction. The curve in Fig. 11 gives the performance of the

which is used in lighting the building and its surroundings.

#### PIPE CONSTRUCTION AND TRANSMISSION LINE

A 12-in. wire-wound wooden-stave pipe carries the water pumped to the main 30-in. flow line. The size of pipe to be used was determined by balancing the value of the

power lost through friction against the interest and depreciation of the investment. The pipe is made of California redwood with a 1-in. net thickness of staves, except at those portions into which the steel fittings are inserted. No. 6 galvanized-iron wire is used for banding, with a spacing of 2 in. and 1.375 in. Steel elbows are employed

on the same poles, below the high-tension wires. The conductor is No. 6 medium hard-drawn copper wire, carried on glass insulators mounted on standard 1½-in. by 9-in. locust pins and standard 5-in. four-pin Washington fir cross-arms.

At the upper plant the line is fed from the station 2300-

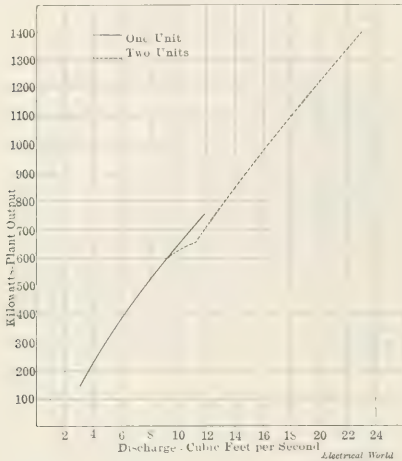


FIG. 8—OUTPUT, LOWER MILL CREEK PLANT

at angles, and a steel T-connection joins the 12-in. pumping-plant line to the main 30-in. flow line.

The connections between the steel fittings and the wooden-stave pipe are of the nature of slip joints, the rivets in those portions of the fittings which are inserted into the pipes being countersunk. In the 12-in. pipe line the inside diameter of the steel elbows was 12 in., the ends of the wooden pipe being reamed out to the outside diameter of the steel fittings. An increaser is supplied at the T-connection so that the velocity of the water will be decreased when it enters the 30-in. pipe, thus avoiding loss at that point. A gate valve is provided in the 12-in. pipe near the point of connection, while a vent pipe is connected in just



FIG. 10—POLE-LINE CONSTRUCTION, SHOWING 22,000-VOLT, 2200-VOLT AND TELEPHONE CIRCUITS

volt bus through disconnecting switches and an oil switch provided with overload trip coils. By means of a recording ammeter the station operator is able to keep track of what is happening at the pumping plant. Garton-Daniels lightning arresters and choke coils are also installed in the upper plant.

#### POWER VALUE OF WATER ADDED FROM SPRINGS

From the table of water available at the lower plant (other than that pumped) the output curve of the lower



FIG. 9—UPPER MILL CREEK CANYON PLANT

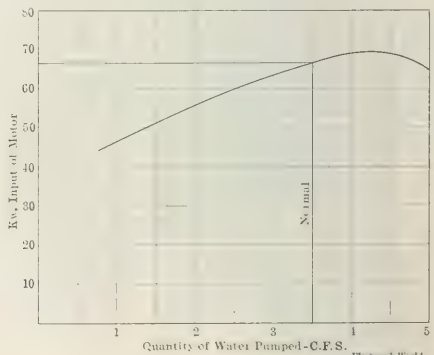


FIG. 11—PERFORMANCE CURVE OF PUMPING PLANT

below, so that the pumping-plant line may be emptied when desired.

The energy for driving the motor is supplied from the upper Mill Creek plant. A 22,000-volt line extends from this plant to the lower station, passing by the pump house, enabling the 2200-volt circuit for the motor to be mounted

plant and the performance curve of the pumping unit it is possible to estimate the value of the pumping installation. From the water-supply table it will be seen that during the months of May and June the water is in excess of the pipe-line capacity, so the use of the pumping plant is out of the question during those two months, but the



spring water is available for use during the remaining portion. From the output curves for the two plants it will be seen that the 3.5 cu. ft. per second will, on the average, be good for 237 kw at the lower plant, with a motor input of 67 kw, making a net gain of 170 kw. On the basis of having 3.5 second-ft. available during ten months, the total possible net yearly gain in energy resulting from the installation of the pumping plant will therefore be 1,224,000 kw-hr. Estimating that one-half of this could be sold at 1 cent per kw-hr., the saving would amount to \$6,120. This is more than the initial cost of the pumping system and shows that the return on the investment can be very large.

Not only is the water supplied by the springs good for immediate use at the lower plant, but at times when it is not needed at the lower plant it can be pumped into the intake reservoir for storage until time of peak load.

The entire work described was designed in the engineering offices of the Knight Consolidated Power Company, and the actual construction and installation were let by contract to the lowest bidder. The total cost of the pumping-plant system was approximately \$32 per net kw of rating gained.

## Utilization of Pulverized Fuel for Boiler Firing

By C. H. WRIGHT

The difficulties of securing perfect combustion with low-grade fuel are well known to all steam engineers, and an inspection of the smoke issuing from stacks and of the methods of stoking confirms the opinion that many common methods of firing are not economical. If finely pulverized fuel could be properly used, it would assist the steam engineers in a number of cases. Such coal blown into the kilns is commonly used as fuel in the manufacture of cement. To use the same material for firing boilers, it is necessary to have a proper mixture of air and to blow this mixture into a heated furnace. This combination acts somewhat as would a mixture of gases and to some extent has to be treated in the same manner to avoid explosions. As the mixture is not a perfect gas, care has to be taken that proper ignition be secured; in fact, to secure continuous ignition of a reliable nature it is necessary to have the mixture surrounded by incandescent firebrick or something similar.

There are a great many places where low-grade fuel or coaldust is available, and this is often found to have considerable heat value. It is unfortunate, therefore, if it has to be wasted and used as ballast for railroads or consigned to an unsightly and dividend-consuming dump.

Many experiments have been made during the past fifty years on the use of powdered fuel by blowing it into ordinary boiler furnaces, but anyone who has had experience with such practice will recognize the difficulty arising from choked flues and disintegrated brickwork, etc. This is particularly true of boilers with horizontal tubes or those which have only a slight rise of the tubes. The dust naturally collects on the top of the tubes, reducing the efficiency of the boilers.

With a number of our standard water-tube boilers automatic stokers and various types of mechanical grates have been installed burning low-grade fuel. Most of these are fairly successful where the coal is not so small that it drops through the bars. There is always, however, the difficulty of introducing the proper amount of air to secure a perfect combustion and the further difficulty of even distribution of heat and continuous steady generation of steam.

The following are the main difficulties encountered in using pulverized coal blown into the firebox: Maintaining a steady flame, for which is required a high temperature in the furnace; proper furnace lining to withstand the high heat necessary to maintain constant ignition; the difficulty

of introducing into the furnace steadily an even mixture of combustible material when the grade of coal varies and when, as is often the case, it is mixed with clinker or other refuse; maintaining this mixture in a satisfactory condition so that valuable matter is not rejected into the stack, as the larger particles are apt to move in a tangent (this difficulty may be overcome to some extent by careful grinding of the coal); handling of the slag which results from the burning of refuse.

In the *Electrical World* of Feb. 1, 1913, page 240, there was shown an installation of boilers using powdered fuel,

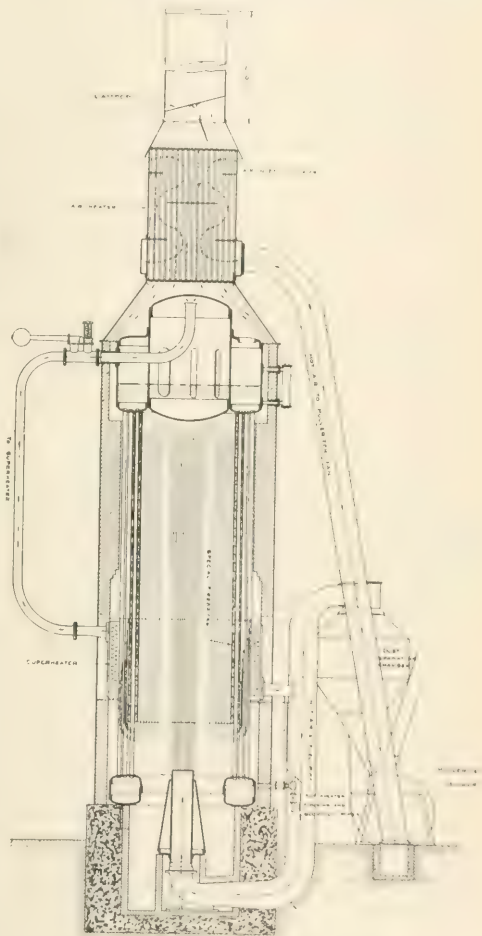


FIG. 1.—PATH OF GASES IN BOILER

and a description of this equipment will indicate how in actual practice a number of the difficulties are overcome. The principal idea consists in the use of a vertical gas-jet inlet so that a mushroom-shaped flame is produced within a closed ring of vertical boiler tubes which constitute the steam-producing plant.

The heating up and continuous ignition of the incoming stream of dust and air is effected primarily by the enveloping sheath of products of combustion, now a true gas, or, rather, a mixture of gases (principally  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and  $\text{N}_2$ ), and at a temperature of about 3000 deg. Fahr. Obviously, this "self-igniter" can never change its predeter-

mined position, no matter how great a velocity is given to the incoming stream of combustible mixture. Ignition is now independent of the incandescent brickwork, which hitherto was in turn dependent upon its proximity to the point of explosion for incandescence.

It is a demonstrated fact that the point of explosion does not rise more than about 10 per cent under the highest feed

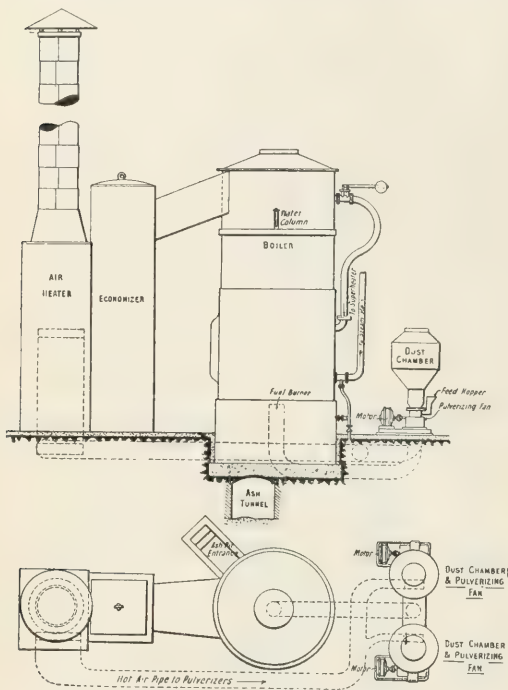


FIG. 2—GENERAL ARRANGEMENT OF UNITS

pressure which it is practicable to employ. The tendency is, for reasons which will be explained later, for the enveloping gases to increase slightly in temperature as the pressure is increased. At the same time these returning gases always insure incandescent brickwork around the tuyère. This has the advantage of storing heat which is sufficient after a temporary stop to re-start the fire by merely turning on the fuel supply.

Owing to the direction of the flow of coal and air, a continuous mixture is secured, thereby overcoming the difficulties mentioned above. The most important mixing of coaldust and air is done before it is blown into the furnace. The solid portion is by weight about one-eleventh of the mixture, and experience seems to show that the coaldust enters the chamber at the same speed as the accompanying air.

The ash is converted into a liquid which is deposited on the brick lining of the furnace, subsequently dropping into the ash pit. The result is that the furnace automatically keeps clear of slag. The spray protects the furnace lining, thus rendering unnecessary the use of fireclay. The fire-bricks are stacked in position, and after a short time there is obtained a proper lining having a glazed appearance.

Referring to Fig. 1, it will be noted that ignition takes place shortly after the gas enters the furnace. It rises until it strikes the top and turns downward again when combustion has practically ceased. The products of combustion form a sort of sheath or gas lining which prevents blow-pipe action but does not prevent radiant heat passing

through to the boiler proper. This boiler can be fired with oil, waste gases or with a mixture of various components.

The coal is fed into a hopper near the pulverizer and is carried by a worm to a chute which leads into the pulverizer proper. The latter is equipped with a blower which delivers the dust into a separating chamber, the smallest particles going directly to the boiler, the larger particles returning to be re-ground (Fig. 2). The gases which leave the boiler pass through an air heater to pre-heat the air for the blower. The pulverizer is generally driven by a directly connected motor. The boiler is first fired by placing a lighted torch at the mouth of the nozzle. After the boiler has once been heated up, however, the gas takes fire from the hot brickwork. It is easy to regulate the supply of air and to secure practically perfect combustion. The boiler is, of course, specially constructed for the work to be done, particular attention being paid to the top header and the brickwork. As the circulation is naturally rapid in this kind of boiler, scale deposit is much less than in ordinary water-tube boilers. With this class of fuel a very small stack is required. Steam can be raised very quickly, and this system can therefore be used to advantage in electric railway power plants and central stations to take care of peak loads. The amount of fuel consumed is, of course, directly proportional to the work done, and the feed can be throttled down or stopped exactly in accordance with the demands of the service. The coal flow is controlled by a lever or cone pulley.

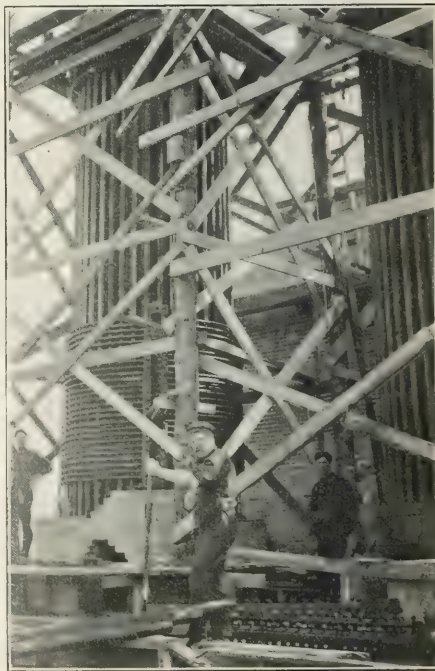


FIG. 3—ARRANGEMENT OF SUPERHEATER WITH BETTINGTON BOILER

In using powdered fuel it is possible to obtain an evaporation of from 6 lb. to  $7\frac{1}{2}$  lb. of water per pound of coal, or a thermal efficiency of from 75 to 80, depending upon conditions.

A test of pulverized fuel with a similar equipment was given in the *Proceedings* of the Institute of Mining Engineers of England, Vol. 43, Part II, February, 1912, which

shows that dust fuel lends itself to high thermal efficiency, smoke consumption, quick steaming, flexibility, small ground space, unbanked fires, low radiation loss, and the possible use of low-grade fuel. This is borne out by other test figures shown below:

TEST ON BOILER USING PULVERIZED FUEL

Test	1	2	3	4
Duration of test in minutes.....	145.5	117	51.5	65.5
Absolute steam pressure in pounds.....	187	189	189	189
Steam temperature in deg. Fahr.....	513	515	513	517
Temperature of feed water in deg. Fahr.....	74	77	76	78
CO <sub>2</sub> in flue gases in per cent.....	14.5	17.6	18.7	16.4
Factor of evaporation.....	1,266	1,265	1,265	1,265
Consumption of coal in pounds per hour.....	2,775	3,676	3,980	3,372
Water evaporated per hour (actual) lb.....	20,100	26,890	28,470	25,300
Water evaporated from and at 212 deg Fahr.....	25,430	34,000	36,000	32,000
Water per pound of coal (actual).....	7.24	7.32	7.15	7.50
Water per pound of coal from and at 212 deg Fahr.....	9.16	9.27	9.05	9.50
Heat value of coal by calorimeter.....	11.50	11.50	11.50	11.50
Efficiency, net, in per cent.....	79.7	80.6	78.7	82.6

The cost of operation and repairs of the pulverizer has been figured at about 5 cents per ton of coal burned, depending, of course, upon conditions.

## Magnetism and Elasticity

By F. J. KEAN

In every dynamo-electric machine there is at least one portion of the magnetic circuit which is subjected to tensile stress by reason of the fact that it is being whirled round at a very high velocity. There are in consequence two distinct problems to consider regarding the behavior of the material which constitutes the rotating element: (1) How does the tensile stress affect the permeability of the magnetic circuit? (2) How does the magnetic force and magnetization affect the mechanical properties of the material?

The effect of tensile stress upon the permeability of the ferro-magnetic materials has been very carefully investigated by such eminent scientists as Kelvin, Ewing and

TABLE I—LOAD AND STRAIN READINGS FROM A MAGNETIZED BAR

Specimen of Annealed Wrought Iron $\frac{1}{2}$ In. in Diameter	Value of $E^*$ in the Virgin Material (Lb. per Sq. In.)	Value of $E$ When Strongly Magnetized (Lb. per Sq. In.)	Percentage Change in $E$
No. 1.....	$28.28 \times 10^6$	$28.96 \times 10^6$	2.4
No. 2.....	$28.28 \times 10^6$	$29.20 \times 10^6$	3.1
No. 3.....	$28.50 \times 10^6$	$28.73 \times 10^6$	0.8

\* $E$  stands for Young's modulus of elasticity

others. The effect of magnetization upon elasticity has also been very carefully investigated, but this effect being of a much more complex nature has not up to the present been really satisfactorily determined.

The practical application of the above problem presents itself to the mind of the writer very emphatically in the case of a salient-pole revolving-field alternator of the type sketched in Fig. 1. Here we have the poles of the magnet traversed by lines of magnetic flux which pass through them radially, while at the same time the material is subjected to direct tensile stress which also acts radially owing to centrifugal force.

To obtain some preliminary idea of what is likely to happen it seems fair to compare the case to that of an electromagnet and its keeper by imagining a section taken through one of the poles and forming a perfect magnetic joint at the surfaces (Fig. 2). Let  $H$  be the magnetic force

in c.g.s. units,  $I$  the intensity of magnetization and  $B$  the induction density in lines per square centimeter. Then any pull applied to the pole would result in separating the two parts of the joint in preference to extending the material of the pole. If this be allowed, and if we agree that when a load is applied to a bar the bar becomes strained and extends itself until the stress set up in the material balances the applied load, it seems fair to assume that in the case of a magnetized bar the applied load will expend itself in overcoming the magnetic pull before it commences to strain the bar and the real stress necessary to balance an applied load will be less than the nominal stress by the stress equivalent to the magnetic pull.

Experiments to determine the amount of strain due to magnetization were first made by Joule<sup>1</sup>, and later by Mayer<sup>2</sup> and Barrett<sup>3</sup>, but the most important were those of Bidwell<sup>4</sup>, who found that iron became lengthened by magnetization in a moderate field but shortened when magnetized in a very strong field. The strain caused by mag-

TABLE II—ELASTICITY OF MAGNETIZED BARS

Load	Strain	Load	Strain
0	0	7000	370
1000	60	6000	450
2000	140	5000	530
3000	220	8000	610
4000	300	9000	690

netization with moderate forces was an extension varying from  $\frac{1}{200,000}$  to  $\frac{1}{400,000}$  of the length; with very large magnetic forces a contraction of length was observed amounting to  $\frac{1}{150,000}$ . When the material was magnetized

while a load was hanging from it the strain caused by magnetization was different from that of the unloaded specimen. The extension was much less and finally disappeared with big loads, the strain being one of contraction even in the weakest fields, and this contraction increased as the load was increased.

Experiments to determine the effect of magnetization upon the modulus of elasticity ( $E$ ) of the material were first made in 1842 by Wertheim<sup>5</sup>, in 1848 by Wartman<sup>6</sup>, and in 1886 by Tomlinson<sup>7</sup>, each of whom found no change in the modulus of elasticity due to magnetization. Later Brackett<sup>8</sup> in 1897, Stevens<sup>9</sup> in 1899, and Tangl<sup>10</sup> in 1900 each found an increase in the modulus due to magnetization. In summing up, however, Tangl says that the effect of magnetization upon Young's modulus depends greatly upon the previous history of the material as regards stretching. Then in 1902 Honda<sup>11</sup> and others investigated similar phenomena, obtaining conflicting results in the case of steel bars subjected to magnetization, and later still Rensing<sup>12</sup> found that a decrease of elasticity took place under magnetization.

It was evident to the writer when he undertook the investigation herein described that extreme care and accuracy would be required. Moreover, it seemed necessary to be very precise in defining the method of determining the modulus as well as in the exact procedure to which the bars

<sup>1</sup>Phil. Mag., (4), Vol. vi, p. 459.  
<sup>2</sup>Proc. Roy. Soc., Vol. xl.

<sup>3</sup>Proc. Roy. Soc., Vol. xl.

<sup>4</sup>Proc. Roy. Soc., Vol. xl.

<sup>5</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>6</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>7</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>8</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>9</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>10</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>11</sup>Phil. Mag., (4), Vol. vi, p. 459.

<sup>12</sup>Phil. Mag., (4), Vol. vi, p. 459.



should be subjected throughout in order to make the results comparable. The method of magnetization had to be decided upon, and for this purpose a yoke of soft iron in the form of a channel section was chosen with all the coils wound on the yoke itself and the bar under test left quite free. The bar to be experimented upon was placed in effect across the channel and passed through two nicely fitting

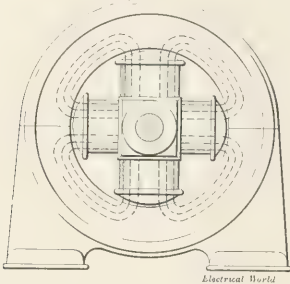


FIG. 1—PATHS OF MAGNETIC FLUX IN DYNAMO

holes without binding in any way on the sides of the holes, and the portions of the bar extending beyond the yoke served for the grips. A free length of 11 in. was available for the measuring gear on the portion of the bar inside the yoke, the bar being 0.75 in. in diameter.

In the tests about to be described the bars were of best Yorkshire iron very carefully annealed by the Farnley Iron Company and turned and ground up true to within one one-thousandth of an inch.

The measuring gear used was the Goodman extensometer, and the tests were made by the writer in the Mechanical Engineering Laboratory at Leeds University, England. To avoid temperature effects the magnetizing coils, as stated above, were kept on the yoke only and no readings were accepted which gave any indication of a temperature change. The magnetizing force used was approximately 40 c.g.s. units, and this gave an induction density in the

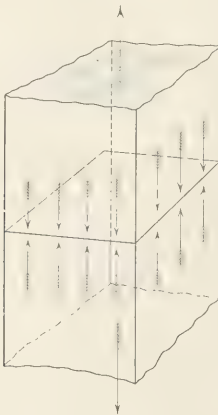


FIG. 2—PERFECT MAGNETIC JOINT

bar itself of about 12,000 lines per square centimeter—a very exact determination was not considered essential for these quantities. In defining the quantity known as Young's modulus of elasticity the writer makes the assumption that a material is elastic if the strain entirely disappears when the load which produced it is removed; that an elastic material obeys Hook's law, which is in effect that

"Stress is proportional to strain" within the limits of elasticity, and that the ratio of stress to strain is constant for the elastic state of the material, the quotient being termed Young's modulus of elasticity. The modulus was determined by direct pull and measuring the strain corresponding to equal increments of load which amounted to 1000 lb. at a time.

In Table I is shown a set of readings taken from one of the magnetized bars. It will be noted that with the exception of the first reading the increment of strain for any given increment of load does not differ very greatly throughout the set. Care must be exercised with regard to the calculation of the modulus of elasticity. Two methods are available: (1) To draw a stress-strain diagram and measure the slope of the elastic line; (2) to calculate the average strain set up by a given amount of load applied, using the "method of differences."

When the bar is in the unmagnetized state and not subjected to any magnetic force other than the vertical component of the earth's field one would expect the elastic line to pass through the origin as shown in Fig. 3, but when a large magnetic force is applied and the bar becomes strongly magnetized it would be expected from Bidwell's researches that the elastic line would run parallel to the previous one but displaced from it by a distance equal to the strain that corresponds to the stress induced in the material by magnetization. If any change occurred in the value of

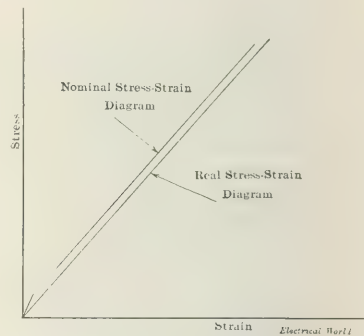


FIG. 3—STRESS-STRAIN DIAGRAMS

the modulus of elasticity, the new elastic line would not run parallel to the old one.

One difficulty that the writer experienced, in common with previous investigators, was that the behavior of the bar after it has once been tested in a strong magnetic field is not the same as its behavior when taken in the virgin state and magnetized strongly for the first time; therefore, instead of attempting to repeat experiments on the same bar by demagnetizing it, he used three different bars of the same material all in the virgin state and examined their behavior when subjected to a very strong field for the first time, and in preference to relying on the graphical method of finding the modulus of elasticity he used the "method of differences" but ignored entirely in each case the first extensometer reading and found the average strain per increment of load from the remaining readings both in the unmagnetized and the magnetized state.

The results which were obtained by him from these experiments are given in Table II, from which it is clear that magnetization increases the elasticity of the bar by an average of about 2 per cent, but the exact amount of the increase varies very considerably for similar bars of the same material. Further experiments were made to ascertain the behavior of the material when the magnetic force was withdrawn entirely and again reapplied, but these are not yet complete.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Routing Out Competitive Illuminants at Nashville

During last month the contract department of the Nashville Railway & Light Company, Nashville, Tenn., secured orders for fifty-three house-wiring jobs, each one of which covered an already-built dwelling in which no wiring had previously been installed. Through the department ninety-nine flatirons were placed, fifty gas arcs and four gasoline plants were displaced by electric lighting, and orders were taken for fifty 250-watt tungsten-lamp units.

## Transformer Truck for Emergency Connections

The Crawfordsville (Ind.) Electric Light & Power Company has equipped a truck with a pair of 25-kw transformers for emergency use. In case of transformer breakdowns, this truck can be dispatched to the scene of the trouble and connected up to render service until repairs are made or a new transformer is installed. The terminals on the portable set are so arranged that 220-volt, three-phase service can be supplied to motors, or the coils can be connected in multiple to deliver temporary 110-volt energy to lighting circuits used for street fairs, circuses, tent shows, etc. The truck equipment can also be utilized for thawing out frozen water pipes.

## An Electric Eastertide Exhibition

A Cyphers incubator containing ten dozen Plymouth Rock eggs of first quality, which are being hatched by electricity, is now on exhibit in the show window of the Kentucky Electric Company, Louisville. The appearance of the young Plymouth Rocks is expected at Eastertide, the process of incubation having been commenced Feb. 27. Meanwhile the company is educating all persons interested in the modern way of producing poultry. A minute record is kept of the number of times the eggs are turned every twenty-four hours, the extent to which they are cooled and the general care taken, while a meter on the incubator registers the consumption of energy so that inquirers may be informed of the actual cost of producing a batch of chickens. The experiment, suitably advertised, is attracting widespread attention.

## Combination Room and Meter Rate at Pittsburgh

The Duquesne Light Company, of Pittsburgh, Pa., a subsidiary of the Allegheny County Light Company, announces a new combined "room" and meter rate for electric service. Present customers may avail themselves of this schedule by making applications for new contracts. The new rate is explained as a step to improve the load-factor on the company's plants, giving customers a better rate for off-peak consumption.

The new schedule combines a flat-rate charge, based on the rooms served, with a kilowatt-hour charge proportional to the energy consumed. For each downstairs room in residences a base rate of 15 cents per month will be charged, with a similar rate for each downstairs hall. Upstairs rooms will be charged at the rate of 5 cents per month, with no charges for bathrooms and upstairs halls. For pur-

poses of billing apartments are to be regarded as downstairs throughout. The minimum monthly charge fixed is 65 cents. Where more than fifty lamp sockets are installed these will be charged for at the rate of 2 cents per additional socket.

In addition to the flat-rate fixed charges above outlined, the energy consumed will be measured by meter and charged for at the rate of 6 cents per kw-hr., with a reduction of 1 cent per kw-hr. if bills are paid within ten days. The former rate of the company was 12 cents per kw-hr., with a 2-cent reduction for prompt payment.

## Wichita Dye Works Using 3000 Kw-hr. Monthly

The cleaning and dyeing establishment of Mr. J. S. Giwosky, at Wichita, Kan., is equipped with fifty electric irons and half a dozen motors, consuming each month from 2500 to 3000 kw-hr. of central-station energy. The majority of the irons are of the 6-in. size and lighter, used for



CLEANING ESTABLISHMENT AT WICHITA, KAN., USING FIFTY ELECTRIC IRONS

pressing delicate fabrics, although the men's clothes department employs fifteen 18-lb. irons. Three centrifugal extractors, five washing machines and one steam-heated tumbler or drier are all driven by a single 15-hp motor. Another extractor has a separate 2-hp motor, and there is a 5-hp elevator motor. Based on its connected load, the cleaning plant guarantees the Kansas Gas & Electric Company a minimum bill of \$75 monthly.

## "Only Way to Make Small-Town Plant Pay"

"The only way to make an electric-light plant pay in a small town is to operate in connection with it a combination ice factory," declares the manager of a successful ice-electric property in a North Texas town of 1200 population.

This man has a 4-ton plant which he operates six months in the year, manufacturing a total of about 700 tons of ice for the local population. His ice equipment represents an investment of about \$5,000. In addition to the refrigerating machinery, ice is stored in a small vault capable of holding about 6 tons, or nearly two average days' output.

Following is his itemized statement of his monthly oper-

ating expenses: Fuel, \$300; labor (including office help), \$100; supplies, miscellaneous, \$25; delivery, \$30.

The actual plant cost to produce one ton of ice on the station platform he estimates at \$3.50. This product is sold at wholesale for \$8 per ton, while the local domestic price for delivered ice is 50 cents per 100 lb.

The balance sheet for a year's operation gives the following general figures: Yearly gross income from ice business, \$5,400; yearly expenses (depreciation, interest, etc.), \$2,520; net income from ice business, \$2,880.

With an investment of \$5,000 this plant is therefore earning about 56 per cent net returns on the original outlay, making a welcome addition to the meager income which an electric plant alone would produce in a community of 1200 population.

### Ice-Electric Operation with Water Pumping

Electric generation, ice making and water pumping should be held up before the small-plant operator as the trinity of maximum economy toward which his efforts should be bent. One such triple-combination station in latitude 40 deg. near the Mississippi River has a 10-ton ice machine which produces 600 tons during its six-month ice-making season. Approximately \$10,000 is invested in the ice department, which returns a gross income of \$3,300. The domestic price for delivered ice is 45 cents per 100 lb. and for wholesale quantities \$4 per ton. The management expresses itself as well pleased with its success in ice-making, reporting combination operation thoroughly satisfactory in connection with its other departments. The population served numbers 2000.

### "Combination Ice Plants a No. 1 Investment"

"Combination ice-electric plants in good localities having suitable shipping facilities are No. 1 investments and beat the business of producing and selling electricity in several ways," to quote a Southwestern operator who has a 10-ton plant in a town of 1300.

But, pointing to his own case as a gentle lesson, this manager warns against installing an equipment too large for the local ice consumption. A 5-ton plant in a town having a market for 5 tons daily is a better investment, he points out, than a 20-ton outfit in a larger community where by reason of restricted demand or outside importation only a fraction of the ice-making capacity is used. Near certain centers large city manufacturers seeking to find markets for their surplus capacity are crowding the small local factories, since the big plants can sell at a rate even less than the production costs incident to ice making on a small scale.

In this Oklahoma 10-ton plant the investment represented by ice machinery and building is about \$10,500, to which must be added \$600 for wagons and teams. There is also storage capacity for 300 tons of ice, an additional outlay of \$1,000. The total investment thus reaches \$12,100.

Coal to operate the ice plant costs \$1.90 per ton, making the fuel expense average \$9.50 per day. Various local items about the plant, including office assistance, etc., total \$17.50.

The plant produces 2000 tons a year, all of which is made during its six-month season. The actual cost of manufacturing a ton of ice is estimated at \$1.30. The wholesale price is \$3.50 per ton. For the domestic supply, delivered to the customer's premises, the local price is 60 cents per 100 lb.

Following is the summary of a year's business: Annual gross income from ice-making, \$3,500; yearly expenses, \$2,500; net return from ice-making, \$1,000.

The operator above quoted is, however, thoroughly pleased with combination operation, and to any company contemplating putting in ice machinery he offers the pointed advice, "Get busy," provided, he adds, the locality affords

a good market for the congealed product. His own plant gives an example of the double service secured from station attendants under combination operating conditions. The engineer here, as in other small ice-electric plants, operates the ice machinery without any hindrance to his regular duties.

### Ice Business Has No Bad Accounts

In comparing the ice-making and central-station departments of their business several combination-plant operators comment particularly on the freedom from bad debts enjoyed by the ice business. Especially is this the case if the retail sales are handled with coupons, books being sold for cash. Ten per cent discount may even be allowed for payment in advance.

"But be sure to use ice tickets in your deliveries," urges one operator, adding the sharp instruction which he gives to his own drivers, "No ticket, no ice!"

Tickets save disputed bills and misunderstandings with customers, especially with the women. "In the ice and light business," declares one man with experience, "the women are worse to deal with than the men. They are disposed to dispute all bills on general principles; they will not take the trouble to inform themselves and will not listen to an explanation. The only objection to the retail business is the female element. If you deliver your own ice, be careful to give full weight and avoid business dealings with the women!"

"Retail all ice by pound coupon books" is the pointed advice which another manager offers. As long as this policy of advance payment is adhered to, however, the dealer may be assured that he will be embarrassed by none of those overdue accounts which too often are the bane of the central-station manager in the small community.

### Commercial Club's Electric Luncheons

The members of the Commercial Club of Corvallis, Ore., which holds weekly noonday luncheon meetings, now enjoy appetizing dishes prepared with the aid of an electric stove loaned to the club by Manager Morton of the Oregon Power Company. The Commercial Club has several other electric appliances so that it is able to handle the preparation of its luncheons with dispatch. This use of electric cooking has proved a great advertisement for the local central-station company. The club members are well pleased with electric service and may purchase the entire outfit.

### Minimizing Unnecessary Meter Removals at Des Moines

It is an axiom among real-estate men that an electric-lighted dwelling does not remain long without a tenant. A corollary to this proposition almost too apparent to need formal statement is found in the fact that no sooner does the electric-light company remove its meter at the behest of a departing tenant than it is required to replace its service in the same premises to meet the demand of the incoming renter.

An effort to obviate the expense and labor of needlessly changing meters back and forth is being made by the Des Moines (Iowa) Electric Light Company, which uses the service-discontinuance card reproduced herewith. When an outgoing customer sends instructions to discontinue his service every effort is at once made to find out the name and present address of his successor. Sometimes this information can be obtained from the old tenant, and usually always from the landlord or his agent. The data, together with the presumptive dates at which service is to



be discontinued and is likely to be needed by the new tenant, are entered on the card. On the day the old occupant moves an inspector is dispatched to the house to read the meter and remove the service cut-out fuses. He also leaves a tag in some prominent location in the house, notifying the next comer that the building is wired for electric light and the electric service is available on order from the company.

The bottom coupon of the card is then filled out for the

## Des Moines Electric Co. 191

### Customer's instructions to discontinue service.

Name .....  
 Address .....  
 Customer gives notice that service is to be discontinued by ..... 191 ..  
 Present customer says premises will ... be occupied by another party by  
 (date) ..... 191 ..  
 Name of prospective occupant is .....  
 Prospective occupant can be found at .....  
 Name of owner or agent of premises who will have key when present occupant  
 vacates ..... Address .....  
 Signature of employee taking instructions .....

**Inspector:** Please fill in blank spaces above if not already filled in. If occupant does not move out on date of your first visit obtain foregoing information only, but give exact date occupant will move ..... 191 ..

If occupant moves out on the date of your visit, read meter, remove fuses and tie tag in conspicuous place. Fuses turned in to .....  
 Where did you tie tag? .....

### KEEP THIS SHEET CLEAN



Reading ..... Constant ..... Our number on meter .....  
 (date) ..... 191 ..... Inspector .....

**General Foreman:** Please be advised that fuses controlling service through meter No. .... at (address) .....  
 for new occupant (name) ..... have this day  
 been put in. Former occupant was (name) .....  
 (date) ..... 191 ..... Chief Clerk .....

**Des Moines Electric Co.** Des Moines, Iowa ..... 191 ..  
 To ..... (address) ..... City .....  
 The former occupant of premises (address) .....

..... instructed us to discontinue our electric service.  
 When you are ready to have the electric service re-connected be good enough to call at our office to sign application when service will be furnished.

Very respectfully,  
**DES MOINES ELECTRIC CO.,** 8th and Locust Sts.  
 (the "Public be pleased" Company)

**General Foreman:** Please be advised that fuses controlling service through meter No. .... for (name) .....  
 at (address) ..... have this day been taken  
 out on account of occupant vacating premises.  
 (date) ..... 191 ..... Chief Clerk .....

**Auditor:** Please be advised that service to (name) .....  
 at (address) ..... through meter No. ....  
 has this day been disconnected on account of occupant vacating premises. Meter  
 reading is .....  
 (date) ..... 191 ..... Chief Clerk .....

METER-TRANSFER CARD USED IN DES MOINES, IA.

auditor, stating the final meter reading, from which the departing customer's last bill is to be computed. The next tag is addressed to the general foreman, advising him of the discontinuance of service and removal of fuses. Another card is provided to be mailed or delivered to the prospective new tenant at his present address, explaining how service can be restored on order. Attention is called to the Des Moines central-station synonym, "the public-be-

pleased company," which is used locally with good effect. Another tag is available for instructions to the general foreman when the new service has been reconnected and the fuses replaced.

The present system was devised with special respect to the large number of meter transfers which ordinarily occur in Des Moines on the proverbial semi-annual moving days. With several hundred meters to be removed and afterward restored to the same locations much unnecessary labor was involved, and some delay resulted to inconvenience customers waiting for service. The present plan provides that no meter shall be removed as long as it is likely to be needed in its present position, and as already stated, electrically equipped houses are at too great a premium to go very long begging for occupants.

## Local Ice Factory as Summer Customer of District-Heating Plant

If the central-station company in the small town prefers not to go into the ice-making business itself, it can sometimes find a profitable disposition for some of its plant by-products by selling steam and distilled water to the local ice factory.

A Middle West electric company, which does a district-heating business in winter, sells steam during the summer to operate the ammonia compressor in the adjoining ice plant, receiving for this steam 30 cents per ton of ice manufactured. For the ice factory's water supply the central station charges 3 cents per 1000 gal., under the condition that the condensing water be returned to the reservoir. The water used for ice making it also sells to the factory at the rate of 7 cents per 1000 gal.

## Capturing a Difficult Power Installation

The following account of the particulars of a motor-service sales problem was recently posted on the sales department bulletin board of the Boston Edison company, showing the general line of attack on an unusually difficult proposition:

"Among the company's present customers is a small factory operating light-running machinery. It formerly had a 50-hp high-speed engine and employed one engineer to do the firing and general repair work around the shop. On receipt of our report previous to the shutting down of the plant the proprietor was so far influenced by our estimate that by the use of electric service a saving of \$800 could be made on his total cost of \$1,600 that he employed a prominent consulting engineer to advise him. The consulting engineer had several tests made on the engine and submitted a complete report advising against electric power, showing a net loss of \$300 per year, estimating that the cost of electric power would be \$1.092. We have a copy of his report on file.

"The proprietor, however, finally followed the central station's suggestion and on its recommendation one 10-hp motor was installed, the company reducing to the rated capacity of the motor to handle a freight elevator that operates through the height of one floor. A police valve was put on the boiler, holding the pressure at 15 lb., and the heating of the building is now handled by the summer who receives a small additional salary. The engineer has been dispensed with altogether as it was found that his services outside the operation of the steam plant were practically valueless. The actual bills for electric power for one year have been \$55, or about the same as the former coal bill, and the proprietor estimates that his saving, taking everything into consideration, is about \$700 a year."

# Illumination and Wiring

## Large Electric Sign in Milwaukee

What is possibly the largest one-word electric sign in the country has been erected on the roof of the Majestic Building in Milwaukee for Gimbel Brothers, proprietors of a department store. The sign consists of the word "Gimbels" made up of letters 34 ft. high. It contains 2210 10-watt tungsten lamps. The edges and backs of the letters are of black enamel, the body of the letters being formed by 12-in. grooves of white enamel. The letters are supported on a steel frame 160 ft. long and 77 ft. high. They are raised 23 ft. above the level of the roof and the whole sign, framework and all, weighs 18 tons. It is said that this sign can be read from a distance of 25 miles under favorable weather conditions. No flashing device is used, the sign being lighted continuously during the evening. Electricity is furnished by the Commonwealth Power Company. The sign was installed by the Thomas Cusack Company, Milwaukee, of which Mr. Joseph T. Aultman is sales manager.

## Improving the Lighting of a Reading Room

The main reading room of the Boston Society of Civil Engineers at 715 Tremont Temple, Boston, Mass., has recently had its illumination remodeled with excellent results. This room is about 40 ft. long by 16 ft. wide and 11 ft. high, and it is at times used for informal lectures. The former lighting was accomplished rather unsatisfactorily by three 4-ft. chandeliers, each of which carried four 16-cp lamp lamps at a height-of about 4 ft. above a reading



IMPROVED LIGHTING IN LIBRARY OF CIVIL ENGINEERING SOCIETY, BOSTON

table whose working surface was 32 in. above the floor. These lamps, being only 7 ft. above the floor, were in the way when lantern-slide talks were planned, and the quality of the lighting was also inferior on account of the low total candle-power available.

The new installation, shown in part in the accompanying photograph, consists of three fixtures hung from the former

outlets and about 10 ft. apart, each carrying four 60-watt tungsten lamps with frosted bottoms set in pear-shaped Carrara translucent shades at each fixture. The lamps are carried about 6.5 ft. above the table, or approximately 9 ft. above the floor, leaving a free space for the use of the stereopticon.

The room is finished in golden oak, the engineering periodicals in the cases being bound generally in black. For a trifling increase in the connected load of from 650 watts to 720 watts the library secures 576 cp, or about 0.9 cp per sq. ft., compared with 192 cp, or 0.3 cp per sq. ft. in the former installation, besides gaining in the quality and distribution of the light.

## Decorative Street Lighting at Cedartown, Ga.

When it was decided to put down asphalt pavement on Main Street, Cedartown, Ga., advantage was taken of the opportunity to lay conduit for an underground system of street lighting and distribution. As there were no cross streets to be lighted and the Main Street curbs are spaced 40 ft. apart, it was decided to install the posts at 80-ft. intervals, staggering alternate groups, to give uniform illumination.

The fifty-one three-lamp standards were made by the local foundry. Each top lamp is a 100-watt unit in a 16-in. Alba globe, while the lower lamps are 60-watt tungstens in 12-in. globes. Service is supplied from three transformers located in different sections of the street, thus maintaining a balanced load on the three-phase primary system. The secondary wiring is arranged in the form of three-wire distribution, with lower lamps in series on 220 volts and top lamps operating at 110 volts. Equal numbers are connected on each side of the neutral, thus reducing the size of the middle wire.

Each post is provided with a three-pole single-branch block, while the feeder posts have two single-pole knife switches arranged to cut out the bottom lamps at 10 p. m. (12 midnight on Saturday). The top lamps burn all night, consuming the same wattage as the series arcs which they displaced. The central post in each circuit is used as the feeding point, from which run the feeders to the transformers located on the intersecting streets. This arrangement permits of a reduction in the size of wire in each run between the posts.

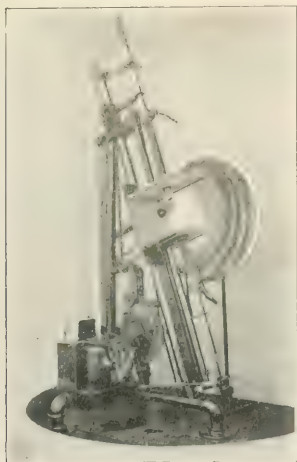


WHITE-WAY LIGHTING INSTALLATION ON MAIN STREET, CEDARTOWN, GA.

The cost of the installation was paid by the property owners on the basis of \$0.75 per front foot. Energy to operate the system is included in the street lighting at an additional cost to the city of 1 cent per post per night. The installation was made and is operated by the Cedartown water and light department, of which Mr. W. T. Hardy is superintendent.

# A Flashing Electric Fog Lamp

In the ferry service at San Francisco, use is being made of a powerful flashing arc lamp for locating the boat piers in foggy weather. Two motor-driven carbon electrodes, each 1.25 in. in diameter, are periodically brought into contact and then separated, drawing the arc into a long lumi-



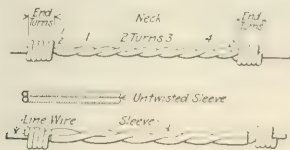
MECHANISM OF FLASHING ELECTRIC FOG SIGNAL

nous flame which, on reaching its maximum, is blown out by an electromagnet. The period of flash can thus be regulated to designate any particular locality by a prearranged time signal. The beam of light from the new lamp will penetrate very dense fog and is useful even in daylight. The United States Supervising Board of Steamboat Inspectors has authorized the use of the lamp, it is reported, for signal purposes on other vessels besides the ferryboats where it was first employed.

## Methods of Splicing Wires and Cables

By H. V. TALBOT

Splices in bare copper line wire can be made as indicated in Fig. 1 and should be mechanically and electrically secure before solder is applied. There should be at least five turns in the neck (Fig. 1) of a splice to insure that the unsoldered splice will be as strong as the wire of which it is made. All splices in wires for conveying electricity should



FIGS. 1 AND 2—CONNECTIONS IN BARE WIRE

be soldered in the neck. It is not always necessary to solder the end turns. McIntire sleeves are very satisfactory and are used to a great extent for splicing aerial line wires. (See Fig. 2.) Solder is not necessary where sleeves are used.

For further information in regard to splices in bare wire see an article published in the *Electrical World* for Nov. 17,

1910, entitled "Some Tests on Splices in Galvanized Iron Wire," which was contributed by Mr. C. T. Kashman.

Splices in insulated aerial line wires are made similarly to that shown in Fig. 1, except that tape is served around the splice for insulation. (See Fig. 3.) If the line wire has only weatherproof insulation, friction tape is sufficient, but if the inner insulation is rubber, rubber tape, to the



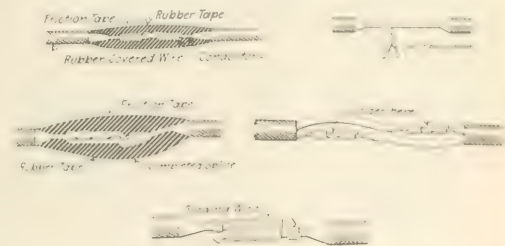
FIGS. 3, 4 AND 5—CONNECTIONS IN WEATHER-PROOF AND RUBBER COVERED WIRE

thickness of the inner insulation, should be applied before the friction tape is served.

In preparing the conductor ends, about 1 in. of each end should be bared and cleaned; then, with a very sharp, thin-bladed knife, the insulation should be beveled for about 1 in. as one would sharpen a lead pencil. The conductor joint should preferably be made with a copper sleeve, sweating the latter on, care being taken to clean off all surplus solder, or if the connection is made by twisting the two ends together, that the ends do not protrude. The bevels and conductor should then be covered with a thin coat of a pure rubber cement, and this should be allowed to "set."

When insulating the joint a strip of 1/4-in. pure rubber tape 6 in. to 8 in. long should be wrapped spirally around the joint, beginning at the bevel on a level with the insulation (A in Fig. 5) and continuing to the other side of the joint as far as the high point of the bevel (B in Fig. 5). The operator should continue to wrap to and fro until the insulation is built up slightly thicker than the regular wall. The tape must be put on under tension—say stretched to about half its width, and care must be taken to have everything perfectly clean.

To vulcanize the joint partially heat may be applied evenly from a spirit lamp, a lighted match or the hand for about one minute. The joint may then be wrapped with two layers of 3/4-in. friction tape. If the wire is braided or taped, the braid or tape should be cut well back so that there are no loose threads overhanging to interfere with the proper insulation of the joint. Should the friction tape become slightly set, as it sometimes does in extreme cold weather, a gentle heat will restore it.



FIGS. 6, 7, 8, 9 AND 10—SPICES IN INTERIOR WIRES

Splices in interior wires are made as shown in Figs. 6, 7, 8, 9 and 10. Not as many turns are necessary in the neck as for aerial line wires, and all splices must be soldered. For rubber tape to the thickness of the rubber insulation must be used on rubber-covered wires and friction tape must be served over the rubber to hold it in place. The so-called "fixture splice" (Figs. 7 and 8) is used



largely by telephone men and in wiring fixtures. It can be conveniently used sometimes in splicing two wires that must be drawn taut in the splicing. A splice in wires is often made at a point between two supports (cleats or knobs) in this way. The duplex wire splice (Fig. 9) is often used by telephone men. The joints should always be "broken"; that is, they should not be opposite each other.



FIGS. 11, 12, 13 AND 14—METHODS OF MAKING TAPS OFF MAIN-LINE WIRE

In conduit work where duplex wire is frequently used joints are not permitted by the National Electrical Code except in junction boxes, but nevertheless they are occasionally made as indicated and pulled into the conduit. Rubber and friction tape are applied to each in the same way as to the joint in a single wire, and then the pair of wires should be served with friction tape. Joints should always be taped so that the insulation over the joint equals that over the rest of the conductor.

Taps in interior wires are made as shown in Figs. 11 and 13. The "knotted" tap has the advantage that the tap wire cannot untwist from the main wire. Tape should be applied as in the case of splices. The tap for small aerial wires (Fig. 4) is made by giving the tap wire one long complete wrap around the main wire and then four short turns. Taps for larger aerial wires can be made as suggested in Fig. 12. The long wrap gives the joint a certain

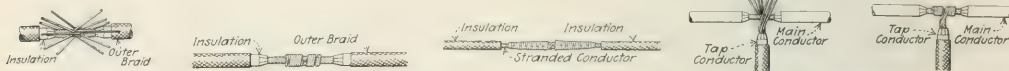
cut from the center of cable so that the joint will not be bulky.

In making any joint the wire ends should be scraped bright with the back of a knife blade, sandpaper or emery paper, so that the solder will adhere readily. Insulation should be cut away as shown at *B* (Fig. 21) rather than as shown at *A*. When cut as at *A* the wire is likely to be

nicked and with the *B* method the tape can be served more neatly about the joint. The outer braid should be cut well back from the joint so that stray strands from it cannot be taped into the joint and, by capillary attraction, conduct moisture thereto.

For soldering joints a non-corrosive fluid is recommended; solutions made with acids should be avoided. The commercial soldering pastes and sticks give good satisfaction in cleaning joints to be soldered. Joints in small wires are best soldered with a soldering copper, and burning of the insulation is thereby avoided. An alcohol or a gasoline torch should be used on medium-sized joints, while on the larger ones it is most convenient to employ a solder pot and ladle.

A soldering flux removes and prevents the formation of an oxide during the operation of soldering, so that the solder will flow readily and unite firmly the members to be



FIGS. 15, 16, 17, 18 AND 19—METHODS OF MAKING SPLICES AND TAPS IN STRANDED CONDUCTORS

amount of flexibility which is necessary for aerial work where the wires are moved by the wind. The tap for very large wires (Fig. 14) is made by serving a binding wire about bared portions of the tap and main wires and then soldering the whole.

Joints in cables are made as shown in Figs. 15, 16 and 17. The wires composing the cable should be spread and each pulled out straight and the core or a few inner wires cut away so that the splice will not be bulky. Then the two cable ends should be abuted as shown in Fig. 15, and the wires interwoven in groups of two each and served along the cable. The joint is soldered by pouring, with a ladle, molten solder through and over it. For interior work a short joint like that of Fig. 16 is frequently used, but in aerial work a longer one, like that of Fig. 17, is preferred. For an aerial joint (Fig. 17) a length of about 16 in. to 20 in. is bared at the end of each cable in order to make a splice.

Taps in cables are made as suggested in Figs. 18, 19 and

joined. For copper wires the following solution is recommended by the Underwriters: Saturated solution of zinc chloride, five parts; alcohol, four parts, and glycerine, one part.

Soldering paste or stick can be made as follows: Melt 1 lb. of tallow and add 1 lb. of common olive oil; stir in 8 oz. of powdered rosin; let this boil up and when partially cool add, stirring constantly,  $\frac{1}{4}$  pint of water that has been saturated with powdered sal ammoniac. Stir the mixture constantly until cool. By adding more rosin it can be cast into sticks.

Galvanized iron or steel wires are spliced as shown in Fig. 1, and five turns are necessary in the neck of the splice to insure that the splice shall be as strong as the wire. The strength of an unsoldered joint is determined by the number of turns in the neck, the end turns having but little holding power.

Small galvanized steel cables are joined in the same way as are wires, as shown in Fig. 22. There should be five



FIGS. 20, 21, 22 AND 23—JOINTS IN HEAVY CONDUCTORS AND STEEL CABLES—METHODS OF REMOVING INSULATION

20. Fig. 18 shows how the tap wires are "fanned" out before being served about the main conductor, and Fig. 19 shows a completed tap joint for interior work. Fig. 20 shows a completed tap joint in an aerial cable. Tap joints in cables can be made with a binding wire similarly to the method of Fig. 14. When a joint like that of either Fig. 19 or Fig. 20 is made the entire core or some wires should be

turned in the neck, as with wires, and a few end turns to finish off the joint. Soldering is unnecessary for guy wires. Larger cables can be spliced as shown in Figs. 15 and 17, or mechanical clamps can be used instead, as shown in Fig. 23. Sometimes it is necessary to use several clamps, instead of one, as the figure shows, in order that the joint may be as strong as the wire.

## Recent Telephone Patents

### SENDERS FOR AUTOMATIC SYSTEMS

Mr. C. A. Bals, of Chicago, is the inventor of an improved type of the sending device for an automatic system. The feature of this invention lies in so constructing and mounting the sender in the base of a desk stand that it may be removed as a unit without disconnecting the wiring or laying bare the terminals. The normal contact between the wiring and the sender is obtained through spring-contact plates. This patent is assigned to the Corwin Telephone Manufacturing Company. Mr. R. C. Nevin has patented an unusual type of sender. He arranges the apparatus in the vertical body of the desk stand as in the illustration. The finger plate can be slid vertically, carrying with it a notched bar. Both bar and finger plate are attached to a dashpot so that the fall of the bar is under control and at constant speed. The falling bar causes the contact contacts to close and open as its teeth pass over them. The number of teeth necessary to pass over the contacts for any one digit depends, of course, upon the height from which the fall begins.

### EXCITING COIL

It is well known that the permeability of iron is not great when the degree of magnetization is low. Because of this it is claimed by Mr. J. H. Cuntz, of Hoboken, N. J., that the ordinary repeating coil does not work at maximum efficiency; therefore he provides an auxiliary exciting coil, which is used to raise the magnetization of the iron to a point where the permeability will be near a maximum.

The accompanying illustration shows a heat-coil arrangement patented by Mr. John Erickson, of Chicago, who has assigned his patent to the Automatic Electric Company. The operation is quite evident when it is understood that the small movable finger is held in position by fusible metal, which melts and releases the finger with the flow of abnormal current.

Mr. J. H. Roberts has invented a ringer designed for special operation. The ringer is of the usual polarized type, but it is so designed that excitation with the opposite polarity shall operate the armature but not move the bell clapper. To accomplish this a flaring tube is mounted upon the armature and the bell clapper is suspended within the tube. The position of the armature is so adjusted that when the clapper is midway between the gongs it will bear upon one surface of the flaring tube. When the armature is tilted slightly this surface drives the rod, the latter being returned by a spring with the return of the armature. When, on the other hand, the armature is tilted in the other direction the conical tube swings freely about the bell clapper, which at this time is held against a stop. This patent is assigned to the Homer Roberts Telephone Company.

### IMPULSE TRANSMITTER

Another patent of Mr. R. C. Nevin, of Oakland, Cal., describes an impulse transmitter contained within the vertical tube of the desk telephone. A dashpot is arranged within the upright, and the actuating rack is carried by the movable member of this. A stud attached to this movable member projects through a slot, and when it is desired to send any number of impulses the stud is raised in the slot to the proper height, as shown by a graduated scale on the tube. When the stud is pushed into the notch it slips behind the wall of the upright and then returns slowly to normal position, the speed of return being adjusted by the air leak in the dashpot. It will be seen that as soon as a call is started the stud is hidden from view and the speed of return cannot be interfered with.

A receiver supporting arm has been patented by Mr. C.

F. Dolle, of Cincinnati. The arm is mounted upon a stud secured in the base piece and arranged to revolve on a horizontal axis lying along the center line of the stud. The supporting arm is secured to the stud by a horizontal screw and stands normally in a vertical position. However, it may be swung a slight distance out of the vertical in a plane including the axis of the stud. In practice the desk instrument is clamped upon the base, and when it is desired to use the telephone the arm is swung forward, the stud turning on its axis. When the telephone is not in use the arm is pushed back and a collar engages the hook switch to hold it open.

### POLE CHANGER

Mr. C. J. Erickson, of Chicago, has invented a new type of pole changer, with two moving armatures, one for driving the pole-changing contacts and the other for controlling the frequency. Both armatures are operated simultaneously by a single pair of electromagnets, one armature being suspended at each end of the magnets. The weighted armature has a back contact which controls the supply of energy to the operating magnets.

## Letters to the Editors

### Electric-Fuse Construction

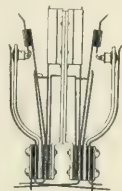
*To the Editors of the Electrical World:*

SIRS:—My attention has been called to an article on "Electrical Fuse Testing," by Dr. A. A. Somerville, in your issue of Jan. 18, 1913, which seems to be full of hasty and unwarranted conclusions. I have also read the communication from Mr. L. W. Downes, appearing in your issue of Feb. 22, 1913, which so ably controverts the conclusions of Dr. Somerville that I do not feel that anything I could say, however fortified by record of experiments with inclosed fuses made under my observation in a long period of years, would add a feather's weight to the truth of Mr. Downes' statements, which are facts, proved and re-proved, some of them being now on record in the federal court.

Your readers' attention might, however, be directed to the danger, from the standpoint of fire hazard and personal safety, of using a type of inclosed fuse which does not comply with the Underwriters' requirements, as follows: "The fusible wire must be attached to the terminals in such a way that a thoroughly good connection is secured and so as to make it difficult for it to be replaced when melted," namely, the so-called refillable fuse. The public has learned that the standard approved inclosed fuse is a reliable and effective electrical device, because it is approved by the Underwriters and has been used with satisfaction. What they do not generally know is the severe physical conditions to which those fuses are subjected in ordinary practical use and the scientific skill, care, experiment, labor and time expended by the Underwriters and the manufacturers to have them operate safely and reliably. Attention should be called to an article by Mr. L. W. Downes in the *Transactions of the American Institute of Electrical Engineers*, page 947, Vol. XXVIII, 1909, and one by Mr. F. N. Conant in Stone & Webster's *Public Service Journal*, page 180, 1911, for real information backed up by oscillograph and careful observation records as to actual conditions met by modern standard inclosed fuses.

Disastrous results might occur from accepting too fully the statements by Dr. Somerville that "any metal may be used as a fuse strip," "any kind of wire may be used as a fuse" and "the character of the insulating powders used around the fuse wire is without effect except in a thermal way."

A refillable fuse, reloaded with two or three pieces of metal designed therefor, and carelessly filled with its sec-



HEAT-COIL ARRANGEMENT

ond-hand filler, is a sufficient cause of apprehension, and one reloaded with copper, iron or aluminum wire with or without filler will be a greater source of fear; but one containing aluminum or magnesium wire and manganese dioxide filler, a possible combination under the suggestion by Dr. Somerville, is extremely dangerous. A mixture of aluminum or magnesium and manganese dioxide is one of the most powerful Goldschmidt Thermit mixtures that can be produced. "Fuse" is an excellent name for it, because it is capable of fusing every known metal when properly ignited. A large fuse thus made, particularly when the filling had already been used once or twice, would give ideal conditions for a Goldschmidt reaction when the fuse blew on short-circuit; that is, hot, finely divided aluminum or magnesium, manganese dioxide and electric arc ignition. Aside from this possibility, manganese dioxide is a conductor, though not a very good one, at ordinary temperature, having a resistance about 500,000 times that of copper, decreasing with rise of temperature, and on heavy short-circuit it might develop the Nernst effect (discovered by Mr. Downes in high-tension inclosed fuses even with fillers of highest resistance) on low-tension service. In any event it will yield free oxygen if its temperature reaches 600 deg. C. The possibility of such combinations with fuses being reloaded by 200,000 engineers, janitors, wiremen and handy men, here, there and everywhere, would represent a menace to property and public safety.

The larger companies manufacturing fuses have spent hundreds of thousands of dollars in evolving and perfecting these devices. Some of them have been at such work for more than twenty years, employing men of high technical and practical knowledge and skill and making use of apparatus of enormous value in order to duplicate practical conditions; furthermore, use has been made of every method of production and efficiency engineering to secure economy of manufacture. If old iron or other cheap wires and filling materials could be safely used in inclosed fuses, the manufacturers would not only know this fact but they would use such materials instead of special alloys of special design and special filling material made by special processes which render them more expensive, because it is fair to assume that under existing conditions of competition an equally satisfactory and cheaper construction would long since have been eagerly seized upon as a source of advantage.

L. B. BUCHANAN,

Boston, Mass.

Engineer for Stone & Webster.

### Light Distribution Curves

*To the Editors of the Electrical World:*

SIRS:—After reading over the article by Mr. R. F. Pierce in your issue of Feb. 8, 1913, I am moved to take the position of defending the time-honored intensity distribution curve. Although I agree with Mr. Pierce in much that he has written, I am of the opinion that there is much to be said on the other side of the question that has not been mentioned in his article.

The candle-power distribution curve has no doubt been much misinterpreted. It is true that many assume that the area of the curve furnishes a measure of the flux emitted. The practice of picturing light rays penetrating darkness in advertising matter pertaining to lighting units has been the cause of others looking upon the distribution curve as an "iso-normal-illumination" diagram; that is, a point on the curve is taken to indicate the distance over which the ray can travel before the illumination normal to its direction falls to a given value. It is doubtful if the proposed method would help in either of these cases in the attainment of the desired results.

In the first case, the more important one, the miscon-

ception arises from the lack of appreciation of the difference in the areas of the zones, but a person will not have gone far wrong when he goes through the next step in forming an idea of the resulting intensities on some horizontal plane in question. The long radii vectors of the curve of an intensive reflector unit in the lower angles do not give any conception of flux. They represent little flux, but along with this is the fact that the areas covered are so small that only little flux is needed to bring the intensity of illumination to a high value. It seems to me that neither method can meet the requirements of minds wholly untrained in such matters and that the one is no better than the other.

Notwithstanding all that has been said against the method of comparing lighting systems on the basis of illumination on an arbitrary working plane, nearly all illuminating engineers make use of such data in their design problems, and knowledge of this sort is unquestionably valuable. It is desirable not only to know average illumination values but also to know the variations. The ratio of highest to lowest illumination is taken into account by engineers in deciding upon a design. These figures cannot be readily obtained from the proposed curves, while on the other hand the flux values can very conveniently be taken from the candle-power distribution curve. By one method it is necessary only to measure the horizontal distance from the point on the polar curve to the vertical axis, to the candle-power scale, and to increase the figure 10 per cent, to obtain the flux in a zone of 5 deg. each way from the point in question. The experienced engineer can measure this distance fairly well with the eye and increasing the figure 10 per cent is the very easiest kind of a mental calculation.

Since our modern sources differ from the old candle, in that they vary considerably in intensity, depending upon the direction from which they are viewed, it would seem that an intensity curve or diagram giving that information would be exactly the thing needed. It is not surprising that this has been obtained by revolving the source about its axis of symmetry and thereby simplifying the whole task by obtaining and later plotting one value which represents the average of the intensities in a complete series of directions, which intensities should by reason of the symmetry of the source be nearly the same. The method is so simple that it has been extended to use with sources that lack this symmetry, but with an appreciation of its limitations. In fact, the amount of labor involved in obtaining more exact information is prohibitive. The results are obtained in terms of intensity. Why change them at once into terms of light flux, thereby obscuring at once much of the information of value?

Granting that only the average illumination of a surface found in a certain zone were wanted, even then the proposed method would not be entirely satisfactory, because the flux curve must, with one scale, take care of a far greater range of magnitudes than is needed on the regular distribution curve. It is readily seen that with the proposed curve it would be very difficult to obtain even a rough estimate of the illumination directly under the source. The curves of Fig. 2 in the article by Mr. Pierce will illustrate this point. It is apparent from a glance at the candle-power curves that the illumination over a surface included in the 5-deg. angle would be six times as great for the  $F$  as for the  $E$  unit. No one could tell what it would be from the flux curves plotted to the scale as shown.

I do not wish to be understood as attempting to discourage in any way the more general use of flux measure. Light sources should, of course, be rated in lumens rather than in candle-power. The light flux concept is useful in many ways, but it seems to me that the intensity concept is fully as useful and necessary and, as a matter of fact, just as logical in every way.

Cleveland, Ohio.

EVAN J. EDWARDS.



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Sole-Plates and Shoes for Electrical Machine Foundations

By F. B. DUGGAN.

There exists considerable confusion in regard to the use of the terms "sole-plate" and "shoe," and furthermore, the functions of these two devices do not appear to be thoroughly understood by the men that erect and operate generators and motors. The object of this article is to define clearly



FIG. 1—SOLE-PLATE FOR DYNAMO FOUNDATION

these terms and to indicate how sole-plates and shoes should be used.

There are three methods in common use for supporting engine-type electric-generator and large electric-motor stators on their foundations or bed-plates.

The method with a sole-plate (Figs. 1 to 4) is used only where the stator is supported on a foundation without an intervening rail, and where it is not necessary to provide means for quickly adjusting the stator relative to the rotor. The method is seldom used with alternating-current machines, because with these provision must usually be made for shifting the stator in a direction parallel with the shaft, to provide for inspection and repair of the armature and field coils.

As a general thing, with direct-current machines, at times when the armature or field coils must be inspected, the upper half of the field frame is removed and the lower half is not shifted from its position on the foundation. Therefore, sole-plates are most frequently used for supporting direct-current machine frames where there is no bed-plate. The generator frame foot rests on the sole-plate, which in

not feasible to lift off the upper half of the frame of an alternating-current unit without incurring considerable trouble and not a little expense, even if the frame is split horizontally, because such procedure would involve unsoldering the connections of the armature coils that bridge the split.

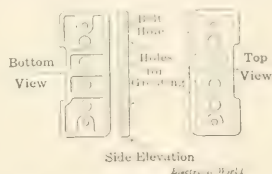


FIG. 3—DETAILS OF SOLE-PLATE

The rail is supported directly on the foundation. The shoe rests and slides on the rail and the generator is carried on the shoe; the adjusting studs and clamping bolts afford means of positively and readily adjusting the stator and clamping it in proper position.

Frequently with large, heavy units carriers are provided, which consist of a series of rollers held between two bars. A carrier is placed in the groove in each rail. In using the carrier the frame must be raised about 1/16 in. with the elevating screws, when the carriers can be rolled under, one carrier under each shoe. Then the frame can be lowered onto the shoes and readily pried along the rails with pry-bars.

The employment of a common cast-iron base for the prime mover and generator constitutes the third method. On direct-current machines the feet may be bolted and doweled directly to the base. The base of alternating-current machines may be grooved so as to constitute a rail and the generator can be supported by and adjusted on a shoe

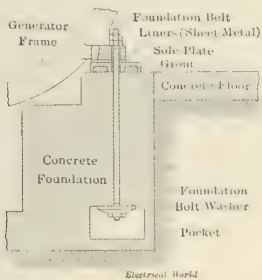


FIG. 2—SECTIONAL VIEW OF SOLE-PLATE INSTALLED

turn rests on a grout bedding directly on the foundation.

The second method is with rails and shoes (Figs. 5 to 7). This method is used for practically all engine and coupled-type alternating-current machines except those that are small enough to be handled readily as complete units. The shoe construction permits the accurate and speedy alignment of the stator after it has been shifted along the shaft to permit inspection or repair of armature or field coils. It is

sliding on this rail. Obviously, a common cast-iron base is feasible only for units of relatively small size.

Sole-plates are merely foundation caps or cast-iron-bearing plates for forming a smooth surface on top of a foundation, to distribute the weight and upon which the feet of the machine can rest. The method of using a sole-plate is shown in Fig. 2. None of the holes through the plate is threaded. The foundation bolts extend through the plate



FIG. 4—APPLICATION OF SOLE-PLATE

and down into the foundation the usual distance. In addition to the bolt holes, large holes are cast through in the plate to provide for the admission of the grout.

In setting the plate it is carefully leveled and aligned and grout is poured through the holes to cement it in position. Frequently, instead of the plate being arranged above the foundation surface, as in Fig. 2, it is built in flush with

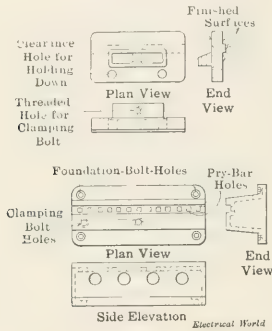


FIG. 5—DETAILS OF RAIL

the surface of the foundation. The plate is always set in or on the foundation somewhat lower, possibly  $\frac{1}{8}$  in., than the elevation that the bottom face of the generator foot will occupy, so as to permit the insertion of liners or thin plates of metal to bring the generator accurately to the required elevation. Studs, turning in threaded holes in the generator feet, are frequently arranged to provide a means of quickly and accurately leveling a machine. The lower ends of the studs bear against, but do not pass into or through, the sole-plate.

The foundation bolt-holes through the feet of the generator should be enough larger than the bolts for the machine to be shifted somewhat to align it accurately with the shaft. The radial clearance between bolt and side of hole should be about  $\frac{1}{8}$  in. for small units and possibly

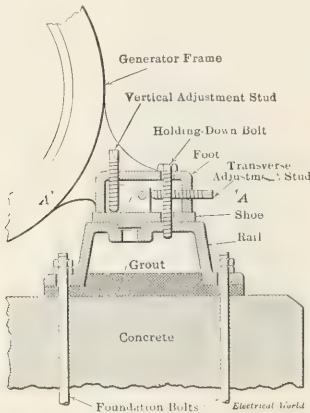


FIG. 6—SECTION OF SHOE AND RAIL-ADJUSTING ARRANGEMENT

$\frac{1}{4}$  in. for large ones. After the generator has been brought into exactly the proper position, the nut turning on the top of each foundation bolt is screwed down tightly, which clamps the machine in position. A lock nut is often turned down on top of the first nut, as shown in Fig. 2.

In Figs. 5 to 7 are shown the components for a shoe-and-rail electrical-machine supporting arrangement. As men-

tioned above, the function of the shoe is to provide a means whereby the frame of an electrical machine can be readily shifted transversely and longitudinally by fine increments to provide for delicate adjustment. Fig. 6 shows the shoe, a casting, with an elongated raised lug upon its upper face. The transverse clamping bolt turns in a threaded hole in this shoe and the ends of the longitudinal and transverse adjustment studs bear against it. A shoe fits under each of the feet of a machine, the lug extending up into the hollow space in the foot. On the bottom of the shoe is a tongue extending its entire length. This tongue fits a longitudinal groove in the rail or in the common base, if there is such, that carries the prime mover and generator.

In Fig. 5 are given the details of a rail on which a shoe, such as that above described, rides. It is a cored-out casting having plain and tapped holes to accommodate respectively the foundation and the clamping bolts. Through the bottom of the groove in which the tongue on the shoe engages are square holes. These are provided to form a gripping space for the pry-bar that is used in shifting the generator along the rails when it is necessary to move it for armature or field inspection. After having been removed and returned approximately to its proper position with the pry-bar, the adjusting screws are used to adjust accurately the frame in relation to the rotor.

Figs. 6 and 7 show sections of one foot, its shoe and the adjusting and clamping screws. It will be noted that there are two adjusting studs at each foot, one bearing against each end of the lug on the shoe, so that the frame can be

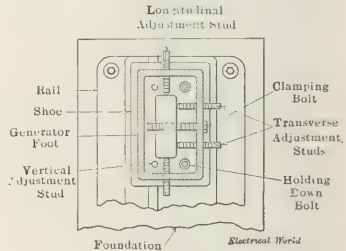


FIG. 7—PLAN OF SHOE AND RAIL-ADJUSTING ARRANGEMENT

adjusted in either direction. For transverse adjustment two adjusting studs and a clamping bolt are provided at each shoe. Transverse movement of the frame is effected by manipulating the adjustment studs, and, after the frame is located, it is clamped in position by setting the clamping bolts, which perform functions similar to those of lock nuts.

Two or more studs are provided in each foot for vertical adjustment. By turning one, two, three or four of the studs by the right amount, the frame can be brought precisely into the proper elevation with very little trouble. Thin metal liners, to the correct thickness, are inserted between the shoe and foot after the proper elevation has been obtained. Then the holding-down bolts are tightened, which firmly maintain the frame where it belongs. On superficial examination one would obtain the impression that there are more adjusting and holding screws in connection with the shoe than are actually necessary. Experience, however, has indicated that every one shown is necessary to effect quick, accurate adjustment and to maintain effectively the adjustment after it has been once made.

Prior to the placing of the machine on it the rail should be carefully aligned and leveled. It should be grouted, as suggested in the illustration, to insure a firm, uniform bearing on the foundation face. Although the various adjusting devices provide for the correction of a certain amount of error in setting the rails, it is always a good plan to set them in the beginning as accurately as possible, both as to alignment and elevation.

## The Obsolete Belt Drive in Power Stations

BY ALFRED KENNEDY

During several years past numerous hydroelectric plants and their equipment have been described in the *Electrical World*, and in every instance where oil pressure governors have been used the statement has invariably been made that "the governor pumps are driven by belts from the main shaft."

The writer, from experience gained as general repairman in a large hydroelectric plant where a number of belt-driven pumps are in use, believes that these pumps should be motor-driven, as the belts, though comparatively small, are capable of doing considerable damage to other equipment and are a source of constant and unnecessary danger to the employees of the plant.

Here is a case in point. One night one of these belts slipped, eventually running off its pulleys and becoming entangled around the shaft, with the loose loop thrashing around like a flail, striking the floor with great force at every revolution of the unit. Close to the shaft, but on the opposite side from the pump, a tachometer was mounted on a frame made from  $\frac{1}{2}$ -in. by 2-in. iron and bolted to the concrete floor. The flying loop of the belt caught on this frame, tore it from its fastenings, breaking the  $\frac{1}{2}$ -in. by 2-in. iron bars in several places, and reduced both the frame and the tachometer to scrap iron. The belt was not greatly injured; in fact, it is still doing duty on the same pump. As it sometimes becomes necessary to throw these belts off the pulleys while the unit is running, in order to stop the pump, it is not very hard to imagine what would happen to an employee should he, under the same circumstances, be so unfortunate as to get an arm or a leg caught in this loop. In the case mentioned above, if one of the pieces of iron had found its way into the clearance space between the rotor and stator a burned-out generator would naturally have been the result.

On another occasion one of these belts while being replaced on the pulleys caught on a gage cock on the nearby pressure tank and, breaking it off, allowed a considerable quantity of oil, under pressure, to escape, bespattering the generator, floor and walls of the power house.

As stated above, there are times when it becomes necessary to stop the pump while the unit is running, and the only way to accomplish this is to throw the belt off the pulleys. To start it again the belt would have to be replaced with the unit still running (and, needless to say, both these operations have been the cause of fatal accidents ever since belts have been in use) or else a shut-down for the same purpose would be necessary, if the load carried at the time would permit.

Moreover, in starting a unit it may become necessary to pump to the required pressure (perhaps previously lost in order to effect needed running repairs), which generally takes about an hour, and, with the belt drive, during this time the turbine cannot be put under the control of the governor. With a motor drive the pump could be started and pressure got up beforehand so the governor could be made to control the turbine immediately.

The writer never could understand why a power company would build a large substantial plant, sparing no expense in installing the most modern and up-to-date machinery and equipment, and then retrograde a hundred years in adopting belt drive for the governor pumps. Furthermore, central stations generally have commercial agents in the field doing their best to induce manufacturers to install individual motor drives, and in continuing to use the ancient, obsolete, inconvenient and dangerous belt the power companies are certainly setting a poor example to their prospective customers, especially in a case of this kind, where a motor drive can be so easily applied with an expenditure small in comparison with the advantages and safety thereby obtained.

## Balancing the Rotors of Turbo-Alternators

How are the rotors of turbo-alternators balanced? The writer has been manufacturing plants of the General Electric Co. in the practice in accordance with the following procedure:

F. C. W.

In American factories practically all turbo-alternators are balanced by a cut-and-try process. The turbine is first assembled on the test floor and connected to the steam and exhaust mains and to the oil and water systems of the plant. As the machine is driven under its own power, the test men determine which end of the machine is the roughest by placing the forehead against the casing at different places. A weight is then inserted into one of the tapped holes provided in the runner, and the machine is speeded up, the result of the "shot" being noted. If the vibrations are less violent but still noticeable, another and heavier weight may be inserted in the same hole. If the first attempt produces more violent vibrations, the weight is removed and placed in some other part of the runner. Each tester generally has his own "follow-up scheme" of placing the successive weights. This process is continued until both ends of the turbine are free from vibration at rated speed. When the generator is attached to the shaft this process is repeated and weights are placed upon the ends of the rotor at various points on the circumference until all bearings and the casings of both the turbine and the generator are free from vibrations as far as can be detected by placing the forehead against them. Many of the foreign factories balance the rotors of their generators dynamically before they are assembled in the machine. Special apparatus fitted with delicate balancing mechanisms is required in this work. As a precautionary measure these machines are generally subjected to a high-speed test before they are allowed to leave the factory.

## Ice-Making by the Flooded System

What is meant by the flooded system of ice-making and what are its advantages?

R. H. G.

In the ordinary or so-called "dry" expansion system of ammonia refrigeration the liquid ammonia is allowed to expand in coils of pipe usually immersed in a tank of brine. During the expansion of the ammonia from a liquid to a gaseous state it absorbs heat from the adjacent brine. Only a limited amount of the liquid ammonia is used in the "dry system," and during its passage of the expansion coils this liquid is all changed to gas. In the "flooded system," however, more liquid ammonia is put into the coils than can be evaporated by the refrigerating work to be done. For this reason slugs of liquid ammonia are carried through the pipes along with the gas. This surplus liquid is conserved, of course, by being allowed to flow back into an accumulator containing the liquid ammonia from which the coils are supplied. It then undergoes another passage of the expansion coils so that none of the compressed gas is lost.

The flooded system has the advantage of insuring even distribution of refrigeration throughout the coils, owing to the fact that alternate slugs of liquid ammonia and gas pass entirely through the pipes so that even when the flood section has been reached there is still an amount of liquid to be expanded. The presence of the liquid ammonia in the pipes makes the mixture a better thermal conductor than the dry gas alone would be, thus more readily transmitting heat from the pipe coils to the surrounding space.

The flooded system allows the compressor to be operated at a thermal pressure ratio of 10 to 1, but the high pressure can be obtained with the dry system and with greater economy. About 60 per cent more ammonia is required in the flooded system, but this material expense is more than made up for by the fact of compression is approximately the same as in the dry system.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Three-Phase Series Commutator Motors.*—L. BINDER AND E. DYHR.—The first part of a mathematical article on three-phase commutator series motors with a double set of brushes as built by the Siemens-Schuckert company. These machines are able to return electrical energy into the network to which they are connected if they are mechanically driven and if the position of the brushes is properly adjusted. But in this case self-excitation of the machine may become troublesome. The object of the paper is to discuss how the self-excited currents in these machines are produced and how they can be suppressed. The article is to be continued.—*Elek. Zeit.*, Feb. 20, 1913.

*Cascade Induction Motor.*—M. I. WILLIAMS-ELLIS.—An illustrated reprint in abstract of a paper read before the South African Institution of Engineers. The first part deals with the early work on cascade construction of Silvanus P. Thompson, Steinmetz, and Georges and Lydall; the second part gives a description of the cascade induction motor of the single-speed and multi-speed type, and its adaptability to mining and general work. There are also references to other multi-speed types of motors.—*London Electrician*, Feb. 21, 1913.

*Phase Compensator.*—A. SCHERBIUS.—A French translation in abstract of his German paper noticed some time ago in the *Digest* on the Brown-Boveri phase compensator for induction motors.—*La Revue Elec.*, Feb. 21, 1913.

*Commutation.*—A. MANDUIT.—In a continuation of his long illustrated paper read before the International Society of Electricians in Paris on the problem of commutation in direct-current generators, the author gives an account of his experiments on artificial commutation with oscillographic tests. He describes in detail the arrangement of the experiments.—*La Revue Elec.*, Feb. 21, 1913.

*Signs and Direction of Rotation.*—A. SCHERBIUS.—An article profusely illustrated by diagrams on the use of signs or direction of currents in polyphase systems. The author summarizes old and new agreements concerning signs of direction and illustrates by an example the object of such agreements. This example relates to the determination of the direction of currents in a polyphase commutator machine.—*Elek. Zeit.*, Feb. 20, 1913.

### Lamps and Lighting

*Tungsten Lamps.*—O. P. ANDERSEN.—An illustrated article on electric sign lighting with tungsten lamps, containing specific information on utilizing the new lamps to the best advantage electrically. It gives a description of the various types of lamps on the market and instructions as to their selection for any special conditions. Specific directions (including diagrams and tables) as to the number of lamps, layout of circuits and sizes of wire, applying both to re-equipping of old carbon lamp signs and to design of new signs, conclude the article.—*Gen. Elec. Review*, March, 1913.

### Generation, Transmission and Distribution

*Electrical Distribution for Mines.*—J. W. ANSON.—An article on details of electrical distribution in South African mines, the power being bought from a large power company. The author emphasizes the great importance of proper design of the switch gear in the transformer house of the mining company, as this is the only portion of the

electrical equipment which cannot be duplicated. He shows how to lay out the general features of the equipment as to busbars, main feeder panels and general arrangement. For the mine feeder cable three-core, paper-insulated, lead-covered, served, double-steel tape or steel tape armored, and served over all, is excellent. In the design of the cable network attention must be paid to reliability of supply to all important motors, to the facility of taking any one or two mine cables off load for the purpose of working on their respective switches or panels in the transformer house, and to the facility of learning quickly the cost of electrical power used for the various purposes at the end of each month. The author then discusses in detail the electric driving of the following machines: winder motors, mine pumps, mills, lift tailings pumps, tube mills, return water pumps, pumps in slime pump houses, pumps, etc., in extractor house, dump haulage motor or motors, mill haulage, butters' filter plant motors, belt motors, etc., for sands plant.—*Transactions of South African Inst. Elec. Eng.*, December, 1912.

*Dangerous Rises of Voltage.*—W. PETERSEN.—A continuation of his long article in which he gives further examples of the various causes which may produce traveling waves in networks and which may result in dangerous rises of voltage. Any portion of the network which is separated from the rest of the network by an inductance has a tendency to concentrate in itself the electric energy from adjoining parts of the network when a transient phenomenon starts. Since transformers, etc., are necessary in the network, provision must be made for traveling waves to pass over them. The article is to be concluded.—*Elek. Zeit.*, Feb. 20, 1913.

### Traction

*High-Tension Lines for Railways.*—E. S. SEEFEHLNER.—The conclusion of his profusely illustrated article on the best methods of constructing an overhead high-tension line for electric railways with special reference to the suspension of the trolley wire and the construction of the insulators.—*Elek. Zeit.*, Feb. 20, 1913.

### Installations, Systems and Appliances

*Control of Switches from a Distance.*—A description of the use at the Egham and Staines central station in England of the method of remote control of switches described in the paper of Duddell in the *Digest* last week. The Egham and Staines system is a single-phase plant, the energy being generated at 2000 volts and 50 cycles. Two concentric feeders transmit the supply to Egham and Staines respectively, where the emf is transformed to 200 volts by transformers placed in street kiosks and distributed on the three-wire system by three-core cables. The "ripple" alternator is installed in a corner of the engine room and is driven by a synchronous motor. It is at present used only in connection with the consumers' meters, and only one frequency is required. For a complete scheme, where several frequencies would be used, the speed of the alternator would have to be varied and a continuous-current motor would probably be used to drive it. The alternator is of the rotating magnet type and the armature is connected in series with the main generator on the outer or earthed main. The whole of the main current passes through the alternator, about 20 amp maximum in this case. The

ripple is used to work relays which cut out the shunt circuits of consumers' watt-hour meters for definite intervals of time, thus giving the consumers so many kilowatt-hours unmeasured, which is equivalent to charging a lower price per kilowatt-hour. The alternator is thus kept running all day, but is shut down during the peak load, when all kilowatt-hours consumed are charged for. An arrangement of cams connected with the shaft of the alternator is caused to make and break the exciting circuit of the alternator at the proper intervals, the breaking of this circuit being, of course, equivalent to removing the ripple. The alternator generates current at about 140 volts with a frequency of 200 cycles. The pressure is transformed to about 7 volts on the low-tension network, which is sufficient to work the relays. An experimental relay was connected to an ordinary lamp holder in a shop distant from the station by some 11 miles of high-tension feeder, and it was seen responding to the alternator as the ripple was imposed and removed. Not the slightest flicker could be detected in a lamp connected as usual across the mains. The relays in use consist of an iron-cored coil and condenser joined in series. A balanced armature is attracted to an electromagnet, and when current of the right frequency is received a very definite pull is obtained on the armature. The system is partly applicable in controlling street lamps, in operating the main switches of consumers supplied on a restricted hour basis and in railway track signaling.—*London Electrician*, Feb. 21, 1913.

**Lighting Batteries.**—An account of the discussion at Manchester of Whysall's recent paper on the use of a large lighting battery in connection with central-station supply. P. H. Whysall said that the situation of the battery depends entirely on the circumstances and the system. In the case of a large direct-current system the advantage is in favor of putting a large battery down at the generating station. In the case of a three-phase system with substation the best place is the substation. As regards the rating of the battery, whether it should be one-hour, two-hour or three-hour, he considered that a one-hour rating to carry over the peak is sufficient. S. J. Watson thought that the fairest method of rating the battery is to take it on the basis of a two-hour rating, because the primary use of a battery is in connection with peak loads. The importance of proper design of the battery switchboard was pointed out. P. P. Wheelwright and C. L. E. Stewart had found that they got the best results by giving their batteries a "rough time."—*London Electrician*, Feb. 14, 1913.

**Arcing Ground Suppressor.**—R. H. MARVIN.—An article in which the author describes the arcing ground suppressor and its uses, indicates its field of application, shows the difference in its construction for overhead and underground systems, and explains, with diagram, the operating cycle. The most effective protection is obtained by its location at the power house.—*Gen. Elec. Rev.*, March, 1913.

**Advertising Electricity.**—H. C. PALMER.—A paper read before the Manchester Section of the (British) Institution of Electrical Engineers on methods of popularizing the uses of electricity. The author deals with press advertising, literature and circularizing, the provision of a central information bureau, local bill posting, and electric signs.—*London Electrician*, Feb. 14, 1913.

**Parallel Operation.**—An account of the discussion which followed the presentation of the paper by A. R. Everest on some factors in parallel operation and in which Miles Walker, S. P. Smith and E. Rosenberg participated. The latter gave diagrams for the flywheel effect required if it is desired that the natural frequency of the machine shall be below the frequency of the engine oscillations. He emphasized the fact that the damper windings are in some cases of great importance as they allow the saving of many tons of flywheel.—*London Electrician*, Feb. 21, 1913.

**Electric Heating of Water.**—A. RITTERSHAUSEN.—An illustrated English translation in abstract of his German

paper, abstracted in the *Digest*, on domestic water heating by electricity and giving details of the Rittershausen water heater.—*London Electrician*, Feb. 21, 1913.

**Electricity for Breweries.**—K. IFFLAND.—The conclusion of his article. The author gives extended data on the cost of generating energy in a private station or buying the energy from the central station under the conditions which obtain for the breweries of the city of Dortmund. The figures show that the Dortmund breweries can, by buying the energy from the municipal station, make considerable savings even if they buy it at the normal tariff rates.—*Elek. Zeit.*, Feb. 20, 1913.

#### Wires, Wiring and Conduits

**Disadvantages of Steel Tubes for Each Individual Phase Conductor of a Single-Phase or Three-Phase System.**—L. BLOCH.—The author emphasizes the great disadvantages and serious heating phenomena which may occur when each individual phase conductor of a single-phase or polyphase system is placed in a steel tube. In this case the magnetic field of each conductor is greatly increased and the eddy currents produced result in additional losses and in an increase of the temperature of the tubes and of the wire. If the two conductors of a single-phase system or the three conductors of a three-phase system are placed together in a tube, no such effect is possible since the actions of the different conductors compensate each other. The author gives results of experiments made by the Berlin Electricity Works with various systems of wiring. It is shown that to place the individual conductors of an alternating-current network in steel tubes is very disadvantageous with currents above 50 amp and should be avoided also with lower currents, not only on account of the increase in temperature but also on account of the greater losses and the serious increase of the voltage drop. If the individual conductors are placed in paper tubes with leaded iron armor the increase of temperature is not dangerous, but with greater currents an increase of voltage drop may be produced which can cause considerable trouble. With currents above 100 amp this method of wiring should be avoided under all circumstances. To place each conductor in a paper tube with brass armor is harmless. The results of the experiments showing the increase of voltage drop, losses and temperature are given in tables and diagrams.—*Elek. Zeit.*, Feb. 20, 1913.

#### Electrophysics and Magnetism

**Maximum Voltage Gradient in a Spark-Gap in Terms of the Radius of Curvature of the Electrodes.**—GEORGE R. DEAN.—This article is the outcome of a special line of study followed up in connection with research work on the dielectric strength of air. Values for the dielectric strength of air are usually based on tests of breakdown voltage between metallic electrodes spaced at given distances. Whatever the potential and shape of the electrodes, it is necessary to have a means of computing the maximum voltage gradient between them, and most of the methods which have heretofore been proposed have been either highly involved or of limited applicability. The author employs only elementary algebra and trigonometry in evolving an exceedingly simple working formula, and he shows, moreover, that the spherical form of electrode may be departed from considerably provided the curvature of the spark point is known.—*Gen. Elec. Rev.*, March, 1913.

**Phosphorescence.**—C. A. BETMAN.—The author deals especially with the mechanism of light production and with the cost of the spectra of phosphorescent materials.—*Gen. Elec. Rev.*, February, 1913.

#### Electrochemistry and Batteries

**Manufacture of Silicon Monoxide.**—A note on a recent British patent (No. 16,044, 1912) of Geb. Siemens. A mixture of carbon and silicon is heated in an atmosphere of carbon monoxide or dioxide, so as to produce a molded body of SiCO and free carbon. It is then heated

to from 1600 to 1700 deg. C. in a non-oxidizing atmosphere; the body remaining is composed of SiC.—*London Elec. Eng'g*, Feb. 20, 1913.

**Edison-Lalande Cell.**—DUDLEY SANFORD.—An article giving the results of a careful test of an Edison-Lalande cell. The arrangement of the test and the results of the measurements are given in diagrams. The following figures of the cost of electrical energy from primary cells are given: If the zinc in this cell is consumed with 100 per cent efficiency, the cost of producing energy is \$2.37 per kw-hr. This is on the assumption that the zinc is the only substance consumed in the production of available energy and that the other materials will be recovered. If, however, the user throws away the remaining materials and buys a complete renewal, the cost will be \$9.40 per kw-hr. If the materials are bought in large quantities, this cost may be much reduced—50 per cent in lots of \$2,000 or more and proportionately for intermediate quantities. Hence under favorable conditions electrical energy obtained from this highly efficient type of primary battery costs about fifty times the ordinary market price of electrical energy.—*Metall. and Chem. Eng'g*, March, 1913.

#### Units, Measurements and Instruments

**Magnifying Feeble Signaling Currents.**—S. G. BROWN.—An illustrated lecture delivered at the last exhibition of apparatus of the Physical Society of London. The instruments described by the author are designed primarily for cable work, but they are equally applicable to recording many other kinds of signaling impulses. He first describes a modification of the siphon recorder which increases its efficiency considerably. He then describes a thermo-electric magnifying relay (Fig. 1) in which the power in the relay circuit is generated by means of five thermo-junctions at different temperatures. The heat is supplied by two little flames CC, and a very light thermopile B is suspended so as to swing in and out of the flames and is coupled to a moving coil through which the received currents pass. The thermopiles consist of alternate junctions of platinum and platinum + 20 per cent iridium, wires being used of 1-mil diameter. Under the saddle which carries the thermopile the two silk fibers are stretched, and to one of these the cross-fiber which transmits the movements of the coil to the thermopile is attached. The top and bottom suspensions are of fine phosphor bronze wire and serve as leading-in wires to the thermopile. The curve (Fig. 2) was taken from a thermopile with seven junctions on each side. When the thermopile was deflected 0.075 second of arc the current it sent through a resistance of 42 ohms (equal to its own resistance) was 0.81 milliampere. With the natural period of the coil equal to 8.7 per second and a 480-ohm, 480-turn coil, a current of 0.03 milliampere through the coil gave

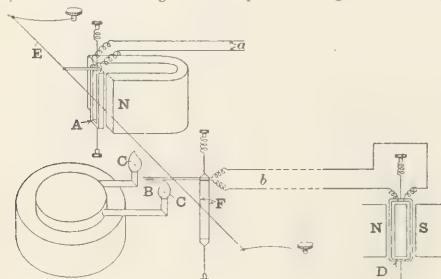


FIG. 1—THERMO-ELECTRIC MAGNIFYING RELAY

a current of 0.81 milliampere from the pile through an external resistance of 42 ohms. For slowly changing currents this corresponds to a magnification of power of about twenty-seven-fold, and, of course, this can be greatly increased by reducing the period of the coil. For quickly

changing movements the power magnification is not so great, owing to the back emf of the coil. Trials of this instrument on an Atlantic cable have shown an increase in speed of about 40 per cent. Fig. 3 shows an entirely mechanical relay in which movements operated by very small forces

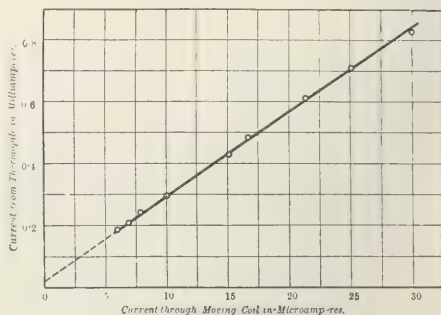


FIG. 2—CURVE FROM THERMOPILE WITH SEVEN JUNCTIONS

are largely increased in strength without affecting their motion. The relay consists in principle of a rotating spindle around which are wound one or more turns of a flexible cord. The spindle is revolving in such a direction as to pull away from the magnified forces and toward the small forces that control the movement. Suppose a heavy weight has to be raised by a force of one-tenth of the amount, it will obviously be necessary to supply 90 per cent additional energy, and this is supplied by the motor driving the spindle. The magnification of force and energy depends on the number of turns which the cord makes round the spindle and follows a compound interest law. Fig. 3 shows an

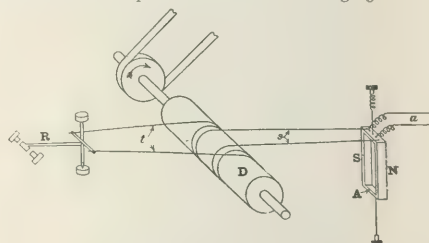


FIG. 3—MECHANICAL RELAY

application of the principle to cable work, in which the small forces operating the coil A are intensified sufficiently to work the coarse relay arm R. The spindle rotates away from the relay arm R and toward the coil and produces a much greater tension in the fibers t than in s. When the coil swings on its axis the tension is increased in one of the fibers and diminished in the other and a similar change in a magnified degree takes place in the fibers t. By using means of this sort it is possible to work an ordinary siphon writer, which normally requires some 3 milliamperes, by a current of 10 microamperes.—*London Electrician*, Feb. 21, 1913.

#### Telegraphy, Telephony and Signals

**Elimination of the Siphon Recorder.**—A note on a new system of submarine telegraphy due to John Gott. The system consists in using a current for each signal of an opposite polarity from the preceding and succeeding currents. This is a very small modification from common usage, but it appears that it results in distinct signals passing through the cable instead of signals running together into a continuous indication in the way which renders the use of a siphon recorder necessary. Thus two successive dots would be signaled by two currents of opposite polarity. On that account the ordinary Morse code can be used in



place of that which becomes necessary with the recorder, and thus a land line can be joined up to either end of a submarine cable and an ordinary Morse message can be sent through the combined circuit with an ordinary key. The operation thus becomes much simpler, and for the ordinary key there may be substituted a Wheatstone transmitter; but this does not mean that the speed of signaling will be much increased. The importance of the method lies in the fact that re-transmission at the cable ends may be omitted; in fact, the siphon recorder can be eliminated, and consequently greater accuracy can be obtained, and indirectly a saving of time can be effected. One of the chief uses of the method will no doubt be the linking up of a number of short cables so as to be able to signal directly from end to end. It is possible to transmit ordinary Morse signals from, say, London to New York direct, provided suitable relays are introduced at the ends of the cable. "Experiments have already been conducted between London and New York on this system with satisfactory results."—*London Electrician*, Feb. 21, 1913.

**Inductance and Capacity of Linear Conductors.**—LOUIS COHEN.—The author gives expressions for the capacity of various arrangements of linear conductors and applies them to the calculation by the capacity of horizontal antennas. The treatment is highly mathematical. The article is to be concluded.—*London Electrician*, Feb. 14, 1913.

#### Miscellaneous

**Electricity for Agriculture.**—VON PUTTKAMER.—A paper discussing in a general way the fundamental principles which should be considered in the design and operation of transmission and distribution systems in agricultural districts.—*Elek. Zeit.*, Feb. 20, 1913.

**Electric Resistance Welding.**—P. BUCHER.—A paper in abstract read at Manchester and giving data on the methods and results of electric resistance welding. The underlying principle of resistance welding—that is, the use of very heavy currents—makes the necessary machinery heavy, cumbersome and expensive. It is, however, simple, accurate and speedy. The various applications of electric welding in commercial practice can be subdivided as follows: There is first plain butt welding, or the welding end-to-end of bars and the like of the same or approximately the same area. A variation of the plain butt welding is the angle, tee and miter welding, which is used on both rectangular bars and various sections of profile iron. Spot welding takes the place of riveting in such a way that only a small percentage of the total area in contact is welded together in circular spots. A development of spot welding is seam welding, in which the two sheets are joined together in an uninterrupted lap weld under one or between two rotating disk electrodes. Some figures are added on the strength of electric welds. Mild steel is most suitable for electric welding. Higher carbon steel can be welded up to about 0.8 per cent carbon, but the results are not so satisfactory as in mild steel as regards either the tensile or the torsional strength. Pure copper welds quite satisfactorily, and so do most of the brasses unless the percentage of zinc in them is too high, when the weld becomes brittle and will not draw. Nickel and most of its alloys weld very well, as do also aluminum, silver, gold, platinum and iridium. These remarks apply, however, only to butt welding, as iron and mild steel are the only materials that lend themselves to spot welding in a satisfactory manner. E. W. Marchant said in the discussion that the energy consumption is remarkably small, as is seen from the fact that a weld between a pair of  $\frac{5}{32}$ -in. rods takes 20 watt-minutes, or in other words 1000 welds of this kind can be made with only 0.33 kw-hr. It is interesting to note that as the diameter of the rod increases the energy consumption per weld goes up very rapidly; for example, comparing  $\frac{5}{32}$ -in. and  $\frac{5}{16}$ -in. rods, nine times as much energy per weld is required in the latter case. This increase is due partly to the increased

contact area and also to the large amount of cooling due to the jaws holding the metal. The current used in the case of the  $\frac{5}{16}$ -in. rods was about 2000 amp. Experiments showed that using copper rods a current of 6000 amp was required against 2000 amp for iron of the same diameter.—*London Electrician*, Feb. 21, 1913.

## Book Reviews

**LIGHT, PHOTOMETRY AND ILLUMINATION.** A thoroughly revised edition of "Electrical Illuminating Engineering." By William Edward Barrows, Jr. New York: McGraw-Hill Book Company. 335 pages. Illus. Price, \$3 net.

An excellent textbook of the most recent illuminating engineering principles, designed for the use of students of photometry and illumination. It is well arranged and illustrated. The descriptions are brief yet clear. The subject is brought up to date in many directions to a remarkable degree considering how many lines of work are covered and how difficult it is to keep informed on all of them. Although the book is principally addressed to students in colleges, yet it will be of much service to illuminating engineers and all who are interested in illuminating engineering. It is, we believe, one of the best modern books on the subject in the English language.

**DIE BELEUCHTUNG VON EISENBAHN-PERSONENWAGEN.** By Max Buttner. Second edition. Berlin, Germany: Julius Springer. 236 pages, 108 illus. Price, 7 marks.

A thoroughly good and comprehensive treatise on the subject of car lighting, a special subject which is assuming greater and greater importance. Starting with a short historical review which goes back as far as 1836, the author goes on to explain the lighting of cars by means of oil and gas, including the latest developments in this line since the introduction of the incandescent gas mantles. This forms the first part of the book. The second part is given over entirely to electric lighting. Practically every known electric system of car lighting, European as well as American, is described in detail, its applications are enumerated and its advantages and disadvantages explained. The book ends with a chapter containing statistics and comparative statements of cost of operation for the different lighting systems. The book is clearly written, well illustrated and should prove of interest to those engaged in car lighting both here and abroad.

**THE THEORY OF LIGHT.** A treatise on physical optics. By Richard C. Maclaurin. In three parts. Part I. New York: G. P. Putnam's Sons. 320 pages. Illus. Price, \$2.75.

A mathematical treatise on physical optics written with great care. The scope of the book is to present the theories of optics, especially as developed by Green and MacCallagh, in such a manner as to reveal the differences between theory and experiment. The treatment is essentially philosophical. The electromagnetic theory of light is barely outlined in this first volume, dependence being placed upon the mechanical or elastic solid theory. The chapters relate to the following subjects: Scope and method of inquiry; preliminary ideas; propagation of light in transparent media; influence of a layer of transparent transparent isotropic plates; propagation of light in transparent uniaxial media; reflection and refraction at transparent crystals; transparent crystalline plates; propagation of light in absorbing isotropic media; Newton's rings formed by metallic reflection; propagation of light in absorbing crystalline media. The book will be of great interest to advanced students of mathematical physics and optics.

# New Apparatus and Appliances

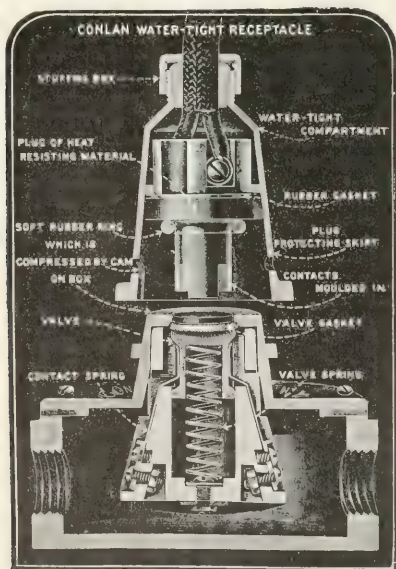
## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Portable Electric Lamps of Pottery

One exhibit at the recent Clay Products Exposition in Chicago was of some interest to electrical men, as it embraced portable electric lamps in various artistic designs, in which both the standard and the shade were made entirely of pottery. These all-clay lamps were shown by the Vasekraft Studio of the Fulper Pottery Company, of Flemington, N. J. This company is said to have been in operation since 1805. The "Vasekraft" wares depend on the colors and texture of glazes to ornament the pottery shapes rather than the modeling in relief on the shape itself. Various designs of portable lamps were shown and the shapes, while usually, perhaps, more ponderous than dainty, were in many cases decidedly novel and artistic. The colors shown in the pottery vases, shades and bowls were generally beautiful and pleasing.

### Water-Tight Plug Receptacle

The water-tight plug receptacle shown in the accompanying illustration has been introduced by the Conlan Electric Company, 43 Murray Street, New York City. Instead of the portable lid for covering the opening disclosed by the removal of the plug an automatically operated valve is employed. The action of the valve spring is also utilized to



WATER-TIGHT RECEPTACLE

produce a quick break in the electrical circuit when the plug is removed. Another feature of this apparatus is found in the use of a cam for connecting the plug to the box. This cam compresses a gasket between the plug and the face of the box which makes the joint water-tight. The gasket is attached to the base of the plug. The operator, who is usually unskilled, is not required to do more than

break the electrical connection and the receptacle is automatically rendered water-tight. This device is well adapted for use on shipboard, by railroads or in mines, breweries, garages or theaters.

### Choke Coils and Disconnecting Switches

The choke coil and disconnecting switch illustrated herewith are typical of a new line of such devices recently brought out by the Electric Service Supplies Company, Philadelphia.

The bases of both choke coils and disconnecting switches are of standard 3-in. channel iron, which permits the de-

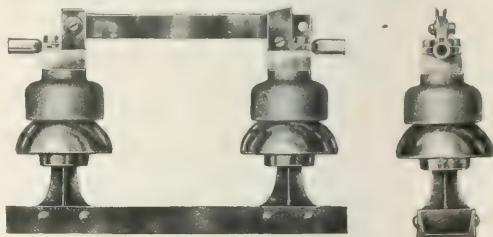


FIG. 1—CONSTRUCTION OF DISCONNECTING SWITCH

vices to be attached to switchboards directly, to cross-arms, poles, pipe or any other suitable supporting means.

The pin insulators are supporting galvanized-iron tops, to which are attached brass terminal blocks for either the choke coil or the switch mechanism.

Choke coils are sweated into these blocks and provided with separable terminals. The manufacturers claim that these choke coils are very rugged in construction, possess great electrical and mechanical strength, and that their design has been worked out so that they afford great protection to electrical apparatus when used in conjunction with their standard types of arresters, known as Gorton-Daniels lightning arresters. The choke coils are made for

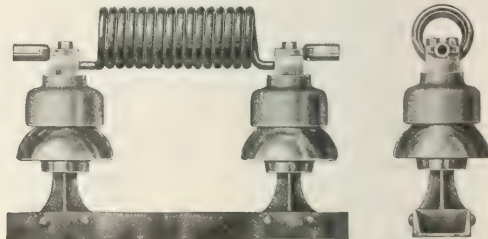


FIG. 2—CONSTRUCTION OF CHOKE COIL

ratings up to 23,000 volts and for all standard current ratings.

In the disconnecting switch the clips are made of machine-finished, pure, hard-drawn copper. The blades are hung in the clips, and tension screws are provided at each end to secure proper contact. Separable terminals are provided on these switches for all ratings.



## High-Tension Air-Break Switches Under Severe Winter Conditions

In order to obtain some accurate knowledge as to the behavior of high-tension air-break switches under severe winter conditions some experiments have recently been made under conditions resembling those of a severe sleet storm. In Fig. 1 is shown a three-pole switch manufac-



FIG. 1—TWO POLES OF A THREE-POLE WEATHER-PROOF HIGH-TENSION AIR-BREAK SWITCH

tured by the Delta-Star Electric Company, Chicago, Ill., mounted on a temporary structure. With a temperature of 25 deg. above zero and wind velocity of 25 miles per hour as recorded by the Weather Bureau, a heavy spray of water was directed on the switch for about two and a half hours. The ice deposit was very heavy and resulted



FIG. 2—MAIN AND ARCING CONTACTS OF SWITCH

in long icicles extending from the insulator petticoats to the channel-iron switch mounting. The operating mechanism connecting the three rotating switch arms is located within the central channel-iron mounting base and therefore was not affected by the ice formation.

Under the conditions illustrated, the flash-over occurred at potentials from approximately 51,000 volts to 57,000

volts. The value varied as the voltage was raised and the icicles began to melt. During the test a spray of water was played on the switch, thus keeping the ice wet. The combination of ice formation, thawing icicles and steady water drizzle was probably equal to the worst conditions.

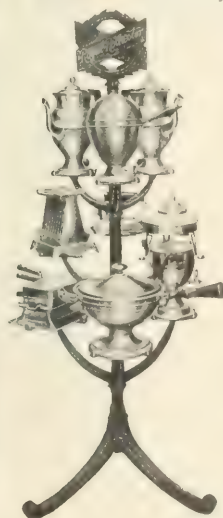
After the break-down or voltage tests were completed the switches were operated by closing and opening the swinging arms, thus breaking the ice at both the main and auxiliary contacts. Fig. 2 shows the action of the main and arcing contacts. The main contact was opened, the arcing contacts still remaining in circuit and in position to take the arcing or burning incident to final opening. Obviously the problems of carrying capacities, voltage, break-down clearances, etc., are relatively simple, as they depend simply on spacing, size of contacts and the type of insulator used. The real problem in outdoor switches is to adopt a construction which will meet the conditions as presented by severe winter service.

## Display Stand for Electric Goods

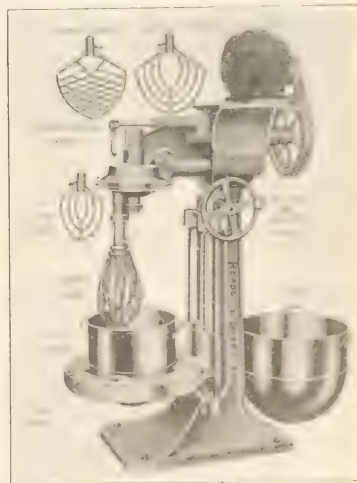
The Rochester Stamping Company, Rochester, N. Y., has designed a very practical display stand which is furnished to the trade with its electric household goods. It measures about 56 in. in height and is made of steel castings sufficiently heavy not to tip over. It is finished in aluminum and provides space for nine articles. By a simple screw arrangement the goods are fastened on the brackets so that they cannot be knocked off but are readily released by a twist of the thumb.

## Motor-Driven Mixer and Beater

The use of machines driven by small individual electric motors has proved a great source of economy in bakeries, confectionery plants, hotels and restaurants. One such



DISPLAY STAND



MOTOR-DRIVEN DOMESTIC APPLIANCE

application of a beater and mixer is illustrated herewith as a typical example of these time-saving and labor-saving devices. This machine is applicable to all classes of plain and fancy cake, biscuit and egg work, fruit and other pie fillers, jams, relishes, sauces, dressings and other preparations of the numerous varieties that require mixing and mashing.



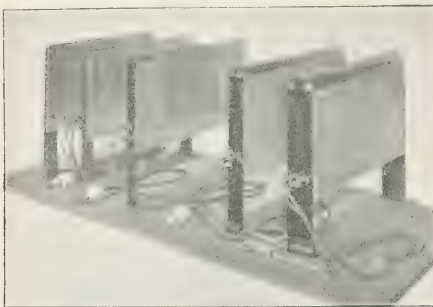
The beating bowl rests on a stand which can be raised to the beater by turning a handle. A variety of styles and sizes of paddles can be supplied for the machine, and one of these patterns can easily be replaced by another one if desired.

The machine has three speeds and is controlled by turning the speed-changing handle. The machines are made by the Read Machinery Company, York, Pa., the electrical equipment being furnished by the Westinghouse Electric & Manufacturing Company.

### Electric Forming Irons for Bookbinding

The Prometheus Electric Company, of 236 East Forty-third Street, New York, has placed on the market an electrically heated forming iron for use in binding books. Unlike the steam pipes and other devices that are commonly employed for this work, these irons are portable. The curved working surfaces are 18 in. long and the tool stands 15 in. high. The curved tops have correct diameters to fit the sizes of books to be formed.

In the use of these forming irons heat is applied at the top only and none of the annoyances which are usually associated with fuel heating is present. The working sur-



ELECTRIC FORMING IRONS

face of the heater is made of nickel-plated cast iron, the end frames are of black jappanned wrought iron, and the sides are of Russia iron. The apparatus is mounted on a slate base. Each heater is equipped with a 6-ft. cord for connecting it to a lamp socket. The cord is removable at the heater. The heating units are built in sizes which will consume from 90 watts to 180 watts.

### Electric Apparatus at the Boston Automobile Show

The Boston Automobile Show, for pleasure cars only, was opened at the Mechanics' Building, Huntington Avenue, Boston, Mass., on the evening of March 8, to last one week, and was characterized by a representative display of the latest models of gasoline and electric machines, ranging in character from the motor cycle to the highest powered and most luxurious touring cars. There were about 300 exhibitors, including accessory manufacturers and dealers. The use of electric self-starting methods and electric lighting has become standard practice with the makers of the highest grades of gasoline cars. The electric automobile display is somewhat scattered this year at Boston, but contains many admirable examples of the brougham and roadster types of equipment. One of the latest models shown, which has been brought out since the New York and Chicago exhibitions earlier in the season, is a new roadster built by S. R. Bailey & Company, of Amesbury, Mass. This machine, known as the company's Model "F," is said to

give 125 miles per charge at an average speed of 20 miles per hour, the maximum speed being in the neighborhood of 27 miles per hour.

The Anderson Electric Carriage Company, Detroit, Mich., is showing a roadster equipped with a new auxiliary seat, foot rest and the latest type of sectional windshield.

The Woods Motor Vehicle Company, Chicago, is showing a new arrangement of a Sangamo ampere-hour meter designed to indicate the ampere-hours left in the battery at a stated rate of discharge, an odometer being installed in the same case. The body is also designed to facilitate an outlook toward the rear, the makers having found this a feature hitherto rather lacking in some designs of pleasure cars with closed bodies.

The Champion Ignition Company, Flint, Mich., is showing a new spark plug with extra long porcelain core protruding slightly below the end of the metal shell and permitting the use of a very short center electrode, which it is contended will not overheat or get out of adjustment, thereby insuring a smoothly running motor. The extra length of insulation makes it practically impossible for soot to short-circuit the plug.

The Arnold Electric Company, Boston, Mass., is showing a new electric vaporizing coil for starting cold motors of the gasoline type. The coil requires 9.5 amp at 6 volts for about one minute and is applicable to either automobiles or motor boats.

The Electric Storage Battery Company, Philadelphia, is showing a full line of "Exide" plates of the latest design, views of its factories and working demonstrations of the power requirements of car lighting and self-starting.

The Waverley Company, represented by the J. W. Bowman Company, Boston, is showing a new model electric limousine, with a divided rear seat giving three spaces for passengers and providing greater comfort, together with room for parcels behind the seating spaces.

The Underhill Company exhibits the Grinnell car, in the form of a five-passenger brougham with a three-position folding swivel seat at the right of the operator. The car has low front windows affording an easy view of the road. A Hupp-Yeats electric limousine with driver's seat completely incased is also being exhibited at the show and is attracting considerable notice.

The Locomobile Company of America displays a new electrically operated starter of its own build mounted on the engine base to provide for the constant alignment of the driving gears. The starter is operated by a switch controlled by the starting pedal of the car. The electric motor starter is designed to give a high acceleration and starting torque for the short period in which its operation is required.

Among the other exhibitors of electrical interest, whose displays also appeared at the New York and Chicago shows, are the Edison Storage Battery Company, West Orange, N. J., which is featuring the cell groups required in specific pleasure car and truck service; the American Storage Battery Company, Cambridge, Mass.; Burn-Boston Battery & Manufacturing Works, Boston, Mass.; Buffalo Electric Vehicle Company, Buffalo, N. Y.; Connecticut Telephone & Electric Company, Meriden, Conn.; Columbia Motor Car Company, Hartford, Conn.; Diamond Rubber Company, Akron, Ohio; Joseph Dickson Crucible Company, Jersey City; Dodge Motor Vehicle Company, Cambridge, Mass.; Gray & Davis, Boston, Mass.; Heinze Electric Company, Lowell, Mass.; Holtzer-Cabot Electric Company, Brookline, Mass.; Marburg Brothers, Inc., New York; Pittsfield Spark Coil Company, Dalton, Mass.; Rauch & Lang Carriage Company, Cleveland, Ohio; Simms Magneto Company, New York; Splitdorf Electrical Company, Newark, N. J.; United States Light & Heating Company, New York, and Willard Storage Battery Company, Cleveland, Ohio.

The Boston motor truck show will open in the Mechanics' Building on March 19.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Demand for Electrical Supplies Feature of Western Electric's 1912 Business.**—As was stated in these columns Jan. 8, the total sales of the Western Electric Company in 1912 were over \$71,000,000, the largest total in the history of the company. Contrary to general belief, this record was not due to the expansion of the company's business in telephone equipment, but chiefly to a large increase in the demand for electrical supplies such as incandescent lamps, dry batteries, fan motors, iron conduit pipe, copper wire, motors, generators, etc. This branch of the company's business doubled from 1906 to 1912 and in 1912 was four times as large as in 1900. Throughout 1912 each month's business was larger than that in any corresponding month in the history of the company. Vice-president Swope, discussing the policy of the company, said this week: "With the increasing use of the telephone and other things electrical, our opportunity is constantly broadening. With study and care as to our methods we should constantly become more efficient, thus deserving the opportunity to serve the community more largely, and by keeping before us the time-tried principles, retain the confidence, respect and patronage of an ever larger number of satisfied customers. With many companies, and indeed partly with our own, in the past, patents have been the basis largely responsible for their growth and success. With us, more and more, patents are useful principally in that they give us greater freedom to develop the best system. Our plan is to develop the best form of apparatus for its purpose, to manufacture it with reference to low cost of maintenance and to sell it on the basis of quality and price. We cannot expect to sell at the same price or a better price than our competitors unless our product is as good or better than theirs. Therefore, 'quality' must be present, must be talked and must be considered to get a share of the business."

**Central-Station Service for Panama-Pacific Exposition.**—A contract was signed on March 5 between the Panama-Pacific International Company and the Pacific Gas & Electric Company under which the latter will supply exclusively during the next three and one-half years all electrical energy required for motors and lighting during the term of the World's Fair in San Francisco in 1915 and during the period of construction and dismantling. The present estimates indicate that the exposition will require 20,000 hp. The gross amount of this business is estimated at \$500,000. Simultaneously contracts were entered into with the Pacific Gas & Electric Company for all gas and steam required by the exposition. The vice-president of the company believes that this is the first time that an exposition of the first magnitude has been able to contract for all its requirements for electrical energy with a single company. The Pacific Gas & Electric Company now has in operation electric generating stations with an equipment rating exceeding 200,000 hp, and it is engaged in the construction of several additional hydroelectric plants with an ultimate rating of 165,000 hp, which when completed will give it a total electric generating rating of 365,000 hp.

**Westinghouse Had Record Year Despite Low Prices.**—For the fiscal year ended with the current month, the Westinghouse Electric & Manufacturing Company will show a record in gross earnings. These will be between \$40,000,000 and \$41,000,000, comparing with \$38,119,312 in 1911, the best previous showing. It is understood, however, that the earnings will not show a proportional increase, although there will be a surplus of about 8 per cent on the common stock available for that issue after payment of the regular 7 per cent dividend on the preferred. The present rate on the common is 4 per cent, and it is unlikely that the directors will make any change in the rate during the present calendar year. While there was considerable activity in the electrical

trade last year and many electrical manufacturing companies enjoyed large increases in their gross earnings, the net profits were not in the same proportion, as was brought out in the canvass made by the *Electrical World* toward the close of 1912. Selling prices for electrical equipment were low during the year and competition was exceedingly severe, while prices for raw materials increased.

**General Electric to Make Diesel Engines.**—In a note in these columns Feb. 8, 1913, discussing the increase in the number of manufacturers now making crude-oil engines of the Diesel type, we said that one of the largest electrical manufacturers was also about to go into the Diesel-engine-building field. That statement referred to the General Electric Company, which is now developing one or two small sizes of Diesel engines at its works at Erie, Pa. The entire project is still in the formative stage, and the extent to which the company will enter the field, as well as the sizes to be built, will depend in a large measure upon the results obtained from the engines now in course of construction. The General Electric Company has been in touch with Mirlees, Bickerton & Day, who are building Diesel engines in Stockport, Eng., and will probably make an arrangement with that concern whereby it will be able to secure the benefit of its shop experience, designs, patterns, etc.

**Slight Decrease in Copper Surplus.**—The comparative statements of the Copper Producers' Association for January and February will be found on page 50. The February statement, issued March 8, showed stocks at home of March 1 of 122,302,198 lb., as compared with 123,198,332 lb. on Feb. 1, a decrease of only 896,134 lb. This reduction is noteworthy, however, in view of the fact that domestic deliveries last month were lower than in any month last year with one exception. The explanation of the decrease in stocks is found in a falling off in production as compared with January and in an increase in foreign deliveries. Export sales were greatly stimulated by the recent price reductions, with the result that copper exports last month were larger than those in any other month since the beginning of 1912.

**Southern Power Company Orders 1500-Volt Converters.**—The Southern Power Company, of Charlotte, N. C., which up to the present time has operated its 1500-volt direct-current railway system from motor-generator sets, the two generators of each set being connected in series, has placed an order with the Westinghouse Electric & Manufacturing Company for three sets of 750-volt, 60-cycle rotary converters. The rating of the rotary sets will be 500 kw and each set will comprise a double converter on a single bed-plate, the two interpole machines being connected in series. The machines will be installed in the Spartanburg station and will be the first units of their kind built.

**New Home for Edison Enterprises.**—Thomas A. Edison's business enterprises in Chicago will be concentrated in one building devoted exclusively to that purpose. This is a four-story building at 250 South Wabash Avenue, with an attractive front of white terra-cotta brick. It is known as the Edison Photograph Building. It contains a room to retain the Chicago offices of the new Photo-graph Company, Edwin C. Barnes & Brothers, local representatives of the dictating-machine department of Thomas A. Edison, Inc., the primary-battery department of Thomas A. Edison, Inc., and the Edison Storage Battery Company.

**Alabama Interstate Interests Elected to American Cities Board.**—James Mitchell and W. W. Freeman, president and vice president of the Alabama Interstate Power Company, and Irving P. Bombaugh, former elected director of the American Cities Company, New Orleans, succeeding William Von Paul, of New Orleans; William P. Bombaugh, of New York, and Lynn H. Dinkens, of the first named city,



**Electrical Compared with Railroad and Industrial Earnings and Failures.**—Several charts showing the relative security of certain classes of stocks and bonds and the relative steadiness and rate of increase in the net earnings of some of these classes have been prepared by Henry L. Doherty & Company. These charts are similar to those which were described in the *Electrical World* Dec. 30, 1911, page 1621, and were prepared by the same company. The first chart shows, year by year, for ten years how the gross and the net earnings increased and decreased for typical gas and electric companies, electric street railways, steam railroads and the large industrial companies listed on the New York Stock Exchange. The curve for the electric properties indicates that the earnings of these companies have increased steadily and rapidly, while the earnings of the industrials and the steam roads have fluctuated. A second chart shows the result of analysis for the thirty years from 1882 to 1911, indicating the percentage of capital in the hands of receivers as compared with the total capital of each group. The aggregate amount of capital considered in this chart is \$545,310,371.443, of which \$9,578,713.793 was found to be insolvent, this being an average for the whole of \$1.75 out of every hundred dollars of stocks and bonds outstanding. Based on figures of all the gas and electric companies in the United States, it was found that an annual average of only 37 cents out of every \$100 of all gas and electric stocks and bonds has been in the hands of receivers, as compared with a total of \$1.93 per \$100 for national-bank capital, \$1.84 for steam railroads and \$2.07 for industrial corporations. In the case of the national banks the figures showed that an annual average per \$100 of securities outstanding of 32 cents has been declared insolvent by the government and that \$1.61 in addition has been voluntarily liquidated, making a total of \$1.93 as above. From the data the compilers deduce that gas and electric companies are about five times as free from receiverships as are steam railroad securities and that they are over five and one-half times as free from receiverships as are the larger industrial companies.

**Emergency Central-Station Service for the Corn Products Company.**—On Feb. 26 a 2000-kw steam turbine in the private plant of the Corn Products Company at Argo, near Chicago, broke down. This turbine operated a 600-volt, 25-cycle, three-phase generator from which electricity was obtained to operate a large number of electric motors throughout the works. In the emergency the Public Service Company of Northern Illinois was appealed to. This company has a 33,000-volt transmission line passing near the Argo plant and an extension was made from this transmission line to a temporary substation building at the power house of the Corn Products Company. The 33,000-volt transmission line is protected by a ground wire, but in the emergency extension choke coils were inserted where the connection was made with the main transmission line, and units consisting of a disconnecting switch, S. & C. fuse, choke coil and spark gap were put in outside the substation. This extension supplied energy to a 750-kw oil-insulated, water-cooled three-phase transformer, which stepped down the emf from 33,000 volts to 460 volts. By this means a temporary supply of 460-volt, 60-cycle energy to the amount of about 750 kw was obtained. It was necessary, however, to change the motors so that this energy could be utilized. About a week's time was consumed in making the temporary connection, but had it not been for the fact that a bad sleet storm was encountered while the work was going on the work could have been done in a much shorter time.

**Will Sell Chicago Properties of Allis-Chalmers Company April 8.**—In pursuance of a decree entered in the United States District Court for the Northern District of Illinois, the Chicago properties of the Allis-Chalmers Company will be sold on April 8. The properties consist of two works. The bids must be accompanied by \$150,000 in cash or \$300,000 in bonds. Judge F. A. Geiger, of the United States District Court, on March 7 denied the motions of the dissenting stockholders and bondholders of the Allis-Chalmers Company and affirmed the sales of the Milwaukee real property and all personal property of the company for a total of \$6,250,000 on condition that the sales of the real property in other states make the total purchase price enough so that the bondholders may realize 62½ cents on the dollar. The dissenting stockholders claimed that the real property,

which was sold on Feb. 3 for \$2,250,000, should have brought \$3,750,000, on the assessed valuation of the property. They also contended that the personal property should have brought \$7,000,000 instead of \$4,000,000, and based their argument on the recent inventory made by Otto H. Falk, the receiver.

**Gas-Engine Sales.**—The Wheat's Ice Cream Company, Buffalo, N. Y., has placed an order with the Bruce-Macbeth Engine Company, Cleveland, Ohio, for a 90-hp engine, which makes the seventh engine of the same make in use by that company. The following installations have been made recently in Cleveland alone by the Macbeth company, in addition to seventy other installations previously made in the same city: The Grabler Manufacturing Company, 150 hp; H. C. Tack Company, 150 hp; Willard Storage Battery Company, 150 hp; Frost Wire Fence Company, 90 hp; Cooper Spring Company, 60 hp; Guide Motor Lamp Company, 40 hp; Ranney Fish Company, 40 hp; Tinnerman Steel Range Company, 40 hp. The Willard Storage Battery Company's order, a 150-hp engine, makes the fifth engine of the same manufacture in use by that company.

**New Officials for Pacific Telephone & Telegraph Company.**—A number of important changes in the list of officials of the Pacific Telephone & Telegraph Company, San Francisco, were announced last week, following the annual meeting. Louis Glass and E. J. Zimmer, vice-presidents and directors, resigned and were succeeded by J. M. Quay and H. D. Pillsbury. E. C. Bradley resigned as vice-president and general manager but continues as a director. His successor was not named. G. E. McFarland, of Omaha, vice-president and general manager of the Nebraska Telephone Company, is to be president of the Pacific Telephone & Telegraph Company, and H. T. Scott chairman of the board of directors.

**Direct-Current Locomotives for Southern Power Company.**—The Southern Power Company, of Charlotte, N. C., which supplies the electrical energy to the Piedmont & Northern lines and other affiliated interests, has placed an order with the General Electric Company for six 60-ton locomotives for operation on the 1500-volt direct-current overhead-trolley interurban line connecting Charlotte and Gastonia, N. C., and which also operates over a stretch of territory in South Carolina. This system when completed will be one of the largest electric freight and interurban roads in the country and will extend from Greenville, S. C., to Charlotte, N. C., with possible extensions far beyond these limits.

**Salida (Col.) Utility Properties Sold.**—The reorganization committee of the Central Colorado Power Company has purchased the Salida (Col.) Light, Power & Utility Company, which is one of the oldest hydroelectric developments in Colorado. The purchase price is given as \$500,000. The Central Colorado Power Company is to be sold at a receiver's sale in Denver on March 31, and will be bid in by the reorganization committee for the bondholders of the Central Colorado and the Leadville Light & Power companies. The generating system at the Salida company consists of two hydroelectric plants of about 1000 hp each. These are capable of development to 12,000 hp.

**Several Large Electrical Companies Organized in February.**—With few exceptions, the largest companies incorporated in the Eastern States in February were public-service enterprises. Some of those taking out charters last month were the Colorado Mines, Railways & Utilities Corporation, \$25,000,000; American Railways Company of Delaware, \$25,000,000; Kootenai Falls Power Company, \$11,000,000; Louisville Gas & Electric Company, \$18,000,000, and the United States Public Service Company, \$10,000,000, all of Delaware. The Toledo Traction, Light & Power Company, \$17,000,000, took out a charter in Maine.

**General Electric Presidency.**—New York newspapers contained advices from Schenectady this week indicating that C. A. Coffin, president of the General Electric Company, will retire shortly and that E. W. Rice, Jr., vice-president, will succeed to the presidency. Mr. Coffin is now in his seventieth year, and it is said that he is desirous of retiring from active duties. Well-informed representatives of the company would neither confirm nor deny the truth of the rumor this week.





## Personal

**Mr. George W. Imhoff** has resigned as assistant treasurer of the Port Arthur (Tex.) Light & Power Company.

**Mr. Arthur L. Kelley**, president of the Narragansett Electric Lighting Company, Providence, R. I., has been critically ill in Boston, where he is under the care of specialists.

**Mr. C. R. Bohannon** has been appointed manager of the new-business department of the United Gas & Electric Company, which furnishes central-station service at both New Albany and Jeffersonville, Ind.

**Mr. Rome C. Saunders** has been appointed commercial agent for the Tacoma Railway & Power Company, Tacoma, Wash. Mr. Saunders was formerly connected with the Minneapolis General Electric Company.

**Mr. Marshall E. Sampell**, of Chicago, president of the Central Illinois Public Service Company, a subsidiary of the Middle West Utilities Company, was elected president of the Illinois Electric Railway Association on March 7.

**Mr. Henry W. Howard** has resigned his position with the commercial department of the Washington Water Power Company, Spokane, Wash., to become commercial agent of the Des Chutes Power Company, operating in the towns of Prineville, Madras, Redmond, Culver and Metolius, Ore.

**Mr. Chester B. Starbird**, an electrical engineer of New York City, has joined Mr. Schuyler R. Schaff under the partnership name of S. R. Schaff & Company, and will open an office in the Paul Jones Building, Louisville, Ky., for the development, extension and operation of utility properties.

**Dr. S. W. Stratton**, director of the United States Bureau of Standards, Washington, D. C., has been elected a member of the Council of the Underwriters' Laboratories, Chicago, Ill. The council is made up of twenty-two leading engineers and experts of the United States and Canada, who serve without recompense and supervise the technical work of the institution.

**Mr. J. F. McGuire** has been appointed manager of the Consumers' Power Company at Minot, N. D., succeeding Mr. H. E. Brandli, resigned. Mr. McGuire has been connected with H. M. Byllesby & Company's new-business department for several years, most recently in the capacity of commercial manager of the Consumers' Power Company at Faribault, Minn.

**Mr. Samuel Insull**, of Chicago, will deliver an address before the Franklin Institute of Philadelphia on March 19, the subject being "The Production and Distribution of Energy." This paper will, in a measure, supplement Mr. Insull's address on "The Relation of Central-Station Generation to Railway Electrification," presented at a meeting of the American Institute of Electrical Engineers in New York on May 5, 1912, and discussed at the Boston convention of the Institute on June 26.

**Mr. S. K. Colby**, vice-president of Pierson, Roeding & Company, of San Francisco, Cal., has become associated with the firm of Allen & Peck, Inc., of New York City, which operates a number of electric-railway lines in New York State. Mr. Colby will continue his connection with the first-named concern. He was graduated from the Rensselaer Polytechnic Institute in 1894. Mr. Colby is a member of the executive committee of the American Electric Railway Manufacturers' Association and has been closely connected with electric-railway developments on the Pacific Coast.

## Obituary

**Leopold Fishel**, one of the organizers of the Babylon (N. Y.) Electric Light Company, died March 9, at the age of seventy-three.

**Frank P. Ohmer**, chief engineer for the Indiana & Michigan Electric Company, South Bend, Ind., dropped dead from heart failure March 3 while inspecting some of the machinery at the power plant. Mr. Ohmer was well known throughout the Middle West.

**Harry T. Johnson**, president of the Manhattan Electrical

Supply Company of New York City, died Wednesday, March 5, at Daytona, Fla., whither he had gone several weeks before for a rest. The end came after a short illness, the immediate cause of death being blood disease. Mr. Johnson was fifty-two years of age and is survived by his wife and mother, the latter ninety-two years old. Twenty-five years ago Mr. Johnson and Mr. J. J. Gorman, then both young telegraph operators, established the company of which Mr. Johnson was president. From small beginnings the concern has grown until it now occupies a leading position among the manufacturing and supply firms of the country, operating three factories and five branch offices. Mr. Johnson was a member of the New York Athletic Club, Wellsville Lodge, No. 230, F. and A. M., Ancient Chapter No. 1, Palestine Commandery, and Mecca Temple.

**Alfred Stromberg**, who had been one of the conspicuous figures in the telephone manufacturing industry of the United States, died at his home in Chicago on March 8.



ALFRED STROMBERG

Mr. Stromberg was born in Sweden on March 9, 1861.

He was connected with the telephone industry from the early days, his first experience being gained with the great Ericsson establishment in his native country, by which he was first employed in 1878. In 1883 young Stromberg came to this country and obtained employment with the Chicago Telephone Company. While in its employ he made some improvements in apparatus, notably in the automatic hook switch, which were regarded as meritorious.

Five years later Mr. Stromberg became connected with the Chicago Electric Protective Company, a concern which operated a burglar-alarm system in Chicago. Here, too, the young Swede's inventive talent was in evidence and he took out a number of patents relating to this business. It was largely due to his work that the business became a success. In 1893 the first of the fundamental Bell telephone patents expired, and Mr. Stromberg was one of the earliest to recognize the possibilities of the independent or competing telephone industry. He was employed by the Western Telephone Construction Company, of Chicago, one of the first independent manufacturers, and in 1896, associated with Mr. Androv Carlson, also a Scandinavian and a former fellow-employee of the Chicago Telephone Company, he organized the Stromberg-Carlson Telephone Manufacturing Company, of which he was made president. The business of this company was very successful almost from the start. It was based at first on the inventions and practical ideas of Stromberg and Carlson, but as the business developed a staff of designers was employed. The growth of the company was very largely due to Mr. Stromberg's great energy and the real genius he displayed in the design and manufacturing of telephone systems. The company was capitalized for \$50,000, but in 1902 the business was sold out to a group of Rochester (N. Y.) capitalists for \$750,000. The new owners retained the services of Mr. Stromberg for three or four years, but he gradually withdrew from the business and returned to Chicago. In that city he organized several years ago the Stromberg Electric Company, which manufactures electric time stamps, and he also was largely instrumental in the organization of the Stromberg Motor Devices Company, which makes carburetors and automobile accessories. Mr. Stromberg was a self-made man of great natural ability. He possessed a magnetic personality and was popular among independent telephone men. In business he was very shrewd, but he was not without a vein of mysticism, which did not usually affect, however, his great common sense in all the practical relations of life. He was a thirty-third-degree Mason, a Knight Templar and a member of the Union League Club of Chicago. He is survived by a widow and four children. While Mr. Stromberg had not been in perfect health for some time, death came rather suddenly.

## Construction

**ANNISTON, ALA.**—The Ragland Wtr. Pwr. Co., of Ragland, has applied to the City Council for a franchise to supply electricity in Anniston. The company will get its power from lock 4 on the Coosa River, about 18 miles from Anniston. W. T. Brown, of Ragland, is president of the company.

**RAGLAND, ALA.**—Preparations are being made by the Ragland Wtr. Pwr. Co. for the construction of a hydroelectric power plant on the Coosa River, lock 4. The company proposes to raise the dam from its present height of 15 ft. to 18 ft. and ultimately to 22 ft. It is estimated that 10,000 hp can be developed, which will be transmitted to Ragland, Anniston and other cities. W. T. Brown, of Ragland, is president of the company.

**ST. JOHNS, ARIZ.**—A franchise has been granted to the Little Colorado Lt. & Pwr. Co. to erect transmission lines along certain highways in Apache County and on certain streets in the city of St. Johns.

**GRAVETTE, ARK.**—The commission has awarded the contract for construction of an electric-light plant and water-works system to A. J. Foster, of Joplin, Mo. Orders have already been placed for material for the proposed systems. The cost of the work is estimated at about \$20,000.

**WALNUT RIDGE, ARK.**—The Public Service Utility Corp. of Delaware is reported to have purchased a large block of stock in the Walnut Ridge & Hoxie Lt., Pwr. & Trans. Co. The new directors, it is said, propose to enlarge the plant at Walnut Ridge and take over the electric plants at Black Rock and Peachahonas and furnish electricity for lamps and motors in those towns.

**BURBANK, CAL.**—A special election will be held March 26 to vote on the proposition to issue \$20,000 for the installation of a municipal electric-light plant.

**FULLERTON, CAL.**—Bids will be received by the Board of Trustees of Fullerton for the construction of a large electrically operated pumping plant for the municipal water-works system. Shain & Robison are engineers.

**GRIDLEY, CAL.**—The Pacific Gas & El Co., San Francisco, has purchased from the city the electric distributing system, consisting of several miles of wires and poles located outside of the city limits. The Board of Trustees has decided to abandon the plan of supplying energy outside of the city.

**IANFORD, CAL.**—The H. G. Lacey Co., which has recently completed an extension of its transmission line to the Eucalyptus schoolhouse, 4 miles south of the city, has completed plans for another extension, work on which will begin at once.

**LINDSAY, CAL.**—The State Railroad Commission has granted the Tulare County Pwr. Co., of Lindsay, permission to issue \$300,000 in bonds, the proceeds to be used to pay outstanding indebtedness and extend its transmission lines.

**LIVINGSTON, CAL.**—The San Joaquin Lt. & Pwr. Co., of Fresno, will soon begin work on the erection of a transmission line from Livingston to the Edgar Hogan ranch on Merced River.

**LOS ANGELES, CAL.**—Llewellyn Brothers, owners of the Llewellyn Iron Works, which have recently started the construction of a large factory, to cost \$750,000, at Torrance, near Los Angeles, will build a large power plant in connection with the proposed factory.

**LOS GATOS, CAL.**—The Los Gatos Tel. Co. has applied to the State Railroad Commission for permission to increase its capital stock by \$25,000, the proceeds to be used for the purpose of making additions to its plant and equipment.

**MOUNTAIN VIEW, CAL.**—The Board of Trustees has decided to call an election to submit the proposition to issue bonds for the installation of a municipal electric-light plant in connection with the water-works system to the voters.

**OROVILLE, CAL.**—The Oro El Corp. has announced that work will start on construction of its large dam and hydroelectric power plant in the Humbug Valley about April 15.

**OROVILLE, CAL.**—The Great Western Pwr. Co., of San Francisco, it is reported, has announced that upon completion this year of the Big Meadows dam work will begin immediately on the construction of two additional power plants at a cost of \$8,000,000. The plans provide for the total development of 675,000 hp, to be completed by 1915, and include the enlargement of the present plant at Las Lunas, increasing the output to 82,000 hp (this work is to be completed in 1913); construction of a new power house at Battles bar on the north fork of the Feather River; erection of a new power house at Grasser's place on the north fork near Mosquito Creek (this will include a tunnel 6 miles long); and the construction of a plant at the junction of Butte Creek and the north fork.

**SAN FRANCISCO, CAL.**—The Mount Diablo Lt. & Pwr. Co., of Lake County, has applied to the State Railroad Commission to issue \$20,000 in capital stock and notes to the amount of \$5,000.

**SAN FRANCISCO, CAL.**—The Board of Supervisors has passed an ordinance ordering the construction of an extension of the Geary Street municipal railway along Van Ness Avenue, from Market Street to the bay.

**SAN FRANCISCO, CAL.**—The Pacific Electric Light & Power Co. has obtained from the State Railroad Commission the franchise for the term of 10 years to erect and operate a power plant and transmission line to supply all energy required for the city and to construct, during the term of the World's Fair at San Francisco, a power plant and transmission line for construction and distribution. It is proposed that some 2,000 ft. of line be required. Contract bids will be taken shortly, the Pacific Electric will furnish all steam and fuel required for the plant.

**VENICE, CAL.**—The City of Venice have secured a franchise from the Venice City Attorney, Henry J. Smith, to construct and operate the first establishment of an electric light plant.

**YREKA, CAL.**—The Yreka Electric Power Co. of Mendocino County is extending its transmission line of 10 miles to connect its power plant with the irrigation pumping plant.

**FARMINGTON, CONN.**—The Farmington Electric Light & Power Co. has petitioned the State Legislature for an act of incorporation to the charter allowing it to increase its capital stock from \$125,000 to \$500,000.

**LITCHFIELD, CONN.**—The Litchfield Electric Light & Power Co. expects to install within the next six months the 500-kw. three-phase, 220-volt, 60-cycle, 2,500-volt generator directly connected to a 500-hp engine. Within the next five months the company expects to purchase a 500-hp engine and within the next four months three 25-kw., 2300-1100-volt, 60-cycle, single-phase transformers and 2 tons of weather-proof wire. A. J. Fromholz is manager.

**WASHINGTON, D. C.**—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 12 for furnishing eleven 15-ton locomotive cranes with grab-bucket equipments, delivered and erected at the navy yards, Pearl Harbor, Hawaii, and navy yard, Puget Sound, Wash. Specifications may be obtained on application to the Bureau of Yards and Docks. The cost of the work is estimated at \$9,000. H. R. Swanson is chief of bureau.

**ARCADIA, FLA.**—The Arcadia Electric Light & Power Co. has sold its electric light and power plant to the Atlantic Southern Electric Co., and will operate the plant under the name of the Atlantic Electric Co. The telephone exchange is still held by the original owners and will be known as the Arcadia Tel. Co.

**CHIPLEY, FLA.**—Contract will be received by the Board of Trustees of ChIPLEY, FLA., until April 15, for the construction of a power plant and transmission line. The equipment will include two 125-hp steam engines, 220-volt, 60-cycle, 2,500-volt generator, and 220-volt, 60-cycle, 2,500-volt transformers. A. J. Fromholz is manager.

**JACKSONVILLE, FLA.**—The Board of Board of Trustees has issued the contract for the underground cable for lighting the business district of the city to the Florida Electrical Co., of Jacksonville, for about \$115,000. H. R. Worthington is manager of the Florida Electric Co.

**MILTON, FLA.**—The Town Council is considering an issue of \$40,000 in bonds for the construction of a municipal electric light plant and water-works system.

**ROSEVILLE, GA.**—E. H. L. Lacey, of Hiram, Ga., is negotiating the installation of electric-light and ice plants here, and would like to communicate with manufacturers in regard to electrical equipment and ice machinery.

**ROCHELLE, GA.**—The J. B. McGowan Co., of Atlanta, Ga., has been engaged to do the surveys and prepare plans for the construction of a municipal electric-light plant and water-works system. The corporation to issue bonds for construction of same will be controlled by a committee as yet estimates are made. W. C. Carter is chief of work.

**SAVANNAH, GA.**—The Eastern Light & Power Co. has been engaged in the development of an industrial system of electric power, including the Sapelo River, in McIntosh County, 40 miles from Savannah. The company proposes to install electric light and water-works system, telephone system, etc. A. R. O'Brien, of Savannah, is general manager.

**ASSUMPTION, ILL.**—The Assumption Electric Co. has increased its capital stock from \$5,000 to \$25,000.

**BETHLEHEM, ILL.**—The Bethlehem Electric Co. has been engaged in the construction of a municipal electric light and water-works system. The company is to build a power plant and transmission line.

**DE KALB, ILL.**—The De Kalb Electric Co. has been engaged in the construction of a municipal electric light and water-works system. The company is to build a power plant and transmission line.

**ELGIN, ILL.**—The Elgin Electric Co. has been engaged in the construction of a municipal electric light and water-works system. The company is to build a power plant and transmission line.

**LINDSEY, ILL.**—The Lindsey Electric Co. has been engaged in the construction of a municipal electric light and water-works system. The company is to build a power plant and transmission line.

**GALESBURG, ILL.**—The Galesburg Utilities Co. contemplates the construction of a transmission line from the city to the Mississippi River, for \$85,000. Energy will be generated from the plant of the Mississippi



RAOR P&L Co. at Keokuk, arrangements having already been made for building a transmission line from the Keokuk dam to Dallas City.

ILLISBORO, ILL.—The Illisboro El. Lt. & Pwr. Co. will build a transmission line which will connect Palmer and Morrisonville with its line at Harvard. J. J. Frey is president and general manager.

LEWISTOWN, ILL.—The Canton Gas & El. Co., of Canton, contemplates extending its transmission line from Canton to Lewistown to supply electricity in the latter place.

MACOMB, ILL. The lighting committee appointed by Mayor Ketter to secure estimates of the cost of installing a municipal electric-light system has submitted its report to the Council. The report provides for an initial installation of 50 arc lamps and 25 incandescent lamps for street lighting. The power plant equipment is to consist of one 100-lamp, 4-amp Brush arc generator, one 75-hp Corliss engine and switchboard, 50 4-amp arc lamps, 25 series incandescent lamps to be erected on wall brackets, 150 miles of pole line construction with necessary arc lamp suspensions, at a total cost of \$13,478. D. H. Simmonds is a member of the committee.

MINONK, ILL.—The Illinois Central R. R. Co. is contemplating installing electrical power at its coal chutes, roundhouse and other buildings in Minonk.

MOLINE, ILL.—The People's Pwr. Co., of Moline, has awarded the contract for rebuilding its power plant in Moline to Henry W. Horst, of Rock Island, for \$25,000.

MONTICELLO, ILL.—An option has been taken on the plant of the Monticello El. Lt. & Pwr. Co. by the Illinois Trac. System, of Champaign, which proposes to supply electricity here, to be transmitted from Champaign. C. A. Tatman is secretary and manager of the Monticello company.

NAPIERVILLE, ILL.—The Du Page County El. Lt. & Pwr. Co., a subsidiary of the Aurora, Elgin & Chicago R. R. Co., has been granted a 10-year franchise to supply electricity here. A transmission line will be erected from the substation at Warrenville to Naperville, a distance of 4 miles.

NOBLE, ILL.—Arrangements are being made for the installation of an electric-lighting system here. The service will be supplied by the Central Illinois Pub. Ser. Co., of Mattoon, from its plant at Olney.

SHELBYVILLE, ILL.—Application has been made to the City Council by the Central Illinois Pub. Ser. Co., of Mattoon, Ill., for a 50-year franchise to operate a high-tension transmission line through Shelbyville.

SILVIS, ILL.—The Village Board has decided to replace the present arc street-lighting system with tungsten lamps. The United Lt. & Power Co., of East Moline, furnishes the street-lighting service.

SOUTH CHICAGO, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 2, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at South Chicago. Drawings and specifications may be obtained from the above office or from the custodian of site at South Chicago. O. Wenderoth is supervising architect.

GOSHEN, IND.—The City Council has approved the preliminary plans of Burns & McDonnell, of Kansas City, consulting engineers, for rehabilitating the municipal electric-light plant. The plans call for two generators, one of 250 kw and the other of 75 kw, the first for night load and the other for day load; one engine, with jet condenser; one new switchboard complete; ornamental lamps on Main Street, from Middlebury to Jefferson Street, and on Lincoln Avenue, from Ninth to Second Street; alternating-current arc and tungsten lamps in the residence district; piping over boilers, and completely remodeling the outside distributing system.

WINDFALL, IND.—The Board of Trustees has entered into a contract with the Indiana Union Trac. Co. to furnish electricity for lighting the town, also for commercial and domestic purposes.

AFTON, IA.—The City Council has voted to enter into a contract with the Creston Mutual El. Lt. & Pwr. Co. to furnish the city with electricity. The company will erect a transmission line to Afton. A 24-hour service will be established when the new system is installed.

ALBION, IA.—A special election will be held March 27 to vote on the proposition to grant a franchise to the Iowa River Lt. & Pwr. Co., of Eldora, to furnish electricity for lamps and motors here. J. H. Hardenburgh is vice-president of the company.

BAYARD, IA.—The proposition to install an electric-light plant in Bayard will be submitted to the voters about May 1. George C. O'Donoghue, of the engineering and mining department of the Alamo Engine & Supply Co., of Omaha, Neb., will make surveys and prepare plans for the proposed plant. F. E. Munger is clerk.

BURLINGTON, IA.—Walsh Brothers have closed a contract with the Mississippi River Pwr. Co., of Keokuk, whereby the latter will furnish energy for the Burlington Street Railway system and the light, heat and power plants.

CLINTON, IA.—The civic improvement committee of the Clinton Commercial Club announces that ornamental street lamps will be erected on four blocks of Second Street. N. D. Patterson is interested.

FONTANELE, IA.—A petition has been presented to the Council asking for action relative to the installation of an electric-light plant and water-works system. An election will probably be called about April 1,

and if the project is approved by the voters it is proposed to erect a 7-mile transmission line to a plant in an adjoining town or to install an oil-engine plant, probably of 80 hp. About 120 meters will probably be needed. As yet no engineer has been engaged.

GREENFIELD, IA.—Contracts will be awarded by the City Council on April 11 for the installation of a new municipal electric-light plant here. J. B. Hill, of Iowa City, is consulting engineer.

LE MARS, IA.—A special election has been called for March 20 to vote on the proposition as to whether the city shall purchase the electric-light and water-works systems now owned and operated by the Le Mars Wtr. & Lt. Co.

LEON, IA.—The Leon El. Co. has increased its capital stock from \$30,000 to \$100,000, the proceeds to be used for additions and improvements to its system. The company is now erecting a transmission line to Garden Grove, which later will be extended to Humeston. The residents of Weldon have asked the company to furnish electrical service in that town, and its transmission lines will probably be extended to that place and possibly to other towns in the county.

LISCOMB, IA.—At an election held recently the proposition to grant the Iowa River Lt. & Pwr. Co., of Eldora, a 25-year franchise to furnish electricity in Liscomb was carried.

LOW MOOR, IA.—A proposition has been submitted to the City Council for the installation of an electric-light plant in Low Moor. As yet no definite action has been taken. John T. Chandler is city clerk.

MANCHESTER, IA.—The Hoag El. Lt. & Pwr. Co. contemplates extensive improvements to its plant and service. Additional equipment will be installed in order to equip the plant to furnish a 24-hour service. E. W. Hoag is owner and manager.

PERRY, IA.—The Chicago, Milwaukee & St. Paul Ry. Co. is planning to install an electric plant at its terminal in Perry, to furnish electricity for lighting the coal and water plants, car shops, yards, etc. Electric lamps will also replace the oil lamps for lighting the switches in Perry.

PRESTON, IA. Plans and specifications are being prepared for a municipal electric-light plant in Preston. J. B. Hill, of Iowa City, has been retained as consulting engineer.

QUASQUETON, IA.—Petitions are being circulated asking the City Council to call an election to submit to the voters the proposition to issue bonds for the installation of a combined electric-light plant and water-works system.

ROCKWELL, IA.—The voters have approved the proposition to grant C. C. Carhart, of Sheffield, a franchise to operate an electric-light system here. A transmission line will be erected from the power plant in Sheffield to Rockwell, a distance of 6 miles.

SPENCER, IA.—The City Council has decided to extend the municipal electric-light service to South Spencer. Plans are being prepared for improvements and enlarging the municipal plant. K. C. Gaynor, of Sioux City, is consulting engineer.

STATE CENTER, IA.—The proposition to grant a franchise to the Iowa Ry. & Lt. Co. to distribute electricity in State Center may be submitted to the voters at an election to be called soon.

BUFFALO, KAN.—The Buffalo El. Lt. & Pwr. Co. has recently installed an electric light and power plant at the Buffalo brick works to furnish electricity for lamps and motors. The equipment consists of two 90-kw. 60-cycle alternating-current generators, with switchboard equipment, transformers, etc.; about 150 poles, 8 miles of wire and 20 Westinghouse meters. At present the company does not furnish street-lighting service. H. J. Huiskamp, Jr., is president.

CONCORDIA, KAN.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 31, for construction complete, including plumbing, heating apparatus, gas piping, electric conduits and wiring and interior lighting fixtures and approaches, of the United States post office at Concordia, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Concordia. O. Wenderoth is supervising architect.

TOPEKA, KAN.—The Shawnee Milling Co. has applied to the city commissioners asking that it might be allowed to utilize the power developed at the city crematory to generate electricity. The company also asks for a franchise to distribute electricity in the main business district in Topeka. It is proposed to secure a lease on the garage plant and to erect buildings nearby to install generating equipment, etc.

CORYDON, KY.—The contract for equipment of the new municipal electric light and power plant has been awarded to the L. H. Swanson Co., of Evansville, Ind.

LAWRENCEBURG, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 8 for construction, including plumbing, heating apparatus, gas piping, electric conduit and wiring and lighting fixtures, of the United States post office at Lawrenceburg, Ky. O. Wenderoth is supervising architect.

MIDDLESBORO, KY.—The property of the Middlesboro El. Co. has been purchased by the Kentucky Utilities Co. for \$100,000.

PADUCAH, KY.—Extensive improvements are contemplated by the East Tennessee Tel. Co. to its local system, involving an expenditure of \$300,000.

PINEVILLE, KY.—Plans for the construction of a large power plant in Bell County, to cost \$1,500,000, are under consideration. It is proposed to supply electricity for lamps and motors at the many coal mines in this section of the State; also to the border counties of Virginia and Tennessee. Col. Charles W. Metcalf, D. Boone Logan, president of the Bell County National Bank; T. F. Gibson and H. J. Gibson, all of Pineville, are interested in the project.

WILLIAMSTOWN, KY.—A franchise has been awarded to J. M. Riley to install an electric-light plant in Williamstown. Equipment for the proposed plant will be purchased in the near future.

WILLIAMSTOWN, KY.—The Queen & Crescent Railway is planning to equip its electric block and switch signals with electric lamps from Williamstown to Ludlow, a distance of 35 miles. It also proposes to light all the railway stations with electricity. The company also plans to equip the division from Ludlow to Danville with a telephone system for train dispatching to take the place of the present telegraph system.

ELLERSLIE, MD.—The Cook's Mill El. & Pwr. Co., owned by Deal Brothers, of Cumberland, has been granted permission by the Allegany County road directors to erect transmission lines over the county roads from the Pennsylvania State line to Corriganville for the purpose of supplying electricity here.

ELLERSLIE, D.—The Allegany County Road Directors have granted the Andrew Ramsay Corp., a franchise to erect transmission lines along the highways of the county from a point near Ellerslie to Corrigansville. The company proposes to erect a large electric light and power plant near Ellerslie to supply electricity for its large brick plant at Mount Savage and also for lamps and motors in Ellerslie. The company has secured permission from the Legislature to consolidate its plants at Mount Savage and Ellerslie.

BEVERLY, MASS.—The Beverly Gas & El. Co. contemplates increasing its capital stock to provide funds for additions to its plant and system and for extending its underground conduit circuit about 5 miles. The present docks on River Street are to be enlarged and the plant improved.

BOSTON, MASS.—The Edison El. Illg. Co. has acquired a site on Stuart Street, on which it will erect a six-story building to be used as a substation to serve a territory within a radius of about a mile. The cost of the station complete is estimated at between \$300,000 and \$400,000.

CHATHAM, MASS.—The Buzzards Bay El. Lt. Co., of Falmouth, contemplates extending its transmission line to Chatham to furnish electrical service.

FALL RIVER, MASS.—The aldermanic committee on street lamps has voted to accept the proposition of the Fall River El. Lt. Co. for the installation of an ornamental lighting system consisting of 84 lamps in the central business section of the city. The committee has voted an extension of the special lighting system on Bank Street between North Main and Rock Streets, and further south on Main Street from Columbia to Morgan Street.

HOLYOKE, MASS.—Proposals will be received by the Gas and Electric Department until March 24, for furnishing various supplies, including coal, coke, gas meters, incandescent lamps, meters and transformers and all other supplies used in generating gas and electricity. John J. White is Mayor and acting manager of the Gas and Electric Department.

**SOUTH HADLEY FALLS, MASS.**—The Amherst Pwr. Co. has purchased the capital stock of the South Hadley Falls El. Lt. Co. The sale does not include the building occupied by the electric plant here. The local station will be closed and energy will be supplied by the Amherst Pwr. Co. from its substation at Mount Tom. Extensive improvements will be made by the new owners, including the erection of a substation in South Hadley Falls and extension of the system to include Granby.

SPENCER, MASS.—The Spencer Wire Co. has decided to equip its plant in Wire Village with electrically driven machinery and to light the five mills with electricity. It is understood that energy will be furnished by the Spencer Gas Co. Improvements will be made to the plant of the Spencer Gas Co. to enable it to supply a 24-hour service.

BATTLE CREEK, MICH.—Plans are being prepared for extending the ornamental street-lighting system on West Main Street as far as Washington Street, then up Washington to the Sanitarium Annex.

CORUNNA, MICH.—The Village Board has entered into a contract with the Consumers' Pwr. Co. to install 50 60-watt street lamps.

DETROIT, MICH.—The Solvay Process Co. has taken out a permit to erect a 10-story steel factory building to cost about \$200,000, work on which will start in the spring. Considerable electric equipment will be used and an elevator will be installed.

**FLINT, MICH.**—It is reported that A. M. Kineman, of Cleveland, Ohio, assistant commercial engineer of the National Electric Lamp Association, has been authorized to prepare two sets of plans for street lighting to be presented to the lighting committee. One plan will provide for a cluster-lamp system and the other for a single-arm lamp erected on a standard.

HOLLY, MICH.—The Edison El. Hg. Co., of Detroit, has applied for a franchise here. The company has asked for franchises in all the townships between Detroit and Holly. An election has been called in all townships to vote on the proposition.

LANSING, MICH.—The Board of Electric Light Commissioners has authorized the purchase of a 2,000-kw steam turbine from the A. C. Chalmers Co., to cost \$31,700; also a 3,000,000-gal. motor-driven center

ugal pump from the Allcoor Pump & Condenser Co., 1 Milwaukee, to be installed in the main condenser.

MARQUETTE, MICH.—Three rotary electric pumps are to be installed in the city water-works. Transmission lines will connect the water works with the city water works and the city water works. Dead River. A switchboard and three transformers to step the current down from 6600 volts to a voltage low enough for the motors will also be installed.

MUSKEGON, MICH.—The city of Muskegon is considering the installation of an ornamental street-lighting system on Western Avenue.

PETOSKEY, MCH.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 1 for the construction, including plumbing, gas piping, steam-heating apparatus, electric conduits and wiring, interior-lighting fixtures and appliances, of the United States post office at Petoskey, Mich. Drawings and specifications may be secured at the above office or from the custodian of site at Petoskey. O. Wenderoth is supervising architect.

**VANDALIA, MICH.**—The town has contracted with the Clinton Hydraulic Co., of Three Rivers, to furnish electricity for lighting in Vandalia. Work will begin on the construction of the transmission line and wiring the village as soon as the frost is out of the ground.

AURORA, MINN.—Work will begin in the spring on the construction of the Northern Minnesota Pwr. Co.'s power plant on the St. Louis River.

LAKE CITY, MINN.—The officials of Lake City are contemplating building a reservoir of 1,000,000 gal. capacity on a bluff back of the city, with a pipe line leading to the present light and water plant. The preliminary report of this extension is to be made by the Oscar Claussen Engineering Co., of St. Paul.

PAYNESVILLE, MINN. Plans are being considered for expansion and improvements to the municipal electric light, heat and waterworks system, including rebuilding and extending transmission lines and possibly changing the system from direct current to alternating current. The company is now building a new steel tank with steel or wood tower. John H. Hengen is recorder.

YOUNG AMERICA, MINN.—The Village Council has granted the Lethert El. Co., of St. Paul, a franchise to supply electricity for lamps and motors here.

NATCHEZ, MISS.—Bids will be received by B. G. Geisenberger, president board of trustees, for material and wiring for electric lamps for Carpenter Memorial School No. 2, Natchez, until March 25. Plans and specifications may be obtained from J. H. Owings, of Natchez, and from R. H. Hunt, of Chattanooga.

JOPLIN, MO.—The installation of a new street-lighting system in the residence section in the north part of the city is being promoted by the North Heights Improvement Society.

HARLOWTON, MONT.—The Meagher County Tel. Co. has voted to expend \$2,000 for improvements and extensions to its plant and toll line; also for the installation of a new switchboard.

DONIPHAN, NEB.—The City Council has decided to call an election to vote on the proposition to grant an electric light franchise. The franchise will be voted to P. J. Burton and L. K. Fisher, to be held in trust until some responsible company meets the requirements of the Council to establish an electric plant.

**LINCOLN, NEB.**—The State Railway Commission has granted the Omaha, Lincoln & Beatrice Ry. Co. permission to issue \$1,000,000 bonds and \$850,000 in capital stock, the proceeds to be used for the construction of an interurban railway between Omaha and Beatrice. Work will begin as soon as the weather will permit.

LINCOLN, NEB.—W. R. Leffler has applied to the State Railway Commission for permission to issue \$250,000 capital stock for the purpose of developing a hydroelectric power plant on the Platte River, near Springfield. It is understood that Mr. Leffler has a patent device whereby he expects to generate electricity at a greatly reduced

PHILLIPSBURG, N. J.—The City Council has granted to the Phillipsburg Light, Heat & Power Co. a franchise to construct and operate electric light and power plant here.

**DEMING, N. M.**—The Mesquite Valley Machine Co. has entered into a contract with the Federal Lt. & Trac Co. for construction of an electric transmission line from the Mesquite Valley Machine Co. to the pumping plants. The Federal Lt. & Trac Co., it is stated, will install a large power plant, to cost about \$400,000, in Deming. It is understood that the project will cost about \$1,000,000. The Mesquite Valley Machine Co. will put down a number of wells.

V. A. CULY, H. B. JONES, and FREDERICK J. L. H. SMITH, in *Colloid Polym. Sci.*, 253, 103 (1975); H. V. OGDEN, in *Encyclopedia of Polymer Science and Engineering*, Vol. 10, H. Mark and N. M. Amiel, Eds., Wiley, New York, 1978, p. 1; and H. H. KILBY, in *Encyclopedia of Polymer Science and Engineering*, Vol. 10, H. Mark and N. M. Amiel, Eds., Wiley, New York, 1978, p. 1.

[illegible]

BROOKLYN, N. Y.—Programs will be carried in the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., and March 18 the wife to be believed in the following way and under schedule



5246 as follows: miscellaneous quantities of galvanized soft-steel armored cable, interior communication cable, plain telephone cable, galvanized, soft-steel, armored and leaded telephone cable, single-conductor wire and twin-conductor wire.

**HORNELL, N. Y.**—The control of the Hornell El. Co. has passed into the hands of a syndicate of Philadelphia capitalists, composed of H. L. Elkins, president of the Colonial Trust Co., of Philadelphia; William M. Measey and E. F. McCabe, electrical engineers, both of Philadelphia. It is understood that the new owners contemplate improvements to the plant and system involving an expenditure of about \$100,000. L. T. Mason will be retained as superintendent.

**LOCKPORT, N. Y.**—The International Ry. Co. is contemplating the double-tracking of 16 miles of its line from a half mile south of the old Erie Depot in North Tonawanda to this city. The proposed work will cost about \$500,000 and will start early this spring.

**NEW YORK, N. Y.**—The Public Service Commission has given its approval to the application of the Long Acre El. Lt. & Pwr. Co. for the construction of an electric plant and for permission to issue \$2,000,000 in capital stock and \$4,000,000 in bonds.

**ONEONTA, N. Y.**—The Public Service Commission, Second District, has authorized the Otsego & Herkimer R. R. Co. to execute a mortgage for \$2,500,000 and to issue bonds to the amount of \$1,200,000, part of the proceeds to be used to purchase the property formerly operated under the name of the Oneonta, Coopersfield & Richfield Springs R. R. Co., which was sold at foreclosure sale, and also to acquire the property of the Hartwick Pwr. Co., which furnishes electricity to operate the railways. The Colliers Lt., Ht. & Pwr. Co. has been authorized to issue \$25,000 capital stock and \$135,000 in bonds to acquire the property of the Clinton Mills Pwr. Co., of Cooperstown, and the Richfield Springs El. Lt. & Pwr. Co., which operates in Richfield Springs. The water-power plant and steam plant formerly owned by the Clinton Mills Pwr. Co. will be used to supplement and as a reserve for the power to be taken from the railroad company.

**SARANAC LAKE, N. Y.**—The Paul Smith El. Lt. & Pwr. & R. R. Co. has decided to extend its transmission lines through Blackbrook to Ausable Forks, a distance of 14 miles, to supply electricity for lamps and motors in several additional villages in Essex County. It also proposes to extend its transmission lines to Rogers and Arnold to supply energy to the Witherbee & Sherman Co. and the Steel company, which own large iron ore deposits in and around Rogers. The power company has already entered into a contract with J. J. Rogers Pulp & Paper Co., at Ausable Forks, to furnish electricity for lighting and operating the plants of the paper company there.

**BURLINGTON, N. C.**—Contracts will be awarded by the Piedmont Trac. Co. about March 25 for extensions to its local plant. The equipment will include three 500-hp boilers with 175 lb. pressure, steam engine or turbine and generators. Details of equipment have not yet been decided upon. J. H. Bridgers, of Henderson, is engineer in charge of the work. G. W. Hatch, of Burlington, is superintendent of the company.

**CLAYTON, N. C.**—Contracts have been awarded to Tucker & Laxton, of Charlotte, for the erection of pole-line work for the combined water and lighting system at Clayton, for \$8,000. Energy for the system will be purchased from the Carolina Pwr. & Lt. Co., of Raleigh, N. C., and a 150-kw outdoor transformer and switching station will be installed. The voltage will be reduced from 60,000 to 2200 for local distribution and two 50-hp electrically driven pumps erected in the pumping station. The lighting equipment will cost about \$15,000. The Westinghouse El. & Mfg. Co., of Pittsburgh, is the lowest bidder. Gilbert C. White, of Charlotte, is consulting engineer.

**GRAHAM, N. C.**—A company headed by State Senator J. H. Bridgers, of Henderson, has taken over the Piedmont Ry. & El. Co., operating a small railway between Burlington and Graham; the Graham Wtr. & El. Co., the Graham Ice Co. and the municipal electric-light plant at Burlington. A new power station will be erected between Burlington and Graham, on the route of the railway, and the old plants will be dismantled. The present 17-ton ice plant operating in conjunction with the central station at Graham will be transferred to the new station and a duplicate plant of the same size installed. The street-lighting system, which operates now on a moonlight schedule, will be reconstructed and an all-night schedule adopted. A day service will also be established in Burlington, Graham, Haw River, Elon College, Swepsonville and Mebane, and the system will be extended. The water system at Graham will be connected with the water system in Burlington. Work will soon begin on the new station, and it is understood that two 750-kw units will be installed. The new company will be capitalized at \$700,000 and the officers are: J. H. Bridgers, of Henderson, president and general manager, and J. W. Murray, of Henderson, vice-president.

**MEBANE, N. C.**—The Piedmont Trac. Co., of Charlotte, has been granted a 50-year franchise to supply electricity for lamps and motors in Mebane.

**SCOTLAND NECK, N. C.**—The Crescent Hosiery Co., of Scotland Neck, is contemplating purchasing power from the municipal electric light and power plant. If the deal goes through, a 24-hour service will be established. The Crescent Hosiery Co. expects to purchase several motors, but as yet details have not been decided upon. L. R. Mills, Jr., is manager of the municipal electric plant.

**SPENCER, N. C.**—The State Legislature has granted the city of Spencer authority to vote on the proposition to issue \$50,000 in bonds for an electric-light plant and water-works system.

**BINFORD, N. D.**—Plans are being considered for the installation of an electric-light plant in Binford. It is proposed to establish a 24-hour service at the start.

**MAXVILLE, N. D.**—The City Council has decided to enlarge the municipal electric-light plant. Work will begin as soon as the weather permits.

**MOTT, N. D.**—C. J. Lee, of Valley City, contemplates the construction of an electric-light plant in Mott.

**CLEVELAND, OHIO.**—The Cleveland El. Ilig. Co. has awarded a contract to F. Hauselmann for the erection of a substation at 5371 St. Clair Avenue. The building is to be 50 ft. by 56 ft. and two and one-half stories high.

**MOUNT VERNON, OHIO.**—The Knox County Commissioners are contemplating the installation of an improved lighting system for the viaduct and also about the exterior of the court house and jail. Cluster lamps are being considered for the viaduct.

**NEW LEXINGTON, OHIO.**—The Public Service Commission has granted T. J. Smith, owner of the local electric-light plant, permission to sell the plant to the American Gas & El. Co., of New York, N. Y.

**PURCELL, OKLA.**—The City Commissioners have awarded the contract for rehabilitating the Purcell electric-light plant and water-works system to J. W. Kennedy. The cost of the work is estimated at \$23,974. The plant has not been in use for several months.

**ASHLAND, ORE.**—The Minney Street Ry. Co. has been granted a franchise to build a street-railway system in Ashland. A similar franchise has been secured in Medford. The company proposes to connect the two cities.

**CORVALLIS, ORE.**—The property owners on Madison Street have offered to install ornamental standards complete for cluster lamps, provided that the city will maintain the lamps.

**PENDLETON, ORE.**—We are informed that the city of Pendleton does not contemplate the installation of a municipal electric-light plant, the project having been abandoned for the present. John Fitzgerald is city recorder.

**ANALOMINK, PA.**—G. Barrett Decker, owner of the Analomink grist mills, has awarded contract for the installation of an electric-light plant. The plant will be installed in the grist mill and will have sufficient output to maintain 800 lamps of 16 cp.

**HARRISBURG, PA.**—Applications will be filed with the State Department on March 21 for new charters for 25 electric companies to operate in Beaver County. The incorporators are: Herbert W. Kaiberer, Arthur B. Dampman and William E. Miller. Wilson & Evans, of Pittsburgh, are solicitors. The towns and townships embraced in the applications are as follows: Ambridge, Baden, Conway, Freedom, Daugherty Township, Harmony Township, Economy Township, Rochester Township, Hopewell Township, Moon Township, Rochester, East Rochester, Monaca, Aliquippa, South Heights, Woodlawn, Fallston, Bridgewater, Beaver, Beaver Falls, New Brighton, Pulaski Township, Patterson Township and Brighton Township.

**LACEYVILLE, PA.**—We are informed that A. L. Vandervort does not contemplate the installation of an electric-light plant as reported in the issue of March 1.

**PITTSBURGH, PA.**—The Pittsburgh & Butler St. Ry. Co. contemplates changing its present electric-power service to the direct-current system. Coincident with this change other improvements will be made, including increased safety protection, new substations, etc.

**PITTSBURGH, PA.**—An additional foundry building is to be erected by the Westinghouse Air Brake Co. at its Wilmerding plant, plans for which have been completed, and estimates are now being taken. The equipment will include two 5-ton and two 10-ton electric traveling cranes, molding machines and appliances.

**READING, PA.**—Mayor Stratton has signed the resolution authorizing the execution of an agreement with the Metropolitan El. Co., of Reading, for furnishing electricity to operate the sewage disposal pumping station. The station is now equipped with steam pumps.

**READING, PA.**—The Metropolitan El. Co., of Reading, will make improvements to its transmission system between Reading and Annville, at a cost of about \$1,500,000. The company will erect six high-tension transmission lines between here and Lebanon and other lines between Lebanon and Hershey.

**SHARON, PA.**—The referendum vote at the election held Feb. 25 resulted in a decision to accept the contract offered by the Shenango Valley El. Lt. Co. in lieu of building a municipal plant to cost \$85,000.

**SHARPSBURG, PA.**—Sealed bids will be received at the office of the borough clerk, Sharpsburg, until March 27 for power plant equipment as follows: Two 375-kva, three-phase, 60-cycle, 2300-volt generators, complete with exciters, etc. Alternate proposals on prime movers as follows: Two 450-hp directly connected type simple steam engines; two 450-hp directly connected cross compound steam engines; two 375-kva steam-turbine-driven alternating-current generating units; complete condensing equipment; three 50-lamp 4-amp metallic-flame arc-lamp equipments complete; one four-panel switchboard complete. Specifications can be obtained from Sidney B. Martin, consulting engineer, 616 Penn Building, Pittsburgh, Pa.

**SHARPSVILLE, PA.**—The Sharpsville El. Co. has asked the Council for a renewal of its street-lighting contract, which expires May 1. The



company has erected six new 100-watt Mazda lamps on Walnut and Main Streets for experimental purposes. The company contemplates the installation of new lamps if granted a renewal of contract.

SOMERSET, PA.—The railroad yards of the Baltimore & Ohio R. R. Co. located south of Somerset are being equipped with electric-arc lamps intended to be supplied by the Somerset L. L. L. It & P. Co. It is understood that the company will soon equip the numerous switches in the yard to be operated exclusively by electricity. The local electric company will also supply energy to operate the switches.

WARREN, PA.—Arrangements are being made by the Warren Lt. & Pwr. Co. for the installation of an ornamental street-lighting system on Liberty Street. Ornamental standards carrying two lamp clusters will be erected on the west side of the street.

EAST PROVIDENCE, R. I.—Plans have been submitted by the Narragansett El. Lig. Co., of Providence, for the installation of a new street lighting system. It is proposed to discard the arc lamp and the 325-watt incandescent lamps now in use and substitute 250-wp. and 60-wp. incandescent lamps.

SEELY, S. D.—All bids opened on March 4 for installing lighting fixtures and electric-light plant in the county court house and jail were rejected. New bids will probably be called for. H. A. Taylor is county auditor.

BROWNWOOD, TEX.—The Texas Pwr. & Lt. Co. has begun work on improvements to its local plant, which will involve an expenditure of about \$70,000. W. C. Riker is engineer in charge.

FLATONIA, TEN.—C. A. Pierson, of Astell, Neb., has purchased the electric light and power plant, waterworks system and ice factory of the Flatonia Ice, Wtr. & El. Co. Mr. Pierson contemplates extensions and additions to the property.

SINTON, TEN.—The Coleman-Fulton Pasture Co. has purchased the local electric-light and ice plant and will make improvements to the system immediately, including the installation of new machinery.

**SALT LAKE CITY, UTAH.**—The Utah Pwr. & Lt. Co. has taken over the Eccles electrical interests in Cache, which includes the property of the Blacksmith Fork Lt. & Pwr. Co., work on which has just been completed, and the High Creek El. Lt. & Pwr. Co., 5 miles east of Franklin. As soon as the Utah Pwr. & Lt. Co. takes over the property it will erect transmission lines and begin the operation of the new plant.

NORTON, VA.—Arrangements are being made for the erection of a large electric-light and power plant in Norton, for the purpose of supplying electricity for lamps and motors to nearby towns, mining operations and manufacturing plants in Wise County. Orders for equipment have already been placed and it is expected to have the plant ready to operate by June 1. The project, it is said, is being financed by the New York Mining & Mfg. Co., M. S. Kummer, 143 Liberty Street, New York, N. Y., is president.

CASHMERE, WASH.—The City Council has passed an ordinance providing for the installation of cluster lamps, to cost approximately \$4,000. Bids for materials and installation are now being received.

COLVILLE, WASH.—A telephone company is being organized to extend the farmers' telephone system from Colville, to the Pend Oreille Lakes along the state road, a distance of 27 miles.

KIRKLAND, WASH.—Preliminary surveys have been made and work will soon begin on the construction of an electric line between Kirkwood and Monroe. A company known as the Kirkland-Redmond Ry., Lt. & Pwr. Co. has been organized to build and operate the system. W. P. Perigo, of Redmond, is interested in the project.

OROVILLE, WASH.—Sealed bids will be received by L. L. Work, president of the Similkameen Pwr. Co., Oroville, until May 15, for the purchase of the hydroelectric plant and other property of the Similkameen Pwr. Co., located on the Similkameen River, in Okanogan County, about 4 miles from Oroville; said property consists of water appropriations, power plant, buildings, machinery, concrete work, waterways and tunnel, transmission lines, transformers, tools, fixtures, wire, supplies, franchises and contracts. Detailed information regarding the property and present and prospective employment of electric current given on application.

PORT TOWNSEND, WASH.—The City Council has authorized the installation of an electrically operated fire-alarm system, bids for which will soon be asked.

**SPOKANE, WASH.**—The Great Northern R.R. Co., it is reported, has contracted with the Edison El. Co. to equip its main line between Spokane and the coast, a distance of 500 miles, for electrical operation. The Edison El. Co. has filed a notice of appropriation of 28,000 cu. ft. per second of water from the Columbia River at Rock Island.

TACOMA, WASH.—Plans are being considered by Owen Woods, commissioner of public works, for the construction of a street car line up Seventeenth Street from Pacific Avenue to connect with the proposed tide flats line. Estimates will be obtained on the cost of both an electric and a cable line.

TACOMA, WASH.—Plans are being considered to utilize the water, now going to waste, at the McMillan reservoir of the municipal Green River gravity water system to generate electricity and to be used as a small auxiliary to the municipal power plant on the Nisqually River at La Grande. It is estimated that 1600 hp could be developed.

VANCOUVER, WASH. Work will begin at once on the construction of a power station, an office, waiting room and substation, in Vtd.

cover for the Portland Ry., Lt. & Pwr. Co., to cost about \$30,000. The steam-power plant will be constructed with a cutting, or waste, power, and or sawdust will be used for fuel.

Wheeling Electrical Co. a 50-year franchise to erect and maintain electric transmission lines from the corporate limits of Warwood to the county of Brooke, at the outskirts of Wellsburg. The company has also been granted a franchise by the Ohio County Commissioners to erect transmission lines through the Ohio County.

BROTHMAN, WIS. — An 8-year-old child, having the symptoms of tetanus, died 49 hr. after the onset of the disease. Autopsy showed that the method

**DOUGLASS, W.O.**—Sealed proposals will be received at the office of the supervising architect, Freeport, Me., through W. J. Jones, Jr., until April 12 for construction of a new, two-story school building, including heating apparatus, electric currents and piping, interior heating fixtures and appliances, at the United States Coast Guard in Bangor, Me. Drawings and specifications may be obtained from the above office or from the custodian of site. O. Wenderoth is supervising architect.

**MEDICINE HAT, ALTA., CAN.**—The Alberta government has awarded the contract for equipment for an automatic telephone Medicine Hat to the Automatic Telephone Co., of Chicago, Ill. The contract is for the installation of 500 automatic telephone lines, and the total ultimate capacity of the exchange is to be 5000 lines.

**STRATHMORE, ALFA, CAN**—A compound is being prepared, to be known as the Strathmore I. A. Par. C<sub>12</sub>, to install an electric light plant here. Present plans provide for the installation of a plant to develop 100 hp. Fuel oil gas, vacuum or kerosene will be used for fuel. A. W. Brown, owner, is interested in the project.

N.W. WESTMINSTER, B. C., CAN. Plans have been filed with the government offices for the construction of a hydroelectric power plant, to be operated by a company known as the Westminster Pwr. Co., Ltd. The names of the promoters are not given.

VANCOUVER, B. C., CAN. The Western Canadian, The Times and templates the erection of a transmission line across the Burnaby municipality to the north arm of the Fraser River which would provide electricity to a large portion of Burnaby, the manufacturing sites along the north arm of Fraser River and on Lulu Island. William McNeil, of Vancouver, is general superintendent.

CAYUGA, ONT., CAN.—The ratepayers have approved the by-law to contract with the Hydro-Electric Power Commission.

OTTAWA, ONT., CAN. The city of Ottawa has applied to the Hydro-Electric Power Commission of Ontario for an additional 1000 h.p. of energy. The present contract calls for 4000 hp.

OTTAWA, ONT., CAN.—The City Council has decided to apply to the Ontario Railway and Municipal Board for authority to issue \$50,000 in debentures to provide funds to enlarge the municipal electric light plant.

ST. CATHARINES, ONT., CAN.—The Niagara St. Catharines & Thorold Co. will erect a new power station in St. Catharines, to be equipped with two 300-kw. rotary converters and transformers, which will be supplied with the Canadian General Electric Co. The company has also contracted for a 250-kw. rotary converter and transformer in connection with its Niagara branch extension.

SARNIA, ONT., CAN. Investigations are being made by R. H. Delev, engineer for the Hydro-Electric Power Commission, with a view of extending the service of the Hydro-Electric Commission to Sarnia.

TORONTO, ONT., CAN.—The Toronto & Niagara Pwr. Co. has filed at Ottawa a map of route of a transmission line from Beeton, Ont., to Toronto and from Highway River, Sarnia, to Ave.

WILLAND, ONT., CAN. The following firm, Willand Engineering, has the complete distribution rights for the Oxy-Fuel Heating and Nitrating Units, Ont., and the other provinces, and is also a distributor of all types of equipment. For details, write to the Oxy-Fuel Heating and Nitrating Units, 1000 Main Street.

proposes to buy a 100-hp motor for the Montreal City Council for permission to distribute electricity here. The

MOORE, LAW SASK., CAN. (1988) *Journal of Great Lakes Research* 14: 109-119.

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the secretary and treasurer of Swift Current, Sask., until March 31 for

## New Industrial Companies

**THE AMATEUR MECHANICS' SUPPLY COMPANY**, of Chicago, Ill., has been incorporated by E. M. Christman, Peter Walker and Charles W. Terrio. The company is capitalized at \$2,500 and proposes to manufacture electrical machinery and novelties.

**THE AUTOMATIC RETRIEVING TROLLEY CORPORATION**, of Los Angeles, Cal., has been incorporated with a capital stock of \$500,000 by S. E. MacFarland, C. Gonzales and B. I. MacFarland.

**THE CARELS DIESEL MOTOR COMPANY OF AMERICA** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$10,000,000. The incorporators are: H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington, Del.

**THE CHICAGO ELECTRIC CASTINGS COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$11,000 to manufacture electric furnaces and equipment. The incorporators are: Wilton Bently, Edward C. Higgins and Matthew Flinn.

**THE CO-OPERATIVE ELECTRIC COMPANY**, of Atlanta, Ga., has been incorporated for the purpose of dealing in electrical supplies and fixtures. The incorporators are: H. F. Gheesling, F. B. Davis and W. T. Proctor.

**THE EGYPTIAN ELECTRIC COMPANY**, Chicago, Ill., has been incorporated by A. A. Rolf, Alvin E. Stein and Matthew J. Mears. The company is capitalized at \$25,000 and proposes to do a general electrical business.

**THE ELECTRICAL & CHEMICAL ENGINEERING COMPANY**, of Los Angeles, Cal., has been incorporated with a capital stock of \$10,000 by R. W. Shoemaker, W. A. Freeman and D. De Laney.

**THE KILMER-RICHARDSON COMPANY**, of Auburn, N. Y., has been incorporated with a capital stock of \$15,000 by Joseph A. Kilmer, Thomas S. Richardson and Nelson L. Drummond, of Auburn, N. Y. The company proposes to do a general contracting and electrical business.

**THE L. R. C. STORAGE BATTERY COMPANY**, of Dayton, Ohio, has been incorporated with a capital stock of \$30,000 by Samuel Loucks, Arthur C. Christy, Frank D. Reeder, Frank P. Brown and David L. Prugh. The company manufactures storage batteries, lighting systems for automobiles, specialties and accessories.

**THE J. D. MAXWELL MOTOR CORPORATION**, of New York, N. Y., has been incorporated by Jonathan D. Maxwell, of Tarrytown; James D. McManus, 361 Fifth Street, Brooklyn, and Leander F. Sniffen, 3411 Fort Independence Street, New York, N. Y. The company is capitalized at \$10,000 and proposes to manufacture and deal in motors, etc.

**THE MEAD ELECTRIC SIGNAL COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$50,000 by T. B. Bolton, F. H. Pelton and F. W. Treadway.

**THE METROPOLITAN LIGHTING COMPANY**, of Baltimore, Md., has been incorporated by William F. Hutchinson, of Baltimore; J. Quintan Lovell, of Garrison, Md., and Charles W. Cullen, of Georgetown, Del. The company proposes to manufacture electrical fixtures.

**THE MORGAN-FUSCO COMPANY, INC.**, of Brooklyn, N. Y., has been incorporated with a capital stock of \$3,250 by Maurice L. Fusco and Joseph Abrams, of New York, N. Y. The company proposes to manufacture and deal in gas and electric fixtures, etc.

**THE MULTIPLE ELECTRIC COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$2,500 by William J. Krueger, Ralph C. Bronsen and Agnes J. Hois. The company proposes to manufacture and deal in electrical supplies.

**THE NIAGARA ELECTRIC STEEL CORPORATION**, of Buffalo, N. Y., has been incorporated with a capital stock of \$50,000 to manufacture steel castings and alloys. The incorporators are: Leroy Lincoln, James N. Mandeville and Karl E. Wilhelm, 506 Ellicott Square, Buffalo, N. Y.

**THE NORTH ELECTRIC COMPANY**, of Chicago, Ill., has filed articles of incorporation with a capital stock of \$2,500 for the purpose of doing a general electrical contracting business. The incorporators are: Max A. Klaus, Henry G. Elser and E. Klaus.

**THE PALTRIDGE METAL EQUIPMENT COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$50,000 by Richard W. Paltridge, Charles Denicke and Charles A. Stone. The company proposes to manufacture and deal in furniture, building equipment and electrical specialties.

**THE PERKINS ELECTRIC COMPANY, LTD.**, of Montreal, Que., Can., has been incorporated with a capital stock of \$50,000 for the purpose of dealing in electrical equipment, including lamps, switch plates and flexible conduits, etc. The officers are: George F. Perkins, president and managing director; F. J. Parsons, vice-president, and P. E. Ferguson, secretary and treasurer. The offices of the company are located at 322 Craig Street West, Montreal.

**THE QUALITY ELECTRIC WORKS**, of Los Angeles, Cal., has been incorporated with a capital stock of \$50,000 by W. B. Palmer, S. M. Karicope and L. H. Palmer.

**THE STATIC ELECTRO-ERADICATOR, INC.**, of Fabius, N. Y., has been incorporated with a capital stock of \$25,000 for the purpose of manufacturing electrical appliances for eradication of static electricity

from machinery. The incorporators are: E. L. Vesina, A. H. Smith and H. S. Palmer, of Syracuse.

**THE STERLING ELECTRIC COMPANY**, of Lynchburg, Va., has been granted a charter with a capital stock of \$5,000 for the purpose of carrying on an electrical supply business. The officers are: A. N. Carroll, president; J. C. Oakes, secretary and treasurer.

**THE THOMSON ELECTRIC COMPANY**, of Philadelphia, Pa., has given notice that it will apply for a charter for the purpose of manufacturing and dealing in electrical machinery, fixtures and apparatus, also repairing, contracting and construction work. George I. Smith, Joseph C. Thompson and Arthur H. Burton are interested in the company.

**THE UNIVERSAL BATTERY COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$25,000 to manufacture and deal in electrical instruments and appliances by Louis C. Mowry, Harry L. Holton and Adolph Silberman.

**THE UNIVERSAL ELECTRIC HEATER COMPANY**, of Los Angeles, Cal., has been incorporated with a capital stock of \$25,000 by C. O. Haskell, J. E. Adams and H. J. Wilson.

**THE WESTERN AUTO-ELECTRIC CORPORATION**, of Los Angeles, Cal., has been incorporated with a capital stock of \$30,000 by C. S. Harper, A. J. Tobey and W. E. Carter.

**THE ZIMBRICH LIGHTING COMPANY, INC.**, of Rochester, N. Y., has been incorporated with a capital stock of \$25,000 for the purpose of manufacturing lighting fixtures, etc. The incorporators are: A. M. Zimbrich, M. Zimbrich and C. E. Bostwick, of Rochester, N. Y.

## New Incorporations

**PHOENIX, ARIZ.**—The Clear Lake Pwr. & Irrigation Co. has been incorporated with a capital stock of \$10,000,000 by R. H. Borland, F. W. Nightingale and I. Lindemann.

**ASHDOWN, ARK.**—The Ashdown Lt. & Pwr. Co. has been incorporated with a capital stock of \$10,000 by H. B. Sanderson, A. B. Du Laney, H. L. Tolland and R. B. Bryant.

**HOT SPRINGS, ARK.**—The Citizens' El. Co. has been incorporated with a capital stock of \$500,000. The officers are: S. W. Rebyrn, president; Harry H. Trieber, secretary, and C. P. Perrie, treasurer, all of Little Rock.

**LOS ANGELES, CAL.**—The Gem Lake Pwr. & Wtr. Co. has been chartered with a capital stock of \$1,000,000 by W. A. Ramsay, H. V. Henry and F. E. Edwards.

**LOS ANGELES, CAL.**—The Southwestern Pwr. Co. has been chartered with a capital stock of \$600,000. The directors are: E. C. Richardson, C. M. Melick, E. V. Fisher, M. B. Simons, E. A. Miller, J. E. Mohi and I. N. Insip.

**HARTFORD, CONN.**—The Gilmore El. Co. has been incorporated with a capital stock of \$50,000 by Jonathan Camp, E. D. Redfield and A. L. Shipman.

**WILMINGTON, DEL.**—Articles of incorporation have been filed for the El. Ser. Co. with a capital stock of \$1,100,000 by H. E. Latter, W. J. Maloney and N. P. Coffin, of Wilmington.

**WILMINGTON, DEL.**—The Consolidated El. Utilities Corp. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$1,000,000. The incorporators are: S. D. Townsend, Jr., of Wilmington; H. S. Homer, of Springfield, Mass., and J. G. Tenster, of New York, N. Y.

**WARSAW, ILL.**—The Tri-State Trac. Co. has been incorporated with a capital stock of \$200,000 to build an interurban railway from Quincy to Hamilton. The incorporators are: J. Henry Bastert and Henry F. Dayton, Quincy; John F. Hungeate and Richard O. Marsha, Warsaw, and Cornelius T. Daugherty and Earl W. Wood, Hamilton.

**INDIANAPOLIS, IND.**—The Indianapolis & Cincinnati El. R. R. Co. has been incorporated and is to form a part of the Indianapolis & Cincinnati Trac. Co. The new company has been formed to extend the railway from Rushville to Cincinnati, by way of Brookville, Ind., and Harrison, Ohio. The directors are: Fred D. Rose, Fred J. Oppel, L. G. Wold, L. W. Henry and William M. Frazer.

**PLYMOUTH, IND.**—The Plymouth El. Lt. & Pwr. Co. has been incorporated with a capital stock of \$100,000 by Charles D. Virginia and Isaac Snorberger.

**LOVELOCK, NEV.**—The Nenzel El. Co. has been incorporated with a capital stock of \$25,000 by Joseph E. Nenzel, J. T. Sullivan, J. H. Causten and J. Berger. The company proposes to build a large power plant at Oregana, which will furnish electricity in Rochester.

**BUFFALO, N. Y.**—The American Cataract Pwr. Co. has been incorporated with a capital stock of \$1,000,000 to generate electricity. The directors are: John F. McDonald, George R. Teller, Howard A. Foran, E. L. Koons, Henry R. Hoeffel, H. A. Meldrum, Eugene L. Falk, William M. Wall and Robert F. Hefford, all of Buffalo.

**MOUNT VERNON, OHIO.**—The Mount Vernon Pwr. & Lt. Co. has been incorporated with a capital stock of \$250,000 by H. L. Montgomery, W. R. Pomerene and George H. Booth.

**SALEM, ORE.**—The Interior El. Lt. & Pwr. Co. has been incorporated by Howard Evans, W. B. Brower, W. T. Parrish, L. H. Richmond and J. A. Bradley. The company has purchased water rights on the Walla Walla River and proposes to develop about 4000 hp.

**HARRISBURG, PA.**—The Governor has approved the charter of the Consumers' El. Lt. Co., of Hanover Township, the Consumers' El. Lt. Co., of Nanticoke, and the Consumers' El. Lt. Co., of Newport Township, all of Luzerne County.

**LEBANON, PA.**—Charters have been granted to the Cornwall, Remont, West Cornwall and South Londerberry El. Lt., Ht. & Pwr. Cos. to operate in Lebanon County, with offices in Lebanon. Each company is capitalized at \$5,000.

**WINDFEL, PA.**—Charters have been granted by the State Department to the Fairview El., Ht. & Pwr. Co. of Paint Township, and the Rockingham El., Ht. & Pwr. Co., of Shade Township. Each company is capitalized at \$5,000, and the incorporators are: J. R. Caldwell, E. A. Delaney and R. M. Mullen, of Windfel.

**DE LEON, TEX.**—The De Leon Gutman El. & Pwr. Co. has been incorporated with a capital stock of \$20,000 by W. E. Lowe, J. T. Collin and W. M. Tollie.

**RUTLAND, VT.**—The Colonial Pwr. & Ltg. Co. has been incorporated by A. Livingston Norman, of New York, N. Y.; George N. Platt and Thomas Muloney, both of Rutland. The company is capitalized at \$1,000,000 and proposes to construct, acquire and operate electric, gas, steam and other power plants.

**CLARKSVILLE, VA.**—The Eagle Point Pwr. Co. has been incorporated with a capital stock of \$50,000. The officers are: W. T. Wimbish, president; H. M. Wimbish, secretary and treasurer.

**REMINGTON, VA.**—The Remington El. & Ht. Co. has been incorporated with a capital stock of \$5,000 and the following officers: J. T. Norton, president; J. R. Culp, vice-president, and W. W. Ashby, secretary and treasurer, all of Remington.

**RICHMOND, VA.**—The Central Arkansas Ry. & Lt. Co. has filed articles of incorporation with a capital stock of \$10,500,000, maximum. The officers are: William L. McKee, of Brooklyn, N. Y., president; L. C. Gerry, of New York, treasurer, and John R. Marsh, of New York, N. Y., secretary.

**SPRINGFIELD, W. VA.**—The Magnolia Pwr. Co. has been incorporated by William E. Walsh, Peter J. Seaver, Cyril R. Gore and others, all of Cumberland, Md. The company is capitalized at \$100,000 and proposes to construct a hydroelectric power plant on the South Branch of the Potomac River and transmit electricity to Springfield, Romney and other places in Hampshire County.

**EDEN, WIS.**—The Eden El. Lt. Co. has been incorporated with a capital stock of \$5,000 by John O'Brien, K. L. O'Brien and Frank Siefelt.

**PORT EDWARDS, WIS.**—The Nekosa Edwards El. & Pwr. Co. has been incorporated with a capital stock of \$5,000 by I. M. Alexander, C. A. Jaspersen and A. V. Marvin.

## Trade Publications

**RESISTORS.**—Resistors for various motor starting and speed controlling rheostats are illustrated and described in Bulletin No. 4973 distributed by the General Electric Company.

**MOTOR-GENERATOR SETS FOR RAILWAY SIGNALING.**—In Bulletin No. 4085 issued by the General Electric Company battery charging motor-generator sets for railway signaling are treated. The bulletin will interest railway men.

**CONTROL SWITCH.**—Bulletin 34070 of the General Electric Company illustrates and describes electrically operated remote-control switches for both alternating and direct current which are adapted for use wherever control from a central point is desired.

**GASKETS.**—The Goetze Gasket & Packing Company, New Britain, N. J., is giving publicity to its products in the form of a large poster, ready for hanging, which contains the latest price list of its gaskets and packings. Its various styles are briefly described and boldly illustrated.

**CABINET SAFES FOR OFFICE AND FACTORY.**—The Glass-Weincke Company, Cincinnati and New York, has issued a circular descriptive of its line of cabinet safes, which form an almost indispensable part of an office or manufacturing plant where records of all kinds must be filed for ready reference.

**ELECTRIC FANS.**—A very attractive 100-page catalogue (No. 332) issued by the Spangue Electric Works of the General Electric Company is devoted to its fans, including desk and bracket, telephone booth, oscillating and non-oscillating, universal joint, mixed exhaust and ceiling, and plain and ornamental ceiling and column fans. Brief illustrated descriptions and specifications on the various types are given.

**COMPUTING CHART.**—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, has issued a chart designed to facilitate the solution of problems in general illumination. A description is given of a graphic method, together with a key to the computation of illumination, while various tables are prepared to show the candle intensities recommended for various classes of service.

**SIGN LAMPS.**—An attractive publication of the General Electric Company, Boston, Boston, is devoted to sign and sign lighting. The bulletin contains reproductions of photographs of various styles and sizes of signs located in various cities of the United States, and also the literature here used in connection with this method of advertising, and illustrates the various signs and signs about the United States used.

**ALUM. ROOM LIGHTS.**—The ALUM. ROOM LIGHTS—A new booklet by the General Electric Company, Boston, is devoted to the use of aluminum in its popular booklet entitled "Better Buildings." Devoted, as the title denotes, to improvement in building, it is devoted to the use of aluminum in building and the allied trades. It is fully illustrated and contains valuable descriptions of the various uses of aluminum material.

**SEMI-INDIRECT LIGHTING FIXTURES.**—New white-glass fixtures for semi-indirect lighting are described in a new booklet by the General Electric Company, Boston, Massachusetts, St. Louis. The booklet is called the Brascolite "Three-Color" fixtures, and contains descriptions of white opal glass, plain glass, and glass with a white enamel coating, and coated glass, and a list of the various fixtures and the various uses of this combination are described.

**SEMI-INDIRECT LIGHTING.**—The General Electric Company, Boston, Massachusetts, St. Louis, has issued a new booklet, "Three-Color" fixtures, and contains descriptions of the various types of fixtures and the various uses of these fixtures. This new booklet also contains a list of the various fixtures and the various uses of the method of obtaining a pure white light and the various uses of the Brascolite fixtures and the various uses of these fixtures.

**OXYGEN AND HYDROGEN EQUIPMENTS.**—The International Oxygen Company, 115 Broadway, New York, in its pamphlet No. 9 describes its system for the separation of water into its elements, oxygen and hydrogen, by means of electricity. The generators (or cells) used, their operation, their safety and durability, and also a comparison of costs, are taken up. The I. O. C. system for the production of hydrogen is considered. Photographs of the apparatus are given, and the system as installed in two manufacturing plants is shown. A booklet is also issued to describe the oxygen and hydrogen generators in detail, and contains general and sectional views of this apparatus. These publications will interest owners, superintendents and managers of industrial establishments.

**SUPERHEATERS.**—"Superheating" is the title of a sixteen-page illustrated pamphlet issued by the Heine Safety Boiler Company, St. Louis, Mo. It consists of a paper reprinted from the *Journal of the Engineering Society of Pennsylvania*, in which are discussed the steam and the economy of superheating, the various designs of superheaters and methods for obtaining control of the temperature of superheat. A brief description is given of the design and operation of the Heine superheater. A chart illustrates the performance of this apparatus and indicates how the steam temperature is maintained within about 5 deg. of the mean. Included in this pamphlet also are abstracts from the *Transactions of the American Society of Mechanical Engineers* on the effect of superheating steam on cast iron. These notes give examples of the effects of increasing steam temperatures and excessive temperatures.

## Business Notes

**THE HUGHES ELECTRIC LIGHTING COMPANY** has moved its Chicago office from 100 Superior Street to 101 West Superior Street.

**THE CENTRAL TUBE COMPANY**, of Pittsburgh, Pa., has moved its new offices covering the eighth floor of the First National Bank Building on and after March 24.

**GENERAL INSULATING COMPANY.**—At the last annual meeting of the stockholders of the General Insulating Company, Inc., New York, it was voted to change the name to the General Insulating Company. The directors have voted to increase the paid-up capital from \$100,000 to \$200,000.

**THE ELECTRIC UTILITIES SHOP** has been organized in New York City, and will have its headquarters at the Electric Utilities Shop, 100 West 42nd Street, New York City. The shop will be in charge of the Electric Utilities Shop, 100 West 42nd Street, New York City.

**THE AMERICAN ROLAND VALVE COMPANY**, of New York City, has moved its headquarters to 100 West 42nd Street, New York City. The company has been organized in New York City, and will have its headquarters at the Electric Utilities Shop, 100 West 42nd Street, New York City.

**S. K. SULLIVAN & COMPANY**, of New York City, has moved its headquarters to 100 West 42nd Street, New York City. The company has been organized in New York City, and will have its headquarters at the Electric Utilities Shop, 100 West 42nd Street, New York City.

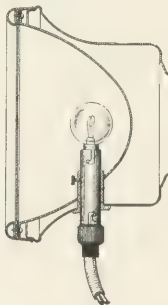


# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 4, 1913.

[Prepared by Robert Starr Allen, 16 Exchange Place, New York.]

- 1,054,690. **ELECTRIC WIRE SUPPORTING DEVICE**; H. A. Hicks, Gerty, Okla., App. filed March 7, 1912. V-shaped arm insulator.
- 1,054,717. **FUSE**; A. W. Schramm, Riverton, N. J. App. filed Nov. 29, 1911. Fuse cartridge inserted through opening in panel, with electric connections at back of panel.
- 1,054,766. **ELECTRIC HEATING SYSTEM FOR CARS**; F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. App. filed Dec. 4, 1911. Resistance coils used at starting impart heat to interior of car.
- 1,054,767. **ELECTRIC RAILWAY CAR-HEATING SYSTEM**; F. Hedley, Yonkers, and J. S. Doyle, Mount Vernon, N. Y. App. filed Dec. 4, 1911. Heaters take current only when propelling motors are not taking current.
- 1,054,783. **ELECTROMAGNETIC MOTOR**; G. M. Mayer, Highland Park, Ill. App. filed June 5, 1911. Motor for advertising purposes, alternating current or direct current.
- 1,054,784. **ELECTRIC CABLE**; F. R. McBERTY, New Rochelle, N. Y. App. filed Feb. 27, 1908. Flat woven multi-conductor cable with insulation omitted for short spaces at intervals to expose wires for connection.
- 1,054,801. **SECONDARY OR STORAGE BATTERY**; E. W. Smith, Philadelphia, Pa. App. filed July 21, 1910. Battery plate with active material surrounding rods and permeable tubular envelopes surrounding each rod.
- 1,054,809. **ELECTRICAL CONNECTOR**; R. H. Welles, Kenosha, Wis. App. filed June 12, 1911. Connection for electrical headlights with bayonet slot lock.
- 1,054,810. **ELECTRICAL CONNECTOR**; R. H. Welles, Kenosha, Wis. App. filed April 17, 1912. For headlights; terminal plug locked in casing by a U-shaped spring-gripping member.
- 1,054,811. **MEANS FOR CONTROLLING ELECTRIC APPARATUS**; E. H. & K. A. Widgren, Alby, Sweden. App. filed June 8, 1910. System of transmitting writings and drawings, uses pulsating current and varies length and interval of pulsations.



1,054,809—Electrical Connector

- 1,054,815. **TEMPERATURE REGULATING MEANS FOR CARS AND THE LIKE**; W. Barstow, San Francisco, Cal. App. filed May 21, 1912. Heater and a cooler, with thermostatic control to maintain a constant temperature.
- 1,054,835. **JAR FOR SECONDARY OR STORAGE BATTERIES**; B. Ford, Philadelphia, Pa. App. filed July 19, 1911. A row of individual jars are bound together by an outer integral side wall which surrounds them all.
- 1,054,845. **CIRCUIT-BREAKER**; L. E. Hodges, Covina, Cal. App. filed Sept. 19, 1911. Thermostatically controlled; for vulcanizing purposes.
- 1,054,862. **VARIABLE INDUCTANCE**; T. E. Paling, Dundas, Ontario, Canada. App. filed Dec. 8, 1911. Current economizer for moving picture machines.
- 1,054,886. **METHOD AND APPARATUS FOR PRODUCING LONG ELECTRICAL ARCS**; P. H. A. Wielgoshski, Christiania, Norway. App. filed May 16, 1912. Arc is lengthened or "stretched" by subjecting it to a wide, thin magnetic field.
- 1,054,887. **AUTOMATIC TELEPHONE EXCHANGE SYSTEM**; F. Wohler, Hanover-Linden, Germany. App. filed Dec. 30, 1912. One test wire suffices to indicate "busy" condition as well as forcibly to disconnect existing connection and simultaneously connect new one.
- 1,054,893. **HIGH-POTENTIAL ELECTRIC SWITCH**; C. C. Badeau, Winthrop, Mass. App. filed Feb. 24, 1911. A series transformer has its primary leads connected to and movable with the movable switch element.
- 1,054,902. **RESISTANCE DEVICE**; L. and H. L. Bradley, Muskegon, Mich. App. filed Dec. 14, 1908. Column of graphic plates each having contact surfaces of amorphous carbon. Thirty-nine claims, some of them on process of preparing the resistant material.
- 1,054,909. **SPARK-PLUG TESTER**; A. De Clairmont, Toledo, Ohio. App. filed Oct. 3, 1911. Spaced electrodes formed with means whereby either one of them may be detachably connected with a spark plug.
- 1,054,917. **REMOTE-CONTROL ELECTRIC SWITCH**; I. R. Gunn, Detroit, Mich. App. filed March 28, 1912. Solenoid rod closes circuit and a magnet draws a catch from under the rod to permit the rod to fall and break circuit.
- 1,054,923. **SAFETY INDICATOR AND CONTROL FOR ELEVATORS**; P. T. Kenny, New York, N. Y. App. filed May 26, 1909. Upon attaining dangerous speed signal is given to operator and then control is taken out of his hands.
- 1,054,937. **VOLTAGE REGULATOR**; M. Pfeffer, Vienna, Austria-Hungary. App. filed Jan. 14, 1910. Voltage regulator for each generator responsive to change of phase relation between the electromotive forces and the currents in the lines of their respective generators.
- 1,054,939. **SNAP SWITCH**; C. D. Platt, Bridgeport, Conn. App. filed Aug. 5, 1912. Down-turned lugs on a guide plate form a guide for the sliding detent, which is operated by an eccentric on the spindle-tension spring intermediate to the spindle and guide plate.
- 1,054,946. **SELF-LOCKING LAMP SOCKET**; W. A. Stacey, Chicago, Ill. App. filed May 16, 1912. Helical spring coil automatically locks lamp in socket.
- 1,054,965. **FUSE CARTRIDGE**; F. J. Ferrari, Syracuse, N. Y. App. filed May 31, 1911. Removable fuse holder within the shell permits of ready inspection and renewal of fuse.
- 1,054,971. **BURGLAR ALARM**; J. E. Liljebled, Chicago, Ill. App. filed Oct. 22, 1909. A line or wire adjacent to the door or window causes an electrical circuit to be formed when interfered with.
- 1,055,003. **ELECTRODE FOR PRODUCING ARCS**; G. Wagnere, Schiebush-Manfort, Germany. App. filed Nov. 22, 1911. Metallic core surrounded by cement, which, when heated, becomes conductive and relieves the metal core of the wear and tear.
- 1,055,018. **ELECTRIC GROUND DETECTOR**; G. A. Burnham, Cliftondale, Mass. App. filed March 1, 1911. Indicating or recording device is permanently placed in circuit with a group of electrical distribution lines through ground line including protective resistance.
- 1,055,035. **ELECTRIC SWITCH**; E. R. Hamilton, Chicago, Ill. App. filed Dec. 29, 1911. Lock for ignition circuit switches.
- 1,055,062. **SOCKET FOR INCANDESCENT ELECTRIC LAMPS**; L. K. Lux, Syracuse, N. Y. App. filed March 7, 1908. Reciprocating bar with exposed thumb piece operates a cam which forces contact spring to complete circuit.
- 1,055,103. **PROCESS OF PRODUCING SULPHONIC ACIDS OF THE NAPHTHALENE SERIES**; A. Vagt, Cologne, Germany. App. filed Dec. 6, 1911. Subjects poly-sulphonic acids of the naphthalene series to action of electric current.
- 1,055,137. **ELECTRIC-LAMP KEY SOCKET**; A. W. Clauder, Bridgeport, Conn. App. filed April 19, 1912. Rotating switch piece with combination of stops for holding it.
- 1,055,153. **SOUNDING DEVICE**; D. B. Ferguson, Aurora, Minn. App. filed March 6, 1911. When device tilts over as it strikes bottom a pivoted member swings into engagement with fixed contact and closes signal circuit.
- 1,055,157. **ELECTROLYTIC RECOVERY OF ZINC AND MANGANESE**; A. G. French, Nelson, British Columbia, Canada. App. filed Sept. 4, 1912. Electrolytic decomposition of solution containing sulphate of zinc, sulphate of manganese and neutral sulphate of sodium.
- 1,055,158. **ELECTROLYTIC RECOVERY OF ZINC AND MANGANESE**; A. G. French, Nelson, British Columbia, Canada. App. filed Sept. 4, 1912. Regenerates sulphate of manganese by treating dioxide of manganese in suspension in water by sulphurous-acid gas or a sulphurous-acid solution.
- 1,055,160. **DEVICE FOR STERILIZING CLOSET SEATS AND THE LIKE**; K. Gasiorowski, Zurich, Switzerland. App. filed Nov. 25, 1912. Seat is first electrically heated and then after a time interval automatically cooled.
- 1,055,165. **ELECTRIC BATTERY CELL**; J. H. Gugler, Minneapolis, Minn. App. filed May 3, 1909. Primary cell with trough in bottom to receive loose particles of anode material and mercury in the trough.
- 1,055,173. **CONDUIT FOR ELECTRICAL WIRES**; F. C. Hodgkinson, Pittsburgh, Pa. App. filed Jan. 15, 1912. Made from single piece of sheet metal with hinged edges which may be interlocked.
- 1,055,177. **ELECTRIC-LAMP SWITCH**; M. J. Hoppock, Frankfort, Mich. App. filed July 10, 1912. Resistance cut into and out of circuit by turning the rotatable part of the lamp socket carrying the lamp.
- 1,055,185. **MERCURY AND OTHER VAPOR ELECTRIC LAMP**; H. A. Kent, Boud's Green, and H. G. Lacell, Finchley, England. App. filed Dec. 27, 1911. Sealing device including communicating receptacle and heating means to vaporize liquid therein.
- 1,055,205. **TROLLEY**; J. W. McKinney, Tyrone, Pa. App. filed March 25, 1912. Guide flanges attached to the harp at each side of the wheel.
- 1,055,221. **ACCUMULATOR**; J. Piotrowski and A. Kilinski, New York, N. Y. App. filed Feb. 10, 1912. Electrodes and insulating plates hung from insulating suspending bars.
- 1,055,227. **AUTOMATIC ALARM**; E. Remacle, Newark, N. Y. App. filed June 19, 1912. Fusible; for gas coaks.
- 1,055,236. **MAGNETO-ELECTRIC MASSAGING MACHINE**; B. Seacombe, Manchester, England. App. filed May 25, 1910. Movement of massaging roller generates current which is imparted to patient through said roller.
- 1,055,261. **ELECTRIC WELDING**; J. O. Ellinger, New York, N. Y. App. filed July 15, 1910. Parts are subjected to a welding current and to pressure while submerged in oil; prevents the loss of temper of the parts.
- 1,055,272. **BULB**; V. Gulesserian, Buffalo, N. Y. App. filed April 6, 1912. Filament supported in pyramidal form.
- 1,055,275. **TROLLEY WHEEL**; B. H. Hawkins, Brooks, Ore. App. filed Feb. 24, 1912. Spiral rollers at opposite sides of wheel.
- 1,055,292. **ELECTRIC-MOTOR CONTROLLER FOR ELEVATORS**; I. C. Smith, Louisville, Ky. App. filed Sept. 23, 1909. Dynamic braking system.
- 1,055,295. **ELECTRODE FOR PRODUCING ARCS**; G. Wagnere, Schiebush-Manfort, Germany. App. filed Nov. 22, 1911. Metallic electrode with a surrounding body of refractory earth.
- 1,055,305. **TEST CONNECTOR FOR ELECTRIC WIRES**; A. Kneisel, Cleveland, Ohio. App. filed May 15, 1912. Angularly bent metallic clips secured together by screws.

# Electrical World

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No. 12

## The Countryside Network

The rural field, as an inviting prospect for central-station service, becomes a reality under the light of such figures

as those marshaled by Mr. Samuel Insull, who now demonstrates for the case of scattered country communities, as he has already done for urban centers, that a unified system of generation and distribution will not only save important plant investment and operating costs but accomplish developments in the extent, variety and usefulness of electric service far beyond anything that would ever be possible with mere individual local stations. In addition to the routine lighting and motor service of the towns themselves as cited by Mr. Insull in his Franklin Institute address, outlined in this issue, the supply of energy for interurban electric railways, water pumping, ice making, farm operations, drainage, mining—and even a hint at railroad electrification in the future—offer important loads for the rural network. And as regards the magnitude of these openings, we need only mention the speaker's own estimate that for the State of Illinois alone the combined service opportunities of this kind exceed by 20 per cent the present output of the great Chicago system itself. But most significant of all is the diversity with which these various rural demands occur, as regards both their daily and annual load curves. Even when not representing distinctly off-peak demands by their very nature, many of these applications are so flexible that they can be controlled with ease to avoid the system peaks. And, although some of the uses cited have not in themselves particularly high load-factors, their combined showing indicates possibilities of a system load-factor of nearly 50 per cent, with a diversity of 35 per cent in the use of the power supply equipment—figures which will certainly arouse the interest, if not the envy, of many central-station operators furnishing electricity in densely populated and progressive urban centers.

## Pennsylvania Electrification

In a recent note on the establishment of a correspondence school of electricity for Pennsylvania Railroad employees stress was laid upon the significance of this step in connection with the company's electrification plans. Confirmation of this view has come sooner than expected in the announcement just made that the Pennsylvania will within the next year spend \$4,000,000 on the electrification of the "main line" out of Philadelphia as far as Paoli, a distance of about 20 miles. The figure stated is understood to cover only the track work and not to include the power house which will be erected or the locomotives. While the announcement refers to this work as being "for suburban passenger traffic," it requires no stretch of the imagination

to see in it the beginning of an electrified system. Even as a localized undertaking, no little satisfaction is to be derived from this latest extension of the territory that electricity is steadily conquering in the world of transportation.

## A Vital Trade Problem

Of all the subjects discussed at the recent meetings of the Society for Electrical Development no one topic

occupied so much time or drew so much fire as did the need for readjusting the merchandising relations and activities of central station, jobber, dealer and contractor. As very forcibly put by one of the jobbers who took a leading part in the discussion, what the dealer, contractor and jobber demand are "decent merchandising conditions." Other speakers reiterated the demand that central stations shall not, as a means of promoting their principal business, namely, the sale of energy, cut under the prices that contractor, dealer and jobber must charge in order to live. This is an old problem, but one of which the last will not be heard until it is met and solved, not because the commercial salvation of certain men demands a solution, but because upon this solution depends the working out of the whole problem of distribution of electrical supplies and apparatus. So far the attempts in this direction have resulted in little more than the development of an irreconcilable conflict. The central stations, on the one hand, say that they are willing that others should do the work if they will really do it effectively, while the dealers, jobbers and contractors, on the other hand, assert that they can and will do the work to be done if a chance is given to them. If the Society for Electrical Development can work out the solution of this problem on a basis of real co-operation, of give and take by all concerned, it will by this one accomplishment contribute enormously to commercial electrical advancement.

## Hydraulic Storage and Auxiliaries

The Mount Hood plant, described elsewhere in our columns, is interesting chiefly on account of the somewhat

unusual hydraulic situation there developed, in that it is constructed for the utilization of three distinct sources of supply of water at three different heads, high, medium and low, the two former being planned for utilization in the same power house. The present plant involves the intermediate head only, the water being collected in a reservoir site some 325 ft. above the river which serves as the discharge. At double this height and very near lies a high reservoir site which can be reached from an independent drainage area by building some 10 miles of aqueduct. The present intermediate head reservoir is reached by a little

more than 3 miles of aqueduct, which is a wooden flume of the type widely used on the Pacific Coast. The reservoir for this head covers about 160 acres and is in the main inclosed by an earthen embankment. The reservoir is large enough to permit the generator to carry full load of some 11,000 kw for thirty-six hours, so that the question of daily peak is eliminated and the real hydraulic problem involves a study of the all-the-year-round supply. The whole watershed touched by the project is of substantially the same character, so that no relief is to be obtained by, so to speak, a diversity-factor in the supply. The rainfall in this region is very large, being probably not less than 7 ft.

In spite of the amount of rainfall and the considerable storage area, the dry season is itself very seriously felt. There exists the somewhat unusual condition of a plant which, in spite of large storage and exceptionally great rainfall, must still be reinforced during a part of August and September by an auxiliary steam plant. This fact shows exceptionally well the conditions which confront the engineer in attempting to secure the maximum use even of a very promising hydraulic privilege. More and more as the water-powers of the country are utilized does the problem of the low-water season confront one. Even a high-head development with good storage facilities can rarely carry its load through the month of minimum rainfall. Remedies for this situation can lie only in extraordinary storage capacity under an exceptionally high head or in the deliberate provision for auxiliary power. In taking the latter horn of the dilemma one faces a yet unsolved problem as to the selection of the most economical form of auxiliary equipment for obtaining a relatively large output during a very brief period.

### The Sounder in Submarine Cable Telegraph

References have recently appeared in the technical press concerning a new method of transatlantic cable telegraphy devised by Mr. John Gott, employing the Morse key and Morse receiving instrument, instead of a pair of keys and siphon recorder at the respective ends of the cable. Details of the apparatus employed have not yet been made public, but an outline description of the method employed, written by Mr. Edward Raymond-Barker, appears in a recent number of the London *Electrical Review*, as referred to in this week's *Digest*. The transmitted signals are ordinary Morse signals, except that they are always successively alternating in direction. That is, they consist of short and long impulses, or dots and dashes, but no two successive impulses have the same polarity, although produced through successive contacts of the same Morse key. Automatic means are provided for reversing the current direction at each contact. The signals thus resemble alternating currents, it being understood that standard alternating currents employ rhythmically reversing impulses of uniform duration and spacing, whereas the impulses used by the new method, in spelling out letters, employ reversing impulses that are not strictly rhythmic and by no means always of equal duration and spacing.

The continued succession of reversed Morse impulses is much more favorable to the operation of a Morse relay at

the receiving end of a long cable than ordinary single-current working or unidirectional Morse signaling would be. On the other hand, double-current working is always the rule in long Morse circuits. In double-current working the marking impulse consists of a short current impulse, say positive, while the cessation impulse consists of a short negative current impulse at the proper moment. In this way dots and dashes are formed by successive impulses that are always in opposite directions—again an approach toward alternating-current transmission. It is thus difficult to see any salient superiority in the new method over double-current working, notwithstanding the manifest superiority over single-current working. A full description of the new system, when it is finally published, may clear up this obscurity.

### New York State Hydroelectric Schemes

Agitation in favor of hydroelectric projects under state ownership and management in New York, inaugurated by the introduction of bills during the last session of the Legislature, continues with increased activity during the present session. Elsewhere we give an analysis of the important Murtaugh bill. In its general scope it is not unlike the Bayne bill considered by the last Legislature, but instead of launching forth at one leap into a state-wide hydroelectric system, the present measure, although it contemplates such a system ultimately, provides specifically for the creation of a single hydroelectric district for the city of Albany and neighboring municipalities, including Troy and Schenectady, with two developments at dams on the new barge canal. As a whole the scheme is inspired, as is well known, by the hydroelectric system of Ontario, concerning the financial success of which many conflicting rumors and stories have been in circulation. Certain causes for these rumors can be learned from the review in this issue of a book entitled "An Expensive Experiment."

The New York project must be considered at present very largely from the standpoint of its general advantages and disadvantages. Viewed first as a municipal ownership project, which must be under the control of one state administration after another, the outlook is anything but assuring. Listening for the moment to the pleadings of idealists, it must be conceded that it would not be impossible for a state executive of great ability, purity of motives and independence of action to stand behind one of these projects and see it through to completion and successful operation as efficiently as any group of private citizens or a public-utility corporation. This, we repeat, would be possible, but it is extremely improbable under the political traditions of the present day. Municipal ownership of public utilities is notoriously weak on the side of administration or management. Prevalence of the spoils system, rotation of officials in office, the temptation to yield to political expediency, and incompetence, all combine to defeat the promises of idealists who maintain that the lowest rates and the best service are obtainable only by municipal ownership.

A specific objection to the Murtaugh bill which covers a point of the greatest importance is the needlessness of creating a new regulating body to administer the project, independent of the Public Service Commissions. Municipalities



are empowered by the measure to engage in the distribution and sale of electrical energy purchased from the State, either by contracting with the local electric utility to act as a distributing agent, or by purchasing the local system, or again by constructing an independent municipal system. The vital point, the source of danger, resides in the fact that state energy will be sold under the sole jurisdiction of the State Conservation Commission. Clearly, then, a local utility which is under the jurisdiction of the Public Service Commission may find itself in competition with a municipal system under jurisdiction, both as to rates and service, of the Conservation Commission. This position is obviously anomalous and should be rectified by placing the whole scheme in the hands of the existing adequate machinery of administration—the Public Service Commission. Otherwise there is no protection whatever to the investors in existing utilities against public caprice, needless competition and the duplication of investment.

A splendid method for solving the fundamental problem of conserving the public water-power and devoting it to public use is found in the water-power law of Wisconsin, under which the Railroad Commission is clothed with jurisdiction and authority over the whole question. New York can hardly do better than follow this example, in the interest both of efficiency and justice to existing enterprises under private ownership.

### Heterochromatic Photometry

An article in this issue by Mr. M. Luckiesh on photometry by flicker and by equality-of-brightness instruments raises some very curious questions as to the nature of the phenomena. Our readers will remember that in some recent researches by Dr. Ives it appeared that while at considerable intensities fairly concordant readings could be obtained by the flicker and by the equality-of-brightness photometers, yet at low values of the luminosity discrepancies appeared, sometimes showing the Purkinje effect, and in the case of the flicker instrument sometimes a small reversed Purkinje effect. Mr. Luckiesh's results on comparing red and green lights with these instruments were of a somewhat startling character, much less reassuring to the photometrist than those obtained by Dr. Ives. With an intensity on the screen of below 2 meter-candles, wide variations were found, a very pronounced Purkinje effect with the equality-of-brightness photometer and an equally pronounced reversed Purkinje effect with the flicker instrument. The former is, of course, naturally to be expected. Unless the reduction of the illumination from screen to eye was very much less than is ordinarily to be found, the magnitude of the discrepancies noted by Mr. Luckiesh is altogether remarkable, and particularly the reversed Purkinje phenomenon found in the flicker photometer.

Numerous observers have apparently found the Purkinje phenomenon itself under circumstances similar to those noted by Mr. Luckiesh, and the reason for this was pointed out by Dr. Louis Bell in our columns on Jan. 27, 1912, as due to the shifting of luminosity in the juxtaposed fields by reason of simultaneous contrast, producing a tendency toward a spurious Purkinje phenomenon at intensities ma-

terially higher than those at which the real phenomenon should naturally make its appearance. It was also pointed out in this paper that the same effect of simultaneous contrast would produce very varying results according to the particular colors involved and their places upon the luminosity curve. When it comes, however, to a marked reversed Purkinje effect with a flicker photometer the case is different. Here there is no simultaneous contrast to shift the apparent luminosities of the colors involved. The particular advantage, in fact, of the flicker photometer is that it abolishes the difficulties which come from simultaneous contrast. But a reversed Purkinje phenomenon is just as bad from the standpoint of precision as the direct effect, and it is therefore worth while inquiring somewhat into the situation as disclosed by Mr. Luckiesh's experiments. The first thing to note is that, whatever the cause of the phenomenon observed with the flicker instrument, it began to be felt at about the same degree of low intensity as the opposite variations in the equality-of-brightness photometer—that is, near the point at which color vision begins to fail. One is induced to ask why under such circumstances the red light should appear too bright instead of too dim as required by the Purkinje effect.

It would have been interesting had Mr. Luckiesh investigated this curious phenomenon at a variety of flicker speeds. It is quite possible that the time relations of the color stimuli might introduce variations in apparent intensity of considerable magnitude. If such were the case, one would expect that color differences would make themselves felt in studies of Talbot's law. The sector disk, however, was pretty thoroughly investigated at the Bureau of Standards a few years ago by Dr. Hyde, who did not find any error due to color difference, although Ferry, working under other conditions, had found such a difference. In view of these latest results it may be that the discrepancy noted could fairly be chargeable to differences in intensity and in speed of rotation of the disk, which latter factor, of course, influences the effect to be produced by the variation in the physiological factor under sudden stimuli. However this may be, it seems clear from Mr. Luckiesh's experiments that at low intensities, and at speeds where flicker is pronounced at these intensities, the color of the lights compared may be the important factor in the results.

The form of the flicker curves indicates that at the lower intensities the question of color adaptation may play an important part. When widely different photometric results are obtained with colored lights for a very small variation in intensity, as they are in this case, one naturally looks for adaptation as the disturbing factor. At all events, it is quite clear that even in using flicker photometry one must anticipate trouble at low intensities. Most observers find the flicker instruments difficult to use with low intensities, and it is perhaps safe to say that errors are not likely to be noticeable at intensities where one could comfortably work by flicker. Nevertheless the situation calls for further investigation. It is somewhat disconcerting to find such difficulties as these just after the investigations of Dr. Ives seemed to have put the flicker method on a sound basis. The difficulties should be cleared up at the earliest possible moment.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### New York Subway Contracts Signed

After three years of complex negotiations and heated controversy, the contracts for the operation of the dual rapid-transit system for New York City were signed on March 19.

These contracts relate to the operation of a system the total cost of which will be about \$400,000,000. Of this, one-fourth covers the existing systems and \$300,000,000 the construction now under way or authorized for the new subway, elevated and surface lines described in the *Electrical World* June 1, 1912. When the new system is placed in operation, which will probably be in 1917, there will be over 600 miles of single track in service, as compared with 271 at present. Chairman McCall, of the Public Service Commission for the First New York District, signed the contracts for the city, and his signature was attested by Mr. William R. Willcox, his predecessor, whose term expired before an agreement was reached on the subway question. Mr. Theodore P. Shonts, president of the Interborough Rapid Transit Company, signed the contracts for that company, and Mr. Timothy S. Williams, president of the New York Municipal Railway Corporation (Brooklyn Rapid Transit Company) signed them on behalf of these interests.

### Work of New England Electric Development Association

The Electric Development Association, Inc., of New England distributed 38,200 copies of the February number of the organization's popular periodical, *The Silk Cord*, among individual users of electricity from lists furnished by central stations and contractors. In addition, 326 copies were mailed to the newspapers and 1000 copies placed on sale on news stands in the New England territory. Of the March number, just issued, 35,400 copies are being mailed to present and prospective electricity users. During recent months the association has encouraged the pushing of electric sales and emphasized the need of co-operation in many New England towns and cities. The secretary of the association is Mr. Zenas W. Carter, 53 State Street, Boston, Mass.

### Nomination of A. I. E. E. Officers

At the meeting of the American Institute of Electrical Engineers, New York, March 14, President Ralph D. Mershon announced the nominations made by the board of directors for Institute officers for the coming year. These names are as follows: President, Mr. C. O. Mailloux, New York; vice-presidents, Messrs. H. H. Barnes, Jr., New York; J. A. Lighthipe, Los Angeles, Cal.; C. E. Scribner, New York, and W. S. Rugg, New York; treasurer, Mr. George A. Hamilton, Elizabeth, N. J.; board of directors, Messrs. F. A. Behrend, Boston, Mass.; P. Junkersfeld, Chicago, Ill.; H. A. Lardner, San Francisco, Cal.; Louis T. Robinson, Schenectady, N. Y., and Charles Robbins, Pittsburgh, Pa.

Mr. C. O. Mailloux, nominated by the board for president, is a charter member of the Institute, having signed the call for its organization in 1883. He has served three times on its board of managers and twice as vice-president. He rep-

resented the Institute at Paris in 1900, at London in 1906, at Marseilles in 1908, at Turin in 1911, and only recently returned from the conference of the International Electro-technical Commission at Zurich, which he attended as president of the United States committee. Mr. Mailloux is also vice-president on international arrangements for the International Electrical Congress to be held at San Francisco in 1915. When the *Electrical World* was founded in 1883 Mr. Mailloux was a leading spirit in its organization, afterward serving as this journal's first editor.

### Missouri Utility Law Enacted

A law creating a state-wide public utility commission for Missouri has passed the General Assembly of that State and on March 18 received Governor Major's signature. The new Missouri measure is in general modeled along the lines of the New York State Commissions law. It provides for the repeal of the Cooper enabling act, passed May 8, 1907, under which the present local commissions were established.

### Annual Meeting of Electrochemical Society

The twenty-third general meeting of the Electrochemical Society will be held at Atlantic City April 3 to 5. At the opening session on Thursday morning Mr. I. Langmuir will deliver an address on conduction and radiation of heat, Messrs. F. A. J. Fitzgerald and A. T. Hinckley will read a paper on experiments with furnace electrodes, and Prof. J. W. Richards one on aluminum nitride. In the afternoon the following papers will be read: "Some Tests of the Edison Storage Battery," by Messrs. C. W. Bennett and H. N. Gilbert; "Concentration Cells Containing Organic Liquids Immiscible with Water," by Mr. R. Beutner; "Concentration Changes in Copper Sulphate Electrolysis," by Messrs. C. W. Bennett and C. O. Brown; "The Three-Phase-Two-Phase Induction Furnace," by Mr. A. E. Greene, and "Making Electric Steel Without Slag," also by Mr. Greene. At 8 p.m. on Friday a lecture on hyper-basis will be given by Prof. Frank B. Kenrick, of Toronto. On Saturday President W. Lash Miller will deliver an address introductory to a symposium on the electrodeposition of metals, during which the following metals will be discussed: gold and silver, by Mr. Francis C. Frary; copper, by Mr. C. W. Bennett, and brass and bronze, also by Mr. Bennett; cobalt and nickel, by Mr. O. P. Watts; lead, by Messrs. F. C. Mathers and B. W. Cockrum. Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa., is secretary of the association.

### Analysis of the Murtaugh Hydroelectric Bill Before the New York State Legislature

The public-utility companies in New York State engaged in the production, distribution or sale of electrical energy in any way are all vitally concerned with the so-called Murtaugh bill now in the Legislature providing for the establishment of state hydroelectric systems, first in limited zones or districts and later in a state-wide system or distribution network. The scheme has its conception in the Ontario hydroelectric system, as made apparent in our

abstract of the bill in the issue of March 15. Great importance attaches to the fact that should this bill become law existing central stations may expect to find themselves sooner or later subject to enforced competition, beyond the jurisdiction of the public service commission and under the regulatory powers of an independent body, the State Conservation Commission. The evils which might grow out of this situation and their bearing on the prosperity of the central-station industry throughout the State need to be brought out into the light and thoroughly analyzed.

The Murtaugh bill contemplates a group of hydroelectric plants and a distribution network of tie lines, transmission lines and the necessary switching or transforming stations, under state ownership and management, for the purpose of wholesaling energy to municipalities and also, under restrictions, disposing of it to individual consumers, at wholesale or retail. The Conservation Commission is made the administrative body which will have charge of the whole scheme and will also fix in each instance the rates at which energy will be sold to the ultimate consumers, regardless of whether a municipality, a distributing company or the commission itself acts as the distributing agent. Municipalities desiring to engage in the sale of such energy may contract for its purchase with the commission and then dispose of it at retail under the jurisdiction—and the sole jurisdiction—of the Conservation Commission. If a central-station company is already in the local field, the municipality may enter into a contract with the company to act as its distributing agent, but is not compelled to do so. Likewise it may purchase the local company's system, for distribution purposes, under due process of law, but again is not compelled to take such a course. Finally, the municipality may reject both of the foregoing plans and construct its own system, thus entering into competition with the local company.

Clearly enough, the local company may exercise its own discretion in the matter of contracting with the municipality to act as a distributing agent of the State's hydroelectric energy, but it is powerless to prevent the purchase of its system, if the voters of the district so decide, and is equally powerless to prevent the municipality from building its own system and competing for local business, whether justified or not.

Taking up the first case, it is not difficult to foresee complications and resultant clashes of authority between the Conservation Commission and the Public Service Commission. Consider at once a company serving several municipalities, with a plurality of generating stations and tie lines and an extended distribution network. The bill would give the jurisdiction over rates and service in the case of customers served with the State's energy to the Conservation Commission, while customers served from the company's own plants would be served at rates fixed by the Public Service Commission. There might obviously be difficulties in deciding whether a customer served from a network received energy from the State's plants or the company's plants, and the source of supply might vary at different times, according to a variety of circumstances not under full or even partial control. Any company which entered into such a contract would face the practical necessity from a commercial standpoint of leveling its rates over the whole system. Thus, if the Conservation Commission fixed rates lower than those sanctioned by the Public Service Commission, the former would have to be generally adopted in order to avoid discrimination. There might be differences, moreover, in the standards of service fixed by the two commissions which it would be difficult or perhaps impossible to reconcile.

Equally grave, from the standpoint of the investor in the securities of the companies, is the prospect, if the bill becomes law, of enforced competition from a separate distribution system under municipal ownership and under jurisdiction as to rates and service of the Conservation

Commission. Clearly the latter could fix rates below those approved by the Public Service Commission, with detriment to the private company, and even under equal rates there would be competition from the municipal system regardless of the necessity for it. Under existing conditions a public-utility company is protected to the extent that no competing company may enter the field without the approval and permission of the Public Service Commission.

In theory the intent of the present law is that unnecessary or unwarranted competition shall be avoided, that is to say, when the company already serving the community does so at the lowest reasonable rates and serves all the consumers which it can reach at a reasonable profit.

Enforced competition under municipal ownership, with no check upon public caprice in rushing into such a situation, and with the competing rates and service under full control of a separate regulating body, presents a possibility which may well alarm the investors in the properties now under private ownership serving the communities of the State.

### Analysis of Proposed New York Barge Canal Water-Power Plans

A presentation on the proposed state water-power development of the New York Barge Canal at the Crescent and Vischer's Ferry dams, analyzing and pointing out the shortcomings of the plan as promulgated, has been addressed to the conservation committee of the State of New York by the public policy committee of the National Electric Light Association, of which Mr. Arthur Williams, of the New York Edison Company, is chairman.

This analysis points out that, although the commission's engineers propose developing from 12,000 hp to 36,000 hp, an actual survey of the water conditions will show that 12,000 hp would be available only 175 days of the year, owing to periodic low water and excessive flow. For a maximum yearly capacity the falls can be relied upon for only 6000 hp, which is equivalent to less than 4000 hp delivered at the consumers' premises.

For this initial development the commission proposes to spend \$625,000. Placing interest at 4 per cent, sinking fund at 1 per cent, depreciation at 6 per cent and loss of taxes at 1.5 per cent, the total annual fixed charge reaches 12.5 per cent. The annual cost of the development, omitting labor, repairs and supplies, therefore becomes \$78,000, or more than \$19 for each hp-year available by the customers. These figures include only cost of transmission and omit the distribution plant at the cities to be supplied.

Although costing \$19 per hp-year, it is proposed to sell this hydroelectric energy in the capital district for \$7 or \$7.50 per hp-year. In addition to this, as a member of the Conservation Commission has publicly advocated, it is the intention to build a large steam plant to supplement the water-power. For this steam plant an investment of at least a million dollars would be required. Including distribution expenses the fixed charge per hp-year at once amounts to \$40, including nothing for labor, supplies, repairs or steam-plant fuel.

The Barge Canal was built entirely from state funds, the presentation goes on to state, so that therefore it is less than fair that the facilities obtained at such large cost should be appropriated by and devoted to cheapening the power service of a comparatively few, thus placing local manufacturers in a position of controlling advantage. The committee points out that since the dams belong to the public, any income derived therefrom should be devoted to the entire State, for the reduction of general taxation, which means that the privileges should be sold publicly, and without any favoritism, to the highest bidder.

Enormous sums of money are already invested in the State's public utility corporations, whose service generally is adequate and their prices reasonable. More than



\$1,200,000,000 of private capital is now invested in the State's utilities, returning about \$18,000,000 to the general welfare of the commonwealth. In conclusion, the committee points out that for the \$625,000 appropriation asked it is proposed to develop hardly more power in the capital district than is required by one of the larger single office buildings of New York City. This power will be developed at a loss to the entire citizenship, in credit upon their taxes and in additional loss through increased taxes to make up deficiencies in the proposed service, while there will be set in motion a policy which cannot but be most destructive to the State's great vested interests.

The committee recommends that, instead of the proposed measure, legislation be enacted if necessary to permit the sale of this and other state water-powers (or at least this power as an experiment) at public auction, to the highest bidder, or their lease upon the most favorable terms, using as a minimum those adopted by the national government, and with the understanding that the operator, whoever he may be, shall be subject to the lawful control of the Public Service Commission.

### Operation of the Ontario Hydroelectric System

In the report of Chairman Adam Beck of the Hydro-Electric Power Commission of Ontario, recently submitted to Sir John Morison Gibson, Lieutenant-Governor of Ontario, much valuable information is given concerning the design features and operating characteristics of the transmission and distributing system installed by the commission throughout the Province. This system was fully described in our issues dated Jan. 6, 13, 20 and 27, 1912.

According to the report the actual operation of the system was attended with certain difficulties at the beginning. A number of interruptions were caused due to changes in the adjustments of the line cables and ground wires, particularly during the winter months when it was difficult to readjust the cables satisfactorily. This trouble was confined to two sections of the line, but since these have been carefully gone over the interruptions of the high-tension lines resulting from windstorms have ceased, and very little trouble is anticipated from these causes in future.

It is also interesting to note that out of the 120,000 high-voltage insulator sections on the line not one has been broken from electrical causes since the beginning of operation, although a few sections were broken during the first few months by rifle bullets.

Because of the proximity of the telephone wires to the high-tension transmission cables large currents are induced in the telephone wires whenever a change occurs in the electrical conditions on the transmission circuits. The telephone apparatus would be frequently destroyed if some provision were not made to lead these heavy circuits to the ground. Difficulty was first experienced with the burning out of the fuses in series with the telephone instruments and the fusing of the heat coils which were later tried. The failure of these protecting fuses always occurred at times when the telephone circuits were most needed and frequently necessitated the employment of the Bell service to conduct the ordinary switching operations at the various stations.

Another difficulty which was also encountered at this time was the fouling of the lightning arrester gaps, which were composed of two blocks of carbon separated by thin strips of mica. The discharges across the arrester gaps were sufficient to dislodge particles of carbon from the blocks and bridge across the air gap. The result was either a ground on one side of the line or a complete short-circuit. Small vacuum-type arresters were then tried, but it was found that the induced currents were so heavy that the arresters would soon deteriorate and become useless. Bleeding coils submitted by one or two telephone manufacturers

were also found inadequate. Finally, one of the commission's engineers designed an entirely new protective equipment which has been found very satisfactory in handling these large circuits.

In addition to the ordinary relays provided at each of the stations for opening the circuit-breakers when overloads or any similar troubles occur, use is made of special sets of line relays designed to cut out faulty sections of the high-tension lines automatically without interfering with the energy supplied to any of the other stations. The use of a relay system of this type is made possible through the loop scheme of distribution which is employed throughout the transmission system between Niagara Falls, Toronto and London. The western portion of the system embraces a loop starting at Dundas and extending to London, via Woodstock, and back to Dundas through the municipalities of St. Mary's, Stratford, Berlin, Preston and Guelph. Thus, Guelph may be supplied with energy around the loop from London instead of from Dundas directly, in case the Dundas-Guelph section of line is out of service. Line switches have been provided at each of the above-mentioned stations which make it possible to cut out of the circuit any section of line between two stations by opening the proper switches at those stations.

The line protective relays are employed to open the two switches at either end of any section out of service, as just described. The operation is accomplished as follows:

The small copper conductors are carried on the telephone poles parallel to the high-tension lines and provide an electric circuit between adjacent stations and connected to the low-tension windings of series transformers which are carried back on the lower ends of the high-tension oil-circuit-breaker bushings.

The low-tension windings at each end of any section are connected in series with each other and force a current through the relay wires proportional in value to the current in the high-tension line conductors, so long as the high-tension line is in normal operating condition. Should a fault occur on the high-tension line the current which flows in at one end of the high-tension line section will be different from that which emerges from the other. The difference will result in different current values in the low-tension windings of the series transformer at either end of the line and naturally disturb the current in the relay wires. The series transformers are provided with a tertiary set of windings, which are connected to the trip coils of the respective oil circuit-breakers. The different current values in the secondary windings of the series transformers tend to produce a potential in the tertiary windings sufficient to produce current in the trip coils and thereby open the circuit-breakers. This operation is accomplished at both ends of the line section simultaneously, and the section is instantly cut out and rendered harmless.

In view of the interest being manifested at the present time in the proposed hydroelectric system for the State of New York, the omission from the report of records of the finances involved in the operation of the Ontario system is noteworthy. The report contains many data as to the cost of the electrical equipment in various localities, but presents no facts as to the cost of operating the system or the revenue derived therefrom.

### New England Power Album

The New England Power Company, the Connecticut River Power Company and the Connecticut River Transmission Company, a group of hydroelectric systems under the management of Chace & Harriman, Inc., of Boston, Mass. have issued a handsome 10-in. x 16-in. album describing the extensive developments of this group of properties in the Connecticut and Deerfield River valleys. The album contains a bird's-eye view in colors of the generating plants,

reservoir and dam installations, transmission lines and principal cities and towns of the companies' territories, a map of the combined high-tension system, a printed description of the present and proposed developments, and about a score of photographic reproductions of the more important engineering features of the enterprise, which were fully described in the Dec. 28, 1912, issue of this paper. The ultimate yearly output of the system through the interconnected operation of its completed plants is estimated at 300,000,000 kw-hr.

## The Production and Distribution of Energy

In his address before the Franklin Institute, Philadelphia, March 19, Mr. Samuel Insull, president of the Commonwealth Edison Company, Chicago, presented carefully considered data and arguments to show that the electrical demands of scattered communities and their related agricultural and industrial regions can be served most economically and to the best advantage of all parties from a unified interconnected transmission network. Furthermore, he demonstrated that the lighting and motor service of the towns, water-works pumping, ice-making, interurban electric railway operation, farm applications, drainage pumping, and mine working—to say nothing of the future electrification of trunk-line railroads—offer loads for the countryside distribution system rivaling in diversity, load-factor and magnitude some of the most favorable conditions enjoyed by the great urban central-station systems.

Commenting first on the advantages of interconnected operation for service to towns, Mr. Insull cited data on the Lake County district where a number of individual stations were replaced by unified service, effecting a decrease in production costs from 7.08 cents per kw-hr. to 2.87 cents per kw-hr., a saving of 4.21 cents per unit. During the conversion to combination supply the region underwent a growth in population from 39,000 to 100,000 inhabitants, meanwhile increasing, however, its energy consumption per capita from 40 kw-hr. to 85 kw-hr. Although the connected load increased from 1438 kw to 3537 kw, the peak rose only from 415 kw to 765 kw, while the load-factor improved from 14.6 per cent to 28.9 per cent. The average price of energy was incidentally decreased from 9.4 cents to 7.7 cents per kw-hr.

### OFF-PEAK USES FOR ENERGY

Interurban railways can profitably purchase their energy supply from the local central-station system. Load curves exhibited by Mr. Insull showed the character of such railway power demands. Water pumping affords another long-hour utilization, with optional interruption during peak periods. Somewhat similar load conditions prevail with electrically operated ice factories, which present, in addition, a desirable annual load curve with reduced winter-month demands. The 1635 hp of motors installed in the electrically operated Chicago ice plants have an average load-factor of 42.7 per cent. Electric pumping for the drainage of farm lands also offers an off-peak use, of the order of 23.2 kw-hr. per acre.

In the State of Illinois the electrification of coal mines presents another great central-station opportunity. Mines already electrified show a consumption of about 1.63 kw-hr. per ton of coal produced, and at least 50,000,000 tons are now mined annually in the State. While the load factors of individual mines may not rise above 20 per cent, their element of diversity gives combined a load-factor of about 25 per cent. As the miners quit work at 4 p. m., this service is essentially off-peak in character.

For conservatism, Mr. Insull based his farm figures on a use of only 2.5 kw per acre of land, although he declared his belief that average farm consumption would reach more nearly 5 kw per acre. The load-factor for this service is estimated at 35 per cent, based on existing installations.

### FACTORS OF COMBINED SYSTEM

Combining the various loads above enumerated, curves were shown illustrating their diversity of demand with respect to both the hours of the day and the months of the year. A diversity factor of at least 35 per cent is thus made available between the primary generation and transmission system and the customer's service. The load-factor of such a system would be 48.7 per cent.

Touching on the future possibility of trunk-line electrification of steam railroads, the speaker referred to the economic value of obtaining energy for such use from power lines already gridironing the countryside, although he predicted that railroad electrification in the Middle West will follow after both terminal electrification of city stations and yards and trunk-line equipment in the more densely populated Eastern States. But railroad loads would affect only slightly the results otherwise obtained by combining the country demands, except to increase the diversity.

### SAVING IN INVESTMENT AND OPERATION

A survey of central-station plants in small Illinois towns has shown that the equipment reserves carried range from 15 to 82 per cent. Even despite the latter expensive provision, the reliability of such small-town service is always questionable.

Although the maximum demands of the various uses above described total 305,000 kw, the simultaneous maximum load on a unified system reaching these customers would be but 225,000 kw. Such a system would show a load-factor of about 48.7 per cent.

Replacing the 437,530 kw in small-plant capacity necessary to furnish the indicated service, with a unified system (allowing 20 per cent capacity reserve above the 225,000 kw of maximum demand), a saving is shown as follows: 437,530 kw in small plants, at \$100 per kw, \$43,753,000; 270,000 kw, unified, at \$75 per kw, \$20,250,000; making a saving in investment of \$23,503,000.

In addition to this tremendous saving in plant investment, there will be similar economies in operation, although it would be difficult to give a fair estimate of these without assuming special conditions, for under conditions of individual-plant operation it is hardly conceivable that there could be obtained, either at all or on anything approaching a similar scale, such applications of electric service as unified operation makes possible.

### CENTRALIZED PRODUCTION ALWAYS MOST ECONOMIC

This fact alone presents one of the strongest arguments that the central-station business can be successfully run only as a monopoly. A study of central-station economics similarly offers the best evidence against the municipalization of power plants and systems. The investment of taxpayers' money in relatively small electrical undertakings, whether in small towns or great cities, declared Mr. Insull, is waste of the worst kind. Whatever use is ultimately made of the energy, it can always be produced most economically under unified conditions, a conclusion reached by study of the conditions of both urban and rural service.

Mr. Insull predicted the day when every corner of the country where density of population justifies it will receive its general central-station supply for small towns and farming districts. Under certain conditions, he declared, it might be more economical to transmit energy direct from cities from mine-mouth generating plants than to haul coal.

In concluding his remarks with an eloquent appreciation of the central-station man, representing the public, Mr. Insull declared that he felt that the history of the world in the present era of electrical development has made him amend his former statement which he had made in 1906, which, abridging distance, have conferred the greatest benefit on mankind, the printing press alone excepted, "those which enable us to carry energy for the use of remote towns and country districts."



## Report on Connecticut River Hydroelectric Development

In a report to the Massachusetts Legislature the Connecticut Valley Waterways Board recommends the construction of a channel 12 ft. deep, with corresponding locks, between Hartford, Conn., and Holyoke, Mass., and the establishment of extensive hydroelectric developments for the benefit of the cities and towns of the central Connecticut Valley. The report favors the charging of a federal rental from any corporation authorized to develop commercial power from the river at any point between its mouth and the Holyoke dam, thus indorsing the principle most strongly opposed as a violation of state's rights in the recent Congressional debates on the Windsor Locks bill.

The report includes broad recommendations for the study of the power and navigation possibilities of the river by commissions representing the State; for State appropriations to be used with those of Congress in making the most of these possibilities, and for co-operation with New Hampshire and Vermont to conserve the headwaters. An important recommendation is that in case any corporation authorized by Congress to develop power at Windsor Locks, Conn., should fail to carry out its task, the work may be undertaken by the States of Massachusetts and Connecticut, after an investigation and report by the Massachusetts Harbor & Land Commission acting jointly with representatives of the State of Connecticut.

## Investigation Into Sale of Energy from Roosevelt Dam

In the report of its investigation of the Salt and Gila Rivers in Arizona and the related Indian reservations and work of the Reclamation Service, the House committee on expenditures (Hon. James M. Graham, Illinois, chairman) submitted some pointed criticism of the water-power negotiations entered into by the Reclamation Service with the Pacific Gas & Electric Company of Phoenix, Ariz. The report is based upon an investigation by the sub-committee, made up of Messrs. Walter S. Hensley, of Missouri, chairman; Oscar Callaway, of Texas, and Louis B. Hanna, of North Dakota, who visited Phoenix in April and May, 1912, to make a first-hand investigation of conditions.

The Indian interests, the report declares, have been outrageously intermingled with the affairs of the Reclamation Service; consequently the appropriations and uses of waters of the Salt and Gila Rivers appropriately formed the bases of the present investigation. Suspicion is directed by the committee against the business transactions between the Reclamation Service in Arizona and the Pacific Gas & Electric Company of Phoenix, the local utility corporation.

Although it was originally declared that electricity from the Roosevelt Dam would make Phoenix "the power city of the world," the various local commercial bodies waited until April, 1908, for some basis of fulfilment upon which to boom their community as a manufacturing center. About this time they received an intimation that negotiations were in progress between the Reclamation Service and the local corporation. On appealing to the Secretary of the Interior, it was found, however, that a contract had already been entered into on June 22, 1907, almost a year before. By the contract, Mr. Lewis C. Hill, for the Reclamation Service, agrees to furnish electrical energy from the Roosevelt Dam to the Pacific Gas & Electric Company at Phoenix for a term of ten years, during which period the government will refrain from retailing power to anyone in Phoenix and from furnishing power to others who would again sell or retail it. The corporation thus received a monopoly of the Roosevelt Dam power in Phoenix, excepting that factories might be permitted to purchase for their own use blocks of 100 kw to 500 kw or more. At the

time this contract was entered into, it is also declared, a brother of the local manager of the electric corporation was engineer for the Reclamation Service in charge of the electrical development at the Roosevelt Dam. Protests were made to President Roosevelt and Secretary Garfield by many local organizations, including the Arizona Legislature, but no replies were received for a year.

The Pacific Gas & Electric Company by the terms of its contract paid 1.5 cents per kw-hr. for its energy and retailed it to domestic users at 20 cents per kw-hr. After many protests this price was reduced to 15 cents and finally to 12 cents. The company, however, capitalized its exclusive contract at \$515,000.

Among other expedients to reduce electric rates in Phoenix a movement for a municipal lighting plant was started, which, although receiving the necessary two-thirds vote, was finally defeated by the failure of the enabling act required from Congress. Among the purchasers of electrical energy from the local company is the government Indian school, which has a monthly electric bill of from \$300 to \$500.

Mr. Hill testified before the committee that the predecessor of the Pacific Gas & Electric Company, the Phoenix Light & Fuel Company, had a contract with the Arizona Canal Company by the terms of which it was entitled to a monopoly of the water-power sites below the Arizona Dam. He further stated that he gave the contract objected to in exchange for this alleged right of the Phoenix Light & Fuel Company.

The report declares, however, that the Arizona Dam had been washed out and that the Arizona Canal Company was in bankruptcy, having had a foreclosure proceeding instituted against it. Experts who had examined the proposed power projects given to the Phoenix Company had, it is said, declared them worthless. The committee also insists that Mr. Hill and his associates persisted in overlooking the act of Congress authorizing the generation of power, in which it is provided that municipalities shall be given preference in the purchase of such energy. The majority report of the committee expresses the belief that action should be taken by the officials of the government, either through the courts or otherwise, looking to the setting aside of this illegal contract and that the Department of Justice should institute such criminal proceedings as the facts warrant.

In the minority report filed by Messrs. F. E. Mondell, of Wyoming, and Charles H. Burke, of South Dakota, the opinion is expressed that if a general investigation of the Reclamation Service be necessary, it should be undertaken by a commission familiar with irrigation laws and practice, and with conditions in the West. The minority report also points out that the apportionment of charges under all reclamation projects is a matter of discretion with the Secretary of the Interior. The report, No. 1506, was submitted Feb. 11, 1913, and has been printed in full.

## Increase in Electric Trucks in Chicago

On the first day of the present year 523 electric trucks were in service in Chicago, or on order. In the following seventy days of 1913, ending with the middle of March, eighty additional trucks were placed in service, bringing the total number up to 603. On the first of January of the preceding year, 1912, it is estimated that not over 270 trucks were in use in the Western metropolis, indicating that during last year the total number of commercial cars was increased by about 100 per cent.

Local interest in the rapid growth of the electric-truck and delivery-wagon service has been stimulated by the "electro-truckometer," a humorous little scale device for recording the number of trucks in service, improvised by Mr. D. C. Arlington, Chicago representative of the Phila-



delphia Storage Battery Company and statistician of the Chicago Section of the Electric Vehicle Association of America. On a graduated scale like a thermometer card a blank column is left for marking in the increase in vehicles until a total of 1000 shall have been reached.

### B. J. Arnold on the Chicago Traction Situation

In response to a request for the co-operation of the Board of Supervising Engineers, Chicago Traction, Mr. Bion J. Arnold, chairman of the board and its representative, appeared on March 7 before the sub-committee of the local transportation committee of the City Council of Chicago. This sub-committee is endeavoring, with the aid of the corporation counsel, to frame a tentative ordinance providing for the merger of all the surface and elevated-railway companies in Chicago. Mr. Arnold gave the sub-committee, in writing, some of the opinions and conclusions at which he has arrived as the result of his experience in administering the famous traction settlement ordinances of 1907, as it is probable that these ordinances, now in operation nearly six years, will be taken as the basis of the new ordinance providing for the merger. These ordinances, drawn up largely by Mr. Walter L. Fisher, consulting with Mr. Arnold, marked a departure in contract ordinances with public-utility corporations, and Mr. Arnold's analysis of them, after his intimate experience with their actual operation, is of great value.

Mr. Arnold makes it clear that he has no personal interest, or, rather, no selfish interest, in the matter. He makes the following interesting statement as to his own compensation: "So far as my own compensation, which was fixed in the ordinance [\$15,000 a year as chairman of the board and \$15,000 a year additional while chief engineer], is concerned, it will perhaps be sufficient to state that my income was for several years prior to my connection with the board, and when I was able to give my entire time to my professional work, over four times the total compensation which I now receive from the board. My only reason for retaining a connection with the board for some time past has been the fact that I felt a moral obligation to the public and the railway companies represented by the board to hold the position long enough to be instrumental in firmly establishing the principles of the ordinances, for it should not be forgotten that, by the terms of the ordinances, I do not directly represent either the city or the companies, but act as an arbitrator between them. I believe that it was the intention of those who wrote my name into the ordinances that I should see that equity was done for both sides, which responsibility I firmly believe I have faithfully discharged up to date."

During its six years of existence the Board of Supervising Engineers, created by the 1907 ordinances, has supervised the expenditure of over \$80,000,000 for the rehabilitation of the surface street-railway properties. The city has received about \$10,250,000 as its share of the net profits of operation during this period. The companies have received an average of 7.4 per cent on their investment, while the city's 55 per cent of the "net divisible receipts" has amounted to 7 per cent of the companies' gross receipts. The supervision of the entire work has been done by the board at an expenditure of about 1.6 per cent of the cost of the work constructed.

Mr. Arnold goes through the ordinance section by section and comments on it as a basis for the proposed merger. He recommends that in the future span wires be attached to buildings, where practicable, doing away with poles. Not less than 16 per cent of the gross receipts should be devoted to maintenance and renewals. The chairman of the board goes into the financial aspects of the discussion at considerable length. In the distribution of income he is inclined to favor the establishment of a contingent reserve

fund for "lean" years or emergencies. This fund might take care of the amount to be set aside for amortization in poor years. As to guaranteed rate of return, it is questionable whether this should be raised from the 5 per cent specified in the present ordinances to the 7 per cent asked by the companies seeking to merge. The board of control, whatever its name, should be non-political. On this point Mr. Arnold says: "The independence of the balance of power of this board from local politics and from traction influence is the crux of the entire traction situation."

### Effects of Recent Sleet Storm Near Chicago

Further reports in relation to the effects of the severe sleet storm of Feb. 21 (see *Electrical World* of March 1, page 437), are of some interest. The greatest severity of the storm, so far as overhead electric wires were concerned, was experienced in northern Illinois. The Public Service Company of Northern Illinois, which operates in the northeastern part of that State, was considerably hampered by the breaking down of wires. This was due not so much to the failure of poles, for the company's records show that only nine poles went down, as to the breaking down of the limbs of trees. The ice-laden branches fell on the wires, short-circuiting the latter and burning them off, or else



FIG. 1.—TELEPHONE WIRE COATED WITH 1 1/2 IN. OF ICE

breaking down the wires entirely by the weight imposed upon them.

Of the nine poles of the Public Service Company that went down, eight were near Crystal Lake and one in Oak Park. Considerable trouble was experienced by the lack of communication between the different parts of this extended electric-service system, owing to the failure, or partial failure, of telephone and telegraph service. Thus, a 20,000-volt circuit leading into a temporary substation at Crystal Lake was shut down to repair ice damage at the substation. The trouble was remedied in twenty minutes, but when an effort was made to telephone an emergency substation to have the high-tension circuit put into service the telephone wires were found to be useless and there was no way of resuming service until a man could get over by train, several hours later. The effects of the storm as experienced by this company were most severe in Oak Park and Joliet, Ill.

The Chicago Telephone Company and the Central Illinois Telephone Company, which are operated conjointly, experienced severe loss from the storm. They report that trouble was experienced on Feb. 21 and 22 in the northern part of the State of Illinois from Wisconsin line as far south as La Salle. The two companies lost about 2500 poles. In a few cases there was as much as 2 in. of ice on wires, but this was exceptional. A view is shown of a telephone wire surrounded by a coating of ice about 1 1/2 in. thick as shown by the tape-line measurement. It was not only the weight

of the ice that caused the damage; the velocity of the wind was responsible for it to an equal if not a greater extent. Local damage to telephone circuits was particularly noticeable in Aurora and Elgin; there was not a great deal in the city of Chicago. Farm lines in particular suffered injury. Emergency service was established by rigging jury lines on the stumps of broken poles or else by laying emergency cables.

Men for the repair gangs were obtained from various places throughout the State. Few new men were hired, but the construction forces of the companies were concentrated at the places where their services were so urgently needed. The repair gangs are entitled to great credit for cheerful and effective work under discouraging conditions. Mr. L. C. Jones, plant superintendent for the suburban division of the Chicago Telephone Company, and Mr. H. B. Lewis, plant superintendent for the Central Union Telephone Company, were in charge of the work of rehabilitation. Service to practically all points in the territories of the two companies had been resumed by the morning of Feb. 25.

In Elgin, Ill., owing to the storm troubles of the Aurora, Elgin & Chicago Railroad Company, which supplies electrical energy in that city, there was no outside source of electricity available to operate the exchange of the Chicago Telephone Company. An alarm was sent out and there was shipped from the Chicago office, 38 miles away, the emergency electric generating outfit kept for such service.

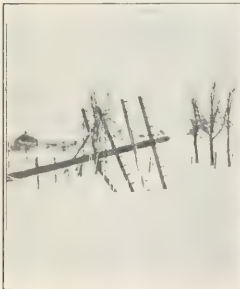


FIG. 2—CHICAGO-MINNEAPOLIS TELEPHONE LINE NEAR M'HENRY, ILL.



FIG. 3—ONE TELEPHONE POLE THAT STOOD WHEN ADJOINING POLES FELL

This set consists of a 5-hp gasoline engine directly connected to a dynamo rated at 50 amp and 30 volts. The unit is mounted on a wheeled truck and weighs about 2500 lb. It was shipped to Elgin and on arrival there connected to the power board of the exchange in time to supply the electrical energy for battery charging and other purposes.

Informal reports from the American Telephone & Telegraph Company show that the storm was localized within a radius of about 100 miles from Chicago, principally west and north, although comparatively slight damage was reported from a small area in Michigan south of Grand Rapids. In this region the long-distance company lost about 1200 poles and nearly all its lines were affected. As is well known, the standard of its overhead construction is very high. Service was recovered by the use of emergency cables principally, and it was restored practically to all points by the night of Feb. 23. Engineers for this company estimated the velocity of the wind as from 45 to 50 miles an hour. Experiments are being made by this company with concrete poles, but even if the poles were made so strong that they would not break down under a sleet storm the wires would probably be stripped off the poles. There seems to be no practicable way of obviating occasional damage to overhead wires from sleet storms except by going to the very great expense of burying the wires.

## Annual Report of the American Telephone & Telegraph Company

The annual report of the American Telephone & Telegraph Company for the year ended Dec. 31, 1912, was made public this week. As in former years, it contains, in addition to statistics showing financial and physical growth, a comprehensive review of the company's attitude on the questions of public policy and public service regulation. It also discusses in considerable detail the relations of the company with state boards and the Interstate Commerce Commission.

Attention is called in the report to the progress made

TABLE I—BELL TELEPHONE FISCAL STATEMENT

	1912	1911	Increase
Gross earnings	\$199,172,154	\$179,477,998	\$19,694,156
Expenses: operation	\$65,246,677	\$60,085,425	\$5,161,252
Current maintenance	31,252,636	30,184,522	1,578,114
Depreciation	34,942,802	28,655,832	6,286,970
Taxes	10,333,349	8,965,922	1,367,427
Total expenses	\$142,285,464	\$127,891,701	\$14,393,763
Net earnings	\$56,886,690	\$51,586,297	\$5,300,393
Interest	14,205,365	13,610,860	594,505
Balance net profits	\$42,681,325	\$37,975,437	\$4,705,888
Dividends paid	29,460,215	25,966,876	3,493,339
Surplus earnings	\$13,221,110	\$12,008,561	\$1,212,549

during the year in the field of telephone engineering, to the many welfare plans which the company has put into effect for the benefit of its employees, and to the satisfactory status of the individual companies, the American Telephone & Telegraph Company, the Western Union Telegraph Company and the Western Electric Company.

The statement of earnings and expenses for the Bell system in the United States for the year 1912 compares with that for 1911 as shown in Table I herewith. The statement shows a gain in gross earnings of nearly \$20,000,000 over those in 1911 and an increase in total expenses of

TABLE II—COMBINED BALANCE SHEET, BELL SYSTEM, DEC. 31, 1912-1911

	1912	1911	Increase
<b>Assets:</b>			
Contracts and licenses		\$2,943,381	\$2,943,381*
Telephone plant	\$742,287,631	666,660,702	75,626,929
Supplies, tools, etc.	21,601,262	20,749,568	2,851,694
Receivables	37,700,623	32,916,127	4,784,496
Cash	35,729,037	41,878,140	6,149,103*
Stocks and bonds	84,942,265	66,777,231	18,165,034
Total	\$924,260,818	\$831,925,149	\$92,335,669
<b>Liabilities:</b>			
Capital stock	\$393,209,925	\$379,727,832	\$13,482,093
Funded debts	294,380,353	241,032,822	53,347,531
Bills payable	38,268,341	41,198,431	2,930,090*
Accounts payable	25,320,335	23,382,438	1,937,897
Total outstanding obligations	\$751,178,954	\$685,341,523	\$65,837,431
Employees' benefit fund	8,845,000		8,845,000
Surplus and reserves	164,236,864	146,583,626	17,653,238
Total	\$924,260,818	\$831,925,149	\$92,335,669

\*Decrease.

\$14,393,763, reducing the increase in net earnings to \$5,300,393.

The net earnings of the American Telephone & Telegraph Company, as an individual corporation, were \$37,907,644, which is an increase of \$4,606,398 over those in 1911. The interest charges were \$5,844,698 and the dividends, at the regular rate of 8 per cent, were \$26,015,587, leaving a balance of \$6,047,357. At the close of the year the outstanding capital stock was \$334,805,700 and the bonds were \$105,002,000. For the capital stock outstanding

there has been paid into the company's treasury, \$356,732,213, or nearly \$22,000,000 more than the par value of the stock. With all duplications excluded, the combined balance sheet as of Dec. 31, 1912, compares with that as of the same day in 1911 as shown in Table II.

A very careful appraisal conducted by the engineers of the physical property of the Bell system as of August 1 last showed that while the book cost was \$736,000,000, the cost of reproduction at that date would have been \$797,000,000. In other words, the company was carrying the property on its books at \$61,000,000 below its actual physical value at the time of its appraisal. In this appraisal there were included no intangible assets whatever, such as good will, patents, franchises, cost of developing the business, etc. For the year, as above, there was an increase in assets of \$92,300,000, of which \$75,600,000 represented current additions to the plant, including the necessary real estate. During the five-year period between 1907 and 1912 the assets of the Bell companies have increased \$311,000,000 while the capital obligations outstanding have increased only a little over \$199,000,000. The surplus and reserves have increased from \$61,300,000 to \$164,200,000, or nearly \$103,000,000, even after setting aside \$8,845,000 for the benefit fund recently created for the employees.

Estimates of the construction requirements of all the operating companies and of the American Telephone & Telegraph Company for 1913 call for a total expenditure of about \$62,000,000.

The steady decrease in revenue and increase in operating expenses per subscriber's station—a conspicuous feature in former years, referred to in previous reports—was checked in 1912, and slight gains over 1911 were shown.

A comparison of figures of revenue and expense per subscriber from 1895 to 1912 shows a decrease in that period of over one-half in the average cost to the subscriber for the service and of nearly that amount in the maintenance and depreciation as well as other expenses, leaving a net revenue per station of \$9.29 in 1912 as against \$23.52 in 1895. Average net profits on the investment have been but slightly affected, however, as the plant cost per station has decreased almost one-half.

Statistics given in the report show that at the end of the year the number of stations which constituted the Bell system in the United States was 7,456,074, an increase of 823,449, including 344,173 connecting stations. Of these, 2,502,627 were operated by local, co-operative and rural independent companies or associations having sub-license or connection contracts, so-called connecting companies.

The Bell telephone toll lines of the United States now reach 70,000 places, from many of which a telegraph message can be sent. The extent of the system is best realized by comparison with less than 65,000 post offices, 60,000 railroad stations and regular telegraph offices at about 25,000 places.

Including the traffic over the long-distance lines, but not including that of the connecting companies, the daily average of toll connections in 1912 was about 738,000 and of exchange connections about 25,572,000. This compares with 645,000 and 23,484,000 in 1911.

Other statistics in the report show that while Europe has three and a half times the telegraph traffic of the United States and nearly twice the first-class mail traffic, it has only two-fifths of the telephone traffic, which is attributed to the greater efficiency and distribution of the telephone service in this country.

Speaking of the distribution of the capital stock, the report says that scarcely any corporation in the United States has its capital stock more widely distributed than has the American Telephone & Telegraph Company. A majority of the shares are held by women and less than 7 per cent, the report says, is held in the name of brokerage houses. The average number of shares held by each stockholder at the close of 1912 was shown to be 66.

The report describes the new plan announced Jan. 1 last for employees' pensions, disability benefits and insurance, adopted by the American Telephone & Telegraph Company, by its associated companies, by the Western Union Telegraph Company and by the Western Electric Company. For the purpose of inaugurating these benefits the American Telephone & Telegraph Company made an initial appropriation of \$2,000,000. There are about 200,000 employees—men and women—in the service of the companies concerned who will be directly or indirectly affected by this provision. The plan has been elaborately worked out and will, it is believed, result in the increased happiness and betterment of employees and prove a factor in obtaining and keeping those of high class.

As regards the engineering accomplishments of the year, after discussing many improvements which have been developed recently, standardized and placed in the plant equipment and service of the associated companies, President Vail says:

"Experience with the engineering devices and methods employed in the New York-Denver line having demonstrated their value under severe practical conditions, a systematic introduction of these improvements was undertaken and actively prosecuted throughout the United States, so that at the end of 1912 there was a total of 54,750 miles of the heaviest-gage wires equipped with the new arrangement, thus doubling their transmission efficiency, and in addition to this there were obtained, without any expenditure for new wires, phantom circuits equivalent to 12,600 miles of the heaviest gage circuit. These improvements have brought into communication with each other places formerly too remote, and between a great number of places less remote noteworthy improvements in the telephone service have been reported.

"Engineering plans have been completed for the extension of four heavy copper wires from Denver to San Francisco, and construction work is to commence as soon as the weather permits."

The report speaks of the fact that there are now in thirty-three states public service and other commissions which supervise the telephone service, and points out that this supervision is entirely distinct from that of the Interstate Commerce Commission.

It also contains a letter under date of Jan. 7, 1913, from the Attorney-General of the United States to the chairman of the Interstate Commerce Commission discussing at length the activities of the company and also the order made by the Interstate Commerce Commission as of Jan. 13 last directing that a thorough investigation be made "concerning the history, the financial operations, the rates, rules, regulations and practices of telephone and telegraph companies subject to the act to regulate commerce, with a view to the making of a comprehensive report and to the issuance of such order or orders as may be necessary to correct such discriminations and make applicable reasonable rates and practices."

The policy of the company, the report goes on to say, as in the past, will be to co-operate with the examiners conducting this investigation and to aid public officials in every possible way in their effort to ascertain the facts respecting the telephone service of the United States.

President Vail, in conclusion, makes this statement: "As to the future of the company, it was never brighter. Business indications are normal, and our relations with the public and with the public authorities are on a mutually satisfactory basis.

"The organization on the line set forth in previous reports is about complete, and the division of the work is so clearly drawn and so closely correlated between the local administration of the associated companies and the central general administration of the American Telephone & Telegraph Company that there is no duplication of effort or conflict in administration."



### The Electric Vehicle at Boston

At the joint meeting of the Electric Motor Car Club of Boston and the New England Section of the Electric Vehicle Association of America held at Boston March 17 nearly 100 persons were present. There are now 104 members of the former club, and at the meeting it was voted to extend the radius of membership to points within 50 miles of Boston, which will enable electric-vehicle men at Worcester, Providence, Lowell, Haverhill, Malden and other important centers to take a more active part in the campaign. Hitherto the radius of membership has been about 5 miles, and while many of the central-station organizations outside Boston have from time to time been invited to the club meetings, their active influence has not been available.

The Boston Edison Company's interest in the work is as strong as ever, and the company is furnishing office space at 39 Boylston Street for the secretary of the club, Mr. O. G. Draper, who is now engaged in a vigorous campaign to concentrate the advertising of the electric-vehicle interests in forthcoming issues of representative Boston dailies. Mr. Draper announced that an inquiry from Durham, N. H., had resulted from the club's publicity work in the Boston press.

At the joint meeting which followed the usual dinner of the club Mr. Draper was elected permanent secretary of the New England Section also. Chairman Fred M. Kimball then called upon Mr. J. W. Cooke, of the Electric Storage Battery Company, Boston; Mr. H. H. Smith, of the Edison Storage Battery Company, Orange, N. J., and Mr. R. E. Russell, General Electric Company, Lynn, Mass., who presented lantern-slide talks on subjects of storage-battery operation and charging equipment.

The battery talk by Mr. Cooke reviewed the latest practice in the operation of lead batteries and included stereotypical views of a miniature cell group under charge and discharge conditions, an analysis of voltage and specific-gravity curves and experiments with a 120-amp-hr. cell, including short-circuit tests, temperature readings and output data. The point was made that the pasted types of plates now used in electric-vehicle service have twice as much capacity per unit of space as the former non-pasted type, besides recuperative powers of great value for trucks and pleasure cars. A momentary output of 1 hp for a 20-lb. cell was easily obtained in the test. Mr. Cooke showed that an iron-clad "Exide" battery of forty-two cells, with a total weight of 1500 lb., has a momentary discharge output of 75 hp without appreciable temperature rise. This point effectually disposes of the idea sometimes held that the storage battery is unequal to the requirements of motive power.

The present tendency is toward both discharge and charge at higher rates. A new electric locomotive to be built for the Boston Edison Electric Illuminating Company's use will have a momentary output of 150 hp, or ten times the normal rate of discharge. Emphasis was also laid upon the ability of modern batteries to receive noon "boosting charges" at high rates, a point of great value in industrial truck service. A good empirical rule is to begin charging at the quotient of the number of ampere-hours taken out of the battery divided by the sum of unity and the number of hours available for the boost.

Reliability features of batteries for operating self-starters for gasoline automobiles were also discussed. Mr. D. C. Tiffany, of the Rauch & Lang Company, Boston, cited the case of such a battery which shows no sign of wear after a year's use.

In discussing the Edison battery Mr. Smith outlined its characteristics and emphasized the rapid growth in its use evidenced by the present fourfold expansion of the factory. He cited various experiences with the battery in service resulting from the ignorance of certain users, one of whom

poured acid into a cell in place of the usual alkaline electrolyte. Excellent service can be obtained from Edison cells in even the coldest weather, he said, provided the battery is protected against air circulation.

### Insulation Problems at High Potentials

At the 281st meeting of the American Institute of Electrical Engineers, held at New York, March 14, under the auspices of the electrophysics committee of the Institute, papers were presented on the topics of "Air as an Insulator When in the Presence of Insulating Bodies of Higher Specific Inductive Capacity," by Messrs. C. L. Fortescue and S. W. Farnsworth, and "The Application of a Theorem of Electrostatics to Insulation Problems," by Mr. C. L. Fortescue. Following the technical session a smoker was held in the Institute rooms.

#### AIR AS AN INSULATOR

In purpose, the paper by Messrs. Fortescue and Farnsworth pointed out conditions determining the disruptive strength of an air path along the surface of a solid dielectric of higher specific inductive capacity. This "creepage" breakdown is even less definite than the disruptive voltage of air alone, but the authors described methods by which the air and solid insulators can be used in combination to the best advantage. By means of an exploring electrode the shape of such fields may be plotted. The higher the specific inductive capacity of the material, the more detrimental will be any projection above the surface of the insulator. A groove in the insulating material will also introduce other unfavorable conditions. If, however, the dielectric surface be formed tangential to the lines of force at every point, the strength of the air path will be unchanged.

Practical examples were then given applying this theory to the case of a terminal rod passing through a casing. Curves presented showed the intensity at various points along the path. New designs of terminals have resulted from the application of the principle. For instance, by a very inexpensive change involving only the addition of a disk covered with tinfoil a certain terminal which could previously withstand only 300,000 volts had its strength increased to 575,000 volts without visible corona. This was accomplished by relieving stresses in the air at the top of the terminal and redirecting the field so that equipotential surfaces in the air were evenly distributed.

Based on the conception above outlined, commercial tests have shown that air can now be used as an insulator more efficiently than in the past. Breakdowns of an air path over a surface averaging as high as 9.4 kilovolts per cm or 23,900 volts per in. have been obtained over distances of 6.7 in. The conditions of design are such that these averages may be maintained at any voltage by increasing all dimensions of the structure proportionately. A maximum efficiency of air path will result from conformance of the dielectric surface to the flow-line between terminals. The strength of such a path is independent of the specific inductive capacity of the dielectric. By proper shaping of the terminals points of high intensity can be avoided, obtaining, instead, a high average intensity for the whole path.

#### AN ELECTROSTATIC THEOREM AND INSULATION PROBLEMS

If a region in any particular electric field be isolated or cut out by any number of closed surfaces, then the electric field in this region will remain unchanged, whatever change may take place in the external field, if the potentials of all points on the inclosing surfaces are maintained at their original value. By employing this principle of electrostatics, various conductors, as Mr. Fortescue showed in the second paper, can be arranged to help in insulating one another. Also, two or more regions separated from one another by any number of surfaces may each have a differ-

ent electric field if at every point of the dividing surfaces the fields in these regions have the same potential.

In practical applications of this principle, however, the means for producing uniform surface distribution are limited both by the finite number of steps to be employed and the necessary use of finite strips of metal. Core-type transformers can be insulated in this way. One such transformer so assembled was tested up to ten-second applications of a potential 573,000 volts above ground. With some changes the same system can be adapted to the needs of polyphase transformers and to shell-type transformers. Designs were also shown for various types of terminals, insulators, suspension disks, etc., employing the principle already outlined. From a comparative test of terminals of the improved type using both large and small disks, it was shown that whereas with the small disks 420,000 volts endangered the terminal, the large 5-ft. disk, 1 ft. thick and with semi-circular edges, exhibited no signs of corona up to 573,000 volts. The well-known guard-ring, as the paper pointed out, is another application of the same principle by which a given electric field may be maintained constant within an inclosed region, independently of the influence of other bodies. The principle, in fact, is one capable of wide application and seems to afford a solution of some of the most perplexing problems of high-potential design.

#### Discussion

Presiding as chairman of the electrophysics committee, Dr. J. B. Whitehead in opening the discussion commented on the close relation between electrical theory and practical engineering as exemplified in the two papers presented.

Mr. Percy H. Thomas emphasized the significance of the two principles, (1) paralleling the insulator surfaces to the lines of electrostatic force and (2) division of the dielectric into equipotential intervals by intermediate conductors, described in the papers. As far as the theory is concerned, the design of these insulating surfaces and spaces will be independent of the frequency, said Mr. Thomas. External fields, however, might have a disturbing effect. Owing to current leakage over the surface and the spreading of such leakage path near the mid-point, the speaker urged that the fall of potential along the path might be different from that resulting from the electrostatic field. He also cautioned his hearers that a perfectly distributed condition of potential might be one most easily upset.

Mr. Ralph D. Mereshon, in referring to creepage distances, pointed out that grooved surfaces on insulators aid in lengthening the surface path through dirt which may be present and thus increase the leakage resistance. After discussing theoretical conditions for very high frequencies, Mr. Mereshon gave a brief account of Professor Ryan's experiments in California with frequencies as high as 1,000,000 cycles per second, at 35,000 volts. The presence of external conductors may have important practical significance, he suggested, in the case of transformers in small cells, etc.

Mr. C. O. Mailloux commended the great practical value of the evening's theoretical papers. The equipotential electrostatic envelope he likened to the form assumed by a blown balloon. Unequal bulges can be corrected for by applying a counter or balancing potential, thus maintaining the equipotential envelope on all sides.

Mr. F. W. Peek, Jr., compared electrostatic with electromagnetic phenomena. Electrical apparatus must be designed, he insisted, to meet abnormal as well as normal conditions, and arrangements theoretically accurate for the assumed conditions may fail badly when exposed to surges, lightning or other high-frequency stresses.

Dr. A. E. Kennelly commented on the demands being made by electrical engineering on pure mathematics. The second theorem, he suggested, was enunciated in the earlier discussion on the condenser-type terminals. The speaker suggested calling the electrostatic unit of flux the "kelvin," corresponding to the magnetic "maxwell."

Mr. Philip Torchio declared that the theorem applies not to high voltages of the order of 100,000 volts but to such moderate pressures as 4000 volts to 20,000 volts. He described tests of a cable in which interesting corona effects were obtained at pressures up to 42,000 volts. Mechanical cracking of the rubber insulation followed.

Mr. J. M. Weed questioned whether the fundamental proposition stated in the first paper holds for the field between parallel wires. In an insulating surface such as the one described, Mr. Weed declared that by flattening the curvature at the midpoint and shortening the radius near the electrodes the stress at the midpoint might be increased, at the same time reducing it near the terminals, and thus securing the most efficient distribution. The consequent reduction in path-length the speaker said he had confirmed by actual experiments. After such a change one surface assumed to be most efficient by the author's theoretical determinations was found to be improved 37 per cent. This result, commented Mr. Weed, emphasizes the necessity for caution in interpreting the deductions of theoretical analysis without confirming them by careful experiment.

Mr. L. W. Chubb pointed out that one of the ideal conditions for the improvement of the toroidal-and-rod body is the use of the dielectric medium as an insulator.

In closing the discussion, Mr. Fortescue declared that the occurrence of local corona at one point in a long path is not likely to become progressive in weakening and breaking down other sections of the path. He denied that because an efficient form of insulation is designed upon a theoretical basis it need necessarily be weak to high-frequency oscillations. Insulation methods have heretofore, he said, too often simulated in crudeness the rough log thrown across the stream by the savage. Mr. Weed's results, he suggested, were obtained with very small rings and rods whose surfaces were highly efficient since the corona point of air was increased by the small curvatures.

#### Lecture on Radioactivity Before A. I. E. E.

The first of a series of four lectures which will be delivered before the American Institute of Electrical Engineers by Prof. Edwin P. Adams, of Princeton University, on the subject of radioactivity was presented in the Engineering Societies Building, New York, on March 19, 1913. In introducing the speaker of the evening President Ralph D. Mereshon called attention to the fact that this is the first lecture course to be given under the auspices of the Institute. He cited the fact that the general lack of knowledge of the subject of radioactivity among the engineering fraternity had led the electrophysics committee to take this means of presenting the subject to the members of the Institute and their friends.

The first lecture covered the following topics: the discovery of the properties of radioactivity, radium and its preparation, ionization of gases, and the nature of the radiations from radioactive substances—alpha, beta and gamma rays. The speaker assumed that the audience had no present knowledge of the subject and presented a general survey of the history and important results of radioactive research and their bearing on the electrical sciences.

Adams stated that the original discoveries relating to the science of radioactivity were made about seventeen years ago and that up to the present time there had been prevalent a general impression that these discoveries tended to overthrow the established principles in electrical theory. The speaker said that it was the object of these lectures to point out wherein the old views were correct and valid and to show the application of the present discoveries to those theories.

In speaking of the effects produced by radioactive substances the speaker told of the radioactive effect upon a photographic plate which, although concealed from ordinary



light, is exposed to the rays from these substances, and he commented on the fact that the air in the neighborhood of the material emitting these rays is a partial conductor of electricity. It was stated further that one way of comparing the radioactive effects of two bodies is by making a comparison of the relative conductivity of the air in their vicinity.

The ionization of gases under the action of the rays from radioactive substances was explained by means of several lantern slides showing the paths of the alpha and beta particles as they leave the cathode and traverse the surrounding media. The paths were clearly marked and the points at which collisions with different atoms and molecules had occurred could be observed from the change in direction of the path of the particle. Although the alpha and the beta rays are deflected from their courses by magnetic or electric fields, it had been found that the gamma rays are not at all susceptible to the influence of either of these fields. The speaker gave some interesting figures concerning the relative velocity of the various rays as compared with the velocity of light and told of the experiments of Prof. R. A. Millikan and others who have succeeded in isolating ionic charges upon drops of water and oil and calculating the number of charges carried by the globules.

The remaining lectures of the series will be delivered by Professor Adams on March 26 and April 2 and 9 in the Engineering Societies Building.

### Chicago Section, Electric Vehicle Association

At the luncheon of the Chicago Section, Electric Vehicle Association of America, March 11, topics of co-operation with the local garage owners' association and the establishment of a school for electric-vehicle chauffeurs and battery men were discussed briefly and plans outlined.

Referring to the subject of rates for garaging electric automobiles, Mr. E. E. Jones, of the General Vehicle Company, declared that no attempt should be made to set a flat rate on the storage of either pleasure or commercial vehicles, as such a rate is unfair to both the customer and the garage owner. Since Mr. G. H. Jones, of the Commonwealth Edison Company of Chicago, has offered to install separate meters in the garages for each vehicle, it was considered a better method to set a certain rate on floor space, another rate on the care of cars and batteries, and charge for the amount of electrical energy supplied to batteries according to the readings of the individual meters. As some owners of electric pleasure vehicles object to having their cars kept next to a commercial truck, it was suggested that commercial and pleasure vehicles be garaged separately.

May 6 has been set as the date for the annual meeting of the Chicago Section. Mr. Arthur Williams, of New York, president of the general association, is expected to be present at that time.

### The Minnesota Convention in St. Paul

Accepting the presidency at comparatively short notice, Mr. Eugene Holcomb, of St. Paul, was the guiding spirit of a successful convention of the Minnesota Electrical Association held in the roof garden of the Hotel St. Paul, in St. Paul, on March 11, 12 and 13. The total registered attendance, about eighty, was not large, but interest was manifested by a good discussion of not too numerous papers. Minnesota has a large number of small municipal plants, and under the constitution of the association both privately owned and municipal plants are entitled to membership. The supply men were well represented, several concerns making exhibits. They entertained the operating men at a banquet.

In presenting the report of the executive committee, Mr.

E. F. Strong, of Chaska, secretary-treasurer, stated that the resignation of President George Marvin, of St. Cloud, was accepted on Jan. 7 last. Mr. Holcomb was elected president at that time and Mr. R. F. Pack, of Minneapolis, was elected a member of the executive committee to fill the vacancy. Mr. Strong's report as treasurer showed that the finances of the association are in satisfactory condition.

### PRESIDENT'S RECOMMENDATIONS

In his presidential address Mr. Holcomb pointed out that the electric-service field is not even approximately covered as yet, as less than 20 per cent of city residences are supplied with electricity. But with the economical methods and appliances of to-day the business is going ahead by leaps and bounds. In the past some managers have handled their problems of economics in an unscientific manner, but the old order is passing. "The greatest good to the greatest number" should be the public-utility operator's motto. In relation to the affairs of the association, the president said that the members must devote more time and energy to the work if it is to count. There are about 200 electric-service plants in Minnesota, public and private, and about 37 per cent of these are represented in the association. The active membership is made up of about twenty-eight private plants and about thirty-six representatives of public plants, but nearly all the most important properties are represented. Mr. Holcomb pointed out an anomaly in the constitution by which publicly owned stations, as such, are apparently not represented. He said there should be a distinction between these two classes in the membership. A continuous performance and more permanency are also needed in the administration of the association. The executive committee should be a continuing body, and it should appoint the secretary-treasurer, who should be subject to the committee.

Messrs. H. J. Gille, of St. Paul; R. E. Brown, of Mankato, and T. C. Gordon, of Little Falls, were appointed a committee on the president's address. Later they indorsed the changes suggested by the president, recommending that suitable constitutional amendments be voted on at the next meeting.

### SAFETY ENGINEERING

Mr. Don D. Lescohier, an expert of the Minnesota State Bureau of Labor, Industries and Commerce, read a paper on "Prevention of Accidents." He spoke of accidents to linemen and to power-house employees and suggested remedies. While the number of accidents is large—too large—it is satisfactory to note that it is declining. Much interest was manifested in this subject. Messrs. Holcomb, Pack, Gille, A. Larney, of Minneapolis; A. H. Dickerson, of Windom; G. Fabianke, of Sherburne; Ludwig Kemper, of Albert Lea, and Strong took part in the discussion. A committee was appointed to consider pending legislation intended to enlarge the scope of the state bureau, but later it reported against taking immediate action.

### THE MANAGER AND HIS PROBLEMS

Mr. Ludwig Kemper, of Albert Lea, past-president, read a short paper on "The Central-Station Manager." He dwelt on the necessity of tactful relations with customers. This paper brought out a discussion that covered a wide range. Among those taking part in it were Messrs. L. Peterson, of Thief River Falls; R. B. Wallace, of St. Paul; Dickerson, Gille, Holcomb, Thomas Pitts, of Hutchinson; E. T. Street, of St. Paul; Holmes Ives, of Redwood Falls; Brown, and E. A. Aspes, of Montevideo.

### STEAM-FLOW METERS

A paper on "Steam-Flow Meters" was read on Wednesday morning, March 12, by Mr. C. R. Matheny, of the Chicago office of the General Electric Company. Sarco, Sargent, St. John, "G. T." and General Electric meters were described, with lantern slides. Among other advantages of this refinement in boiler-room practice is its value in regulating feed-water input. Messrs. Aspes, F. A.



Otto, of St. Paul; Kemper, Pitts, Wallace, and T. D. Crocker, of St. Paul, took part in the discussion.

#### DEVELOPING CENTRAL-STATION BUSINESS

Mr. R. F. Wherland gave an interesting illustrated talk on the business he has built up in distributing electrical energy in Redwood Falls, Morgan, Morton and other villages ranging from 1600 to 100 in population. These small Minnesota communities keep up to the times. For instance, Morton has a domestic science school where all the cooking is done by electricity. The average price received last year was 13.72 cents per kw-hr. for electrical energy developed by water-power, with oil-engine auxiliary.

A paper giving an instructive account of the manner of securing motor-load customers in Duluth, written by Mr. C. E. Van Bergen, manager of the Duluth Edison Electric Company, was read by Mr. George W. Gibeau, of the same company. Mr. Crocker opened the discussion, in which Messrs. J. C. Bang, of Madison; E. W. Erick, of Canby; Aspnes, Egbert Douglas, of St. Paul, and others took part.

#### CO-OPERATION WITH THE UNIVERSITY

"The University and the Central Station" was the title of a paper read by Prof. George D. Shepardson, professor of electrical engineering in the University of Minnesota. The author indicated how co-operation could be effected. Among other things he spoke of a "university week," to be given in various cities, during which lecturers from the university may discourse on electrical subjects, popular and technical, while the local central-station management conducts a "whirlwind campaign" for new business. Evening classes are now given at the university in eight electrical courses. The university also offers its facilities for testing apparatus. But its greatest function lies in training men.

Mr. R. F. Pack, of Minneapolis, opened the discussion. As a central-station manager, he is heartily in favor of cordial co-operation between the university and the central-station interests. College men not too academic, with some idea of business and of the spirit of compromise necessary in the practical affairs of life, are needed. Mr. Bang, Mr. W. R. Rutledge, of Howard Lake, and Mr. Wherland also spoke on the subject.

#### DIRECT AND INDIRECT LIGHTING

"Modern Illumination" was the subject of a lecture given on Thursday morning by Mr. W. N. Goldschmidt, of the National X-Ray Reflector Company. The speaker explained and illustrated with lantern-slide pictures the indirect and show-window lighting systems of his company. In the discussion Mr. Wallace said a good word for direct lighting and added that shadows are not always objectionable. Mr. Goldschmidt answered that in a properly designed indirect-lighting system there was not an entire absence of shadows but an absence of grotesque shadows. Mr. Hogan, of St. Paul, rather favored the semi-indirect idea; "straight" indirect is rather cold and dead in effect. The author of the paper, referring to the efficiency of the semi-indirect system, said that the loss of light in passing through translucent material is as great as in reflection from a good ceiling. Mr. Gille declared his belief in indirect illumination, but said that the question was to interest architects and the public. To this the response was

that a national advertising campaign was started by the X-ray company on Jan. 1 last. Mr. M. A. Pocock, of St. Paul, spoke of the necessity of redecorating ceilings in old premises for the indirect system and mentioned the practical difficulty in keeping the fixtures clean and therefore efficient. Mr. Goldschmidt retorted that the decorating and frequent cleaning were a benefit to humanity in a sanitary sense.

#### DIESEL OIL ENGINES DISCUSSED

Mr. E. A. Aspnes, manager and engineer of the Montevideo Electric Light & Power Company, gave a report of a test made by him on a 170-hp Diesel oil engine installed as an auxiliary in the municipal hydroelectric plant at Granite Falls on the Minnesota River. His conclusion was that the engine, installed in October, 1911, had not maintained its rated output and efficiency. On the other hand, Mr. Peterson, superintendent of the municipal plant at Thief River Falls, reported very satisfactory results with two engines of about the same size, also auxiliary to a water-power plant, in service for about a year. Mr. Kemper, of Albert Lea, expressed doubt of the advantages of this type of engine, pointing out the greater first cost com-

pared with steam equipment, and the increasing price of fuel oil. Mr. Ives, of Redwood Falls, spoke favorably of the Diesel engine as an auxiliary in a water-power plant, speaking from experience. Mr. Rutledge, of Howard Lake, favored it in small units.

#### CONCLUDING BUSINESS

Mr. Rutledge brought up again the complaint made at last year's convention that manufacturers are selling incandescent lamps on consignment to hardware dealers in small towns, the prices being such as to put electrical operating men and dealers at a disadvantage.

A resolution was passed requesting the Legislature to make a suitable appropriation for the representation of Minnesota at the Panama-Pacific Exposition of 1915 in San Francisco.

On the report of a nominating committee consisting of

Mr. B. W. Lynch, of Minneapolis, Mr. Otto and Mr. Aspnes, these officers were elected: President, Mr. Eugene Holcomb, St. Paul; first vice-president, Mr. R. E. Brown, Mankato; second vice-president, Mr. E. F. Strong, Chaska; secretary-treasurer, Mr. F. A. Otto, St. Paul; executive committee, Mr. Holcomb, Mr. Brown, Mr. Otto, Mr. H. J. Gille, of St. Paul, and Mr. Leonard Peterson, of Thief River Falls. Mr. Otto, it should be explained, was, despite his protests, put on the ticket by his fellow-members on the committee.

#### THE NEW PRESIDENT

Mr. Eugene Holcomb, who was elected president of the association, is vice-president of the Consumers' Power Company (controlled by H. M. Bylesby & Company) and general manager of the company's business in St. Paul. He has had an interesting career. Born near Grand Rapids, Mich., he evinced an aptitude for electrical work at an early age. While still a boy he removed with his parents to California and for a number of years thereafter he was identified with early transmission lines, arc-lighting plants and telephone installations. He was connected with both the Thomson-Houston and the Edison General company and built a number of electrical plants on the Pacific Coast.



EUGENE HOLCOMB

In 1892 he became contract agent of the Portland (Ore.) General Electric Company, and two years later he organized the McCaskey & Holcomb Company, of Springfield, Ill., which operated the Capital Electrical Company's property under a lease. Here he rebuilt a number of 10-amp series arc machines to operate at 6.6 amp, with marked economy. In 1902 he sold out his Springfield interests and went abroad for the Westinghouse Electric & Manufacturing Company. In Argentina he built what were then two of the largest gas-driven electric plants in the world. Three years later he came back to this country and was placed in charge of all foreign sales of the Allis-Chalmers Company of Milwaukee. He became connected with the Byllesby interests early in 1910 and for over two years has been located in St. Paul, where he takes an active part in civic affairs. Mr. Holcomb is an alert, all-around American electrical man. He has taken out several patents, belongs to a number of technical societies and social clubs, has developed apparatus, sold goods and managed properties. His paper on "Central-Station Economies," read at the Byllesby convention in Chicago in 1911, was a valuable contribution to the literature of plant operation.

#### BANQUET AND ENTERTAINMENT

Manufacturers and dealers gave a dinner and vaudeville entertainment to the plant operators at the Hotel St. Paul on Wednesday night. Mr. H. J. Gille was toastmaster, and Mr. Archie M. Hayes, representing the Governor of the State; Mayor Keller, of St. Paul, and others made speeches. Professional performers entertained, and there were some interesting electrical decorations and "stunts."

#### Accident Compensation Costs in Massachusetts

In a special bulletin just issued the Massachusetts Industrial Accident Board cites that in the last six months of 1912, representing the first half-year of the board's service, there were reported 42,882 industrial accidents, and that not over 30 per cent of these represented injuries which disabled the employee for twenty-four hours or more. It is estimated by the board that the total payments for its first year, based on one-half the average weekly wage of employees killed or injured while in the course of employment, and including medical attention, hospital care and medicines, will be more than \$2,000,000.

About 30 per cent of this amount will go to doctors and hospitals and 20 per cent to the dependents of those fatally injured, the remaining portion going to disabled employees.

This total of insurance benefits will net the injured wage earners of the State more than five times as much as they received in the year under the former employers' liability law, which was superseded by the workmen's compensation act of 1911. In the figures cited no consideration is given to the cost of insurance administration. As a result of a special investigation of eight representative concerns, employing 25,803 persons, the board concludes that as a whole the premiums charged for workmen's compensation are too high and might be reduced 25 per cent or more without difficulty, although the reduction is not safely to be accomplished by horizontal cutting. The Boston Edison Company was one of the organizations investigated, and in the four months' period covered by the investigation it paid \$1 in compensation under the act for each \$115.21 of wages, there being 1500 employees, 107 accidents and \$9,000 insurance paid. The payroll was \$490,227. The percentage of compensation paid for injuries during the four months to the insurance premiums paid was 47.2 per cent. For the total group of 25,803 employees investigated, figured on the payrolls, the average cost of workmen's compensation amounted to the sum of \$1 for each \$492.88 in wages.

#### Right Relation Between Capital and Labor

At the last meeting of the Electrical Manufacturers' Club Dr. Charles W. Eliot delivered an address on "The Fortunate or Happy Condition of a Life of Labor," which made a strong impression at the time and which the club has now published for distribution among its members. The following extracts from the address are made from an advance copy.

Dr. Eliot enumerates the conditions essential to happiness in labor as being the feeling of freedom to choose and change employment, the pleasure derived from exercise of bodily and mental powers, the joy of achievement, the hope of advancement, the element of risk or danger, and most important of all, "a loyal state of mind on the part of the workman."

"Employers and employed alike need to understand better than they do now the conditions under which satisfaction in daily toil becomes not only attainable but natural and inevitable, and to see clearly that the prime condition is loyalty on both sides.

"This club consists of employers on a large scale in a new industry made possible by comparatively recent discoveries in science, both pure and applied. I imagine your business to be as good a one as any in the country in which to work out and put in practice the best doctrines with regard to satisfactory conditions of work and to friendly and loyal relations between employers and employees. It seems to me that within the last fifteen years good progress has been made in developing both in employers and employees the right state of mind on these subjects. Employers have learned that it is 'good business' to make all the surroundings of their working people healthful and cheerful, to take thought for the housing of their workmen, to put their factories in such places that their permanent employees can live a family life in cottages with gardens, to make provision in the vicinity for public playgrounds and play buildings, so that wholesome recreations may be within easy reach, and to do everything possible to promote the safety, health and sensible pleasures and satisfactions of the workmen and their families.

"All this is not charity, but mutual service. If he is sufficiently independent or belongs to a trustworthy association of employers, [the intelligent employer] resists steadily all efforts to create monopolies in the kinds of labor he employs, and especially tries to carry on his works in a way to secure to his workmen the precious freedom to work zealously. He makes just provisions for dealing promptly with complaints, consults his employees beforehand concerning any changes in methods or rules which will affect them, and explains the benefits to both parties which he anticipates from the changes proposed. He is experimenting carefully on profit-sharing methods, the most promising mode of creating and maintaining satisfactory relations between employers and employed. He maintains a rising scale of wages based on efficiency and length of service, does his utmost to secure for his workmen steady employment, and takes care of employees who have passed their prime and need lighter jobs. In the interest of his workmen, as well as his own, he seeks assiduously steady, and hence broad, markets—world-wide are the best; so that no local depression can close his factory.

"He makes the discipline of his works contribute to train all newcomers to neatness, punctuality and fidelity. Fully realizing that the interests of his workmen are bound up with the life of his works, he labors to keep his industry profitable, and therefore a sure support for his employees as well as for himself, lays by an ample reserve of profits, charges off every year adequate amounts for deterioration, and in general keeps in mind the permanence and solidity of his business as the source of the livelihood of his hundreds or thousands of employees. If the establishment is old enough to have secured a firm reputation for success-



ful management, and therefore for durability, he establishes a pension system, thereby increasing efficiency in his works and also making promotion more rapid among the permanent workmen.

"He rejects the policy of the highest possible immediate profit, without regard to stability of the business in the future, as inconsistent with the right view of his trusteeship for his partners or shareholders and his employees alike, and believes that the only way to bring in the reign of industrial peace is to deal righteously and humanely with the people he employs, competes with, buys from or sells to."

### New Arkansas Law on Theft of Electricity

Owing to the lack of a comprehensive statute dealing with the theft of electricity or tampering with electric meters, offenses of this kind have heretofore been quite prevalent in Arkansas, while punishment of the delinquents was under the former laws very difficult. The Arkansas State Legislature has just passed an act, worded as follows, imposing a fine of \$100 or one year's imprisonment, or both, for electrical offenses of this kind:

"Whoever unlawfully and intentionally injures or destroys, or permits to be injured or destroyed, any meter, pipe, conduit, wire, line, pole, lamp or other apparatus belonging to any person, firm or corporation engaged in the manufacture or sale of electricity for light, heat, power or other purpose, or unlawfully and intentionally prevents an electric meter from duly registering the quantity of electricity supplied, or in any way interferes with its proper action or just registration, or without the consent of such person, firm or corporation unlawfully and intentionally diverts any electric current from any wire of such person, firm or corporation, or otherwise unlawfully and intentionally uses or causes to be used, without the consent of such person, firm or corporation, any electricity manufactured or distributed by such person, firm or corporation, shall be deemed guilty of a misdemeanor and shall for every such offense be punished by a fine not exceeding \$100, or by imprisonment not exceeding one year, or by both fine and imprisonment."

### Lighting Controversy at Webster Groves, Mo.

Several weeks ago bids for lighting the streets of Webster Groves, a suburb of St. Louis, were advertised for. It was stipulated in the specifications that 1 per cent of the gross receipts should be paid to the city in consideration of a franchise. Both the Electrical Construction & Maintenance Company and the Western Power & Light Company filed bids, but the Maintenance company offered to furnish light at \$383 a year less than the Western company, so the contract was awarded to the former concern. Although Mr. Einstein, president of the Maintenance company, said that the 1 per cent clause was contained in the bid of his company, it was not mentioned specifically, so Mr. F. W. Mott, president of the Western company, petitioned the courts not to allow the city officials to contract with the Maintenance company. When the case was brought before Judge McElhinney of the Circuit Court, it was, however, dismissed.

### Opinion on Refund of Excess Charges

In the case of the city of Louisville, Ky., versus the Cumberland Telephone & Telegraph Company, seeking to compel a refund of amounts collected by the telephone company during several years past in excess of ordinance rates which were upheld not long ago by the Supreme Court of the United States, Judge Walter Evans, in the United

States court at Louisville, recently handed down two interesting opinions. In the petitions which A. Englehard & Sons and others of the Cumberland company's subscribers wished to enter supporting the city in its stand for a refund Judge Evans declared that such action could not be admitted until it is determined whether or not the present ordinance under which the Cumberland company is forced to operate is confiscatory. Overruling the protest of City Attorney Clayton B. Blakey, Judge Evans amplified the powers of Special Master Allie G. Ronald, who has been appointed to investigate the Cumberland company's collections and to determine the amount of the refund which is asked, and has complimented Special Master Ronald upon his work thus far.

### Bill to Tax Utilities for City Revenue

Representative Isler, of Pittsburgh, has introduced before the Pennsylvania Legislature a bill to permit cities of the second class to tax all street-railway, telegraph, electric-light, power, water, gas and heating companies for general revenue purposes. The tax on street railways is fixed at 25 cents per linear foot of track; on telephone, telegraph and electric-light companies at 0.5 cent a foot for each linear foot of pole lines or wires laid and 5 cents a linear foot for conduits, and on water and gas companies at 3 cents for each linear foot of pipe laid.

### Protest Against Higher Rates at Lexington, Ky.

To protest against the proposed increase in rates of the Fayette Home Telephone Company, of Lexington, Ky., and also against the proposed award of a franchise for the Lexington Utilities Company, to sell electricity at a slightly higher rate during the next twenty years, special committees of Lexington citizens have been appointed at mass meetings recently held. Strenuous opposition has developed to either of these steps on the part of Lexington public utilities, but it is believed that ultimately the stand of the Lexington Utilities Company for more liberal rates, in order to enable it to improve its plant, will be supported.

### All Concerns Selling Energy Must Pay Tax as Utilities

Reversing the ruling made by former Attorney-General U. G. Denman, Attorney-General T. S. Hogan, his successor, has rendered an opinion to the State Tax Commission of Ohio to the effect that all companies, firms or individuals which sell energy, whether excess or from their regular business, should be classed as public utilities and pay the excise tax on their gross receipts. They are immune from the Willis tax under his ruling. Both Cleveland and Cincinnati have a large number of companies which sell energy to neighboring concerns but do not make this their main business. They will be compelled to pay the excise tax just as if they were engaged exclusively in selling energy. The tax commission has held this view all along and this is the reason why an opinion was asked the second time.

### Public Utility Measures Before Illinois Assembly

Representative Hollenbeck has introduced into the Illinois Legislature House bill No. 186, providing for special taxation up to the local authority on account of bonds on electric-light plants, street-railway systems and other utilities where a city or village is about to forfeit such improvements through inability to meet payments due. Repre-



sentative Rinehart has introduced House bill No. 201, which requires a public hearing and advertisement before the confirmation of public-utility franchises. Senator Harris has introduced Senate bill No. 236, one of the Chicago charter measures, which is a public-utilities bill for the city of Chicago.

## Public Service Commission News

### OHIO COMMISSION

The Public Service Commission of Ohio has authorized the Hocking Power Company to issue to the John A. Stewart Electric Company \$60,000 worth of stock for the purchase of the Stewart company's business and property by the Hocking company. The purchaser asked permission to issue in all \$90,000 in return for the Stewart property, but the commission has limited to \$60,000 the amount allowed.

The Public Service Commission has also granted the Buckeye Light & Power Company authority to issue \$8,500 worth of additional capital stock. Of this amount, \$5,500 is to be expended on improvements to the company's generating plant and \$3,000 for the building of a transmission line to Ludlow Falls, Ohio.

### CALIFORNIA COMMISSION

The United Light, Fuel & Power Company, operating in San Diego, Coronado and vicinity, has applied to the commission for authority to issue \$100,000 of capital stock to pay indebtedness for construction work and improvements.

Complaint has been filed by citizens of Jamestown asking that the Railroad Commission regulate the rates and service of the Tuolumne County Electric Power & Light Company.

The Pacific Gas & Electric Company has applied for permission to devote a portion of the proceeds received from the sale of its last issue of \$5,000,000 of bonds to the enlargement of the Bear River Canal. This canal will carry water from Lake Spaulding reservoir, making it available for irrigation purposes in Placer County.

The Great Western Power Company has applied for a certificate of public convenience and necessity to serve Yuba County and the city of Marysville with electricity.

### NEW YORK COMMISSION

The New York Public Service Commission, Second District, has authorized the Deer River Power Company of Watertown, to issue \$45,000 of 6 per cent bonds, the proceeds to be used in discharging liabilities incurred for capital purposes.

The Second District commission has given to the Schenewus Electric Light & Power Company its permission to transfer to the Great Bear Light & Power Company all its property and franchises. The latter is authorized to construct a transmission line from its Worcester plant to the lines of the Schenewus company and to furnish electricity at Maryland in Otsego County.

### WISCONSIN COMMISSION

The Wisconsin Railway, Light & Power Company, of Milwaukee, has been authorized to issue \$1,229,000 of capital stock and \$2,225,000 of 5 per cent first mortgage refunding gold bonds. These securities are to be issued for the purpose of acquiring the following: All property and assets formerly belonging to the La Crosse Water Power Company and sold at a foreclosure sale on Oct. 11, 1912; all of the outstanding \$365,000 of common stock, \$67,500 of preferred stock and \$483,000 of bonds of the Winona Railway & Lighting Company and the \$302,200 par value of capital stock of the La Crosse City Railway Company.

### MASSACHUSETTS COMMISSION

The Massachusetts Railroad Commission gave a public hearing last week on the service conditions of the Worcester Consolidated Street Railway, which was of unusual interest in view of the discussion it brought out concerning the

larger power problems of Worcester County transportation. The city had appealed to the board to order service improvements, filing reports on conditions of traffic and energy supply at Worcester during the past month. President Dewey of the Consolidated company and President Henry I. Harriman of the Connecticut River Transmission Company outlined the work now under way to improve the power supply of the system. At present energy is furnished by a 5600-kw turbine station at Millbury, Mass., a 3450-kw engine-driven plant of old design at Worcester and the Connecticut River system through a 600-kw substation north of the city. Contracts have been let for the installation of an additional 5000-kw turbo unit at Millbury and for the purchase of 7000 kw from the interconnected system of the Connecticut River and New England Power companies through a switching station to be built at Millbury. President Harriman stated that inside of two months it would be possible to supply the company with 2000 kw at Millbury, and that when the new 100-mile line is completed between the Shelburne Falls district and Millbury the transmission system would have 10,000 kw of primary power and 6000 kw of secondary power available for the service. President Dewey of the railway company spoke briefly, contending that the utmost effort is being made to increase the power supply and strengthen the service in Worcester.

## Current News Notes

**NORTH ST. LOUIS BUSINESS MEN TO VISIT KEOKUK.**—As the guests of the Union Electric Light & Power Company of St. Louis and the Mississippi River Power Company of Keokuk, Ia., a party of North St. Louis business men will visit the great water-power plant under construction at Keokuk on March 26. Special trains have been chartered.

\* \* \*

**DAMAGE TO BLACK RIVER FALLS DAM.**—During the high water of March 14, 1913, three of the Tainter gates in the dam of the hydroelectric development at Black River Falls, Wis., were destroyed by ice. The accident is said to have been due primarily to the breaking of a gear hoist when the attempt was made to lift the gates. After the ice went out the river fell rapidly but at the crest of the flood there was 8 ft. of water going over the gates. No damage was done to the concrete work or the power house. Black River Falls was the scene of a disastrous flood in October, 1911, when much damage was done to the property of the La Crosse Water Power Company.

\* \* \*

**INCENDIARISM IN NEW YORK CITY.**—In his report on incendiarism in New York City, submitted to Mayor Gaynor, Mr. Joseph Johnson, fire commissioner, declares that the crime of arson is responsible for one-fourth of New York's annual fire losses and involves the destruction of \$4,000,000 worth of property each year. The commissioner's report is a 160-page volume containing interesting accounts of many cases of incendiarism, together with pictures of fires, "plants," portraits of firebugs, etc. Lax methods followed by the fire insurance companies in granting policies are largely blamed for the appalling growth of professional arson. It is shown, for example, that on property worth only \$3.96 it was actually possible to obtain \$127,500 worth of insurance in the form of 135 different policies. Many trades profit from incendiarism. The report, which was prepared by Mr. W. B. Northrop, temporary inspector in the Metropolitan Bureau of Fire Prevention, recommends that rigid investigation be made into the character of all applicants for fire insurance and that the property be inspected carefully. Appendices to the report outline the methods followed by German and other European fire insurance companies in making property examinations.

**SEWER DISCHARGE TO BE UTILIZED FOR POWER GENERATION.**—It is reported that Mayor Laughlin of Niagara Falls, N. Y., is behind a scheme to develop hydroelectric power from the outflow of the city's trunk sewers. These sewers now empty into the lower Niagara River, and the Mayor is said to believe that the energy going to waste is sufficient to light the city.

\* \* \*

**UP-TO-DATE BURGLARS.**—According to the police, burglars who blew open a safe in the office of a small theater in Chicago recently used modern methods. It is surmised that the thieves bored a hole in the safe near the combination lock by the use of a high-power electric drill. This hole was filled with an explosive and plugged up with a cartridge. It is believed that electricity was also used to fire the cartridge.

\* \* \*

**FIRST AID TELEPHONE SERVICE.**—A plan proposed in Chicago may make it possible to secure quick emergency attention in case of injury, by the co-operation of the Chicago Telephone Company and the police department. It is proposed that in case of accident, or where immediate medical attention is needed, any person may call up "Main 13," the police call. Connection will at once be made with the nearest police station by the telephone company, and the desk sergeant in turn will send the nearest physician on the first-aid list in his possession to the address given. In case of serious accident this first-aid emergency service through the nearest telephone might prove of great value.

\* \* \*

**BRITISH ELECTRICAL MANUFACTURERS' ASSOCIATION.**—At the annual dinner of the British Electrical and Allied Manufacturers' Association, held recently at the Savoy Hotel, London, Lord Amphil presided, and was supported by Lord Suffield, Mr. Bruce Anderson, chairman of the association; Mr. W. Duddell, president of the Institution of Electrical Engineers; Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago; Sir Alexander Kennedy, Mr. Worthington Evans and Sir Laurence Gomme. In proposing a toast to the association, Mr. Insull urged the need of greater co-operation between the manufacturers of electrical apparatus and the producers of central-station energy. The toast of "Kindred Institutions and Our Guests" was proposed by Mr. S. Z. de Ferranti and responded to by Mr. W. Duddell and Colonel Sir N. J. Moore.

\* \* \*

**PROPOSED PERMANENT QUARTERS OF ELECTRIC CLUB OF CHICAGO.**—A subject of much interest to the members of the Electric Club of Chicago is the proposal to establish permanent quarters. The committee appointed the week before on this subject by President Keech reported at the meeting of the club. It consisted of Messrs. J. H. Goehst, F. W. Harvey, H. A. Mott, H. E. Niesz, N. F. Obright, C. G. Sharpe and F. P. Vose, representing the general membership of the club and not any member of the administration. This committee said that the project of obtaining the fifth and sixth floors of the old Hamilton Club Building on the corner of South Clark Street and West Monroe Street was feasible and practicable. The rental would be \$4,000 for the first year and \$4,800 for the three succeeding years. It is proposed to have the usual club comforts, including the serving of meals, billiard and pool tables, a reading room, etc. The committee recommended that the membership be increased to 500 and the dues be raised from the present rate of \$5 a year to \$12 a year, with an initiation fee of \$10 instead of \$5, as at present. There was an extended discussion on the subject, some of the members being reluctant to abandon the plan for a simple luncheon club, which has been quite successful. It was finally decided to print the report of the committee and send it to all the members, asking them at

the same time to express their views on the subject of enlarging the club's scope of operation and increasing the dues.

\* \* \*

**ONE THOUSAND FIVE HUNDRED AND SEVENTY-FOUR INVENTORS SEEK TRAIN-STOP PRIZE OF \$10,000.**—In reply to the offer of President Charles S. Mellen of the New York, New Haven & Hartford Railroad to award a prize of \$10,000 for a successful automatic train-stop which will prevent engineers running by danger signals, 1574 applications have been received. Hardly 5 per cent of the number obtained are, however, worthy of consideration, according to the engineers for the road. Two devices which are regarded as practical will be tested at once. Several startling schemes were proposed. One inventor's device was guaranteed to work with entire safety to the passengers but "would probably kill the engineer and fireman." Another invention provided for a spring hook to rise in the track and firmly grasp the axle of the locomotive. Applications were sent in from all over the world—Panama, Porto Rico, Jamaica, Belgium, France, Ireland, Hawaiian Islands, England, Scotland, Wales, Germany and Denmark are among the countries represented. The competitors represent nearly every walk of life, from clergymen to jailbirds. Four of the inventors are now in jail, and four are in insane asylums. One has been indicted in Canada for attempting to sell stock in his train-stop company.

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**COMMONWEALTH EDISON SERVICE.**—At a recent meeting of the Commonwealth Edison Company Section of the National Electric Light Association in Chicago, Mr. Peter Junkersfeld, assistant to the second vice-president, gave an interesting talk, illustrated by lantern-slide diagrams, on "Commonwealth Edison Service." He said that of the 450,000 houses and apartments in Chicago, 104,800 use electric service. The company has about 2000 stockholders, and of these about 300 are employees. The total number of employees is 3770. Of their number 2000 are depositors in the savings fund by means of which they may eventually become stockholders. One interesting chart gave the proportion of employees engaged in the actual production, transmission and distribution of electricity, as compared with the number engaged in the other departments which are necessary for modern central-station service. It was shown that the first group is very much smaller than the second. Referring to the company's railway load, Mr. Junkersfeld said that roughly about 70 per cent of the kilowatt-hours consumed for railway transportation in the city of Chicago is furnished by the Commonwealth Edison Company. The entertainment features consisted of selections by the banjo club and a fencing contest.

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## SOCIETY MEETINGS

**NEW YORK JOVIANS.**—Mr. John W. Lieb, Jr., vice-president and general manager of the New York Edison Company, addressed the luncheon meeting of the Sons of Jove, New York, March 19, on the subject of "Rates."

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**DETROIT INDUSTRIAL ELECTRICAL SOCIETY.**—At a meeting of the Industrial Electrical Engineering Society, Detroit, Mich., March 13, Dr. Edwin S. Sherrill gave a practical demonstration of the pulmotor loaned for the occasion by the Detroit Edison Company.

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**MEETING OF THE ELECTRIC VEHICLE ASSOCIATION.**—On Tuesday, March 25, at 8 p. m., the regular monthly meeting of the Electric Vehicle Association of America will be held in the Engineering Science Building, New York. Mr. H. F. Thomson, of the Massachusetts Institute of Technology, will present a paper on "Observations on Horse and Motor Trucking."



LYNN SECTION, A. I. E. E.—At the meeting of the Lynn (Mass.) Section, A. I. E. E., March 12, the subject of street lighting by means of arc lamps was discussed by Messrs. G. N. Chamberlain, C. A. B. Halvorson and Lyman Arnold, of the General Electric Company's Lynn works.

\* \* \*

WASHINGTON UNIVERSITY BRANCH, A. I. E. E.—Mr. H. F. Thomson, research assistant at the Massachusetts Institute of Technology, Boston, addressed the meeting of the Washington University Branch, A. I. E. E., March 10, on the subject of "Costs of Trucking by Horse, Gasoline and Electrical Power."

\* \* \*

NEW YORK STREET LIGHTING.—At a meeting of the New York Electrical Society to be held in the Engineering Societies Building on March 28 Mr. C. S. Lacombe, chief engineer of the Department of Water Supply, Gas and Electricity of New York City, will lecture on street lighting and fixtures of New York City.

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MISSOURI CONVENTION IN KANSAS CITY.—The annual convention of the Missouri Electric, Gas, Street Railway and Waterworks Association will be held in the Baltimore Hotel, Kansas City, Mo., on April 17, 18 and 19. Mr. P. A. Bertrand, of Jefferson City, is president of the association, and Mr. Percy W. Markham, of Brookfield, is secretary and treasurer.

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NEW YORK SECTION, N. E. L. A.—At the first "ladies' night" meeting of the New York Companies' Section, N. E. L. A., March 17, Mr. Raymond Ditmars, of the New York Zoological Gardens, gave an illustrated lecture concerning "Reptiles" and his experiences in capturing most of the specimens in the Bronx Park collection. The speaker exhibited a number of live snakes and explained how to avoid danger in handling poisonous reptiles. Nearly 400 persons were present.

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COSMOPOLITAN COMPANY SECTION, N. E. L. A.—The Cosmopolitan Electric Company Section, N. E. L. A., held an interesting educational meeting on March 13, when, with Mr. Ira Hampton as temporary chairman, the "Story of a Kilowatt" was detailed, from the cial pile to the consumer, by the various employees of the company in daily contact with each department. Mr. H. E. Wulfinck acted as interlocutor. Messrs. H. E. Niesz, manager, and Mr. A. H. Sweetnam, electrical engineer, also spoke briefly during the evening. At the meeting in April Mr. F. P. Vose, past-chairman of the Electric Club of Chicago, will give an illustrated lecture on the Panama Canal.

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PITTSBURGH SECTION, A. I. E. E.—"Standardization" was the subject of discussion at the meeting of the Pittsburgh Section, A. I. E. E., March 11, when several papers read at the recent New York midwinter convention were abstracted. The topic of ratings provoked an especially lively discussion. Among those who took part in the meeting were Messrs. B. G. Lamme, Charles Robbins, C. Fortescue, E. M. Olin, S. W. Farnsworth, L. W. Chubb, P. M. Lincoln, J. W. Welsh, R. W. Atkinson, J. S. Jenks and E. L. Farrar. Mr. F. D. Newbury presided in the absence of Vice-chairman A. M. Dudley. Arrangements are about completed for the Institute meeting at Pittsburgh on April 18 and 19, under the auspices of the committee on electricity in mines.

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JOINT ILLUMINATION MEETING AT BOSTON.—At a joint meeting of the New England Section of the Illuminating Engineering Society and the New England Section of the National Commercial Gas Association at Boston on March 12 President Preston S. Millar of the Illuminating Engineering Society presented a paper and demonstration illustrating various phases of modern lighting practice. The

three model rooms with miniature furnishings and fixtures, formerly shown in New York, were used to exhibit a large variety of combinations. A brief discussion followed the demonstration, the participants being Messrs. Sidney M. Bewley, C. E. Ware, Jr., J. W. Cowles, R. B. Hussey and C. E. Mason. The point was made that complaints of poor lighting often arise from the use of improper glassware or fittings or from insistence upon the use of bare lamps.

\* \* \*

RAILWAY SIGNAL ASSOCIATION.—The stated meeting of the Railway Signal Association in Chicago on March 17 drew the largest attendance at any convention of the association in the last six years. Mr. B. H. Mann, signal engineer of the Missouri Pacific Railroad, presided. The committees on "power interlocking" and "manual block" made reports. The outcome of the first committee's report was the drafting of specifications for minor accessories in interlocking towers. The "manual block" committee favored displacing hand signaling at interlocking plants with caution cards stating that the block was out of order. The specifications submitted for alternating-current signaling on steam roads were adopted. A report was submitted on the progress made toward formulating specifications for storage batteries, and more time was requested for completing this work. Reports on standard designs, on specifications for wire and cable and on methods of recording signal performances were made by the respective committees.

\* \* \*

CHICAGO JOVIAN LUNCH CLUB.—Mr. George W. Elliott, of New York, advertising manager of the *Electrical World*, addressed the Chicago Jovian Lunch Club on March 17. He spoke of the work of the Society for Electrical Development and said that this organization, like Jovianism, exemplified the spirit of co-operation—the bringing together of all branches of electrical work. Mr. Elliott commented on the fact that similar work is being undertaken in Great Britain. He claimed that the great national movement, to be effective, must be backed by local work and local enthusiasm. Every man must "boost the other fellow's game." Mr. George C. Richards, statesman for Illinois, presided at the meeting. On motion of Mr. J. H. Delany, former statesman, it was voted to request the Society for Electrical Development, as far as practicable, to handle its work in Chicago through the local branch of the Jovian Order. Mr. H. E. Niesz moved that a committee be appointed to co-operate with other electrical organizations in Chicago, notably the Electric Club, in the matter of securing permanent quarters for the various electrical societies.

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LOS ANGELES SECTION, A. I. E. E.—The deferred February meeting of the Los Angeles Section of the A. I. E. E. was held on March 4 at the Hollenbeck Hotel. No original paper was presented at this time but several written discussions of certain of the papers presented in New York at the midwinter convention were read. Mr. A. W. Harris read and discussed the paper entitled "Rating of Oil Circuit-Breakers with Reference to Rupturing Capacities," by Mr. G. A. Burnham. Mr. E. Woodbury discussed Mr. Paul Dushman's paper, "The Heating of Cables Carrying Current," and described certain tests and calculations on high-voltage cable. Mr. E. R. Northmore spoke briefly upon painting underground cables black to raise the safe carrying capacity. The paper "The Temperature Rise of Stationary Induction Apparatus as Influenced by the Effects of Temperature, Barometric Pressure and Humidity of the Cooling Medium," by Messrs. J. J. Frank and W. O. Dwyer, was discussed by Prof. R. W. Sorenson of Throop University. Professor Sorenson described the conditions under which the test data were obtained. Chairman George A. Damon announced that the members of the section will be the guests of the Southern California Edison Company at Long Beach in the near future.



## Mount Hood Hydroelectric Developments—I

**Hydraulic features of the system for generating 60,000 hp from glacial streams and transmitting it to Portland, Ore. By W. P. Brereton and R. H. Mulock**

PORTLAND, ORE., is a city of about 225,000 population and, on account of its advantageous geographical position, is destined to be one of the most important centers on the Pacific Coast. Although the Portland market has been served by the Portland Railway, Light & Power Company, which has from time to time added to its equipment in an endeavor to meet the increased demand, the market was sufficiently inviting for the Mount Hood Railway & Power Company to enter the field.

The Mount Hood Railway & Power Company was formed in 1906 and at that time secured land and water rights on the Big Sandy, Little Sandy and Bull Run Rivers. Surveys were made and a scheme was worked out for the generation of electricity which would, when completely developed, deliver 60,000 hp to Portland. Some work was done during 1906-07, particularly on the grading of the railroad and the excavation for the generating station, penstocks, etc., and contracts for two turbines were awarded to the Platt Iron Works. From 1907 to the fall of 1910 enough work was performed to hold the rights obtained.

In the fall of 1910 work was recommenced and it has since been energetically prosecuted. Franchises were secured in Portland and surrounding towns giving the company the right to sell energy for heating, lighting and industrial purposes and to construct and maintain transmission and distribution systems on the streets. Franchises were also secured from the counties of Multnomah and Clackamas, giving the company rights to construct and maintain transmission systems along certain roads. The railroad was rushed to completion as quickly as possible to allow delivery of construction materials and equipment.

### HYDRAULIC DEVELOPMENT

The hydraulic development, as originally proposed, consisted of three distinct schemes, a high-head development,

an intermediate-head development and a low-head development. The intermediate-head development only is at present constructed, but short descriptions of the other two developments are here given.

The drainage areas are those lying west and south of Mount Hood, these being drained by the Big Sandy, Little Sandy and Bull Run Rivers and their tributaries. Because the rivers above mentioned are all similar in the rate of fall, the three schemes were naturally very similar in general features. The water was in each case to be diverted from the river channel into a flume or canal, the difference in fall of the river and flume accounting for the available head.

Near the junction of the Big Sandy and Bull Run Rivers is located a naturally advantageous reservoir site, there being a bench of approximately 300 acres area which is in general 325 ft. in elevation above the Bull Run River. This is the site of the reservoir for the intermediate-head development. Immediately adjoining this bench is the terminus of the watershed between the Big Sandy and Little Sandy Rivers, and on top of this is located a site for a much smaller reservoir at an elevation of about 650 ft. above the Bull Run River. This was to be the site of the reservoir for the high-head development.

The high-head aqueduct was to be built along the Big Sandy side of the watershed for a distance of approximately 10 miles to a location just above the junction of the Salmon and Big Sandy Rivers where water from both would be diverted into it.

The intermediate-head aqueduct is built on the Bull Run and Little Sandy River side of the watershed for a distance of about 17,000 ft. to a point where the diversion dam is located on the latter river. Just above this dam water is delivered from the Big Sandy River by means of an aqueduct in a tunnel through the above-mentioned



FIG. 1—VIEW OF GENERATING AND TRANSFORMER STATIONS ON BULL RUN RIVER

watershed. The intermediate-head development is, therefore, supplied from both the Big and the Little Sandy River. A large storage reservoir on the Salmon River was to be formed to regulate the water supply for these two developments.

One power house was to be used for the intermediate and high-head developments, the water from which, as well



FIG. 2—INSPECTION CAR AT BEGINNING OF FLUME

as from the Bull Run River at this point, was to be carried in an aqueduct for a distance of about 7 miles to a reservoir which was to provide a head of 245 ft. above the Sandy River. A branch feeder for this aqueduct was to carry a supply from the Big Sandy River from a point a short distance from its junction with the Bull Run River. This formed the low-head development.

The area drained by the Big Sandy River for the intermediate head is approximately 225 sq. miles, and that drained by the Little Sandy River 28 sq. miles. The precipitation over these areas varies with the elevation, the mean at 700 ft. and 3600 ft. above the sea level being respectively 71.6 and 82.5 in. annually for a period of twenty years. As the mean elevation of these two watersheds is 4800 ft., the probable mean rainfall is 87 in. August, September and October of each year are very dry months, but the nature of the formation is such that the precipitation in the rainy season percolates into and is stored in the porous volcanic rocks, soils and glacial and other gravelly layers, to be discharged slowly and somewhat regularly during the dry seasons. Thus the rivers have a general supply from this source. The Big Sandy River is also sup-

mation, as the head above the riverbed (rock) does not exceed 12 ft. In relation to the direction of the river the dam is located diagonally, increasing the length of the spillway so as to limit the rise of head during high water to 2½ ft. A portion of the spillway, that located in the center of the watercourse, is depressed 3 ft. to act as a sluiceway for debris during high water. This portion is provided with stop logs to be used during the dry season if required. The intake is situated at the extreme northerly end and is provided with wooden racks and stop logs. An additional short spillway is provided behind the stop log location, as the water is gradually accelerated to the velocity required in the flume.

#### LITTLE SANDY FLUME

The Little Sandy flume is built entirely of wood, Douglas fir being used exclusively with the exception of the footings, which are of cedar. Just below the diversion dam, the flume crosses the river on a Howe truss bridge, supported on rock-filled cribs, to the south side of the canyon. This mountainside is very steep and irregular, the flume being carried on bents in places, while in others rock or earth was excavated, allowing the caps on which the stringers rest to lie direct on the mudsills.

In general a bearing pressure of 1½ tons to the square foot was allowed for footings. The floor and sides are of 2-in. planks, leakage between planks being prevented by the use of ½-in. by ¾-in. splines in properly formed

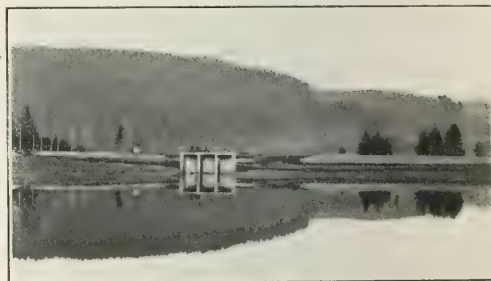


FIG. 4—RESERVOIR AND PENSTOCK OPENINGS

grooves. The flume has a fall of 2 ft. in 1000 ft. and is designed to carry 800 cu. ft. of water per second. Posts and mudsills were cut along the line of the flume. All dimension timber, however, had to be delivered from the lower end, and as the country was so rough as to eliminate almost the possibility of road construction for this purpose, a standard-gage service track was built on the floor of the flume and gasoline motor cars with trailers were used with very satisfactory results.

#### RESERVOIR

The reservoir is formed by the construction for about two-thirds of its periphery of an earthen embankment which varies in height to a maximum of 45 ft., while for the remainder the natural elevation of the land serves to confine the water. Very great care was taken in the construction of this embankment, the material for which, taken from the reservoir site, consisted of red clay with not more than 5 per cent of gravel at any location mixed with it. The material was hauled to the embankment in wagons, deposited in layers of not more than 12 in., harrowed and rolled. During the dry season sprinkling was resorted to in order to assist in the packing. All vegetable matter in the foundation had first been removed. The water face of all built embankment was ripped and a considerable area at the discharge of the flume was also ripped.

Considering the area of the reservoir in comparison with the maximum quantity of water available from the flume, it was deemed unnecessary to provide a spillway, as ample

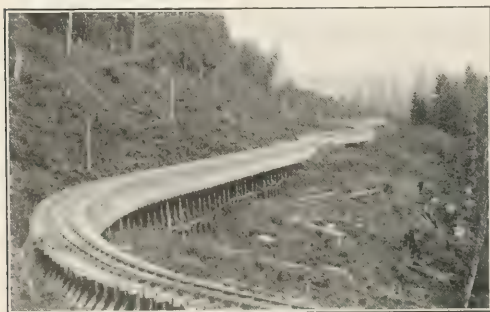


FIG. 3—FLUME ALONG THE MOUNTAINSIDE

plied from the melting glaciers on the west slopes of Mount Hood. The intermediate-head development has been practically completed.

#### LITTLE SANDY DAM

The Little Sandy dam is composed of solid concrete resting on basaltic rock of comparatively dense formation. No borings were made to investigate the underlying for-



time would elapse for the placing of stop logs at the intake to the flume before the water would reach a dangerous elevation.

The area of the reservoir at a level of 5 ft. below the top of the embankment is 160 acres and its total capacity is 2103 acre-ft., sufficient in case of any total interruption in the water supply to develop the full capacity of five tur-



FIG 5—PENSTOCKS AND SURGE TANKS

bines for thirty-six hours with a load-factor of 60 per cent. It is so large that it need not here be considered in relation to the daily peak load but should be studied in connection with the dry periods.

The maximum and minimum monthly consumption of electric energy in Portland occur during December and April respectively. There is, however, an abundance of water available during both months. During September the demand for energy is little in excess of that in April and about 80 per cent of the demand in December, but the water supply is limited. Considering that during December the demand is sufficient to load five machines, using 60 per cent as the ratio of the average load during the month to the maximum hourly load for the month, there would be required approximately 660 cu. ft. of water per second, and 660 divided by 0.8 gives 825 cu. ft. of water per second required during September, as the same load-factor obtains. Assuming 1910 as an average year, there is available only 365 cu. ft. of water per second, and by allowing the water in the reservoir to be lowered 30 ft., 91 cu. ft. of water per second would be available from that source. The rest of the energy must, however, be obtained from an auxiliary steam plant. During the month of August of an average year the steam plant will also be required to deliver energy, but during the other months the supply of water is sufficient with the aid of the storage to develop enough energy to meet the demand.

#### PENSTOCKS AND INTAKE

Provision is made for three complete penstocks, although two only are at present constructed. The intake is completed in every respect for three. It is built of reinforced concrete provided with one 10-ft. diameter butterfly (motor-operated with hand auxiliary) valve for each penstock, wooden racks and provision for stop logs. The head end of each penstock is anchored in the concrete intake.

Each penstock is 9 ft. in diameter and placed at such an elevation that it will practically drain all the water from the reservoir. This necessitated the placing of the upper portions in tunnels driven under the earthen embankment to the face of the bluff. There is built in place only 160 linear ft. of the third penstock, sufficient to carry it well beyond the earthen embankment. Great care was ex-

ercised to prevent leakage around the intake through the tunnels, by means of cut-off walls, by concreting the upper ends of the tunnels and by clay puddles at the intersection of tunnels with the face of excavation.

From the face of the bluff the penstocks are laid in trenches along a bench at points near the edge of which they dip sharply into a second pair of tunnels, through which they pass to the power house. All penstocks in tunnels are surrounded by a very lean mixture of concrete which completely fills the space around the pipes. Concrete anchor blocks are provided in the trenches. Immediately above the power house each penstock branches into two pipes 72 in. in diameter.

Although each turbine is provided with a synchronously operated relief valve, it was thought advisable to neglect them in designing the penstocks. Each pipe is, therefore, designed to withstand an impact caused by the closing of the turbine gates in three seconds. The gates are designed to remain one-third open in case they become disconnected from the servometer of the governor. At the lower end of each 72-in. branch is located a 16-in. branch in which is placed a bursting plate to break at 250 lb. pressure per square inch. Special care was taken and experiments were performed to secure reliable results with these bursting plates. A dozen plates were cast from the same ladle. They were designed to fail in shear, a groove being cut in each on a diameter slightly less than that of the pipe. By trial and error, the proper thickness of metal at the bottom of the groove was determined. Each result was carefully checked against others for uniformity of material.

At a point on each penstock immediately below the lower ends of the upper tunnels is located a surge tank having a capacity sufficient to supply the needs of two machines for a period of five seconds.

#### POWER HOUSE

This is of solid reinforced-concrete construction with steel roof trusses and one temporary cement plastered end to allow for extension. It is at present built of sufficient length to accommodate four main units and two turbine-driven exciters. The generator room is 150 ft. long by 44 ft. wide; the height from generator room to bottom of roof



FIG 6—CONCRETE GENERATING AND TRANSMISSION BUILDING ON HILLSIDE

trusses is 39 ft. and the height of crane rail above main floor is 31 ft. The roof of the building is 44 ft. high. A railroad switch is built into the power house just far enough to receive one standard car.

In a subsequent issue a description of the electrical features of the generating station on Bull Run River and of the transmission system to Portland, Ore., will be published.



## The Purkinje Effect and Comparison of Flicker and Equality-of-Brightness Photometers

By M. LUCKIESH

With the increasing diversity of types of light sources the demand for a means of comparing lights of different color is constantly growing. Recent investigations in heterochromatic photometry indicate the flicker photometer as the best means for such work, although there is not a complete agreement on some of the phenomena encountered when comparing lights of different color. Dow<sup>1</sup> found the Purkinje effect to be less with the flicker method than with the equality-of-brightness method, while Ives<sup>2</sup> found a reversed Purkinje effect with the former method. Miller<sup>3</sup> in photometering a mercury arc against incandescent lamps reported that the former measured much brighter at lower illuminations than would be indicated if the inverse square law rigidly held. With the flicker method this effect was absent. In connection with investigations being conducted by the writer at the Physical Laboratory of the National Electric Lamp Association, Cleveland, Ohio, it seemed of interest to test this point with a commercial flicker photometer at hand and at the same time make comparisons with an equality-of-brightness photometer both with contrast and without. At the same time it was desirable to compare the sensibilities of the three methods. For this purpose a Marten's flicker photometer was chosen. A simple photometer fitted with contrast screens was chosen for the direct comparison of brightnesses. Both instruments were made by Messrs. Schmidt and Haensch. The sources of light were tungsten lamps, and a red screen and a bluish green screen were placed one on each side of the photometer.

Two observers carried out parallel sets of observations throughout, the ordinary precautions being taken against prejudiced settings. The two observers checked identically with all three methods when balancing lights of the same color.

The results are plotted on a scale of illumination which was calculated on the assumption that the red light obeyed the inverse-square law. This, of course, is not true, but no better method presented itself and the effect is merely either to elongate or to telescope the scale somewhat at the low values of illumination. The values of illumination are those on the photometer screen calculated from the value obtained at a high illumination when the red light was balanced against that from a standard tungsten lamp by means of a flicker photometer. The actual illumination on the eye was of less importance because commercial photometers were used without alteration, making it easy to reproduce the same conditions in practice. The field size, which is of vast importance in heterochromatic photometry, was practically the same in both photometers—about 10 deg. The field in the Marten's flicker photometer consists of an inner circle surrounded by a circular ring, while the shape of the field in the equality-of-brightness photometer was a circle divided vertically. The contrast screens covered the upper and lower halves of the semicircles respectively.

The ratio of the square of the distance of the "red" lamp from the flicker photometer screen to the square of the distance of the "green" lamp is plotted as ordinates in the two upper curves in Fig. 1, for the two observers. It is significant to note that the two observers checked identically when there was no color difference. Observer K for a wide range of illuminations obtained a value for the ratio  $R/G$  about 13 per cent higher than observer L even with the flicker photometer. A pronounced reversed Purkinje effect was found for illuminations of the screen less than 1 meter-candle. The lamp and screens were reversed to eliminate any instrumental errors. The values obtained

after reversal are indicated by the crosses, which show a close check. The same ratio calculated from the writer's data obtained with the equality-of-brightness photometer is plotted in the lower curve. The circles represent values obtained with a contrast field, while the dots represent the values obtained without contrast. It will be noted that there is a large difference between the values of the ratio  $R/G$ ,

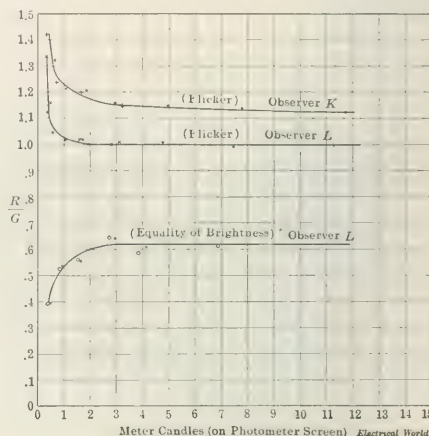


FIG. 1—PURKINJE EFFECT AND REVERSED PURKINJE EFFECT OBTAINED BY THE EQUALITY-OF-BRIGHTNESS AND FLICKER METHODS RESPECTIVELY

obtained by observer L by the two methods. The values obtained by the equality-of-brightness method (which were practically the same with a contrast photometric field as without contrast) were, for a wide range of illuminations, only 62 per cent of the values obtained with the flicker photometer. This difference illustrates that although the flicker photometer offers a means of eliminating the disturbing influence of color difference it does not measure the same quantity as measured by the equality-of-brightness photometer. The researches of Ives<sup>4</sup> show, however, that the flicker photometer which he used (a modification of the Whitman disk) is more desirable than the direct-comparison photometer.

The equality-of-brightness observations by observer K on being plotted were found to be quite scattered but indicated a real Purkinje effect. This observer was quite inexperienced in the photometry of lights of extreme color difference, while observer L has had considerable experience. The latter's data presented here check with data previously obtained by him and presented by Ives in his extensive research in heterochromatic photometry. The difference in the flicker measurements by the two observers was first thought to be due to a different criterion in each case. That is, it was found that slightly different results were obtained with the flicker photometer used if flicker was made to disappear in the central field or in the surrounding peripheral ring. This was found to be so slight, however, that in no way could it account for the 13 per cent difference. The flicker on the outer ring was disturbing and tended to cause difficulty in fixation of the eye on the central part of the field.

The sensibility of the three methods was next determined. The average deviation from the mean was computed for the various points of observation. These are sufficiently regular or consistent for the flicker method to bear plotting and are therefore shown in Fig. 2. At an illumination of 10 meter-candles on the photometer field the average deviation from the mean found by the writer was about 0.5 per

<sup>1</sup>J. S. Dow, *Phil. Mag.*, January, 1910; page 58.

<sup>2</sup>H. E. Ives, *Phil. Mag.*, July, 1912; page 149.

<sup>3</sup>P. S. Millar, *Trans. Ill. Eng. Soc.*, November, 1909; page 179.

<sup>4</sup>H. E. Ives, *Phil. Mag.*, 1912.

cent. This rose to about 0.9 per cent for observer K. However, it is a point highly in favor of the flicker photometer that a comparison of a red light with a blue-green one can be made with such small average deviation from the mean of a number of settings.

In the photometry of lights of different color by the equality-of-brightness method the writer has always favored a two-part field without contrast, but had previously made no determinations of the sensibility of the two methods. In the comparison of lights of such extreme color difference as those used in this investigation there was no consistent change of sensibility with illumination so that it seems legitimate to average the sensibilities computed at the various illuminations used. The average of the mean deviation from the mean of a large number of settings at each illumination was found for observer L to be 1.9 per cent and 1.6 per cent for photometric fields with and without contrast respectively. For observer K the sensibility was found to be 2.9 per cent and 3.3 per cent respectively, apparently being in favor of the field with contrast. But owing to the inexperience of observer K little weight can be given to this result. When there was no color difference the flicker method of 15 meter-candles gave results for observer L which sometimes indicated a sensibility as high as 0.2 per cent. Of course, under the condition of no color difference there is no reason to use the flicker photometer because a sufficiently high sensibility can be obtained with the equality-of-brightness method.

Comparison of the red and blue-green lights on various days checked very closely by means of the flicker method. Fairly close checks were made by the experienced observer from day to day with the equality-of-brightness method.

#### SUMMARY

When a red light was compared with a blue-green light a pronounced reversed Purkinje effect was found by both observers with the flicker method for an illumination of the photometric screen less than 1 meter-candle. The illumination at which the effect appears depends, of course, on the absorption of the optical parts of the photometer and the area of the artificial pupil.

A real Purkinje effect was found with the equality-of-brightness method. The same results were obtained with an equality-of-brightness photometer with and without a contrast field. The writer favors a photometric field without contrast where there is a color difference.

With the flicker method one observer obtained a value for the ratio of  $R/G$  when calculated according to the in-

$R/G$  obtained by observer L with the equality-of-brightness method was found to be only 62 per cent of its value by the flicker method at an illumination of approximately 10 meter-candles. Observer K also obtained a lower value, which was 76 per cent of its value by the flicker method and 87 per cent of the value obtained by observer L with the latter method.

The fact that the flicker method shows a reversed Purkinje effect seems to be established. While it is known that the two methods of photometry herein considered yield different results, the other data are presented here for the purpose of emphasizing this point.

The writer acknowledges the assistance of Mr. Leonard Krill throughout the experimental work outlined herein.

### Transmission Tower Design for the Central Colorado Power Company

By W. E. BELCHER

Several articles have appeared at various times in the *Electrical World* descriptive of the overland high-tension transmission lines and general construction work of the Central Colorado Power Company, and also of the Great Falls (Mont.) Power Company. Both lines employ single-circuit transmission towers whose special features of design as originated for the former company may make a more detailed description of interest.

The Central Colorado tower was among the first to be used for carrying electrical conductors on strings of suspended insulators, which were then in the early stages of their development. The construction of the tower is not unlike that of other styles of tower now in use, in so far as it is made up of light angle sections, galvanized, and arranged to be self-supporting on four main legs. It is believed, however, that the arrangement of parts has shown certain advantages for this design, and it has been found that the tower is well suited to meet the severe conditions experienced on the lines erected in 1908 across the Colorado mountains.

The high-tension distribution system of the Central Colorado Power Company is notable on account of the length of the line, the high voltage used, and the very high altitude and mountainous character of the location.

The length of the line from Denver to Glenwood is 153.4 miles by the way of Leadville, and from Denver to Boulder 28.8 miles, a total of 182.2 miles. The line reaches a maximum elevation of 13,628 ft. at Argentine Pass. The nominal pressure employed is 100,000 volts, the circuit being composed of three No. 0 copper strands with hemp core. On account of the rough topography the spans vary widely in length. Originally, the standard span was to have been 660 ft., or eight towers per mile, but as constructed the average span is greater than this, an average of about six towers being used per mile, with spans varying from 300 ft. to 2900 ft. The 2900-ft. span mentioned is carried, however, by double-circuit towers, a few of which were erected in 1907 previous to the decision to build only a single-circuit line. A number of spans from 1500 ft. to 2000 ft. in length are carried by the single-circuit towers.

By taking advantage of the ridges and high points of the line for tower sites long spans were possible with ample ground clearance, and it was not necessary to follow the profile down into the narrow canyons as would have been necessary with a wood-pole line. The cross-arm used was provided with connections for side-guying so that on the turns no special towers were required. Throughout most of the line only one ground wire was used. This was of Siemens-Martin galvanized stranded cable, 0.25 in. in diameter, pulled up with less sag than the conductors in order to avoid whipping on exposed spans. The cables themselves were drawn up nearly to their elastic limit to

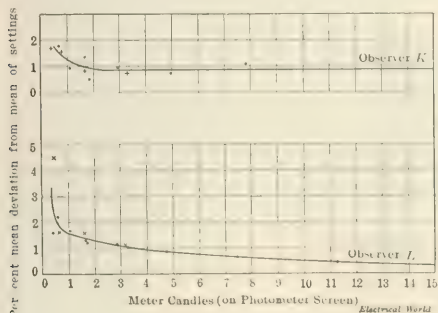


FIG. 2—SENSIBILITY OF THE FLICKER PHOTOMETER

verse squares of the distances of the red and blue-green lamps from the photometer screen about 13 per cent higher than the value obtained by the other observer for an illumination of the photometer screen of 10 meter-candles. Throughout the whole range of illuminations used (from 0.5 meter-candle to 13 meter-candles) a large difference between the two observers was obtained. The value of

prevent flapping in the wind. They showed little tendency to remain parallel during strong winds, swaying independently with considerably wave motion whenever the direction of the wind was not at right angles to the line. The wind action is very severe owing to the nature of the country (see *Electrical World*, June 1, page 1205). An attempt was made to measure the actual wind pressure at one of the towers located on the Argentine Pass, but the anemometer was broken and the gage board blown away after registering a pressure of 20 lb. per square foot. During certain seasons of the year sleet accumulated on the lines at some of the low places, this amounting to 1.9 lb. per foot of conductor in an instance cited by Mr. P. T. Hanscom, electrical engineer for the Central Colorado Power Company, before the Chicago convention, A. I. E. E., June 26, 1911. The case mentioned occurred, however, previous to putting the line into operation.

#### DESIGN OF TOWERS

The height of the tower is about 44 ft., leaving 40-ft. clearance measured from the ground line to the three conductors, which hang in a horizontal plane 10 ft. 4.25 in. apart. The minimum clearance between the conductors and any part of the tower is 4 ft. when the insulators are hanging vertically, or 2 ft. 6 in. when they are swung out at an angle of 45 deg. The maximum loading of the conductors was assumed as the resultant of the weight of the wire covered with 0.25 in. of ice all around and acted upon by a wind force of 8 lb. per square foot of projecting area, which corresponds to an actual wind velocity of approximately 60 miles per hour. The test loads were established in excess of any possible reactions on the tower due to this loading with tower spacing up to 1500 ft. They also provided for 2500 lb. unbalanced load at any insulator support, which is the elastic limit of the single No. 0 copper strand at 30,000 lb. per square inch. The test loads and the deflections observed during the test are shown in the accompanying table.

DEFLECTIONS OBSERVED IN TEST OF TRANSMISSION TOWER

Test Loads.	Strain Applied, Lb.	Deflection, In.	Permanent Set, In.
A. Applied to cross-arm end, parallel to line.	2,500	4.0	0.50
B. Applied to cross-arm center, parallel to line.	2,500	0.5	0.25
C. Applied to cross-arm end, vertical downward.	2,500	1.75	0.00
D. Applied to cross-arm end, right angles to line.	6,000	2.5	0.25
D'. Applied to cross-arm end, right angles to line.	9,500	8.0	Failed

The method of applying these loads to the tower is shown graphically in the accompanying diagram, with the resultant stresses. After withstanding a loading at right angles to the line of 6000 lb., it was decided to increase the load to a breakdown value. This loading is referred to as D', the ultimate strength of the tower, which failed at 9500 lb. by the buckling of the main leg in compression on the side nearest the load, about 3 ft. above the ground.

During a later test the horizontal loading at the end of the cross-arm A was increased until the tower failed. At a loading of 3000 lb. there was a permanent deflection of 5 in., which increased very little at a loading of 3500 lb. At 4000 lb. the cross-arm was severely distorted, but the load reached 4500 lb. before complete failure, which occurred from buckling of the main leg. After removing the load the tower partly recovered, the permanent set being 9 in. When this loading reached 3300 lb. the stress in the main leg was equivalent to that produced by three No. 00 conductors pulling in the same direction when stretched to their elastic limit with all conductors broken on the opposite side.

The tower was designed with an arrangement of parts such that all the stresses produced by loads in any direction at the insulator supports are taken care of in the tower by the four main legs in tension or compression and by four main diagonals. These stresses travel to the ground in straight lines from the point of cross-arm connection, without the customary crossing back and forth through alternate struts and diagonals. The result was to reduce the number of main connections and weight of details, which was essential, as each pound of weight shown on the design has added nearly 3 tons to the total weight of the towers of this style which have been manufactured up to the present time.

**Main Leg.**—Maximum stress, 11,700 lb. compression; section, one single angle, 2.5 in. by 2.5 in. by 3/16 in.; ratio of length to least radius,  $65 \div 0.49 = 133$ ; area, 0.91 sq. in.; strength,  $0.91 \times (27,000 \div 2) = 12,300$ .

This value of 27,000 lb. ultimate strength in compression per square inch is taken from the 1900 edition of the "Pencord Handbook," where results are shown of tests made on struts of medium steel with flat ends, under the

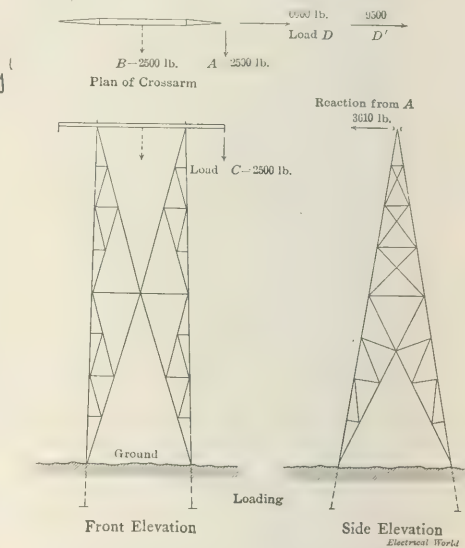


FIG. 1.—DIAGRAM OF TOWER LOADING

direction of the late Mr. James H. Christie. This strength is divided by a safety factor of two in the above calculation, to keep below the elastic limit, the assumption being made that the elastic limit of the column in compression is greater than one-half of the ultimate compressive strength. For safe working values for ordinary practice the factor of safety recommended by Mr. Christie varies from 3 to 5.8, being 4.3 for the above ratio of length to radius. When tested to breakdown, this main leg angle failed at 15,800 lb. or 17,500 lb. per square inch. The writer was interested in comparing this allowable stress of 13,500 lb. per square inch with that indorsed by Mr. R. Fleming in his paper presented at the annual convention of the Association of Iron and Steel Electrical Engineers, Milwaukee, Wis., Sept. 30, 1912. His formula B works out almost exactly the same, that is, 13,600 lb.

In a structure like this where very light sections are used—often with many one-bolt connections—it is essential that the details of the design be made so as to avoid secondary stresses as far as shop practice will permit. The structure cannot be expected to stand an increase of load which will cause stresses above the elastic limit in any of the mem-



bers, as the distortion brings severe secondary stresses and consequent collapse.

*Diagonal.*—Maximum stress, 10,400 lb. tension; section,  $1\frac{3}{4}$  in. by  $1\frac{3}{4}$  in. by  $\frac{3}{16}$  in.; area, 0.62 sq. in.; net area, 0.51 sq. in.; strength  $(60,000 \times 75 \text{ per cent}) \div 2 = 22,500$  lb. per square inch;  $22,500 \times 0.51 = 11,200$ .

This value allows for a factor of safety of two, applied to the ultimate strength of the material, reduced by 25 per cent on account of connection being made to one leg of the angle only. At the time the tower was tested to

shown. This was found to be correct by the test, as after deflecting 134 in. under the vertical load (C) the channels resumed their original position upon the removal of the load. The bending moment in the cross-arm due to the horizontal load was taken care of by spreading apart the two channels in the central portion of the cross-arm and connecting them rigidly by short channel diaphragms bolted to the webs. The flanges of the cross-arm channels were not punched.

*Web Members and Connections.*—The purpose of the web

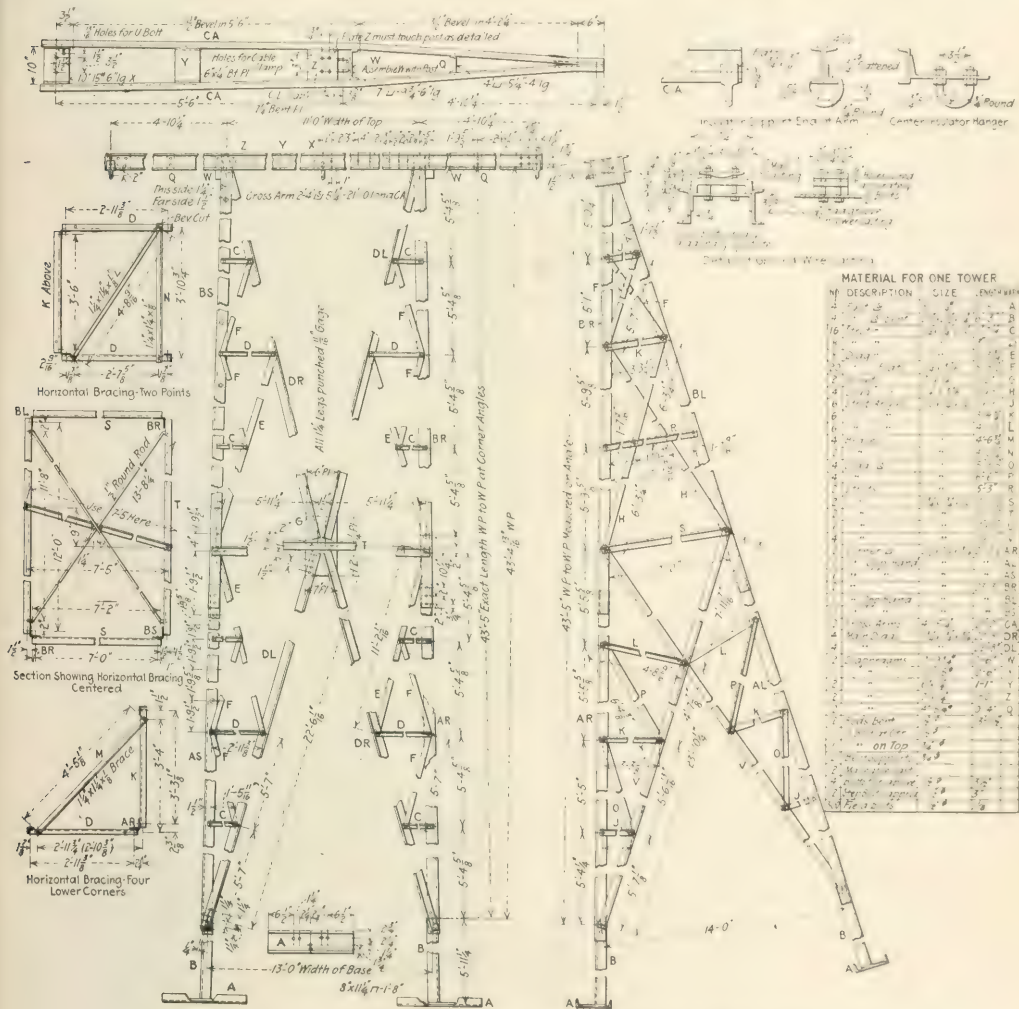


FIG. 2—SINGLE-CIRCUIT STEEL TOWER, CENTRAL COLORADO POWER COMPANY

breakdown, this angle was carrying 16,400 lb., or 31,800 lb. per square inch.

*Cross-arms.*—Section 2, 4-in. channels, 5.25 lb. per foot; maximum stress due to side pull on end, 20,000 lb.; length  $\div$  radius  $= 23 \div 0.45 = 62$ ; compressive strength  $(40,000 \div 2) \times 1.1 = 22,500$ ; bending moment, 139,000 inch-lb.; section modulus,  $2 \times 1.9 = 3.8$ ; maximum stress,  $139,000 \div 3.8 = 36,000$ .

This section was used, as it was believed that the elastic limit of the material would not be exceeded by the stress

members is to support the main legs at intervals of  $\pi/2$  with the use of as little material as possible. The ratio of length to radius is in general kept below 200, minimum size of angle being 14 in. by 14 in. by 1/2 in.

The connections throughout were made with galvanized bolts  $\frac{1}{2}$  in. in diameter, with rolled threads, the maximum calculated load for any bolt being 2600 lb., which is equivalent to a shear per square inch of 13,200 lb. Under the loading D' at the time of failure of the main leg, the diagonal stress, being shared by four bolts, brought 4200 lb. on each.

This would correspond to 21,390 lb. shear per square inch.

#### METHOD OF ANCHORAGE

The tower stands upon four angles, each  $2\frac{1}{2}$  in. by  $2\frac{1}{2}$  in. by  $\frac{1}{4}$  in., buried 6 ft. deep in the ground. The lower end of the leg is bent out and punched for two  $\frac{3}{4}$ -in. bolts. The anchorage for each leg is an 8-in.  $11\frac{1}{4}$ -lb. channel 1 ft. 8 in. long, laid flat, with upstanding legs, presenting an area against uplift of 1.1 sq. ft. The maximum uplift from the specified test loads amounts to 11,100 lb. on any one of the anchors. This anchor was tested with a direct upward pull when embedded in well-tamped sand. A pull of 20,500 lb. was required to start the anchor, and this pull when exerted for eight minutes raised it 2 in., after which it stopped. The anchor finally came up under a pull of 30,000 lb. The anchor itself showed no signs of failure except for strain lines in the immediate vicinity of the bolts.

A test was made, for comparison, upon another style of footing, composed of two 3-in. by 3-in. angles 2 ft. long, crossed and presenting an area of 1 sq. ft. This anchor, buried as before, came up 3 in. under a steady pull of 11,000 lb. and gave way at 17,000 lb. The buried channel proved satisfactory under all conditions except in solid rock. Very little concrete was used, the holes for the legs being back-filled with the excavated material. On solid rock a wedge bolt was grouted in with sulphur, the top being shaped and drilled to take the standard tower angle. A few of the towers were located on swampy ground and these footings were set in concrete.

#### PROVISION FOR SHIPMENT

The total shipping weight of the tower is 2200 lb., subject to rolling-mill variations of weight. It was found in practice that the weights as received from the mill were from 2 to 5 per cent less than figured, based on weights given in the "Manufacturers' Handbook," which was just about made up for by the additional weight due to galvanizing. On account of convenience in handling, each tower was shipped in several bundles weighing less than 200 lb. each. The bolts and fittings, weighing 200 lb., were shipped in two boxes. The pieces with like marks were first wired together and then these sets again wired in convenient bundles. By dividing in this way the distribution of material along the line was made more easily and accurately. The material was hauled to the nearest accessible point by wagon, being left at points above the tower site wherever possible and from there dragged or carried on mule-back to the site. Shipped in this way, there was very little loss of small parts. The convenience of handling packages of this weight over rough country is to be appreciated when compared with a weight of about 1600 lb. for a wooden pole 45 ft. long.

#### METHODS OF ERECTION

The surveying party when locating the line left center stakes, numbered consecutively, to mark each tower site. The excavation for the anchor legs and the setting of same was done by a Japanese contractor, who took care of his own men and camp. The first contract price for this work was only \$11 per tower, but the actual cost to the contractor overran this figure on account of the character of the soil. A great deal of porous lava rock was encountered, which, covered over with a few inches of soil and sagebrush growth, had given no surface indication whatever of its presence to the surveyors. The actual cost of this work is estimated to have been about \$14 per tower. Wooden templets, with steel connections at each corner, were furnished, these forms being the exact duplicates of the tower-base and main-leg connections. After the excavation was completed the anchor legs were set in position, connected to the templet and the holes back-filled. Care was taken to get a firm bearing for the legs near the ground surface by tamping in the largest pieces of rock available.

An assembling crew bolted the towers together and was followed by a raising crew. This erection force put up from six to eighteen towers per day, averaging about a mile per day where no special construction was necessary. The assembling and erection of the towers, including the guying required, average about \$15 per tower.

Estimates which have been made recently show that the first cost of a steel-tower line is less than that of a wooden-pole line where conditions and requirements are similar to these. The pole-line expense is largely due to the cost of handling the poles in rough country as well as to the increased number of expensive insulators and fittings required.

The construction work was in charge of Mr. H. L. Vercoe, superintendent of the transmission lines, acting under Mr. G. H. Walbridge, general manager of the Central Colorado Power Company.

Other transmission lines have since been erected, using single-circuit towers similar to the original towers described, with slight modifications in each case. The more important of these lines, three of which cross the Continental Divide, are as follows, the number of towers belonging to each company being given in each case: Central Colorado Power Company, 600; Carolina Power & Light Company, 187; Madison River Power Company, 536; Great Falls Power Company, 2400; Tennessee Power Company (to date), 1150.

All of the above towers were fabricated by Milliken Brothers, Staten Island, New York, with the exception of those for the Tennessee Power Company, which were made by the American Bridge Company. The Great Falls Power Company has a two-circuit line strung on two parallel lines of single-circuit towers, the telephone line being carried on wooden poles midway between the transmission lines and transposed at every fifth pole. The conductor used is a No. 0 copper strand, medium hard-drawn. Six insulator units are used for the pressure of 102,000 volts with two  $\frac{3}{8}$ -in. galvanized, stranded ground wires. The accompanying illustrations give a good idea of the general construction. The standard span of the line is 600 ft. In mountainous country the towers are erected at distances of from 1200 ft. to 2000 ft.

The span crossing the Missouri River is 3000 ft. long, two standard towers being used in series at each end. At turns the angles were divided up at several points, and auxiliary cross-arms were used below the conductors with an additional string of insulators to hold the wire in position, preventing upward or sidewise movement.

The Carolina Power & Light Company used the same type of tower, with modifications, on its line from Buckhorn Falls to Raleigh. For the telephone line steel strand was used, supported by the towers and carried on cross-arms laid against the slanting braces in the upper part of the tower. This necessitated adding braces to the interior panel between the main legs and the telephone cross-arm.

The Tennessee Power Company line is a single-circuit line, with No. 00 seven-wire copper strand carried on strings of seven insulator units, the horizontal spacing of conductors being 10 ft. 6 in. and the working pressure 110,000 volts. The telephone line is No. 6 copper-clad wire supported on malleable-iron brackets attached to one side of the tower. A top extension is used for supporting the ground wire at the dead-end towers, raising the ground wire about 4 ft. above the cross-arm at the center of the tower. Standard base extensions were provided, 5 ft. and 10 ft. in height, the use of which saved putting in additional towers in many instances.

Further information and description of the Central Colorado transmission lines may be found by reference to articles which appeared in the *Electrical World* Jan. 27, March 9, June 23, June 30 and July 14, 1910; July 8 and Oct. 11, 1911, and June 1, 1912. The Great Falls (Mont.) system was described in these columns July 6, 1912.



# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electricity for the Automobile Owner

An expert demonstrator has been employed by the Kentucky Electric Company, Louisville, to explain to owners of electric and gasoline vehicles the facilities afforded by the modern central station for charging power and ignition batteries, pumping tires and operating other electrical conveniences and comforts in connection with the machine. During the recent show of the Louisville Automobile Dealers' Association, a model garage was fitted up in the electric company's window. Here the use of electrically operated tools, vulcanizers, soldering irons, etc., was explained and attention called to the merits of electric foot warmers, cigar lighters, etc.

## The Kind of Ice Equipment to Install

Some practical advice is offered to the small operator contemplating the addition of ice-making machinery to his electric-light plant by a Kansas manager who manufactures 2700 tons of ice each year for his local community of 8000 population.

"If you have sufficient generating capacity, put in an electrically operated ammonia compressor, especially if your motor load is light. If, however, your engines are operating non-condensing, their capacity can not only be increased to advantage by installing surface condensers but the condensed water obtained will be available for freezing into ice. If you are now using jet condensers, put in a raw-water plant.

"The ice season is, of course, heaviest when the lighting load is at its lowest ebb, so that an electrically operated plant will assuredly increase the efficiency of your electrical machinery."

## The Partnership of the Public

Recognition of the public as a partner with capital and labor in the successful operation of utilities was emphasized by Mr. William McClellan, electrical engineer for the New York Public Service Commission, Second District, in his recent address before the New York Railroad Club.

This new recognition of an always existing relation has been very tardy by all business, said Mr. McClellan. It is seen at present more clearly by public-service men because of the very nature of their business. In the end, it will be found to be fundamental to all. Indeed, it is a truism to say that labor, capital and the public are the three partners that must join in the conduct of any business. Each has resources that the others need.

Business will fail when any one of the three partners fails of proper reward. Business will be unsatisfactory when any one of the three partners neglects to hear its proper share of the burden of direction and support. The public-service company that does not keep this constantly in mind fails as certainly as does the banker or the baker who is neglectful. To recognize it freely and to act accordingly is to be modern in a necessary and practical way.

The partners must learn to live and to work together—each respecting the rights of the others. Learning means a process of education—self-education usually and often with much difficulty. Occasionally the dull ones must be

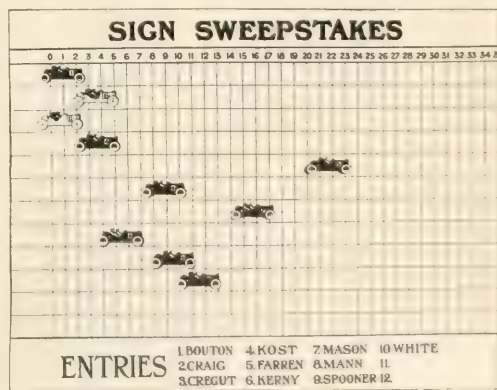
gently prodded, the unruly must be given a bit of the rod, and the vicious will assuredly be expelled from the business entirely. And what must be learned?

Capital, which has heretofore regarded itself as the principal or even sole partner, must recognize the equality of the three. It must deny itself dividends that are not earned. It must learn that its chief asset is a property with full service value. It must learn that good service and good wages are as sacred as good dividends.

The public must learn that expenses and proper returns to its partners can come only out of earnings and that rates must be fixed accordingly. It must learn to be willing to pay for what it demands. It must learn that men and material have physical limitations and that allowance therefor must be made. It must learn that the public-service business is its business, and that agitation and baiting are hampering and extraordinarily expensive to all the partners, including itself.

## Salesmen's Record Chart

"The Sign Sweepstakes" is the title of a salesman's chart recently installed at the Third Avenue office of the New York Edison Company. As the illustration shows, it consists of a vertical column of miniature automobiles, each differently colored and numbered. One of these numbers and cars is assigned to each agent of the department. Across the top of the chart is a row of figures representing the number of contracts secured, and each day the cars are advanced by the corresponding amount. The cars can be moved from the rear of the card, the dimensions of



SALESMEN'S RECORD CARD USED BY NEW YORK EDISON COMPANY

which are 38 in. by 43 in., making it large enough to be seen readily across the room.

Aside from injecting a spirit of competition among the salesmen, the chart inspires a keen interest in the amount of new business secured. It gives at a glance the exact standing of each agent without the effort required to read a column of figures for comparison purposes.

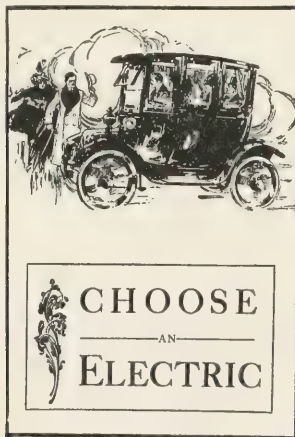


### Line Gang Upheld by Judge

Judge Morson, of Toronto, Canada, has handed down a written judgment quashing the conviction against a number of Toronto Electric Light Company employees on a charge of being disorderly. The men were digging post holes and refused to stop at the request of the police, who were acting under instructions from the city. They were accordingly arrested and a conviction registered against them with the right to appeal. The judge did not deal with the city's right to restrain the company from digging holes or erecting poles, but merely decided that the action of the appellants did not constitute disorderly conduct within the meaning of either the law or the criminal code.

### The Electric Vehicle at Dayton, Ohio

During the recent automobile show at Dayton, Ohio, a number of electric vehicles were exhibited. To co-operate with the manufacturers as well as to stimulate interest in the electric-vehicle field locally, the Dayton Power & Light Company distributed a number of folders covering points of interest to prospective users of electric automobiles. These included the schedule of rates for private charging service at Dayton, a mention of the public garage service available locally, a list of the 130 electric-vehicle owners



CENTRAL-STATION BOOKLET

in the city with their addresses, makes of cars, etc., and a brief enumeration of the advantages of the electric vehicle.

For private-garage charging service the Dayton company's rates are as follows, a readiness-to-serve charge of \$5 per month being made as the minimum:

Up to 100 kw-hr.....	\$0.0660	1429 kw-hr to 2857 kw-hr....	\$0.0540
101 kw-hr to 285 kw-hr....	0.0635	2858 kw-hr to 4285 kw-hr....	0.0460
286 kw-hr to 714 kw-hr....	0.0615	4286 kw-hr to 5714 kw-hr....	0.0388
715 kw-hr to 1428 kw-hr....	0.0560	5715 kw-hr and above.....	0.0315

A discount of 5 per cent is allowed if account is paid within the discount period.

Another page of the folder directs attention to the advantages of electric over gasoline vehicles under heads as follows:

*Economy of Money.*—1. Greater simplicity, hence fewer repairs. 2. Lower cost of insurance. 3. More durability than reciprocal type. 4. Less care. 5. No elaborate repair tools. 6. Small loss of power. 7. No need of experienced chauffeur, who must get high wages, with small number available. 8. Freedom from insurance limitations.

*Economy of Time.*—1. Simplicity of adjustment. 2. No cranking. 3. Instant readiness. 4. Develop power despite conditions of weather. 5. Less time in repair shop.

*General.*—1. Simplicity of construction. 2. Simplicity of operation. 3. Danger of fire or explosion eliminated; hence wider field. 4. Universality of electric power. 5. No freezing. 6. No tanks to leak. 7. Electric vehicles permitted on docks and terminals where gasoline vehicles are not allowed. 8. No noise. 9. No odor. 10. Advertising feature. 11. Does not spot liveries with grease, or impregnate goods with odor.

### Newspaper Electrical Page in Texas Town of 4500

The distinction of having an electrical page appear three times a week in the newspaper of a town of 4500, without even a local electrical contractor to lend co-operation, belongs to the Bay City (Tex.) Ice & Light Company, whose manager, Mr. W. C. Duncan, promoted and carried through the scheme. The seemingly forlorn task of arranging for an electrical page to appear three times a week received its first encouragement from the newspaper itself, which offered a low advertising rate under the conditions that an entire page was to be contracted for. The Bay City electrical page also has the distinction of being the first page of its kind in Texas.

### 55-Ton Ice Plant Showing 16 Per Cent Net Earnings

One of the comparatively large combination ice-electric plants located in a Gulf State town which has a population of 12,000 yielded during the past season a net income of 16 per cent on the investment. This plant is in operation only four months of the year and during this time employs eight wagons in supplying its retail trade.

The compressor is steam-driven and the distilled water for the ice make-up is obtained from the condensed steam of the several prime movers in the plant. A storage capacity of 120 tons is at hand to help tide over the periods of high demand.

This 55-ton plant represents a total investment of \$75,000 and is able to produce ice at the platform for \$1.35 a ton. Employing a sliding scale of prices the frozen product is retailed at a figure varying from \$5 to \$10 a ton, while wholesale consignments are sold at prices which vary from \$4 to \$5.50 a ton. In 1912 the gross annual income to this central station from its ice business amounted to \$30,000, of which \$18,000 was spent in operating and charged to interest and depreciation, leaving \$12,000 net profit.

### Importance of Ice-Storage Capacity

The demand for ice, which varies with variations in summer temperature, can be met most economically by proper cold-storage facilities, since in this way the compressor outfit may be uniformly loaded throughout the dull periods.

Special care should also be taken to design the ice plant so as to secure low labor costs, for, according to the experience of a New Mexico operator who has a 6-ton plant, the item of labor is likely to be expensive owing to the necessity of suddenly caring for a maximum number of "rush" orders. If, however, adequate storage capacity has been installed in advance, such peaks of demand can be met without increased operating expense.

Where the quality of labor available requires close supervision this correspondent further recommends that the output be sold wholesale if satisfactory arrangements can be made. In this way, he points out, the manager can

concentrate his efforts on the plant's operation, at the same time enjoying the advantage that comes from doing a cash business.

Under ordinary conditions he thinks that it will not prove profitable to install a plant of smaller capacity than 10 tons' daily output. He further declares that unless the day business of the electric-lighting plant be almost enough to operate the station profitably throughout the twenty-four hours the cost of running the ice factory may prove to be as great as when operating singly, if not more.

## 26 Per Cent Returns from Southwestern Ice-Electric Plant

A combination ice-electric plant in a Southwestern town of 2700 inhabitants made and sold 1500 tons of ice during the summer season of 1912. This company has no wholesale market and must rely exclusively upon its retail customers. That the ice consumers of this hot and thirsty village have made the most of their opportunity to purchase the distilled-water product is evidenced by the fact that the ice consumption was more than 1000 lb. per capita.

Distilled water for filling the cans is supplied by the condensate from the steam-driven compressor and the steam engine which drives the lighting generator. The cost of producing a ton of ice at the platform is estimated by this company to be \$2. The retail price at which all ice was sold was \$5 a ton. The following tabulated figures show the result of the ice campaign which was carried on last year by this busy central station:

Total investment.....	\$12,000
Gross yearly income from ice business.....	7,500
Net income from ice business.....	3,400

It will be seen that, although this company unfortunately had no wholesale market for its product, it was still able to show a net return of 26 per cent on the amount invested in its ice business.

## Lighting, Water and Ice Plant at Graham, N. C.

Graham, N. C., is a small town of about 2000 inhabitants on a branch line of the Southern Railway running from Goldsboro to Greensboro. It contains a few mills driven by isolated steam plants, and the electric-lighting station is a small affair operated only at night, no day service being available.

About a year and a half ago the Piedmont Railway & Electric Company, backed by Richmond (Va.) capital, built a railway line from Graham to Burlington, a town having fewer than 5000 inhabitants. This railway has thus far been just about able to meet expenses. The Graham Ice Company, which differs from the electric company only in name, manufactures and retails ice in the town and in addition sells coal and wood. At Burlington a municipal plant has been in operation which, besides giving unsatisfactory service, is unprofitable financially.

All of the properties above mentioned have, however, just been bought up by a new company, and the charter of the Piedmont Railway & Electric Company being broad enough, its corporate name is retained by the consolidation. A new station will be built between Graham and Burlington, but until late in the fall the individual companies will continue to operate as they have in the past.

### PRESENT COMBINATION STATION

The Graham Water & Electric Company and the Graham Ice Company have a combination station under the same roof on the edge of the town adjoining the Southern Railway Company's tracks. The equipment installed consists of a 90-hp Reeves engine directly connected to a 65-kw Crocker-Wheeler 2300-volt, 60-cycle, three-phase alternator.

Steam is generated in two 100-hp return tubular boilers fired with run-of-mine coal costing from \$3.50 to \$3.65 a ton delivered.

In the same engine room there is a 17-ton De La Vergne ice machine and a fire pump for forcing the water from a 100,000-gal. reservoir to a 75,000-gal. tank situated nearer town.

The water is pumped to the reservoir from wells 450 ft. deep by an electrically driven pump and a steam-driven pump, the former being used at night when the electric-lighting plant is in operation. The steam-driven pump is employed when making ice. A De La Vergne condenser collects the steam from the ice machine and the Reeves engine. Circulating water from a well cools the ammonia and steam condensers and also the water used in making ice. The well water has a constant temperature of 55 deg. Fahr., and the distilled water thus treated is still further cooled before entering the cans to about 40 deg. Fahr., in a De La Vergne pre-cooler. The ice is pulled from the cans by means of a hand hoist. Storage for 300 tons is provided. The ice house is insulated with cork and paper, and the temperature within is kept down to freezing by ammonia circulation.

### EXPENSES AND RETURNS

At the present time one day and one night engineer are required in addition to two firemen and two tank men. There is in addition a chief engineer who is also superintendent of the system and attends to all line work, etc. The tank men receive \$1 a day, the firemen \$8 a week and the engineers \$75 a month.

The yearly income from the sale of ice is greater than the income from either electricity or water, being only a trifle less than the water and electricity income combined. The ice is retailed by the company at from 35 cents to 50 cents per 100 lb., depending on the quantity. In ton lots it is wholesaled at \$4 a ton. The ice is shipped in ton lots, by wagon and motor truck, 8 to 15 miles to the surrounding villages. The ice season is of five months' duration, while during the rest of the year there is not a great demand for ice.

When the new plant is in operation the ice-making machinery will be transferred to the new station and a duplicate plant installed. The fire and water pumps will then be all electrically driven and the cooling water which is now permitted to run to waste will be saved and all surplus water sent through 1.5 miles of 6-in. main to Burlington, where it will be sold to the city. The change will also be accompanied with extensions of service to outlying towns and a reduction in rates.

### INAUGURATION OF NEW SERVICE

Day and night service will also obtain, and the streets, which are now lighted only on dark nights, will be lighted every night during the year. Customers will also be provided with free carbon-lamp renewals hereafter, and tungsten lamps will be sold at cost less the price of a carbon lamp.

The rate for electricity in Graham is 14 cents per kw-hr. The town pays \$40 per lamp year for fifty four 250-watt multiple tungsten lamps on moonlight schedule. The rate to be established by the new company will be 9 cents per kw-hr. by meter or 1 cent per month per watt of demand, as limited through an "Excess" indicator. Tungsten lamps will also be used in place of the present multiple units.

Mr. J. H. Bridges, Houlston, N. C., will be president and general manager of the new company, which will be capitalized at approximately \$700,000. The new station will contain two 750-kw turbo-generators and will cater to the needs of about 17,500 inhabitants in Burlington, Graham, Haw River, Eden College, Swansboro and Mebane.

# Illumination and Wiring

## Peculiar Freak of Lightning

The accompanying illustration shows in a rather interesting manner how difficult it is to protect distribution circuits from lightning and also affords an example of lightning's perversity. The pole shown in the foreground was located in Delaware County a few miles from Philadelphia, and at the time it was struck there were no wires attached to it, but a cross-arm made to bear six pins had been placed in the top gain.

Within a radius of 50 ft it will be noticed there are a trolley wire, positive and negative trolley feeders, a group of trees, the tallest of which is about 50 ft. high; a house equipped with a lightning rod, and a 55-ft. Bell telephone pole with fifty or more wires thereon. Not one of these



RESULT OF A FREAKISH LIGHTNING STROKE

showed any signs of injury whatsoever from the lightning stroke which split the pole of the Philadelphia Electric Company shown in the foreground.

## Example of Efficient Machine-Shop Lighting

The accompanying illustrations show the method of lighting the new assembly-room extension of the Heald Machine Company, of Worcester, Mass., one of the newer industrial plants to be completed in central Massachusetts. The company manufactures special grinding machinery, such as is shown assembled in the photograph and is a believer in the importance of good lighting in connection with rapid and accurate production. The shop addition is 100 ft. wide and 200 ft. long and is built of reinforced concrete. Its roof is of the saw-tooth type and the walls are provided with a large proportion of window space. With the ordinary type of building having a plain roof the lighting is usually much better near the outside walls than at the center, but the saw-tooth type of construction supplies the center with

practically as much natural light as the outside. The photograph shown was taken with an ordinary camera solely by the illumination furnished by the electric-lighting equipment. The light-colored glass panes seen in the saw-tooth portion owe their appearance to reflection from the interior,

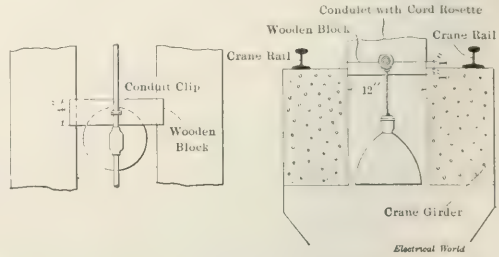


FIG. 1—PLAN AND ELEVATION OF FIXTURE SUSPENSION

their illumination not being derived from any external source of lighting.

A typical plan and section of this portion of the building show it to be composed of bays 20 ft. sq., the roof being supported on four rows of posts running lengthwise. The posts are of reinforced concrete and carry girders supporting traveling cranes. The four rows of posts divide the shop into five sections, so that five lines of traveling cranes can be operated at once over parallel rows of bays, permitting the simultaneous assembly of machines in all five sections. Each crane is equipped with two motors and is controlled from floor handles. The use of a number of small cranes here was considered more desirable than one or two of larger capacity, as many pieces too heavy to be lifted by hand have to be frequently put on and taken off the machines in the process of scraping and fitting. For this reason the saw-tooth roof and multiple craneways met the conditions in the most satisfactory manner, but the problem of artificial lighting was thereby rendered more difficult.

A careful study was made of different styles of lighting in the design of this installation, and this resulted in the selection of 150-watt tungsten lamps and Holophane metal shades with aluminum finish. These reflectors inclose the lamps so that the light is substantially all thrown downward, none being lost in horizontal or upward distribution.



FIG. 2—LIGHTING A MACHINE SHOP WITH 150-WATT TUNGSTEN LAMPS

In the middle of each bay one unit is hung from the roof at a height of 15 ft. above the floor, and between each pair of crane girders are suspended two similar units 10 ft. apart and 10.5 ft. above the floor as shown. Conduit wiring is employed and the lamp cords are hung from conduit fit-



tings carried on wooden blocks laid between the crane girders. The benches are served by smaller lamps hung from the ceiling. At various points on the floor plug receptacles facilitate the attachment of circuits from portable motors operating tools moved from point to point as occa-

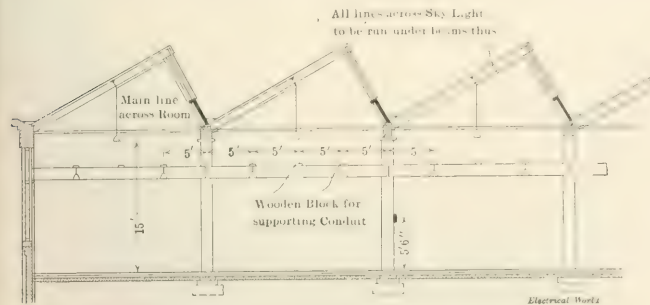


FIG. 3—SECTION THROUGH SAW-TOOTH ROOF

sion requires. The shop extension and its lighting were designed by Lockwood, Greene & Company, of Boston, Mass.

### Increased Conduit Construction with Reduced Restrictions

Returning from a visit of several months in Australia, where he investigated local methods of interior-wiring practice, Mr. William Gitt, an electrical contractor of Honolulu, Hawaii, points out some of the directions in which he thinks the English code, there followed, is superior to approved American construction, although he also admits certain essential shortcomings in Australian practice in other respects.

The wiring rules in force in Australia are identical with the English rules drawn up by a committee of the Institution of Electrical Engineers of Great Britain. While many of the provisions are loosely worded and would hardly be tolerated in the United States, a great many more, insists Mr. Gitt, could be adopted in America with profit to ourselves. All inside wiring, for example, must be in conduit.

Among the rules, however, which American inspectors would consider objectionable are:

(1) Permitted installation of conduit elbows of 1.875-in. radius, even when the tube is to be used in non-accessible places between walls or floor and ceiling. Elbows of this radius require that the wire be drawn in when the installation of conduit is first made. They also preclude the possibility of ever drawing out a defective wire and replacing it with a new one, except by demolishing plaster or other interior finish.

(2) The English rules do not require the use of outlet boxes, but permit the bare end of the conduit to project through the ceiling. They also permit a wooden sub-base, hollowed out like a flat canopy, to be fastened to the ceiling at outlets and the rosette or fixture fixed to this.

(3) The rules abroad permit the use of junction boxes with various branch conduits terminating therein, to be installed in non-accessible places.

On the other hand, according to Mr. Gitt, British practice includes several rules which the American craftsman would do well to adopt. These he enumerates as follows:

(1) Permitted use of No. 18 S. W. gage wire for conduit work. This conductor is a trifle smaller than our No. 16 B. & S. gage.

(2) Permitted use of conduit 0.25 in. in internal diameter.

(3) Permitted use of two No. 18 S. W. gage wires in a 0.25-in. conduit.

(4) Rating of current-carrying capacity of No. 18 S. W. gage wire at 7.2 amp.

The net result of these rules is that an average installation of, say, fifteen outlets would cost for labor and material only two-thirds as much under the English rules as a conduit job under our National Code rules.

But, to put it another way, if conduit work could generally be done for two-thirds of the present average prices, it seems possible that it would be used in nearly twice as many buildings as at present. After twenty-odd years' experience in the contracting field, Mr. Gitt declares that the deciding factor whether knob-and-tube or conduit construction is to be used is always the difference in cost, so that a reduction such as mentioned above would, in a great many cases, result in an immediate choice in favor of the safer installation.

Actual test will show that it is just as easy to pull two English-made No. 18 S. W. G. wires through a 0.25-in. conduit

with four quarter bends as it is to pull two No. 14 B. & S. wires through a 0.5 in. conduit with the same bends. The abrasion of the insulation after drawing the wire through twenty-five times in the former case was practically nil.

The size of No. 14 wire is certainly, therefore, not required for mechanical strength, he thinks. As to carrying capacity, the National Code gives 6 amp as safe for No. 16 B. & S. rubber-covered wire, and this is 660 watts at 110 volts. There would therefore be no overloading of circuits or excessive drop, especially in the average residence where lengths of run are short. No. 16 B. & S. shows only 2 per cent drop when delivering 6 amp a distance of 40 ft.

In conclusion, Mr. Gitt is firmly convinced that the fire hazard would be distinctly lessened by the adoption of 0.25-in. conduit and No. 16 rubber-covered wire of about the same insulation as the rules require for fixed wire.

Anybody who has ever "shot trouble" for a lighting company, he reminds us, can tell some significant tales of old clothes, trunks, tools and other rubbish thrown into the attics on top of the lighting wires. Under such conditions, he insists, a conduit job would be much the safest.

### Recent Telephone Patents

#### IMPROVED TRANSMITTER

In a transmitter invented by Mr. R. Royal, of Chicago, the chief feature is the means of transmitting the motions of the diaphragm to the microphone button. In this transmitter a flat spring is bent to the shape of a figure 3. The middle point is secured to the movable electrode, while the two ends are secured to an insulated base plate which is securely mounted upon the bridge piece. The bridge carries the button in the usual manner, and thus an initial tension adjustment of the button may be effected. The diaphragm bears upon the two bows of the figure 3, the points of contact being provided with insulating studs. The patent is assigned to the Corwin Telephone Manufacturing Company.

#### SWITCHBOARD CIRCUIT SYSTEM

A patent granted to Mr. H. P. Clausen, of Chicago, and assigned by him to the Springfield Edison Telephone Manufacturing Company, describes a cord circuit system for common-battery operation. According to this system, the cord circuit is divided at its center by the insertion of a repeating coil, the middle points of the two windings of the repeating coil being joined respectively through two condensers. The battery feed is obtained through supervisory relays, two such relays being used for each

end of the cord circuit. It will thus be understood that the battery feed is accomplished by means of the retardation effect of the relays, while the trunking is effected by means of the inductive effect of the repeating coil.

Mr. A. H. Dyson, of Chicago, has obtained a patent for a switchboard circuit system including a trunking system, which is more particularly designed for connecting a common-battery central office with a central signaling office. With the central signaling office the transmitters of the stations are energized by local batteries, but the signaling is done by common batteries. This system provides the features usual for such a circuit scheme, the invention being concerned chiefly with the details of the parts and their arrangement.

Another patent granted to Mr. Dyson also covers a switchboard circuit system which involves trunking. The trunking system is adapted to meet a particular type of line circuit and its arrangement is therefore made with this in view. One of the features of the invention lies in the use of two parallel relays, one of high resistance and one of low resistance, so arranged that when the supervisory light of the subscriber's cord circuit is to be extinguished the high-resistance relay is cut in and when this light is to glow the low-resistance relay is connected. Both of these relays perform the same function at their contacts, the condition of the called subscriber's cord determining whether the high-resistance or the low-resistance relay shall be in service.

Both of the above patents have been assigned to the Stromberg-Carlson company.

## Letters to the Editors

### Change in the National Electrical Code

*To the Editors of the Electrical World:*

SIRS:—Concerning the proposed change in the National Electrical Code whereby fuses of refillable construction would be approved, it may be stated that the entire proposition resolves itself into the question whether or not there would be greater abuse of approved fuses (including the refillable type) under the new wording of the code than now exists. Manifestly any conclusion at this time must be in the nature of a psychological speculation, not being based upon experimental facts, and any decision arrived at should be governed entirely by what is for the best interest of the electrical industry. If it is shown that the change of the code as proposed will cause a greater abuse of approved fuses, including refillable types, than now exists, it would clearly be for the interest of all that such change be avoided, but if, on the other hand, under the new revised code less abuse will prevail, then the change is a good one and should be encouraged.

Owing to their defective plan of construction, considerably over 75 per cent of the various types of refillable fuses that have appeared on the market during the last few years cannot be approved by the Underwriters until they are greatly revised. They, therefore, drop out of consideration and do not come within the scope of the present question. It is reasonably certain that no form of refillable fuse will be approved that does not, as submitted to the Underwriters' Laboratories, comply in every detail with the present specifications, except the clause relating to refilling, and that will not be refillable by the user so as to maintain the same degree of accuracy and dependability. Any variation from the specific instructions of the manufacturers as to how their fuses should be refilled, as approved by the Underwriters, will constitute an abuse of the fuses.

It is the contention that serious abuse of the present approved fuse has given excuse for the introduction of a refillable fuse and has raised at this time the question of

a revision of the code. Abuse of fuses must result either from deliberate intent or from lack of information on the factors that affect their variation. A very large percentage of the specific causes of abuse detected and recorded by the electrical inspectors relate to the substitution of copper wire in the cartridge or the use of a small auxiliary strip soldered to the ferrules or of a small jumper wire between the cut-out clips employed to prevent too frequent blowing of the fuses after the maximum capacity of the cut-out has been reached. It is difficult to see how the refillable-fuse construction will change the mental attitude of the attendant toward such cases, as the carrying capacity of an approved refillable fuse would be the same as that of the standard fuse. It would therefore appear that a large percentage of the abuses now experienced would continue after the proposed change in the code went into effect. Moreover, a large number of users who have been restrained from this form of abuse by the influence exerted by the Underwriters, through their electrical inspectors, in behalf of safe construction would then avail themselves of the opportunity to increase the carrying capacity of the fuse without discovery.

In addition to the above deliberate attempts to increase the carrying capacity of the fuse, there would necessarily creep in a vast number of abuses through lack of information regarding the factors that affect fuse operation. Anyone familiar with the difficulties of building a line of fuses to comply with the present code specifications will appreciate that any slight variation in assembling the fuse, or in quantity of filler used or condition of that filler, will suffice to throw the fuse outside the code specifications and thus condemn it. It is difficult to imagine that any fuse can be so accurately constructed that after being reloaded by many different users in its life of from five to ten years it will maintain the standard that was required of it when it was originally approved. It would seem that the Fire Underwriters would hardly care to assume the responsibility of placing their approval upon that fuse when it had come into the hands of parties of whom they knew nothing. In the majority of cases it would be fair to assume that the user refilling the fuse would not be conversant with all of the factors affecting its operation. Under present conditions the Underwriters know that if the fuse is returned to the manufacturer defective parts are replaced with new material and the same degree of care is exercised in refilling as with the fuses when new.

In view of these facts, it would seem beyond question that the introduction of a refillable type of fuse into general use would result in a much greater abuse of approved material than is now encountered, and therefore would result detrimentally to the electrical industry.

C. T. McDONALD,  
Chief Engineer Chicago Fuse Manufacturing Company.  
Chicago, Ill.

*To the Editors of the Electrical World:*

SIRS:—Any manufacturer of approved fuses to-day can easily change the arrangement of his fuse so that the fusible element may be readily replaced when melted. It is necessary merely to provide means for clamping the element to the fuse terminal. The company with which I am associated has had a great many requests for fusible elements so arranged that the fuses may be reloaded by the user. Many good customers have been lost on account of the stand taken against such refilling, but we have always felt that the policy with reference to furnishing elements was a step forward toward higher standards.

The accompanying illustration shows an overload-time-characteristic curve of a 60-amp, 250-volt fuse. The curve would coincide with the vertical axis if the load were so large that no time elapsed between the closing of the circuit and the operation of the fuse; this condition is ap-

proached on a "dead" short-circuit. The curve becomes parallel to the horizontal axis at a current value equal to the maximum carrying capacity of the fuse. Fuses in service are blown under conditions between a slight overload and a dead short-circuit. The first condition involves heat dissipation and accurate rating; the second involves the smothering of the arc and providing strength to withstand the explosion when the fusible element is volatilized in almost zero time.

Some idea of the pressure on an inclosed fuse when short-circuited can be gained from a letter by Prof. F. A. Laws, of the Massachusetts Institute of Technology, in part as follows: "I have made certain tests on the pressure occurring when fuses are blown on short-circuit. My experiments are not complete, but I will say that for the conditions under which I worked the pressure was from 250 lb. to 400 lb. per sq. in. maximum. Different circuit conditions would probably vary the figures. Great accuracy, of course, is not possible in such work. There is considerable difficulty in making a pressure gage which will

tampered with. Inclosed fuses are not abused to-day, except, perhaps, in a few isolated instances, and I believe that these can be controlled easily by the Underwriters themselves, if they desire to do so. What is needed is merely education and co-operation between the Underwriters and the fuse users.

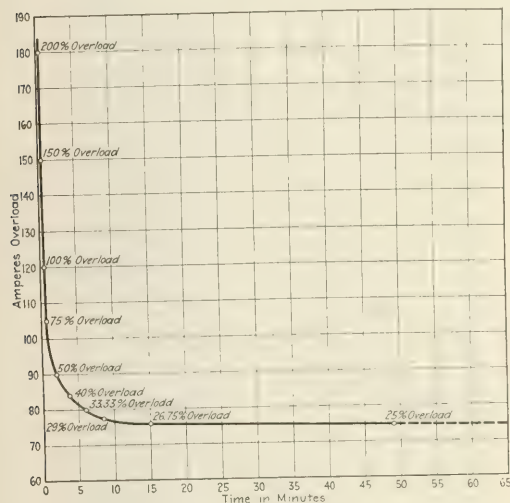
The writer is certain that if the public is allowed to refill fuses the number of accidents and losses will be so great that the days of the inclosed fuse as a reliable, scientific and efficient protective device will be numbered. A refillable fuse will bring back into use the most objectionable type of contact found—the screw-clamp contact. The screw clamp will not be placed outside the fuse where an inspector can determine at a glance whether or not it has been abused, but will be inside where it can and will be abused and remain undetected.

Fuses were standardized some years ago because of the number of types and sizes and the fact that the fuses of no two manufacturers would interchange. This same condition will be produced again if refillable fuses are approved. No jobber would attempt to carry in stock all of the different types of links and filling materials necessary to furnish the trade with the large number of proper fusible elements and filling materials for the special designs of all manufacturers.

Present standards should not be lowered; they should be raised. Fuses should be safe to property and to persons. There should not be put in the hands of the general public something which under any possible condition may be dangerous.

B. D. HORTON,

Electrical Engineer Detroit Fuse & Manufacturing Company.  
Detroit, Mich.



CHARACTERISTIC CURVE OF A 60-AMP, 250-VOLT FUSE

operate in, say, five-thousandths of a second with accuracy. However, I think that the overrunning on the gage did not exceed 5 per cent."

Pressures of from 250 lb. to 400 lb. per sq. in. are not to be taken lightly. What could be the result except a dangerous explosion if improper materials such as copper and aluminum whose vapors expand rapidly were used, and what if an element were used with a fuse larger than that for which the case was designed and specified by the National Electrical Code, and what, too, except a fireworks "flower-pot" if the filling—the arc smothering material—were omitted?

The writer believes that to allow the public to refill fuses and take the matter out of the hands of the Underwriters cannot help but result disastrously to property and to humanity as well. An inclosed fuse with an improper element in it, or a badly designed element, is really very dangerous. It may produce fire on a long-time overload and is dangerous to life because of the resultant explosion and also the fire on short-circuit. The writer firmly believes that the number of fuses which are wrongly reloaded to-day is practically insignificant compared with the number of fuses used properly. Of all the fuses which have been returned to our factory to be refilled, not one made by us had been

To the Editors of the *Electrical World*:

SIRS:—For a number of years, perhaps the past fifteen, several types of refillable fuses have been brought forward and thrust upon a market ready to be convinced as to their value. A large number of purchasers became interested in these fuses while the refillable theory was in its infancy, but as none of the fuses was practical or accurate to any sufficient degree, a prejudice soon began to be apparent against the refillable type of fuse. This prejudice soon extended itself to fire underwriting boards, to fire prevention bureaus and to all other bodies whose duty it was either to approve or reject electrical apparatus the use of which might invite disaster.

Several types of refillable fuses from time to time were submitted for approval to local fire prevention bureaus and the National Board of Fire Underwriters, and each was rejected. During the past five years two or three manufacturers of refillable fuses have succeeded to some extent in overriding this prejudice and antipathy, and although they have not as yet received the support and approbation of the National Board of Fire Underwriters, they have succeeded in demonstrating conclusively to a large body of fuse users that there is a great deal of merit in the refillable type.

The past five years have seen these two or three larger manufacturers seeking the approval of the National Board of Fire Underwriters, more because the approval by this board would remove all existing discredit upon the refillable fuse type of construction than for the purpose of the approbation of this board is a prime requisite to its utilization.

The refillable fuse has suffered long from the arbitrary rulings of various associations, but the day of prejudice and unreasonable attitude has begun to fade and the refillable fuses will, I believe, shortly receive in the near future the approval of these bodies.

JAMES ARTHUR NOBLE

Secretary-Treasurer Ackley Brake & Supply Company.  
New York, N. Y.



# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Thawing Water Pipe with Series Transformer

Use was made of an 80-amp series transformer in thawing out a frozen  $\frac{3}{4}$ -in. water pipe in a substation of the Yonkers (N. Y.) Electric Light & Power Company during a recent cold snap. The series transformer used had a ratio of 16 to 1, and for the thawing work its secondary winding was connected in series with a bank of eight 80-watt lamps, fed from a 110-volt circuit. For each ampere passing through the secondary winding approximately 16 amp was thus delivered to the pipe circuit. With the nearly 100 amp available in the pipe-thawing circuit when the transformer was connected as described, it required only eight minutes to free the pipe and set the water running. The total energy registered on the meter amounted to about 42 watt-hr., which at the company's lighting rate of 13 cents per kw-hr. would have cost barely half a cent.

## Improving Boiler Performance

In a discussion following the reading of a paper on "Steam Flow Meters" by Mr. C. R. Matheny, of Chicago, at the recent convention of the Minnesota Electrical Association, Mr. F. A. Otto, of St. Paul, commented on the number of appliances offered to the plant manager to increase the efficiency of boiler operation. The steam-flow meter is one of these. It must be used intelligently to be of value and must be checked up at intervals. The best piece of apparatus that can be put into a boiler room, however, is an efficient fireman, said Mr. Otto, and the labor required to educate the fireman is well spent. The  $\text{CO}_2$  meter is also a valuable help to detect waste.

Mr. T. D. Crocker, of St. Paul, told of a generating plant whose rating had been increased from 16,000 kw to 56,000 kw with an increase in boiler capacity of from 11,000 hp to 18,000 hp. This was accomplished by the use of improved generating units, with low-pressure steam turbines; further, the entire boiler plant was worked at 50 or 100 per cent overload during the peak and nearly all of it at normal rating at other times.

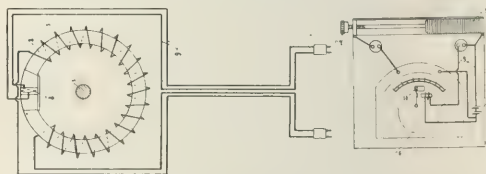
## Split-Core Instrument for Measuring Large Direct Current

For measuring large direct current without interrupting the conductor, using a principle already applied to alternating-current measurements, the Pacific Gas & Electric Company has constructed instruments for laboratory and underground-cable testing, under patents granted to Mr. O. A. Knapp, of Oakland, Cal. The devices as built have proved to be as convenient and useful as the alternating-current split-core ammeter. The range of application for the direct-current outfit is even larger, since the length of connecting cord has no effect upon the calibration. The device is therefore also adapted for long-distant measurements and recording.

Of the two instruments built for the company, the one for laboratory work has been used with good success and high accuracy for measuring currents from 1000 amp to 10,000 amp, the accuracy being as good as a high-drop shunt instrument will permit. The instrument for under-

ground cable work is designed for currents up to 1000 amp, and the results of tests already made demonstrate its value in distribution work. It is a very rugged instrument and said to be fool-proof. The split core weighs 7 lb., and the ammeter, including rheostat and battery,  $6\frac{1}{2}$  lb. Each of these appliances requires only one man to operate it.

The accompanying illustration shows the simple principle involved in these instruments. The current flowing through the conductor sets up a magnetic flux in the soft-iron core. This flux the tester opposes by sending through the winding a current which produces 1000 ampere-turns for the 1000-amp outfit. This opposing current comes from the battery, is regulated by a rheostat and is indicated by a 1-amp direct-current ammeter, the whole contained in a small portable box. A slight turn of the knob raises the current and deflects the ammeter needle to any part of the scale, the latter being marked "0 to 1000." The moment the ammeter needle passes the scale point which numerically equals the line current, the flux in the core, which has previously drawn the small pivoted magnet needle to the left, reverses, throwing the magnet needle to the opposite side, thus closing the circuit and at the same instant throwing the "read" signal to the right. The



SPLIT-CORE INSTRUMENT FOR MEASURING LARGE DIRECT CURRENTS

read signal indicates directly on the scale plates on the ammeter just below the scale and gives the signal for the tester to read his ammeter. When the exact reading is reached by the ammeter needle the signal will start to vibrate rapidly, like the vibrating reed of a frequency indicator, producing a plainly audible buzzing tone. As long as the ammeter needle is above the correct reading, the signal will stand to the right; as long as the ammeter is below the correct reading, the signal will stand to the left, thus enabling the tester to close up on the correct reading instantaneously.

By observing a simple little rule, particularly on low amperages, a very high accuracy is obtained. The tester raises his reading to twice the amount given by the read signal and then, going up and down a few times with the needle, closes up gradually on the current reading. If the average of a fluctuating current is being determined, no demagnetizing is required, as the magnetic lags and leads average, of course, just as the lags and leads caused by the damping of the average indicating instrument. The procedure, therefore, to obtain average currents on fluctuating currents, as, for instance, in testing watt-hour meters on railway circuits, is simple.

The tester deflects the ammeter needle up and down the full scale, and reads every time the signal is given by the read signal. The average of these readings is likely to be a truer average of the line current than the average

obtained from the same number of readings taken from a direct-indicating ammeter. External fields produce very slight effects, since all stray lines near the magnet needle are shunted off through the core instead of through the air-gap in which the needle moves.

### The Prevention of Accidents

One feature of the work of the Minnesota Bureau of Labor, Industries and Commerce is co-operation with organizations of employers and others in the work of preventing industrial accidents. In line with this policy Mr. D. D. Lescobier, an expert of the bureau, read a paper on "Prevention of Accidents" before the St. Paul convention of the Minnesota Electrical Association on March 11. The author gave statistics to show that the number of accidents in Minnesota plants is all too large, the one mitigating circumstance being that the total is decreasing.

Linemen appear to be the greatest sufferers in accidents growing out of electrical work. They are killed or injured by contact with high-potential wires, by falling from poles and, rarely, by being struck by falling poles during construction work. More active efforts should be made to cover all neighboring wires with rubber shields during work on poles carrying live wires. Usually the wire which is occupying the lineman's attention is not the one that causes the trouble. Requirements as to safety precautions on overhead circuits should be stringent and should be uniform in the various states. The foreman should be held rigidly accountable for the use of protective devices. He holds the key to the situation, and on him should the responsibility be concentrated.

To prevent falls from poles the speaker said that safety straps should be used under all circumstances. Here again the foreman should be looked to.

Power-plant accidents are usually due to contacts with wires or apparatus carrying dangerous potentials, to unprotected shafts or to falls from platforms or elevated structures. The remedy in the case of the contact hazard is not only to shut off the electricity on the circuit or circuits being repaired but to lock the controlling switch or switches. Specific rules to this end should be promulgated and enforced.

Mr. Lescobier praised the book of safety rules of the Minneapolis General Electric Company. Central-station men, he said, are apt to underestimate the dangers of their business, and a corresponding statement is true of all industries. The grounding of the frames of switchboards controlling circuits of 250 volts or over was recommended. The practice of the Illinois Steel Company and the Oliver Mining Company was commended. It is no evidence of courage or cleverness to be indifferent to the dangers of electricity, said the expert. Shafts should be covered with shields or heavy wire screens.

Strong railings should be used in all portions of power houses where there is danger of falling. Stairways should take the place of ladders where possible. Platforms, scaffolding and the like should be made very secure. The collapse of scaffolds is inexcusable. The statement was made that ladders caused more accidents in Minnesota during the last two years than most of the machines that are well recognized as dangerous. The International Harvester Company has given especial attention to the proper design and use of ladders; for instance, as to the kind of base to prevent slipping on various floors.

Mr. Lescobier's closing word of advice was to pay the greater attention to the man rather than to the thing. Organize safety committees among the men. The employees must be thoroughly imbued with a sense of their own responsibility. The Minnesota Bureau of Labor has worked out a complete plan of organization for the formation of workmen's safety committees in the smaller industries.

The lecturer exhibited a number of photographs, some showing switchboards entirely protected by screens. The electrical men did not think this ordinarily practicable, but in the main they agreed with the bureau expert.

Mr. Eugene Holcomb, manager of the Consumers' Power Company, St. Paul, emphasized the point that men became careless.

Mr. R. F. Pack, manager of the Minneapolis General Electric Company, said he believed that in 1912 his company had no fatal accident and told of its safety rules.

Mr. H. J. Gille, assistant general manager of the St. Paul Gas Light Company, said that his company has used a set of safety rules for a number of years. He spoke of the value of cut-out switches and thought an investigation of the subject very important.

Mr. A. Jarney, of the Minneapolis General Electric Company, pointed out that it is not always practicable to switch out high-potential wires needing attention. Some industries dependent on central-station energy would be seriously embarrassed if this were done.

Mr. E. T. Street, of St. Paul, declared that it is often impossible to "kill" all the wires on a pole to effect repairs on a certain circuit. What ought to be done is to devise plans so that the work may be done in safety without resorting to this drastic alternative.

Mr. G. Fabianke, of Sherburne, excited interest by the statement that in his town the Council gives the electric-service company permission to remove trees where the latter interfere with the company's wires. Mr. Ludwig Kemper, of Albert Lea, admitted that, although he is in the electric-service business, he would rather see the trees than the poles. He advocated co-operation with the owners of shade trees.

### Simple Circuits for Wireless-Telegraph Station

Kindly specify the simple practical circuits necessary for the operation of a wireless telegraph station. C. D. O.

For a receiving station the necessary circuits and apparatus consist of an aerial connected to ground through a tuning coil, and a condenser in series with a detector which is shunted around the tuning coil. A 1000-ohm telephone receiver bridged around the detector completes the necessary equipment. In the sending circuit the key, the battery and the primary of the transformer coil are connected in series. The aerial is now connected directly to ground through a spark-gap. The secondary of the transformer coil and a condenser bridge the spark-gap and complete the sending apparatus necessary for operation of a small station. The aerial need not be so extensive as is generally supposed. In many instances an iron fire escape can be made to serve as an aerial for a small receiving station.

### Unequal Heating in Transformers

We have two small transformers connected in series, the secondary of one connected in series with the primary of the other. The secondary of the first transformer is connected to the same in potential as the secondary of the second transformer. A. B. W.

If two transformers are connected in series there is no certainty that they will divide the potential equally between them, the exact division depending upon the characteristics of the magnetic circuits. The transformer system through which all of the electrical apparatus is star-connected, has been found to possess somewhat the same characteristics. The neutral may drift out of its proper place and there will be unequal potentials between it and the three terminals of the circuit, due to unequal heating and different magnetic forms or in transmission circuits. Such unbalancing would cause unequal heating of the transformers, and when a four-wire, three-phase system of distribution is employed it may seriously interfere with the voltage regulation.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*Alternating-Current Commutator Motors.*—L. BARRILION AND F. CLARET.—In a continuation of their serial on the operation of single-phase commutator motors the authors discuss with the aid of formulas and diagrams repulsion motors with two systems of primary fields and repulsion motors with two sets of brushes, and then give the theory of commutation in commutator motors.—*La Houille Blanche*, December, 1912.

### Lamps and Lighting

*Street Lighting.*—An illustrated description of a system of electric street lighting used at Southgate, England, and specially adapted for tramway roads. The essential feature is the use of 50-cp metallic-filament lamps upon the tramway span wires, in suitable fittings, at a considerable height over the roadway, a few feet from the curb line.—*London Elec. Eng'ing*, Feb. 27, 1913.

*Shades and Reflectors.*—J. G. CLARK AND V. H. MACKINNEY.—A paper read before the (British) Illuminating Engineering Society. The paper begins with some remarks on the need for efficient shading and the choice of suitable methods of screening and directing light. The chief functions of a shade are analyzed and the results given of a series of tests of the distribution of light from various shades and reflectors with gas and electric lamps. Subsequently an account is given of some experiments on the shadows cast by various sources, and direct and indirect lighting are compared in this respect. Some new apparatus for this purpose is described and illustrated. In conclusion appendices are added containing a brief account of four installations, illustrated by photographs taken entirely by artificial light. These are selected with a view to illustrating special points in shading.—*Illumin. Engineer* (London), March, 1913.

### Generation, Transmission and Distribution

*Norwegian Power Plant.*—J. GARSTAD.—An illustrated article on the water-power station of the city of Trondhjem in Norway. The first plant was erected in 1900 with a rating of 10,000 hp, and a second additional plant in 1910 with a rating of 18,000 hp. Since the city of Trondhjem has 48,000 inhabitants but only a few industrial plants, it was important to attract as many of the inhabitants as possible as customers, and for this purpose a flat rate of charging was devised. But at the same time the consumers were at liberty to install meters and pay according to the amount of energy used. The flat rate has given very good results. There is one house connection per nineteen inhabitants and one consumer per five inhabitants. Out of the 9500 consumers of electric energy for lighting purposes only 100, with connections amounting to 230 kw, have watt-hour meters and pay according to the energy consumed; 1000 (with a rating of 1800 kw of connections) have maximum-demand indicators or apparatus limiting the power, and 8400 (with a rating of 1400 kw of connections) pay a flat rate per lamp. From the consumers with watt-hour meters the station received in 1912 \$16.75 per kw or \$40 per consumer, while the consumers with maximum-demand indicators or limiting devices paid \$25 per kw or \$45 per consumer, and the consumers with flat rate per lamp paid \$45 per kw or \$7.50 per consumer. Even if the lamps installed for a flat rate are used twice as much as the lamps metered

in the hours of maximum load, the flat-rate consumers are more advantageous to the central station than the consumers who have meters. In Trondhjem the yearly hours during which the flat-rate consumers use electric energy are from 1200 to 1500, but when electric cooking and heating become more general this may increase to 3000 hours. Load-factor curves are given.—*Elek. Zeit.*, Feb. 20, 1913.

*Power Requirements of Fans and Blowers.*—C. W. DRAKE.—After a description of the features of centrifugal fans, disk or propeller fans and positive-pressure blowers, the author gives formulas for calculating the power requirement from the volume of air handled and the pressure of vacuum obtained. In making recommendations for motors to be used as driving blowers or exhausters it should be remembered that the name-plate, size or number gives no indication whatever of the amount of power required. The same fan will require many times as much power in some conditions of service as will be required under other conditions. If the volume and pressure are known, the application is a simple one, but for some purposes the only way in which the required volume and pressure can be satisfactorily determined is by trial.—*Elec. Jour.*, March, 1913.

*Development of Water-Powers.*—LEON MÄHL.—A report to the Fourth Congress of Public Works in Paris discussing the technical and commercial factors which must be taken into consideration in the development of water-powers, especially with respect to the height of the falls.—*La Houille Blanche*, January, 1913.

*Modern Condensing Systems.*—A. E. LEIGH SCANES.—A paper read before the (British) Institution of Mechanical Engineers. The object is to indicate as briefly as possible the lines along which development in condensing systems has taken place during recent years and will probably continue in the future. It is shown that the tendency is toward smaller and cheaper plants of high vacuum efficiency and toward simplicity in auxiliaries as exemplified by rotary pumps.—*London Engineering*, Feb. 21, 1913.

### Traction

*Single-Phase Traction in Europe.*—An illustrated description of two European single-phase railways. The first is the Mittenwald electric railway of 105 km (63 miles) length, running through mountainous districts in Bavaria and Austria. For transmission an emf of 50,000 volts is employed and special care was taken in choosing a suitable type of insulator. The overhead line follows a series of sharp curves, and the poles have to withstand the jerks produced by the swift motion of the current collectors. Investigation showed that only chain-link (disk) insulators would withstand this heavy stress, no part of these insulators being exposed to traction or inflection strains. The type of insulator ultimately developed possesses a breaking strength of from 7800 kg to 8000 kg (about 3600 lb.) with a weight of only 2.8 kg. It also possesses excellent insulating qualities. An essential difference between this insulator and those used by American engineers is that the channels are not of circular cross-section, and instead of a wire rope exposed to rusting, steel bands applied throughout their width on the porcelain (so as not to injure the enamel) are used to fix it. After fitting the insulators in position, the channels are filled in, thus preventing any water from entering and freezing within the insulator. An-



other distinctive feature is the flexible armature of the insulator, which absorbs all shocks, thus preventing any damage to the enamel. The rolling stock of the Mittenwald railway at present comprises nine locomotives, each having a normal output of 800 hp. The maximum gradient of 36.4 per mile is found extensively on this railway; each locomotive will haul over this gradient a gross train weight of 124 tons at about 30 km per hour, which corresponds to a tractive effort of about 7500 kg. The driving motor is a twelve-pole single-phase commutator machine of 800 hp normal output, at a speed of 30 km per hour. It is designed on the A. E. G. system, in accordance with which the current in the armature is produced by transformer effects. The rotor winding is closed by short-circuiting brushes, thus obtaining the secondary winding of a transformer, the primary winding of which is the field winding of the stator. Excitation is effected from the rotor, current being supplied to the armature through another pair of brushes from a special exciter transformer connected up in series with the stator winding. A brief discussion is added of the Rjukan railway, which is the first standard-gauge electric railway in the south of Norway to be installed on the single-phase system. It is mainly intended for the transport of the artificial saltpeter manufactured in Saaheim to Notodden. The rolling stock comprises three four-axle and two two-axle locomotives. The former have two bogie trucks and are fitted with four alternating-current motors, each having an hourly rating of 125 hp and weighing approximately 46 tons. The two-axle locomotives have two motors of the same size and weigh about 23 tons. The locomotives are constructed for a line pressure of from 10,000 volts to 11,000 volts at from 15 cycles to 16 cycles and are designed for contactor control.—*London Elec. Review*, Feb. 28, 1913.

#### Installations, Systems and Appliances

*Austrian Central-Station Statistics.*—L. ROSENBAUM.—The Austrian central-station statistics compiled by the Electrical Society of Vienna have been enlarged in the present year by including statistics of Austrian railways, giving data on sixty-four electric roads with 1040 km (624 miles) length of track. The central-station statistics give data of 854 public central stations in Austria. Of these 335 are owned by municipalities and 519 are privately owned. There are 143 central stations transmitting energy over districts for agricultural purposes. Since there are 2000 cities and towns in Austria in which electric energy is sold, there must be 1150 cities and towns which are supplied with energy from a power station in a neighboring city. On Jan. 1, 1907, there were 446 central stations (with a generator rating of 168,850 kw); on July 1, 1910, there were 675 central stations (318,614 kw), and on Jan. 1, 1913, there were 854 central stations (457,010 kw). The systems used by the different stations are as follows: 309 stations (71,863 kw) use the direct-current system with storage batteries; 182 stations (6653 kw) use the direct-current system without storage batteries; seventeen stations use the single-phase system and four stations the two-phase system, the combined rating of these twenty-one stations being 48,872 kw; 285 stations (172,292 kw) use the three-phase system, and fifty-seven stations (157,330 kw) use the combined alternating-current and direct-current system. The three-phase stations have lately shown the greatest increase, both with respect to their number and to their rating. Six hundred and fifty-two stations (44,275 kw aggregate capacities) have a generating rating of up to 250 kw each; seventy-eight stations (28,652 kw) have a rating of from 251 to 500 kw; fifty-one stations (29,350 kw) have a rating of from 501 kw to 1000 kw; thirty-one stations (42,380 kw) have a rating of from 1000 kw to 2000 kw; nineteen stations (68,050 kw) have a rating of from 2000 kw to 5000 kw, and thirteen stations (215,150 kw) have a rating above 5000 kw. As to the source of power the following figures are given: 375 stations use

water-power, 138 stations steam power, 104 stations gas power, ninety-six stations water and steam, sixty-three stations water and gas, twenty stations steam and gas, thirteen stations steam, water and gas. In 607 systems (60,000 kw) overhead wires are used; in 132 systems (144,000 kw) cables are used; in 235 systems (222,000 kw) both cables and overhead wires are used. Some details are also given concerning the distribution systems. It appears that in recent distribution systems the three-wire system with from 200 volts to 250 volts finds most favor.—*Elek. und Masch. (Vienna)*, Feb. 16, 1913.

*Electrical Progress in China.*—A long editorial discussion of the electrical advances taking place in Shanghai. The new Riverside power station is designed to accommodate a plant of 14,000-kw rating and the first instalment amounts to 4000 kw, but it has already been decided to install two more 5000-kw turbo-alternators. In order to advertise electricity the station will use "everything electrical," and it pays much attention just now to electric vehicles. Electric radiators are being readily adopted by Chinese consumers. The total connections of electric heaters and cookers in Shanghai now aggregate over 500 kw. A number of cotton mills are being electrified. Attention is called to the fact that German firms are securing the bulk of this work.—*London Elec. Review*, Feb. 28, 1913.

*Wages in British Central Stations.*—J. S. AINSWORTH.—In reply to an inquiry as to wages and vacations in British central stations, forty-seven stations send replies concerning maximum and minimum salary, average hours per week of charge engineers and switchboard engineers, also as to Sunday and vacation arrangement and emergency arrangement. The results are given in form of three tables.—*London Elec. Review*, Feb. 28, 1913.

*Charging Storage Batteries.*—A note on a recent British patent (No. 5434, 1912) of K. von Dreger. To minimize the loss in the series resistor generally used in charging small accumulators from lighting mains, the cells to be charged are connected in parallel with a large storage battery through series resistors. This storage battery is permanently in series with the mains.—*London Elec. Eng'g*, Feb. 20, 1913.

*Alternating-Current Switchboards.*—C. H. SANDERSON.—This continuation of his illustrated serial on switchboards for alternating-current stations deals with remote mechanically controlled switchboards, their advantages, applications and types.—*Elec. Jour.*, March, 1913.

#### Wires, Wiring and Conduits

*Cables for Shafts in Mines.*—E. KILBURN SCOTT.—An illustrated paper read before the Association of Mining Electrical Engineers in London the author recommends that high-tension aluminum cables be used in mine shafts; that armoring should be dispensed with on shaft cables, a return path for current being provided by metal work already in the shaft or by steel ropes specially suspended to serve this purpose; that silicious tire rubber be employed in place of steel to provide mechanical protection on cables exposed to moisture and hard wear, and that split telegraph poles be used in place of the sawn casing hitherto used when cables have been inclosed.—*London Elec. Review*, Feb. 28, 1913.

#### Electrophysics and Magnetism

*Vacuum Tube Discharge in a Magnetic Field.*—N. A. KENT AND R. M. DAVIS.—An abstract of an American Physical Society paper. Although many have studied vacuum-tube discharge in a magnetic field, no investigator has fully identified the resulting spectrum and classified the effects obtained upon the variation of the field. The authors have found that the decrease of the effective cross-section of the tube and the smallest amount of the ions reflected against the glass both caused by the magnetic field—result in the production of one or more of the following classes of spectra: (1) Those of impurities in the tube.

examples, hydrogen appearing in an argon tube and argon in a nitrogen tube. (2) Those of dissociation products of the original gas; example, the oxygen spectrum appearing in a carbon-monoxide tube. (3) Those of dissociation products of the glass; example, sodium and oxygen lines appearing in the spectra given by many tubes when in the field. The case of nitrogen and argon above mentioned is of special interest, as some of the lines of the blue spectrum of argon persist for at least ten minutes after the magnetic field is removed, and the reappearance of the band spectrum of nitrogen is gradual. This is a unique phenomenon.—*Phys. Rev.*, March, 1913.

**Effect of Magnetization on Thermal Conductivity.**—N. F. SMITH.—An abstract of an American Physical Society paper. Contradictory results have been obtained by other observers. The present investigation has been confined thus far to a determination of the change produced in the thermal conductivity of iron by a longitudinal field. Observations have been made on metallic tubes  $\frac{3}{8}$  in. in diameter and about 3 ft. in total length. The iron tube and a comparison tube of brass were mounted side by side. One end of each of these tubes was maintained at a constant temperature of from 200 deg. to 225 deg. The two tubes were surrounded by similar solenoids, connected in series. The coil surrounding the comparison tube was wound non-inductively, while the winding of the other could be changed from non-inductive to inductive by a commutator. By a suitable arrangement of thermocouples two points of equal temperature were determined in the two tubes, while there was a non-inductive current in each coil. The magnetic field was then applied to the iron tube by shifting the commutator, and after time had been given for temperature conditions again to become steady the point of equal temperature in this tube was again determined. Fields up to 163 c.g.s. units were employed. The sensitiveness of the apparatus was such that a change of conductivity of 0.1 per cent could have been detected with certainty, yet in no case was an effect as great as this observed.—*Phys. Review*, March, 1913.

#### Units, Measurements and Instruments

**Damped Moving-Magnet Galvanometer.**—C. FÉRY.—In all commercial galvanometers with moving magnets the coil encircles the two poles of the magnet so that the interior diameter of the coil must have at least the length of the moving magnet. If, on the other hand, only one of the poles is subjected to the action of the coil, it is possible to make the internal diameter of the coil very small. This results in an increase of the counter emf due to a displacement of this pole and to a decrease of the resistance of the wire of the coil. In consequence of this such strong currents are produced on short-circuit in the coil during a displacement of the magnet that an important damping effect is obtained. This condition can be realized by placing each pole of the suspended magnet between two pairs of

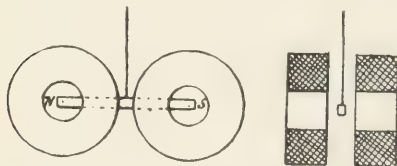


FIG. 1.—MAGNET SUSPENDED BETWEEN COILS

coils near enough to constitute a single solenoid, as shown in Fig. 1, while Fig. 2 shows an astatic arrangement made up of the combination of identical bars joined together in twos, poles of the same sign being connected together. A testing galvanometer of this kind gave a deflection of 1 mm on a scale at a distance of 1 m for a current of 0.000000008

amp. Each of the four coils has an external diameter of 12 mm and has 160 turns of wire of 0.5 mm. The resistance of the four coils in series is only 2 ohms. The duration of oscillation is fifteen seconds. The author expects to increase the sensibility still further by using a magnetic

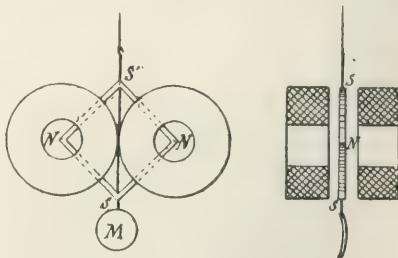


FIG. 2.—AN ASTATIC ARRANGEMENT

casing and a suspension wire of quartz.—*Comptes Rendus*, Vol. CLV, page 1008; abstracted in *La Revue Elec.*, Feb. 21, 1913.

**Micropyrometer.**—G. K. BURGESS.—An abstract of an American Physical Society paper. A small incandescent lamp is mounted within the Huyghens eyepiece of an ordinary microscope, which is then used as a Morse or Holborn-Kurlbaum pyrometer. Combined with a suitable furnace, such as platinum or other metallic strip heated electrically in vacuo or in a suitable gas such as hydrogen, melting points and emissivities of minute specimens (0.01 to 0.001 milligram or less) are readily observed. The apparatus is most conveniently calibrated empirically in terms of known melting points. It is being used for measurements on the rare refractory elements.—*Phys. Rev.*, March, 1913.

**Comparison of Small Electrostatic Capacities.**—J. C. HUBBARD and H. F. STIMSON.—An abstract of an American Physical Society paper. The electrostatic capacities of small bodies such as lead wires, binding posts, electrometers, small spheres or the change in capacity when two such bodies are joined, as when a lead wire is connected to a sphere, are compared by the method of divided charge with the capacity of a straight wire used as a standard. The instrument making these experiments possible is a gold-leaf electroscope of constant capacity. The method is especially applicable for measuring the capacities of bodies used in oscillation and ionization experiments.—*Phys. Rev.*, March, 1913.

#### Telegraphy, Telephony and Instruments

**Sounder in Submarine Telegraphy.**—E. RAYMOND-BARKER.—An illustrated article on John Gott's new principle of telegraph working, which enables the ordinary Morse, with its attendant automatic-translation facilities, to be worked on long submarine cables. The consequent close succession of signals, whether dots or dashes, of alternate + and - polarity, not only tends, during the progress of a letter or of a word, to keep a cable in an electrically neutral condition but also discourages distortion. While complimenting highly Scott's achievement the author points out that cable Morse telegraphy is not entirely new and gives an outline of the achievements of Pierre Picard. Picard sought to arrive at absolute sign alternation, combined with equality in the strength and duration of actual electrical charges, and this without any reference to the duration of an actual signal—that is to say, to the duration of the interval between the first impulse of a given sign and the following impulse of opposite sign. What differentiates Picard's principle from all others employed or tried up to his time has been his absolute abandonment of any idea of bringing back the electrical condition of the cable to a neutral condition after the application of each



charge. Picard has brought about that each transmitted impulse finds the cable in a symmetrically neutral electrical condition. In other words a + charge finds the cable influenced by a — charge of known value; a — charge finds in the cable a + charge equal to the preceding — charge

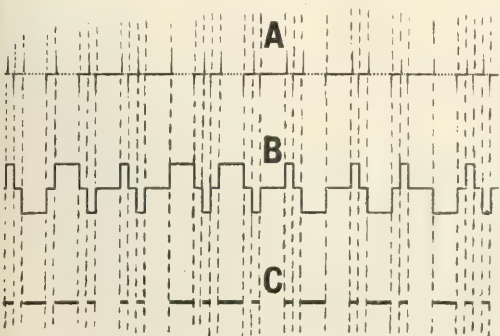


FIG. 3—PICARD AND GOTT TRANSMISSION PRINCIPLES COMPARED

and so on. Fig. 3 compares the Picard and the Gott transmission principles, and shows the word "Picard" in conventional graphs illustrative of the two principles, and in corresponding Morse. The Picard system is illustrated in A, the Gott system in B. Fig. 4 shows the master device of Pierre Picard, applicable to hand Morse, to Wheatstone automatic, to the Hughes or to the Baudot. In the illustration a simple cable Morse circuit is shown. Continuous lines represent main circuit, interrupted lines the local circuits;  $R_1$  and  $R_2$  are two polarized relays;  $LB_1$  and  $LB_2$  are local batteries. Owing to the presence of the local condenser  $LC$  any depression of key  $k$  causes a momentary "kick" of relay tongue  $T_2$  up against its stop contact on the + pole of the sending battery  $SB_2$ . Again, each time  $K$  comes to rest after each dot or dash the relay tongue  $T_1$  makes a momentary contact against its stop contact on the — pole of  $SB_1$ . During the interval between the two-relay tongue kicks caused respectively by the depression and the raising of  $K$ , the sending end of the cable remains insulated on the electrically connected tongues  $T_1$  and  $T_2$  at rest. A graphic presentment of the working of the momentary + and — impulses is shown by A in the first diagram, which does not pretend to represent the real electrical conditions in the cable. At the receiving end of the line is  $SCR$ , a suspended-coil relay specially designed by Picard. The coil has no self-retractive force, but is absolutely free to respond, in its movements, only to cable impulses. Between the "relay" and earth is the receiving condenser  $RC$ . It will be seen that in Picard's system + and — momentary impulses cancel out, whether in a signal, a letter, a word

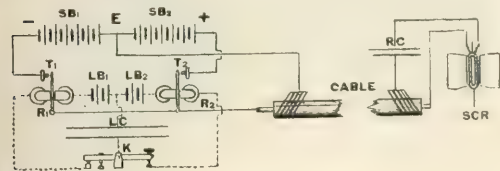


FIG. 4—PICARD'S MASTER DEVICE

or 1000 words. The Gott system of transmission, illustrated in B, if subjected to similar analytical treatment, gives interesting results, showing a certain + percentage of overcharge in some cases and a — percentage in others, but balancing out very evenly on the whole.—*London Elec. Review*, Feb. 28, 1913.

## Book Review

AN EXPENSIVE EXPERIMENT. The Hydroelectric Power Commission of Ontario. By Reginald Pelham Bolton. New York: Baker & Taylor Company. 281 pages, illus. Price, \$1.25.

The story contained in this book, which covers the establishment and operation of the Ontario transmission scheme, would be interesting at any time. Making its appearance at a time when the State of New York is considering the adoption of the scheme tried by the Province of Ontario, it is doubly interesting and instructive. The author has evidently spent considerable time in assembling and presenting information not easily obtainable which relates to the workings of a governmental undertaking after the general lines of which it is intended that the New York scheme is to be patterned. He claims that such schemes as these, while appearing under the guise of conservation or other beneficial activities, are in reality proposed for political ends only, and he anticipates that an exposition of their fallacies will not be well received, to put it mildly, in certain quarters. The strangest part of the situation, as set forth, is the small desire apparently felt by the inhabitants of the progressive Canadian Province in which the experiment is being tried to ascertain for themselves the whole truth, instead of accepting comfortably and somewhat blindly the statements issued by those in responsible charge.

Considering more particularly the Canadian experiment, the author makes it appear that the political bait which has been dangled before the eyes of taxpayers is the very beautiful theory that everyone, no matter how situated, would share in the benefits of having an unlimited supply of electricity brought to his door at cost. He argues that the theory does not work out very well in practice, and that sooner or later the taxpayers will realize that they have financially backed and assumed responsibility for a project which apparently supplies energy to a few of the inhabitants at less than cost while others will be obliged to make up the deficit. It has been denied by the promoters that any increased taxation will result from these operations. But the author maintains that this is inconceivable when it is considered that several of the activities embraced in the experiment have been carried on at the expense of the Province as a whole; for instance, the purchasing of materials, the canvassing of prospective motor users and the free engineering which has been done for some of the cities and towns served.

When a private company in the ordinary course of events enters the field to supply conveniences to a community it is taxed and bears a portion of the expense of that community and thus proportionately reduces the taxes paid by others. The service supplied, being a convenience and not a necessity, is not used by all and is paid for only by those using it. On the other hand, no taxes are paid on equipment used in the Canadian experiment for furnishing similar service to comparatively few users. Mr. Bolton draws attention to the light that is beginning to dawn in some of the cities using the energy, such as Berlin, Ontario, where requests have recently been made that the apparent book profits shall be used toward the reduction of general taxation in that city. These requests, it seems, have not been granted.

It is understood that the material included in the book formed a large portion of the minority report of the committee of the New York Legislature on the hydroelectric system of Ontario before which Mr. Bolton recently gave testimony to show that the system is not operating so successfully as claimed by those in charge. The book will be read with much interest both by those who agree with the author's presentation and by those who do not.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Socket Extension for Unskirted-Base Lamps

The lamp manufacturers are now furnishing the 60-watt tungsten lamp with unskirted medium screw base. The distance from the base contact to the center of the filament has thus been shortened approximately an inch and the former proper relation between filament and reflector accordingly destroyed.

A socket extension made by the Benjamin Electric Manufacturing Company, Chicago, meets this condition by lengthening the sockets enough to overcome the defect. The new type of lamps can thus be used and proper lighting results obtained without change of reflector. Changes from a larger to a smaller size lamp can also be made by means of the same device.

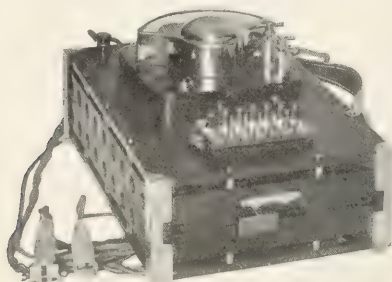


SOCKET EXTENSION  
FOR TUNGSTON  
LAMP

### Meter-Testing Set

A meter-testing set, known as the "Knopp set," has been placed on the market by the Western Electro-Mechanical Works, Oakland, Cal. The apparatus, which weighs complete only 8 lb., consists of a light box holding the resistor, upon which is mounted an indicator which shows the watts applied to the meter being tested and also indicates the current and line voltage during the test. A regulating slide is provided for holding the power supplied at a predetermined value.

The test set is used in such a manner as to do away with all computation for ascertaining the accuracy of the meter. The tester applies to the meter values of watts, which are numerically decimal multiples of the watt-hour calibrating constant,  $K$ , of the meter, thus causing the



METER-TESTING SET

meter, if correct, to complete a certain number of revolutions in one one-hundredth of an hour. This time interval is measured with a special stop-watch which makes one revolution in one one-hundredth of an hour and has a decimally divided scale so that it will read in millihours and tenths thereof.

If the meter being tested is incorrect, the watch will

show at once the correction factor of the meter; for instance, if the watch has passed through 104 divisions before the meter has completed the allotted number of revolutions, the meter has a correction factor of 1.04, or is approximately 4 per cent slow.

The simple rule for testing is to apply a multiple of  $(100 \times K)$  watts to the meter. For a load of one hundred times  $K$  one revolution is counted; for two hundred times  $K$  two revolutions, and so on.

### Circular Snap Switches

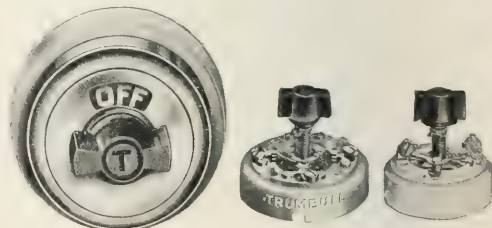
The Trumbull Electric Manufacturing Company, Plainville, Conn., has brought out a line of circular snap switches, some of which are illustrated herewith. They are especially notable on account of the smooth action and the strong and rigid construction.

The best movement in this type of switches is obtained by the use of an eccentric. In these switches use is made of a large release plate and two bearings, one at each end,



FIGS. 1 TO 3—SINGLE AND MULTI-POLE SNAP SWITCHES

so that the eccentric can move the release plate easily and smoothly. The ratchet plate is secured in a larger plate, which is recessed into the porcelain base and secured by means of a brass bushing, the latter in turn forming a long and rigid bearing for the spindle. The locking and releasing parts are made of hardened steel. The wire spring is long and flexible and the blades have a large contact surface. The dials are fastened directly to the spindle, thereby obviating the tendency to get loose which is said to show in



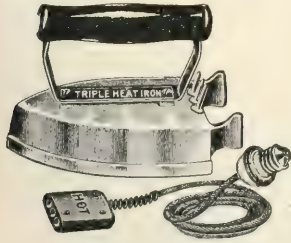
FIGS. 4 TO 6—CIRCULAR SNAP SWITCHES

self with dials fastened to the blade mechanism. In multiple-pole switches the pair of contact plates are mounted in different planes, increasing the break distance and also the factor of safety.

The terminals in all but the smallest sizes are flat so that the screws are operated directly from the front, which makes installation easier especially near a corner.

### "Triple-Heat" Electric Iron

An electric iron which is of unusual interest on account of the flexibility of heat intensity and the localization of the heat has recently been patented and placed on the market by the Waage Electric Company, 674 West Madison Street, Chicago. In fact, with the connections available four different heats can be obtained, but by the manufacturer the iron is called the "triple-heat" flatiron.



"TRIPLE-HEAT" FLATIRON

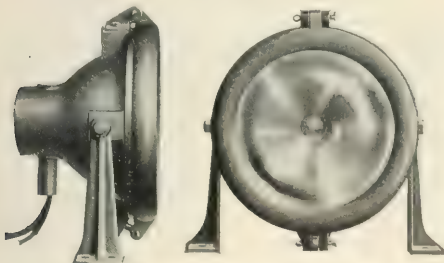
From the illustration it will be noted that the switch block is marked on one side "hot"; on the other side it is marked "medium."

The regulation of the heat is accomplished through attaching this block in different ways to the plugs. The heating element consists of mica leaves around which the heating coils are wound, each one of the latter being connected to isolated terminals, which in turn are connected to the plugs. Through the switching mechanism more heat can also be applied to either the front or the rear of the iron as may be desired.

The two extensions at the rear of the iron take the place of a stand, it being considered easier to tip an iron back than to lift it to a stand.

### Lamp Giving Fog-Penetrating Light

It has been recognized in lighthouse and marine work that a golden-yellow light will penetrate fog and mist to a greater degree than ordinary white light. A lamp for such service made by the Esterline Company, Lafayette, Ind., has recently been submitted to extensive tests on the Great Lakes and on the seacoast. The glass used in these lamps possesses a greenish-yellow color, which is said to give to the light a remarkable penetrative power. In a similar lamp placed on the market by the same company for electric railways and steam and mining locomotives a new feature is the reflector, which consists of a molded plate-glass parabola, ground accurately to size and shape and polished and silvered like a plate mirror. On account of the great efficiency of the reflector, the heat as well as the light is reflected so that the front glass will not remain coated with snow or ice in even the coldest weather.

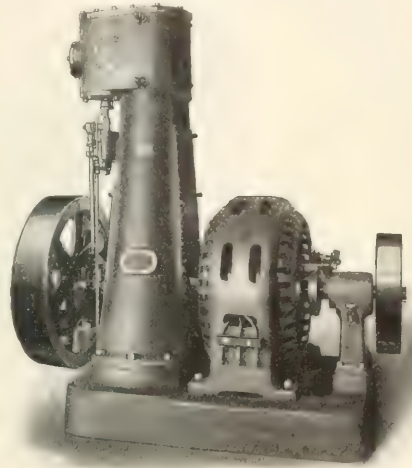


HEADLAMP FOR LOCOMOTIVES AND CARS

A standard spherical incandescent bulb is used with a standard Edison base. The front of the lamp is hinged to the top and pressed tight against a gasket, thereby rendering the lamp practically water-tight and dust-tight. The illustration shows a hood-type lamp designed for mounting on top of a car. In the dash-type a part of the lamp is recessed into the surface on which it is mounted.

### Alternating-Current Direct-Connected Generating Set

A line of alternating-current generator sets directly connected to steam or gas engines is now manufactured by Engberg's Electric & Mechanical Works, St. Joseph, Mich.



ALTERNATING-CURRENT DIRECT-CONNECTED GENERATING SET

Standard sets are made in sizes up to 70 kva for 240, 480, 600, 1200 and 2400 volts and for several different speeds. The engine is said to be extremely simple and compact with full accessibility of all working parts. The generator is designed to have considerably lower temperature rise than is provided in the A. I. E. E. Standardization Rules. It will carry a continuous overload of 20 per cent and a momentary overload of 60 per cent. The ventilating system is said to be exceptionally effective, much open space being provided in the armature core and field coils so as to allow free circulation. The design is such that excitation can be caused by 125-volt direct current.

### Panelboard Lightning Arresters

For the protection of individual machines and apparatus, particularly against "leakage" in the ordinary arresters in case of severe lightning disturbances, the Electric Service Supplies Company, Philadelphia, has designed and placed on the market a line of panelboard lightning arresters for both alternating-current and direct-current service.

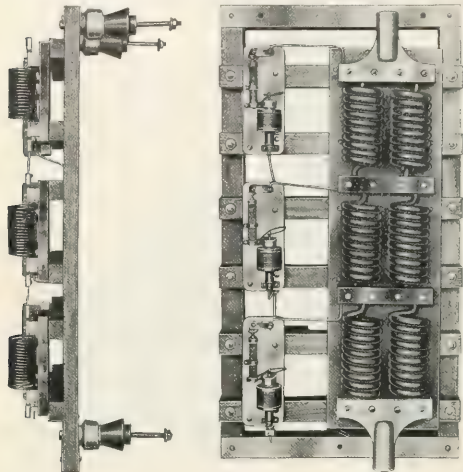
These arresters are said to take care of the leakage by interposing choke coils between the line and the apparatus to be protected and by connecting lightning-arrester units ahead of these coils. Any leakage passing the first arrester unit, for instance in a triple board, must pass through three choke coils and by two additional arrester units before it can get into the apparatus.

With only a single choke coil and a single arrester unit, and assuming that 90 per cent of the discharge goes to ground through the arrester, it is seen that 10 per cent will be left to enter the apparatus. If an additional choke coil and a second arrester unit be placed back of the first set, and assuming that the second unit takes 90 per cent of the leakage, only 1 per cent of the original charge remains to flow into the apparatus. Similarly with a third choke coil and a third arrester unit, only 0.1 per cent of the original charge will be left to enter the apparatus to be protected. In other words, by the addition of extra arrester units and



extra choke coils, the protection to apparatus is said to be increased tenfold by a double panelboard, a hundredfold by a triple panelboard, and a thousandfold by a quadruple board.

The boards are regularly built in station type, mounted on heavy impregnated oak framework and are complete with



PANELBOARD LIGHTNING ARRESTER

insulators for attaching to any suitable support. They are designed for railway systems for emfs up to 6600 volts alternating current and 2500 volts direct current and for arc circuits operating at pressures up to 6000 volts direct current or alternating current. They are built for any current within these ranges of voltages.

### Semi-Indirect Store Lighting

A lighting installation which is unusually attractive and efficient was recently completed for the Einstein-Wolff



SEMI-INDIRECT LIGHTING IN STORE

Company, New York. The goods carried by this company consist mainly of imported laces and embroideries, requiring a strong soft light without glare.

The first floor, a view of which is shown in the accompanying illustration, is lighted by forty fixtures, each equipped with four 100 watt tungsten lamps. The glass

dishes of so-called Doric glassware were designed and made by the Lighting Studios Company, 16 East Thirty-third Street, New York. They are 28 in. in diameter and are suspended by three-6-ft. chains. The metal parts are finished in French gray silver. It is said that an illumination of approximately 10 foot-candles is obtained at the working plane. The installation was made by the Goodwin & Kintz Company, 25 West Broadway, New York.

### "Dead-Front" Theater Switchboard

At the Palace Theater, New York, which is now nearing completion, there has been installed a so-called "dead-front" switchboard. It is constructed in two separate sections, the front section being of marble, on which are mounted the operating handles and rods, all of which are insulated from the rear section, which carries the live-contact parts. The rear section is made up of busbars feeding energy through fuses and switches from the various circuits of the magazine panel. The magazine panel is made up in sectional panels containing busbars and link fuses, and



"DEAD-FRONT" SWITCHBOARD IN THEATER

these separate panels are contained in a steel cabinet mounted on the wall directly back of the switchboard, with channel arrangements provided to carry the wires from the switchboard to the magazine without interfering with the open space back of the board. The dimmer equipment is mounted on top of the board with the operating handles extending down to bring them in reach.

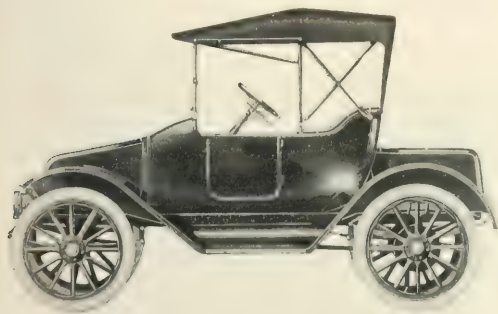
Three separate circuits are controlled from the board. One of these furnishes energy for the auditorium, one for the stage lighting and one for the arc lighting. This arrangement prevents the possibility of trouble on the stage interfering with the lighting in the auditorium and adds to the element of safety. A main switch on the board controls each separate feeder, and the entire lighting in the house or on the stage can be thrown on or off at one time, or with the separate switches which have been provided for the separate sections. For the foot-lighting and border lighting there are red, white, blue and amber lamps, and the board is arranged with a separate switch for each color, and in addition a master switch controlling each color on the entire stage.



The board was furnished by the Worcester Electric & Manufacturing Company, Worcester, Mass., through the Empire Engineering & Supply Company, New York, and was erected by the Van Wagoner Linn Construction Company, New York.

### Electric Roadster

The new roadster made by the Baker Motor Vehicle Company, Cleveland, Ohio, is said to contain the latest and most modern features in automobile-design. It is equipped



ELECTRIC PLEASURE VEHICLE

with a thirty-two-cell "Exide" battery, a complete set of electric head and tail lamps, a Weston volt-ammeter and a shaft odometer. It has a wheelbase of 88 in. and is equipped with 34-in. by 4-in. pneumatic tires. It has wheel or lever steer, open mohair top with side curtains and metal fenders skirted to a chassis frame.

### Horn-Type Disconnecting Switch for Pole-Top Mounting

The disconnecting switch herewith illustrated has been designed by Mr. J. R. Townsend, 700 East Sixty-first Street

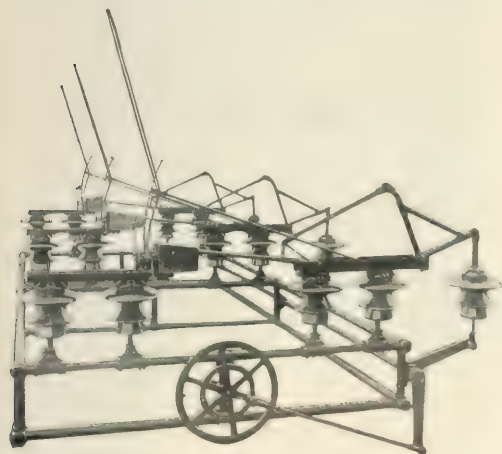


FIG. 1—SWITCH IN CLOSED POSITION

North, Portland, Ore. The main contacts of the switch consist of a rotating disk mounted in a yoke so that a set of spring clips on the switch arm when forced over the disk cause it to rotate, giving a grinding-in contact. A looped stationary horn acts as a guide for the main contacts and insures the arc being drawn from the

horn under all conditions. A small grooved trolley wheel mounted on a flat spring is the auxiliary contact and is said to prevent any arcing from the main contacts, the circuit being finally broken between the movable horn and the grooved trolley, the arc climbing up the stationary horn until sufficiently high to cause it to rupture.

Fig. 1 shows a three-pole, 60,000-volt switch in closed position, with sleet shields in place for protection of con-

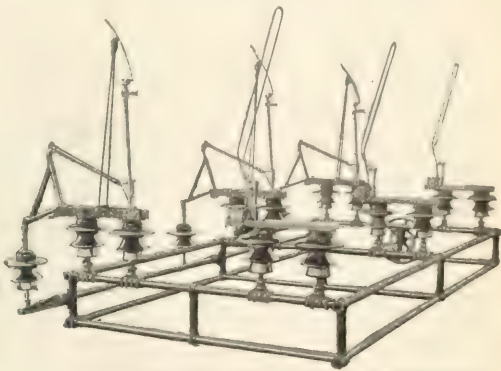


FIG. 2—SWITCH OPEN WITH SLEET SHIELDS REMOVED

tacts. The grooved wheel operates through an angle of 180 deg. from open to closed position and is provided with limit stops. Fig. 2 shows the same switch from the opposite side in the open position with the sleet shields removed. A switch installed on a 60,000-volt line of an interurban electric railway system is shown in Fig. 3. On this line nine such switches are in use.

The entire switch is mounted on a rigid pipe framework and is assembled completely around four poles on the



FIG. 3—HORN-TYPE DISCONNECTING SWITCH

ground and then hoisted into position by block and tackle.

Oscillograph tests made on the opening charging current characteristics of this switch are said to have shown less tendency to set up high-frequency currents, with the resultant increased voltage, than is ordinarily encountered with the best type of oil switches.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Personnel of New Allis-Chalmers Manufacturing Company.**—As a part of the plan for reorganizing the Allis-Chalmers Company, articles of incorporation for the Allis-Chalmers Manufacturing Company, with a capital stock of \$42,500,000, were filed in Delaware on March 15. Of the new stock \$16,500,000 is preferred and \$26,000,000 common. The incorporators of the new company held an organization meeting early this week, at which directors and officers were elected. Voting trustees, who will manage the company for some time to come, were also chosen by the reorganization committee. Directors for the Allis-Chalmers Manufacturing Company were chosen as follows: John H. McClement, chairman of board of directors; O. H. Falk, president of the company; O. C. Fuller, J. D. Mortimer, G. G. Pabst and Frederick Vogel, Jr., all of Milwaukee; Max Pam and F. O. Wetmore, of Chicago; A. W. Butler, C. W. Cox, O. L. Gubelman, R. G. Hutchins, Jr., Arthur Coppel and W. C. Potter, of New York, and J. P. Winchester, of Wilmington, Del. The executive committee, all of whose members are Milwaukee men, is as follows: Frederick Vogel, Jr., chairman; O. H. Falk, O. C. Fuller, J. D. Mortimer and G. G. Pabst. Active operation of the manufacturing plants will be started under the direction of five voting trustees as soon as the final steps in the reorganization are taken. This will probably be not later than May 1. Sale of the Illinois property is to take place on April 8, as stated in these columns last week, and confirmation of the sale will be given shortly afterward. A meeting of the reorganization committee will be held in the near future to determine the dates for calling the balance of the assessments on the old preferred and common stocks. There is still a payment of \$8 per share on the preferred and \$4 on the common stock to be made. The Allis-Chalmers Company was incorporated in New Jersey in 1901, and by taking out the new charter in Delaware the incorporators of the new company effected a saving of over \$5,000 in annual franchise taxes. The incorporation of the new company in Delaware is regarded as a further indication of the intention of large corporate interests to take charters elsewhere than in New Jersey, on account of the severe corporation laws recently enacted in the last-named State, to which reference was made in these columns Feb. 22 and March 1. From the list of officers which is given above, it will be noticed that the personnel of the company consists largely of Milwaukee men, as was forecast in these columns Jan. 11. Many of these men are prominent in the civic and financial affairs of that city. According to statements made this week to a representative of the *Electrical World* by a member of the reorganization committee, the operating headquarters of the new company will be at Milwaukee. The New York office will be continued, chiefly for financial purposes, board meetings, etc.

**Does Not Expect Large Profits in Contracting This Year.**—A member of one of the best known electrical contracting and consulting engineering firms in the country, with headquarters in New York, in discussing conditions in the electrical industry said this week that he feels that the current year will not be an especially good one for electrical contractors as a whole, from the standpoint of profits. "The field is greatly overcrowded," he said, "and of course, with active competition, price-cutting and small profits are the consequence. Raw materials are higher also. There is a great deal of new work going on here in the East, but the individual jobs are rather small and consist chiefly of extensions and remodeling of present installations. The supply dealers are very busy just now. As far as our own firm is concerned, there is nothing to complain of. We are in a more fortunate position than most

contractors, for we have a standing contract with a very large public-service corporation to do all of its installation work, of which there is always a great deal, and in this way we have something on hand at all times to keep our force engaged. Then we pay a great deal of attention to our soliciting methods and utilize modern ideas in conducting all of our affairs. Many contractors are lax, exceedingly so, in their business methods. At present we are at work on the complete electrical equipment for a number of the largest office buildings, department stores, railroad stations and banks in the country, particularly in the Middle West. There is plenty of business as far as we are concerned. The prospects are good, but in the majority of instances the profits for the year do not loom up very large, as I see conditions at this time."

**Electrification Plans of New Haven Railroad.**—An initial order for equipment of various kinds, amounting to about \$2,000,000, was placed this week by the New York, New Haven & Hartford Railroad Company. The order for electrical equipment was placed with the Westinghouse Electric & Manufacturing Company through its New Haven office. The electrical equipment includes twenty-three multiple-unit motors, twenty-two multiple-unit trailers and twelve electric locomotives. Other equipment ordered includes eighty-five steam road engines, twenty-five switching engines, eleven steel dining cars, fifty steel vestibuled coaches, twenty-five steel postal cars and fifty steel baggage cars. The purchase is designed to equip the through service of the Shore Line Route with all-steel cars. Another order, to be placed shortly, will cover complete equipment for all-steel cars for the New York-Boston service. Preliminary plans are being made in connection with forthcoming electrification by the New York, New Haven & Hartford Railroad of the main line between Boston and Providence, although it has not yet been definitely announced whether the New Haven-Providence or the Boston-Providence section will be first equipped. The company will four-track the road for the entire distance. Electrification and grade-crossing abolition will be important parts of the work. At East Junction, R. I., through trains from Boston to New York will be operated through a tunnel into Providence. Thirteen grade crossings are to be eliminated between Readville and East Junction, and it is expected that the detailed plans for the work will be completed by the coming fall.

**Steam Engine Manufacturers to Enter Oil-Engine Field.**—While no details will be given out at this time and the names of the interested parties are withheld, it is learned that several well-known manufacturers of reciprocating engines, of long connection with the steam-engineering field, are carrying on negotiations with American representatives of a foreign Diesel-engine-building company, with a view to forming a company to manufacture crude-oil engines of the Diesel type. If present plans materialize, the proposed company will be a large one and will have strong financial support. The marine as well as the stationary type of engine will be built by the new company. Details of the plan will be available in about two weeks, according to statements made this week by a representative of one of the parties.

**Good Business in Small Motors.**—"Our sales of small motors, particularly our single-phase line, are much larger now than they were at this time last year," said A. W. Eckhoff, of the New York office of the Bell Electric Motor Company, this week. "We are doing a good business in all our other lines as well. The demand for our small motors for industrial purposes is very good, especially from the West and South. I think the prospects for good business during the rest of the year are very bright."



**Improvements in Indianapolis.**—A number of important additions to its system are being made by the Indianapolis Light & Heat Company. During the month of February the company purchased a 9000-amp-hr. "Exide" battery, which is to be installed in July and August and is to float on the system as an emergency installation only. A 12,500-kw horizontal-type Curtis turbine unit has been purchased from the General Electric Company for the Mill Street station of the Indianapolis company. Excavation for doubling the size of the Mill Street building was begun on March 11, preparatory to installing this turbine and 3000 additional boiler horse-power. The enlarged building will be of sufficient size to accommodate two additional 15,000-kw turbine sets and 5000 additional boiler horse-power. At the same station the company has just completed a sub-aqueous coal-storage bin. Details of the plans for this bin, which has a capacity of 30,000 tons, appeared in the *Electrical World* for Oct. 5, 1912, page 714. Requests for bids on a locomotive crane for handling the coal to and from the bin have been sent out by the company. A large quantity of underground feeders, together with considerable overhead construction, are being installed by the company this year. A contract for a thirty-thousand-dollar warehouse to be placed on Kentucky Avenue, Indianapolis, has been let by the company, and work on this is now in progress. All of the engineering in connection with the foregoing was done by Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company.

**Chicago, Milwaukee & St. Paul Electrification Contract.**—Henry F. Kroyer, secretary of the Montana Power Company, in a statement reviewing that company's affairs, sent this week to the stockholders, calls attention to the contracts made by the Great Falls Power Company and the Thompson Falls Power Company with the Chicago, Milwaukee & St. Paul Railway for supplying the latter with electrical energy to operate 450 miles of its main transcontinental line. A reference to this contract appeared in the *Electrical World*, Feb. 8, 1913. By these contracts, which cover a period of ninety-nine years and go into effect on or before Jan. 1, 1918, the railway company is obligated to take and pay for 20,000 kw of electrical energy and has taken options on additional energy to the amount of 30,000 kw. This option must be exercised one-half in five years and the other half in ten years, but not less than one-half of the amount under option must be taken, if any. The aggregate capacity of the plants of the Montana system is 104,000 hp. The estimated capacity of water-power sites owned by the Montana company, undeveloped and in course of development, is 243,000 hp, making a total capacity with the foregoing, developed and undeveloped, of 347,000 hp.

**Detroit Insulated Wire Company's New Manufacturing Facilities.**—At a recent meeting of the stockholders of the Detroit Insulated Wire Company E. E. Keller, the president, presented one of the most satisfactory reports in the history of the company. This showed that the successive annual increase in business during previous years had been largely increased in 1912, the increase in sales last year over those in 1911 being approximately 75 per cent. In view of the optimism that prevails as to the industrial outlook for the current year, the officials expect that the company's record for 1913 will be even better than that of 1912. Extensive additions have been made to the manufacturing facilities, including increased floor area and new machinery and equipment, which within the next thirty days will permit of a 50 per cent increase in the present output. The company is now manufacturing all sizes of solid and stranded rubber insulated wire, including the largest size cable, and has just completed more than a mile of 2,000,000-circ. mil cable for one of its customers.

**Electric Furnace Manufacturers Are Busy.**—The Pittsburgh Electric Furnace Company, Pittsburgh, Pa., is receiving estimates on iron and steel materials to be used in a 100-ton electric furnace which is to be erected in Arizona and will be used for reducing copper ore. Several electric furnaces were recently erected in Indiana by this company, which, in addition to the Arizona furnace mentioned above, is building five furnaces to be used for reducing silver ores. These will be installed at Bridgeport, Conn. The Electric Furnace Company, Alliance, Ohio, which builds the

Baily electric furnace for heating bars, ingots and billets, has increased its capital stock from \$50,000 to \$100,000. A number of installations of its furnace in automobile works, drop-forging and other plants in various parts of the country are being made by this company.

**Open Sales and Engineering Offices in Baltimore.**—The Chesapeake Engineering & Equipment Corporation, which was organized a short time ago, has opened offices at 19 East Lombard Street, Baltimore, Md., and will sell electrical and steam apparatus and supplies, do engineering work and assist in financing and installing generating plants. The president is N. B. Hoskins, who was formerly connected with the General Electric and Westinghouse Electric & Manufacturing companies and with the Southern Engineering Corporation, and the secretary and treasurer is C. B. Hellman, who was also with the General Electric Company at one time. The company is representing several well-known manufacturers of steam and electrical equipment.

**Equipment for New York Edison Company.**—In addition to the 21,000-kva, 6600-volt, 25-cycle, three-phase horizontal turbo unit which it is to build for the New York Edison Company's Waterside Station No. 2, as stated in these columns March 1, the Westinghouse Electric & Manufacturing Company is to furnish to that company the following apparatus: one 3300-kva, one 1285-kva, one 3850-kva, six 500-kva and twenty-one 2000-kva, three-phase, air-blast transformers. Two 96-kw booster sets, consisting of one 150-hp direct-current motor and two 48-kw direct-current generators wound for 30 to 60 volts, together with a Westinghouse Le Blanc condenser and accessories to go with the turbine unit, are also included in the order.

**Seek to Reopen Long Acre Case.**—Upon application of the New York Edison Company, a writ of certiorari was issued this week by Justice Davis, of the New York Supreme Court, and served upon the Public Service Commission for the First New York District. This writ calls for a review of the commission's order of recent date, referred to in these columns March 8, authorizing the Long Acre Electric Light & Power Company, of New York, to issue \$4,000,000 in bonds and \$2,000,000 in stock and to begin construction of a power station to operate in New York.

**Pennsylvania Railroad to Extend Electrification.**—The directors of the Pennsylvania Railroad have authorized the electrification of the company's main line for suburban traffic out of Philadelphia to Paoli, a distance of 20 miles. This is in line with the plan of the company to change the motive power from steam to electricity on all of its branches within the city limits of Philadelphia. The cost of the work is estimated at \$4,000,000. This, it is understood, covers only the track and electrification work, and not the power station or equipment changes.

**Going Ahead with Cleveland Municipal Plant.**—Following a court decision favorable to the city in a suit which had been brought to restrain the sale of \$1,500,000 municipal electric light bonds, work on the erection of the generating plant for the city of Cleveland is to be rushed in the hope of being able to obtain service from the plant by Nov. 1, 1913. In trying the case the court took the view that the public had voted on the bonds, had known what it had voted for, and had shown by its vote that it was in favor of issuing them.

**Power-Station Apparatus for Havana.**—Among contracts recently closed by the Westinghouse Machine Company was one from the Havana Electric Railway Company, Havana, Cuba. This called for about \$800,000 worth of equipment, which included six turbine units, three condensers, several boiler-feed pumps and a quantity of power-station auxiliaries.

**Will Enlarge Station at Connellsville, Pa.**—Plans are being made by the West Penn Railways Company to make extensive additions to its Connellsville station at Connellsville, Pa. Orders have been placed with the Westinghouse Machine Company for two 1000-hp turbine units. About \$500,000 is to be spent in the carrying out of the improvements.

**New Station for Cincinnati.**—A four-million dollar generating station is to be built in connection with the Columbia Gas & Electric Company, according to unofficial reports.



**Changes in Canadian Companies.**—In accordance with a recent act of the Legislature, the Saraguay Electric & Water Company, of Montreal, has changed its name to the Montreal Public Service Corporation. The company has also acquired the Paul Electric Light & Power Company, the Dominion Light & Power Company and the distribution system of the Canadian Light & Power Company. As a result of these changes, the distribution of energy in Montreal by the Roberts interests will be done under the name of the Montreal Public Service Corporation. The president of the latter is E. A. Robert, the secretary and treasurer H. R. Mallison, and the chief engineer and operating manager K. B. Thornton. The Montreal Tramways & Power Company, Ltd., of Montreal, of which E. A. Robert is president, is the holding company for the Montreal Public Service Corporation, the Montreal Tramways Company and the Canadian Light & Power Corporation. The latter, which supplies the energy for the Montreal Public Service Corporation, has a 22,500-hp hydroelectric development on the St. Lawrence River, near St. Timothé, Que. This is capable of an ultimate development of 75,000 hp. The delivery of energy from this station was begun in September, 1911.

**Large Gains by Otis Elevator Company in 1912.**—The pamphlet report of the Otis Elevator Company for the year ended Dec. 31, 1912, issued this week, shows net earnings, after deducting all charges for interest, patent expenses and renewals and repairs for maintenance of plant, of \$1,282,195, as compared with \$1,082,116 in 1911. After payment of \$389,808 in preferred dividends there remained a balance of \$892,387, which is equivalent to 14 per cent on \$6,375,000 common stock, before charging out depreciation, as compared with 10.9 per cent on the same stock in the previous year. Common dividends amounted to \$255,012, leaving \$637,395, from which was deducted \$100,000 for the pension fund and \$298,868 for depreciation. After these deductions there remained a surplus of \$288,507, which compares with \$110,110 in 1911. W. D. Baldwin, president of the company, said in part: "Your company during the past year has shared in the general industrial prosperity of the country, and a volume of business was done in excess of any previous year and a larger amount of unfinished work carried forward for completion into the year 1913."

**A New Canadian Company Formed.**—The International Light & Power Company, Ltd., of Toronto, has been incorporated with \$20,000,000 capital stock. Its charter authorizes it "to underwrite, subscribe for, purchase or otherwise acquire and hold, either as principal or agent, the bonds or other securities of any incorporated company." It has been said that the new company will effect a rearrangement of the three subsidiary concerns of Henry L. Doherty & Company, the idea being to obtain a Canadian charter for the purpose of holding American companies and in this way avoid conflicts with American legislation pertaining to large corporate business. Representatives of Henry L. Doherty & Company said this week that there was no truth in the rumor.

**Michigan State Telephone Company to Make Improvements.**—At a meeting of the board of directors of the Michigan State Telephone Company at Detroit on March 13, improvements in the system that will entail the expenditure of \$2,500,000 were approved. Most of this work will be done outside of Detroit and special attention will be given to the improvement of the long-distance lines, according to A. von Schlegell, general manager of the company. The acquisition of the Home Telephone plant has given the company an abundance of equipment in Detroit. Frank W. Blair, president of the Union Trust Company, and Emory W. Clark, president of the First National Bank, are two Detroit men who were added to the board at the meeting.

**Elections at Central Illinois Public Service Meeting.**—At a meeting of the stockholders of the Central Illinois Public Service Company held Feb. 26 at Mattoon, Ill., the following directors were elected: Samuel Insull, chairman; A. J. Authenreith, R. B. Donnelly, George W. Hamilton, Martin J. Insull, F. S. Peabody and Marshall E. Sampsell. The board of directors elected the following officers: President, Marshall E. Sampsell; vice-president, F. S. Peabody; secretary and treasurer, R. B. Donnelly; assistant secretary, E. C. Beatty; assistant treasurer, Carl Cripe, and auditor, P. A. Erlach.

**New Public Utility Company Formed in Colorado.**—The Western Colorado Power Company, with a capital of \$5,000,000, has been incorporated by D. E. Wilson, M. A. Lewis and H. B. Teller, attorneys, of Denver. The company will operate in La Plata, San Miguel, San Juan, Ouray, Montrose, Delta, Montezuma, Mesa and Dolores Counties, which are in the western and southwestern parts of the State. Construction work is to be started shortly, according to statements credited to Mr. Lewis, and energy supplied as soon as possible to the extensive agricultural districts in the sections named above.

**To Merge Mississippi River Power Distributing Company.**—The Suburban Electric Light & Power Company of St. Louis has recently changed its name to the Electric Company of Missouri. It has increased its capital stock from \$750,000 to \$3,000,000 and has been authorized to issue bonds to the amount of \$1,750,000. With the proceeds of this bond issue it is proposed to purchase the Mississippi River Power Distributing Company and the small companies at Union, Pacific and Washington, Mo., which the Power Distributing company acquired recently, as noted in these columns Feb. 22.

**Abandon Municipal Lighting System at Middleboro, Mass.**—After twenty years of operation, municipal gas and electric lighting has been found inexpedient at Middleboro, Mass., and a committee has been appointed to enter into negotiations with the Brockton Electric Company for a supply of electrical energy. It is stated that the municipal plant has over \$200,000 liabilities and that the loss last year on the gas plant alone was 10 per cent.

**American Light & Traction Expanding.**—At a special meeting of the American Light & Traction Company this week the stockholders voted to increase the common stock from \$15,000,000 to \$40,000,000. All the directors were re-elected at the annual meeting.

**Completes Line to Nashville Substation.**—The Tennessee Power Company has finished stringing copper and guard wire between Murfreesboro and the 110,000-volt substation in Nashville.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND			QUOTATION		
		Per Cent	Period		Mar. 12	Mar. 12	Mar. 19
Allis-Chalmers, t.r., 3d pd.	\$15,501,800	.....	.....		3 1/2		3 1/2
Allis-Chal., pf., t.r., 3d pd.	14,115,500	.....	.....		9		8
Amalgamated Copper	153,887,900	.....	.....	1 1/2	69 1/2		68 1/2
American Tel. & Tel.	344,096,000	.....	.....	2 1/2	132 1/2		131 1/2
Electric Storage Battery, c.	16,074,425	.....	.....	1	51		51
General Electric	101,203,500	.....	.....	2	138		136
Mackay Cos., c.	41,380,400	.....	.....	1 1/2	83 1/2		81 1/2
Mackay Cos., pf.	50,000,000	.....	.....	1	67 1/2		67 1/2
Western Union Tel.	99,745,400	.....	.....	1 1/2	60 1/2		60 1/2
Westinghouse E. & M., c.	33,845,300	.....	.....	1	68 1/2		62
Westinghouse E. & M., pf.	3,998,700	.....	.....	1 1/2	118 1/2		117

\*Last price quoted.

## NEW YORK METAL MARKET PRICES.

Copper:	March 11		March 18	
	Bid.	Asked.	Bid.	Asked.
Standard, spot	14.37 1/2	14.75	14.00	14.75
London, standard, spot	65	8 1/2	64	8 1/2
Prime Lake	14.90	15.00	14.85	14.95
Electrolytic	14.85	14.95	14.85	14.95
Casting	14.70	14.80	14.65	14.75
Copper wire, base	16.00	16.25	16.00	16.25
Lead	4.35		4.35	
Nickel	40.00	45.00	40.00	45.00
Sheet zinc, f.o.b. smelter	8.25		8.25	
Spelter, spot	6.40	6.50	6.30	
Tin, spot	46.25		46.00	
Aluminum:				
Prompt delivery	25.50	26.00	26.50	26.75
Future	25.50	26.00		26.50

## OLD METALS.

Heavy copper and wire	13.62 1/2	13.62 1/2
Brass, heavy	9.00	9.00
Brass, light	7.75	7.75
Lead, heavy	4.15	4.15
Zinc, scrap	5.12 1/2	5.12 1/2

## COPPER EXPORTS IN MARCH.

Total tons to March 19..... 21,423

## Personal

**Mr. Thomas Edwards** has been appointed manager of the Malvern (Ark.) Electric Company.

**Mr. Henry L. Doherty** sailed for London on March 19. He will be away about three weeks.

**Mr. Joseph K. Choate** has been elected a vice-president of the J. G. White Management Corporation.

**Mr. J. V. Smeaton** has been appointed manager of the Bay Point Light & Water Company of Bay Point, Cal.

**Mr. J. T. Bateman** has been appointed superintendent of the Clarendon (Ark.) Electric Light & Ice Company.

**Mr. C. N. Wiley** has been appointed manager of the newly instituted central-station service at Ragland, Ala.

**Mr. C. M. Brewer** has been appointed local manager for the Western States Gas & Electric Company at Richmond, Cal.

**Mr. F. E. Bunnell** has been appointed superintendent of the Estes Park Electric Light & Power Company, Estes, Col.

**Mr. I. W. Day** has succeeded Mr. G. E. Matthies, formerly manager of the Seymour (Conn.) Electric Light Company.

**Mr. Weldon Thompson** has succeeded Mr. H. H. Bailey as superintendent of the Enterprise (Ala.) electric-lighting system.

**Mr. F. A. Faust** is manager for the Burbank (Cal.) Electric Light & Power Company, which recently began operation.

**Mr. H. G. White** has been appointed manager and superintendent of the municipal electric-lighting plant at Glendale, Ariz.

**Mr. A. G. Sangster**, for the last three years electrical superintendent of the Saskatoon (Sask.) municipal system, has resigned.

**Mr. J. A. Taylor** has resigned as superintendent of the Weston (Ont.) municipal plant and has been succeeded by Mr. Robert Greer.

**Mr. W. A. Watts** has succeeded Mr. Thomas O'Rourke as new-business manager of the Lancaster Electric Light Company, of Lancaster, Ohio.

**Mr. H. L. Harris** has succeeded Mr. L. D. Lovett as superintendent of electric lighting for the Texarkana (Tex.) Gas & Electric Company.

**Mr. A. S. Jourdan** has been appointed superintendent for the Housatonic Power Company at Branford, Conn., succeeding Mr. E. T. Gilbert.

**Mr. J. C. Anderson** has succeeded Mr. N. H. Chapman as manager of the Monte Vista Light, Heat & Power Company of Monte Vista, Col.

**Mr. J. E. Noeggerath**, consulting electrical engineer, New York, has returned from a nine months' visit to Norway, Sweden and Germany.

**Mr. W. A. McClellan** has been appointed superintendent and chief electrician of the Abbeville (Ala.) electric-light plant, succeeding Mr. W. M. Voss.

**Mr. Edward Hanson**, late of the Montreal Light, Heat & Power Company, has been appointed superintendent of electric lighting at Saskatoon, Sask.

**Mr. George J. Cadwell**, one of the well-known electrical men of the Northwest, is now power engineer for the Minneapolis General Electric Company.

**Mr. H. A. Goodridge**, manager of the Alamosa (Col.) Mutual Electric Light & Power Company, has been appointed a vice-president of the company.

**Mr. H. L. Heffner** has succeeded Mr. A. W. Lindgren as manager and superintendent of the Huntington Beach (Cal.) Electric Light & Power Company.

**Mr. Charles M. Duncan** has become manager of the Arvada Electric Company of Arvada, Col., succeeding Mr. W. Corson, who formerly held that position.

**Mr. M. P. Jemison**, formerly vice-president of the Tuscaloosa (Ala.) Ice & Light Company, has succeeded Mr. Robert Jemison as president of the company.

**Mr. W. H. Hodge**, manager of the publicity department of H. M. Bylesby & Company, of Chicago, is making an extended trip to the Pacific Coast properties of that company.

**Mr. Motosuke Masuda**, chief engineer of the Tokio (Japan) Municipal Railway, is on a visit to the United States to study electric-railway operating conditions in the principal cities.

**Mr. C. A. Howe**, manager for the Holophane Company of Canada, Toronto, addressed the March meeting of the Hamilton (Ont.) Section of the National Electric Light Association on the subject of "Illumination."

**Mr. W. A. Ostrom**, chief electrician in the Saskatoon (Sask.) power house for the past year, has resigned to enter again the employ of the Canadian General Electric Company as superintendent of construction in the West.

**Mr. Theodore N. Vail**, president of the American Telegraph & Telephone Company and the Western Union Telegraph Company, has been elected a member of the corporation of the Massachusetts Institute of Technology, Boston.

**Mr. H. H. Smith**, head of the research department for the Edison Storage Battery Company, Orange, N. J., addressed the March meeting of the Cleveland Engineering Society on the subject of electric traction by means of storage batteries.

**Mr. Julian C. Smith**, superintendent of the Shawinigan Water & Power Company, Montreal (Que.), has been made a member of the Institution of Electrical Engineers of Great Britain. There are now eight members of the Institution in Canada.

**Mr. A. J. Kennedy**, formerly manager for the lamp department of the Westinghouse Electric & Manufacturing Company's Los Angeles office, has joined the firm of B. F. Kierullf, Jr., & Company, Los Angeles, as sales manager of its electrical equipment department.

**Mr. F. L. Dame**, who resigned recently as vice-president of the Electric Bond & Share Company, is at Daytona, Fla., for the remainder of the winter season after taking a motor trip from Jacksonville to Miami. Mr. Dame will remain at Daytona until some time in April enjoying a rest.

**Mr. J. D. Lyon**, who resigned recently as commercial manager of the Union Gas & Electric Company of Cincinnati, Ohio, has opened an engineering office at 410 Mercantile Library Building, Cincinnati, where he will specialize in the supervision and operation of existing plants and properties, in addition to general consulting work.

**Mr. C. H. Ellis** has been appointed manager of the Ariston Ice & Electric Company, of West Palm Beach, Fla., which was recently purchased from the W. S. Barstow Company by a local corporation headed by Mr. H. C. Adams. Mr. Ellis was formerly manager of the municipal plant at Tallahassee, Fla. At West Palm Beach he succeeds Mr. R. E. Childs.

**Mr. Alvin Schlarbaum** has resigned his connection with Messrs. Smith, Kerry & Chase as assistant engineer on the Healey Falls development, to become hydroelectric engineer for the Riordan Pulp & Paper Company, Ltd., of Hawkesbury and Merritt (Ont.). This company plans to develop 9000 hp on the Rouge River to meet the demands of recent extensions to its plant.

**Dr. W. F. M. Goss**, dean of the schools of engineering, University of Illinois, Urbana, is to make the principal address at the reception at Leipzig, Germany, June 22, with which the Verein Deutscher Ingenieure will welcome the party of members of the American Society of Mechanical Engineers who are to make the trip to be present at the Verein's fifty-fourth annual meeting.

**Mr. C. R. Smith**, designer of stations for the General Electric Company, who has been in charge of the reconstruction work of the Newport News & Old Point Railway & Electric Company at Hampton, Va., since April, 1912, has returned to the General Electric Company, having completed the rebuilding of the station and ice-making plant at Hampton. The property in question is owned by Messrs. Allen & Peck, of Syracuse, N. Y.



**Mr. D. H. Macdougall** has been appointed assistant to Mr. R. J. Fleming, general manager of the Toronto Electric Light Company, Toronto, Ont. Mr. Macdougall was formerly treasurer of the Electrical Development Company and assistant comptroller of the Toronto Power Company. He has been connected with the water-power companies at Niagara Falls since March, 1903.

**Mr. John W. Ellis**, of Woonsocket, R. I., has been placed in general charge of the work of electrification of the New York, New Haven & Hartford Railroad between Providence and Boston, the active supervision being in the hands of his son, Mr. John Ellis. The latter has for eighteen years served as chief electrician for the Lonsdale company, in which position he is succeeded by Mr. James Pennien, Jr.

**Mr. J. M. Curtin**, heretofore assistant manager of the industrial and power department of the Westinghouse Electric & Manufacturing Company, has been appointed manager of this department to succeed Mr. Charles Robbins. Mr. Curtin is an electrical engineering graduate of the Pennsylvania State College and has been continuously identified with this company since his graduation in 1898.

**Mr. Alexander Dow** has been elected to the presidency of the Detroit Edison Company, as well as the Peninsula Electric Light Company. Mr. A. C. Marshall, formerly assistant to the president, succeeds Mr. Dow as vice-president. Mr. Dow retains his position as general manager. Mr. J. V. Oxtoby continues as vice-president with Mr. Marshall, while Mr. S. C. Mumford is made secretary in addition to his duties as comptroller.

**Mr. M. C. Osborn**, contract agent for the Washington Power Company of Spokane, Wash., addressed the Tacoma Jovian Luncheon League at its recent luncheon, taking the ground that municipalities should be permitted to charge owners of property with the expense of installing cluster lighting on streets, the city then maintaining the lamps. Mr. A. L. Thorn, superintendent of city lighting, also spoke on the subject, taking the same view. A measure of this nature is now being considered by the Legislature.

**Mr. Marshall E. Sampsell**, president of the Central Illinois Public Service Company of Mattoon, Ill., was elected president of the Illinois Electric Railways Association during its recent Chicago meeting. Mr. Sampsell was born at Marshall, Tex., in 1874, and was graduated from the University of Chicago with the class of 1896. In 1910 he was appointed president of the Mattoon company and of the Central Illinois Traction Company, which offices he continues to hold. Mr. Sampsell, as receiver for the Chicago Union Traction Company and the North & West Chicago Street Railway, took an active part in the settlement of Chicago traction matters in 1907 and 1910.

**Mr. Charles Robbins**, since 1909 manager of the industrial and power department of the Westinghouse Electric & Manufacturing Company, has been appointed assistant sales manager of the company, with headquarters at East Pittsburgh. Mr. Robbins, who has been associated with the Westinghouse Electric & Manufacturing Company for the past fourteen years, was for a number of years located in New York City. Previous to 1899 he was associated with the Cutter Company of Philadelphia. He is a member of the National Electric Light Association and the American Institute of Electrical Engineers, having been closely identified with the latter organization in connection with the standardization work as a member of the committee on rating. His successor is Mr. J. M. Curtin.

**Dr. Ira N. Hollis**, for twenty years professor of engineering at Harvard University, has accepted the presidency of the Worcester Polytechnic Institute, of Worcester, Mass. Dr. Hollis will succeed on July 1 Dr. Levi Conant, who has served as acting president during the past two years. The new president has been professor of engineering at Harvard since 1893. He was born at Mooresville, Ind., in 1856, and is a graduate of the United States Naval Academy, class of 1878. Professor Hollis is widely known as an expert in the special department of steam-plant practice. One of his most recent investigations has been the use of the low-pressure turbine in the Cambridge (Mass.) Electric Light Company's plant. He is president of the Engineers' Club of

Boston and a member of a number of national engineering societies.

**Mr. A. C. Harrington** has succeeded Mr. W. J. McCorkindale as manager of the Marquette County Gas & Electric Company, Marquette, Mich. Mr. McCorkindale's resignation to become manager of the Wilmington (Del.) Gas Company was noted in these columns recently. Mr. Harrington entered the field of electrical construction in 1888 and later had charge of electric railway projects for the Edison electric company in both London and St. Petersburg. He served as designer and active manager during the construction of the Pennsylvania & Erie Rapid Transit Railway and recently acted as supervising engineer for a large hydroelectric plant in Utah. In the operating field Mr. Harrington has served as manager of the South Covington & Cincinnati Railway Light, Gas & Power Company.

**Mr. Leigh S. Keith**, the new member of the firm of McMeen & Miller, Inc., and its secretary and treasurer, is a graduate of the Massachusetts Institute of Technology.



LEIGH S. KEITH

His first experience was in the engineering department of the New York Telephone Company. During his later years with that company he devoted his efforts to making special investigations under the direction of the chief engineer. About four years ago he entered the employ of McMeen & Miller, and he has been engaged in a wide variety of engineering work, relating particularly to public-service investigations of light, power and telephone properties and special problems in electric railway work, such as the location of substations, the design of feeder systems

and the prevention of electrolysis. For the past three years Mr. Keith has been managing engineer, so that in becoming one of the principals the change involved is more one of name than one of function.

## Obituary

**Edward H. Sturtevant**, vice-president and director of the Franklin (N. H.) Power & Light Company, died March 8, aged sixty-seven.

**Francis Boradnax**, a consulting engineer residing at Montclair, N. J., died at Utica, N. Y., March 15. Mr. Boradnax was sixty years of age and, among other work, installed the electric-lighting plant at the Chicago World's Columbian Exposition in 1893.

**Charles T. Bishop**, traveling auditor for the H. W. Johns-Manville Company, died in St. John's Hospital, Brooklyn, N. Y., March 11, of appendicitis. Mr. Bishop was fifty-two years of age and had formerly been connected with the naval service.

**Henry H. Furbish**, a retired wood-pulp manufacturer, who died March 12 at Bath, N. Y., early conceived the commercial future of electric lighting and introduced arc lamps into his pulp mill at Berlin, N. H., years before any similar installation was in use in the district. Later he organized the Berlin Electric Light Company, one of the first central-station undertakings in New England, and served as its first president. Mr. Furbish retained his interest in this company until his death.

**Robert E. Steele**, comptroller of the General Electric Company, died at his residence near Schenectady, N. Y., March 4, at the age of forty-four. Mr. Steele was an attorney by profession and had served as Deputy Attorney-General for the State of New York. His financial knowledge figured prominently in the readjustment of the affairs of the Knickerbocker Trust Company of New York following its failure. Mr. Steele was appointed comptroller of the General Electric Company May 11, 1908.



## Construction

### New England

**NORTHPORT, MAINE.**—The town of Northport has voted to contract with the Penobscot Bay El. Co., of Belfast, for the installation of a street-lighting system. The contract provides for 15 street lamps. The company will extend its transmission line from Little River to the entrance of the Wesleyan Grove Campmeeting Association grounds.

**PORTLAND, MAINE.**—Extensions to the ornamental street-lighting system will be made this year if an appropriation is granted. Ornamental standards carrying four-lamp clusters will be erected.

**WOODSVILLE, N. H.**—The Woodsville Aqueduct Co. is rebuilding its electric plant recently destroyed by fire. The company has contracted with the General El. Co. for two 150-kw, 2200-volt, three-phase, 60-cycle generators with directly connected exciters and necessary switch-board equipment; also for one 10-kw constant-current transformer for street circuits. The contract for one 125-hp Rollins engine, shafting and pulleys has been awarded to Charles Griffen, of Lowell, Mass. The other equipment consists of one 130-hp Phoenix boiler, two waterwheels, one 165-hp S. Morgan Smith and one 150-hp Holyoke Machy. Co., with Lombard governors. Fort Wayne meters are used. G. E. Mann is chief engineer and electrician.

**EAST LONGMEADOW, MASS.**—At a town meeting held recently it was voted to add 50 more street lamps to the 90 already installed.

**MILFORD, MASS.**—The Worcester Suburban El. Co., of Uxbridge, has petitioned the Selectmen for a franchise to erect transmission lines on the Park Hill Road.

**WORCESTER, MASS.**—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 25, for a conduit and wiring system, gas piping and lighting fixtures for the United States post office, Worcester, Mass., in accordance with drawings and specifications, copies of which may be obtained at the above office or from the office of the custodian, Worcester. O. Wenderoth is supervising architect.

**NEW BRITAIN, CONN.**—Plans for the new street-lighting system prepared by Dr. Louis Bell, of Boston, Mass., will be submitted to the Public Works Board. It is understood that the plans provide for 64 flaming arc lamps, 300 250-watt incandescent lamps and 560 smaller incandescent lamps.

**NEW LONDON, CONN.**—The Rockville-Willimantic Lt. Co., of New London, has applied to the State Legislature for permission to increase its capital stock from \$700,000 to \$1,000,000.

### Middle Atlantic

**ALBANY, N. Y.**—Governor Sulzer has signed the bill giving the common councils of second-class cities the right to establish, alter or extend a special lighting district for ornamental street-lighting purposes. The bill was introduced for the benefit of the city of Troy.

**ALBANY, N. Y.**—The Senate judiciary committee on March 12 reported favorably on the Murtaugh hydroelectric bill providing for the development of electricity at the dams of the barge canal on the Mohawk River. This bill has been amended so as to empower the state conservation commission to establish hydroelectric districts in other parts of the State. The bill carries an appropriation of \$600,000 for the establishment of a plant at Crescent.

**BUFFALO, N. Y.**—Sealed proposals will be received by the commissioner of public works, Room 5, Municipal Building, Buffalo, until April 4 for furnishing and installing heating, plumbing and power-plant equipment in connection with the erection of a new high-school building, to be known as the Masten Park High School, to be located in Masten Park. Separate proposals must be submitted for the following divisions of the work: (a) Heating, ventilating and power plant equipment, including boilers, pumps, tanks, fans, motors, high-pressure piping, radiation, temperature regulators, air washers, humidifiers, etc.; (c) plumbing, drainage and gas fitting, including water heaters, water purifiers and filtration apparatus, vacuum cleaning system, cooking stoves, ranges, etc. Plans and specifications are on file at the office of the deputy building commissioner, Room 6, Municipal Building, where blank proposal forms may be obtained. Francis G. Ward is commissioner of public works.

**JAMESTOWN, N. Y.**—The report of Clayton O. Johnson, superintendent of the municipal electric light plant, to the commissioners recommends the installation of a new turbogenerator unit and a mechanical stoker in the municipal electric plant.

**NEW YORK, N. Y.**—Sealed bids will be received by R. Waldo, police commissioner, at bookkeeper's office, 240 Centre Street, borough of Manhattan, until March 25, for furnishing and erecting all materials required for construction and installation of new underground cables necessary to transfer police telephone service from old to new police headquarters, Brooklyn, and install police telephone service at new police stations, Beach and Varick Streets, East Fifth Street, West One Hundred and Twenty-third Street and Simpson Street, borough of the Bronx. Blank forms together with copy of contract, including speci-

fications, may be obtained upon application at the time of the superintendent of telegraph, headquarters of Police Department, 240 Centre Street, New York.

**POUGHKEEPSIE, N. Y.**—The Edison Power Co., of Poughkeepsie, it is understood, will equip its plant to be operated by electric power for operating the works and will be supplied by the Central Hudson Gas & El. Co., of Poughkeepsie.

**PITTSBURGH, PA.**—Additional generating units will be installed at the Brimons Island power house of the Longfellow Lt. Co., increasing the output of the plant by 98,000 hp. Four new turbines have been ordered.

**PITTSBURGH, PA.**—The West Penn. Trac. Co. is contemplating enlarging its Connellsville power plant during the next two years. Orders have been placed with the Westinghouse El. & Mfg. Co. for two turbines of 34,000 hp each. The cost of the work is estimated at \$200,000.

**SUNBURY, PA.**—Owing to the restrictions placed on the Northumberland County Gas & El. Co., which wished to erect high-tension transmission lines in this city, the company, it is reported, has decided to move its power plant from Sunbury to Northumberland.

**BEVERLY, N. J.**—The Public Ser. El. Co. will reconstruct its transmission lines and cables in Beverly and vicinity. In connection with this proposed improvement the Borough Council is negotiating with the company for the installation of an underground conduit system for such service lines through Beverly.

**BOONTON, N. J.**—The Boonton El. Co. has applied to the Hanover Township committee for a franchise to operate in the Mountain Lakes and Parsippany districts.

**FREEHOLD, N. J.**—The Board of Utility Commissioners has granted the Monmouth Lig. Co., of Freehold, permission to issue \$14,000 in first mortgage bonds and \$2,500 in emergency notes to provide for extensions.

**JAMESBURG, N. J.**—The electric plant of the Jamesburg Lt. & Wtr. Co. was destroyed by fire on March 8, causing a loss of about \$10,000. It is understood that the plant will be rebuilt at once. Frederick Green-slade is superintendent.

**LINDEN, N. J.**—Bids will be received by the Borough Council until March 25 for lighting the streets of the borough with electricity for a term of five years. Bids are to be submitted for furnishing 74 lamps of 32 cp. to be placed where directed by the Council. Clarence H. Smith is borough clerk.

**NEWARK, N. J.**—The Roseville Business Men's & Citizens' Association has appointed a lighting committee to negotiate with the Pub. Ser. El. Co. for additional electric lamps in the Roseville section and to secure estimates of cost.

**CAMBRIDGE, MD.**—The contract for installing an electric-lighting system at the Cambridge Hospital has been awarded to the Cambridge Gas, El. Lt. & Pwr. Co. The contract also calls for complete equipment for the X-ray department.

**SHARPTOWN, MD.**—Bids will be received by the State Road Commission until March 27 for operating machinery and lighting for the draw span of the Sharptown bridge over Nanticoke River in Dorchester and Wicomico Counties. William L. Marcy, 534 North Howard Street, Baltimore, is secretary.

**EASTVILLE, VA.**—Plans are being considered for the installation of an electric-light plant here. Stanley Scott, of Eastville, is interested in the project.

**WASHINGTON, D. C.**—Plans are being prepared by Walter C. Allen, electrical engineer, of the District of Columbia, for the installation of an ornamental street-lighting system between the Capitol and the Treasury Building, on Pennsylvania Avenue, for which Congress has appropriated \$8,000. The plans provide for the substitution of 1500-cp lamps for the 700-cp lamps now in use.

**WASHINGTON, D. C.**—Sealed proposals and bids received at the office of the general supply committee, Executive Department, Washington, D. C., until April 15, on blanks supplied by the general supply committee for the furnishing supplies for the executive departments, including the following: Blankets, stationery, including blanketing, for the executive departments, including engineering and plumbing supplies, including a large quantity of electrical supplies, mechanical electrical, and plumbing supplies, and other supplies and materials. R. O. Fisher, Asst. Secy. of Gen. Supp. Com., is in charge.

### North Central

**HASTINGS, MINN.**—The Hastings El. Co. has ordered improvements to its plant, including the installation of a new generator and the replacement of the old plant with a new one. The M. H. El. Co. is the engineer.

**HIGHLAND, MINN.**—The Highland El. Co. has ordered improvements to its plant, including the installation of a new generator and the replacement of the old plant with a new one. The M. H. El. Co. is the engineer.

**IRONWOOD, MINN.**—The Ironwood El. Co. has ordered improvements to its plant, including the installation of a new generator and the replacement of the old plant with a new one. The M. H. El. Co. is the engineer.

LANSING, MICH.—The State Railroad Commission has authorized several companies, said to be owned by the Commonwealth Pwr. Co., to issue bonds aggregating \$453,000, the proceeds to be used for improvements of the various plants. The bond issues were granted to the following companies: Pontiac Pwr. Co., \$6,000; Saginaw Pwr. Co., \$12,000; Consumers' Pwr. Co., \$5,000; Commonwealth Pwr. Co., \$102,000; Au Sable El. Co., \$13,000; Economy Pwr. Co., \$130,000; Au Sable Pwr. Co., \$126,000; Grand Rapids-Muskegon Pwr. Co., \$48,000; Bay City Pwr. Co., \$4,000, and Flint El. Co., \$7,000.

MARQUETTE, MICH.—The City Council has adopted a resolution appointing a special committee to inquire into the feasibility of a municipal telephone system. It is proposed to use the poles of the municipal electric light plant.

MARQUETTE, MICH.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 3 for a conduit and wiring system, gas piping, lighting fixtures, etc., in the United States post office and court house, Marquette, Mich. O. Wenderoth is supervising architect.

MOUNT CLEMENS, MICH.—The County Supervisors are contemplating the installation of an electric-lighting system at the county infirmary, the present lighting system being inadequate.

SAGINAW, MICH.—The Wilcox McKim Co. contemplates the installation of electrically driven machinery in its proposed new plant for the manufacture of steering gears, universal joints and other automobile parts.

CLEVELAND, OHIO.—Sealed proposals will be received at the office of the secretary of the director of public service, No. 104, City Hall, Cleveland, Ohio, until April 1, for surface condensers for the municipal electric-light plant, plans and specifications for which may be obtained at the office of the engineer of construction, Room 319, City Hall. W. J. Springfield is director of public service. W. H. Kirby is secretary.

COLUMBUS, OHIO.—Sealed proposals will be received at the office of the Board of Trustees of the Ohio State University, Columbus, until March 31 for two horizontal sectional water-tube boilers and two automatic underfeed stokers for the power plant at the university, in accordance with specifications prepared by William C. McCracken, chief engineer. Plans and specifications may be seen at the offices of the architect, the chief engineer and the secretary of the board. Carl E. Steel is secretary.

CORYVILLE, OHIO.—The County Commissioners have granted the Ohio Valley El. Ry. Co., of Huntington, W. Va., a franchise to erect transmission lines between Coryville and Ironton. The company will furnish electricity for lighting the streets and residences of Coryville. Arc lamps will be used for street lighting.

FINDLAY, OHIO.—The City Council has authorized the light committee of the Council to instruct the city solicitor to prepare a resolution by which bids can be secured for lighting the city streets.

IRONTON, OHIO.—Plans have been completed by the Ohio Valley El. Ry. Co. for the construction of a new car-house and power house in Ironton, to cost about \$100,000.

SPRINGFIELD, OHIO.—Arrangements have been completed by the Springfield Lt. Ht. & Pwr. Co. for laying 4200 ft. of conduit in the central portion of the city this year.

WAPAKONETA, OHIO.—The Western Ohio Ry. Co., of Lima, has authorized the erection of two high-tension lines between Wapakoneta and St. Mary's, at a cost of about \$20,000.

HAZARD, KY.—The Hazard El. Lt. & Pwr. Co., recently organized, is planning to erect a power plant on the Messer branch, near Hazard, at once, to cost about \$10,000.

LEXINGTON, KY.—The Kentucky Utilities Co., of Lexington, has purchased a franchise to erect transmission lines through Montgomery County and work will begin on the erection of the lines at once. The company is also erecting a new transmission line to Winchester and to Mount Sterling.

MAYSVILLE, KY.—The City Council is considering the installation of a boulevard lighting system in the entire downtown district.

MIDDLESBORO, KY.—The Kentucky Utilities Co., of Lexington, which recently purchased the plant of the Middlesboro El. Co., contemplates enlarging the plant for the purpose of furnishing electricity for lamps and motors to the coal mines in Bell County.

WILLIAMSTOWN, KY.—J. M. Riley has purchased a franchise for the construction and operation of an electric light and power plant in Williamstown. Work will begin on the installation of the system at once.

LOGANSPOUT, IND.—The Board of Works has awarded the contract for installation of an Alberger surface condenser in the municipal electric-light plant to the Reeves-Skinner Co., of St. Louis, Mo., for \$12,783. The board will soon let contracts for the installation of coal and ash conveyors, for which an appropriation of \$12,000 has been made.

MARTINSVILLE, IND.—We are informed that Charles J. and Edgar V. Mitchell were not granted a franchise to install an electric-light plant in Martinsville, as reported in the issue of March 1.

PLYMOUTH, IND.—The Plymouth El. Lt. & Pwr. Co. contemplates extending its system to several adjoining towns. The company was recently incorporated by C. D. Snoeberger, Virginia Snoeberger and Isaac Snoeberger.

TERRE HAUTE, IND.—The Springfield & Central Illinois Trac. Co. has applied to the Board of Public Works for a franchise to build an interurban railway on Walnut Street.

VINCENNES, IND.—The Board of Works has signed a contract with the City El. Ltg. Co. whereby the latter will supply electricity to operate and light the sewer pumping station and incinerating plant located 2 miles below the city, for a period of five years. Under the terms of the contract the city agrees to install two 15-hp motors and also to pay for the erection of the transmission line from the city limits to the plant and to pay the company \$50 per month and 2 cents per kw-hr. for all energy used.

BROCTON, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has submitted a proposition to the Village Board to furnish electricity in Brocton. The company asks for a 10-year franchise and a contract for street lighting. If granted a franchise a transmission line will be erected either from Newman or Oakland to supply the service.

DALLAS CITY, ILL.—The Dallas City Lt. Co. has petitioned the City Council for a 25-year extension of its franchise. The Mississippi River Pwr. Co. proposes to enter the city and purchase the local electric plant for \$40,000, also to erect a transmission line from Niotia to Dallas City, at a cost of \$60,000.

PALMER, ILL.—The Village Board has granted the Hillsboro El. Lt. & Pwr. Co., of Hillsboro, a 50-year franchise to operate an electrical distributing system in Palmer.

PAXTON, ILL.—The Central Illinois Utilities Co. has purchased the property of the Paxton El. Co., of Paxton, and will take over the property immediately. It is understood that the new owners will make improvements to the plant. The Utilities company has franchises in a number of surrounding cities and towns, including Rankin, Fairbury, Arrowsmith and Gibson City. H. L. Clark is vice-president and general manager of the Central Utilities Co.

PERRY, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has been granted a franchise by the Village Board to operate an electrical distributing system in Perry for a period of 50 years.

ROCK ISLAND, ILL.—The officials of the Rock Island Southern Ry. Co. are negotiating with a number of towns along and near the interurban railway to supply electricity for lamps and motors. The company is planning to erect transmission lines to places a considerable distance from its power plant.

SPRINGFIELD, ILL.—Sealed proposals will be received by the Board of Administration, Capitol Building, Springfield, until March 24 for the installation of conduits, wiring, electric lamps, etc., at the Illinois Industrial Home for the Blind, 1900 Marshall Boulevard, Chicago, Ill. Specifications will be furnished upon application to the managing officer of the home at the above address. Frank D. Whipp is fiscal supervisor.

GREEN LAKE, WIS.—J. R. Stewart has been granted a franchise to furnish electricity for lamps in Green Lake.

HATFIELD, MINN.—Plans are being prepared for raising the large power dam at Hatfield 5 ft. above its present level. R. M. Howard is manager.

ROSEAU, MINN.—At an election held March 11 the proposition to issue bonds for the installation of a municipal electric-light plant was carried. As yet an engineer has not been engaged. P. H. Buran is clerk.

DAVENPORT, IA.—The People's Lt. Co., of Davenport, has begun work on the erection of a high-tension transmission line from this city to the substation of the Iowa & Illinois Ry. Co. at Pleasant Valley, a distance of 8 miles. From Pleasant Valley energy will be distributed to the various substations of the railway company. Electricity will also be supplied to the towns and villages along the lines for lamps and motors. The cost of the lines is estimated at about \$40,000. The People's Lt. Co. also contemplates the erection of a transmission line between Walcott and Durant, a distance of about 7 miles, to cost about \$30,000. This line will be a continuation of the line recently completed between Blue Grass and Walcott. If granted a franchise in Buffalo (at a special election to be held March 31) the company will erect a transmission line from Blue Grass, a distance of 6 miles. The cost of the line to Buffalo is estimated at \$25,000.

GREENFIELD, IA.—Sealed proposals will be received by M. C. McCreight, city clerk, Greenfield, Ia., until April 11 for furnishing, f.o.b. Greenfield, two generators, one 100-kva and the other 75-kva; switchboard, two constant-current regulators, one 15-hp motor and starting apparatus, line material, transformers, motors, one steam engine, one 225-boiler-hp feed-water heater, receiver, separator, and one 7-in. exhaust head, or for furnishing and installing the above-named apparatus complete with all necessary piping, etc., ready for operation. Instructions to bidders, plans and specifications may be seen at the office of the city clerk, Greenfield, or at the office of J. B. Hill, Iowa City, engineer. A complete set of plans may be obtained upon application to the engineer, for which a deposit of \$5 will be required, the same to be refunded upon return of plans. H. J. Chapman is Mayor.

HAWKEYE, IA.—C. Miller & Sons, of Clermont, who were recently granted a franchise to furnish electricity here, will erect a transmission line from their plant in Clermont to Hawkeye. The substation will be equipped with a transformer to transform energy from 13,000 volts to 2300 volts; also with a number of transformers to step down the current from 23,000 volts to 110 and 220 volts; about 8 miles of No. 6 bare copper wire and 30-ft. poles will be used for overhead lines; 40-watt



Mazda lamps will be used for street-lighting and about 200 Westinghouse meters installed.

**KIMBALLTOWN, IA.**—At an election held March 10 the proposition to grant a franchise for the installation of an electric-light plant was carried. For further information address John Neilsen.

**MEDIAPOLIS, IA.**—L. E. Sherrill, of Burlington, representing the Walsh interests, of Burlington, is negotiating with the City Council with a view of securing a franchise to distribute electricity in Mediapolis. Energy will be supplied by the Mississippi River Pwr. Co., of Keokuk.

**OSKALOOSA, IA.**—An option has been taken on the property of the Oskaloosa Lt. & Trac. Co. by W. B. McKinley, of Champaign, Ill., president of the Illinois Trac. Co. The Oskaloosa company is capitalized at \$350,000 and controls the electric-lighting and street-railway systems in Oskaloosa.

**FESTUS, MO.**—The Festus Glass Co., it is reported, contemplates the purchase of an engine, boiler, generator and motors and would like to receive prices on same. H. S. Warwick is manager.

**PALMYRA, MO.**—The Mississippi River Pwr. Co., of Keokuk, Ia., is negotiating with the City Council for a contract to sell energy in Palmyra. It is proposed to erect a transmission line from the company's distributing station in Ilasco to Palmyra, at a cost of \$25,000. The municipal electric-light plant requires new equipment.

**SPRINGFIELD, MO.**—A franchise has been granted by the City Council to J. H. Rathbone, M. C. Baker and Roy Cox, of Springfield, for the installation of an electric-light plant. This franchise will be submitted to the voters for approval at the municipal election to be held in April. E. C. McAfee, Baker Block, Springfield, is attorney for the company.

**WILLOW LAKE, S. D.**—At an election held March 4 the proposition to issue bonds for the installation of an electric-light plant was carried. Bids for construction of the plant will be asked for in about two months. J. F. Flindt is auditor.

**BASSETT, NEB.**—The contract for constructing an electric-light plant, bids for which were opened Feb. 17, has been awarded to the Alamo Engine & Supply Co., of Omaha, for \$12,565. W. E. Buckenderf is clerk.

**CANTON, KAN.**—Bids will be received by the City Council of Canton until March 26 for the construction of municipal electric-light plant, including brick power house, one 60-hp oil engine, one 30-hp oil engine, 35-kw generator, 35-amp storage battery and eight counter cells, 10,000-gal. fuel tank, 15 steel electroliers, copper wire and pole-line material.

**GOFF, KAN.**—At a meeting held recently the citizens decided to install a waterworks system first. Later on it is expected that connection will be made with the Centralia plant for electric-lighting system. D. A. Steiner is superintendent of the Centralia municipal electric plant.

**HOLTON, KAN.**—Plans are being prepared by Worley & Black, engineers, Reliance Building, Kansas City, Mo., for improvements to the municipal electric-light plant, including line extensions, etc. The proposition to issue bonds for the work will be submitted to the voters on April 1.

**JETMORE, KAN.**—The installation of an electric-light plant in Jetmore is under consideration.

**RUSSELL, KAN.**—The proposition to issue bonds for the installation of an electric-light system will be submitted to the voters. It is proposed to secure electricity for operating the system from Chariion.

**TURON, KAN.**—Bids for construction of a combined electric-light plant and water-works system will probably be received the latter part of this month. A 50-hp steam plant will be installed. Rollins & Westover, of St. Louis, Mo., are engineers in charge.

## Southern States

**DURHAM, N. C.**—The Durham Trac. Co. will install new 4-amp General Electric magnetite-arc lamps to replace the 6.6-amp series closed-arc lamps now in use as agreed under the terms of the new 10-year contract recently awarded by the city. The lamps will be maintained by overhead wires. The contract calls for a minimum of 200 arc lamps at \$60 each per year. R. S. Lindsey is general manager.

**WHITNEY, N. C.**—H. R. Hadaway & Co., of Atlanta, Ga., have secured the contract for the construction of a large dam across the Yadkin River, near Whitney, for the Southern Aluminum Co., which recently acquired the Whitney property. The new dam will be of concrete and will be located about 7 miles below the old Whitney stone dam. It is estimated that about 45,000 hp will be developed at the plant now being constructed by the Southern Aluminum Co.

**WILSON, N. C.**—At an election to be held April 15 the proposition to issue \$80,000 in bonds for improvements and extensions to the municipal electric-light plant will be submitted to the voters.

**ANDERSON, S. C.**—The properties of the Anderson Wtr., Lt. & Pwr. Co., including the Portman Shoals plant on the Seneca River, have been acquired by the Southern Pwr. Co., of Charlotte, N. C.

**ABBEVILLE, GA.**—At an election to be held April 8 the proposition to issue \$8,000 in bonds for the construction of a municipal electric-light plant will be submitted to a vote.

**VIDALIA, GA.**—The proposition to issue \$15,000 in bonds, the proceeds to be used for improvements to the municipal electric-light plant and water-works system, will be submitted to the voters on April 5.

**CHIPLEY, FLA.**—The Chipley Lt. & Pwr. Co. has engaged the Solomon-Norcross Co., of Atlanta, Ga., to take charge of the construction of its proposed electric-light plant. A. A. Myers, Jr., is president.

**LIVE OAK, FLA.**—The property of the Live Oak El. Co., including ice and light plants, is reported to have been purchased by the Engineering Securities Co., of New York, for \$50,000. It is understood that the new owners will combine and improve the plants.

**MIRANOPY, FLA.**—Bids are invited on equipment for an electric plant, including a 75-kva, 2300-volt, 60-cycle, three-phase generator, with switchboard, instruments, exciter, non-condensing, four-valve steam engine, 100-hp boiler with pump, feedwater pump, engine to be directly connected to generator. For further information address post office box 375, Gainesville, Fla.

**BRISTOL, TENN.**—The City Councils of Bristol, Tenn., and Bristol, Va., have awarded contracts to the Bristol Gas & Electric Co. for the installation of an ornamental street-lighting system on practically all the business streets of the city, all wiring to be placed in conduits. The company has already awarded the contract for the five-lamp and three-lamp standards to the Union Foundry Co., of Anniston, Ala. S. M. Vance is general manager.

**DYERSBURG, TENN.**—Bids are being received by the business men of Dyersburg for the installation of an ornamental street-lighting system in the business section of the city.

**NASHVILLE, TENN.**—The Nashville Ry. & Lt. Co. has amended its charter providing for an extension of its street railway system.

**JACKSON, MISS.**—Plans are under consideration by the Council to acquire the plant of the Capital Lt. & Pwr. Co. Under the terms of the franchise of the company, the city is given an option to purchase the plant at the end of ten years, which expires in April.

**ESTHERWOOD, LA.**—The Town Council is considering the question of installing an electric-light plant to light the streets and residences in the village. The cost of the plant is estimated at \$1,000.

**GEORGETOWN, LA.**—A franchise has been granted to Captain Rouse, of Poplarville, to install an electric-light plant in Georgetown, to be operated in connection with the proposed water-works system.

**JENNINGS, LA.**—The local electric-light plant, owned by C. C. Johnson, has been purchased by the Southern Ht. & Lt. Co., which owns and operates the local gas plant. The company contemplates building an addition to the gas plant at a cost of \$10,000, to provide space for the equipment of the plant purchased and for additional turbines and generator.

**FRANKLIN, TEX.**—The Franklin Wtr. & Lt. Co. is rebuilding its power house which was recently destroyed by a storm. The steam plant will be abandoned and the plant will be driven by two gas engines. The company also proposes to rebuild its distributing system throughout the town.

**MERCEDES, TEX.**—Application has been made to the City Council by S. A. Robertson, of San Benito, for a franchise to operate an electric-light plant and water-works system. Mr. Robertson proposes to purchase and extend the local systems.

**MOUNT PLEASANT, TEX.**—Plans are being prepared for improvements to the local electric-light plant which will involve an expenditure of about \$50,000. The Albert Emanuel Co., of Dayton, Ohio, has recently purchased the plant. The McCandless Engineering Co., of Kansas City, Mo., has charge of the engineering work.

**SAN ANTONIO, TEX.**—Work has begun on the survey of the proposed electric interurban railway between Austin and San Antonio. A large hydroelectric power plant will be installed on the Guadalupe River by the Guadalupe Pwr. Co., a subsidiary of the interurban company, which will furnish electricity to operate the railway. John W. Maxey is director and general manager.

**WICHITA FALLS, TEX.**—Plans have been adopted and a contract agreed upon by the City Council for lighting the streets of the city. The plans provide for 150 Silvert lamps for the street, the residential districts and 90 ornamental standards, carrying two-lamp clusters, in the business section. The plans adopted contemplate the installation of 710 lamps, for which the city is to pay the company \$4,200 per annum for maintenance. The contract covers a period of ten years.

## Pacific States

**CONCUNULY, WASH.**—The local electric-light plant, owned by Morton & McDaniel, was recently destroyed by fire.

**MONROE, WASH.**—The Kirkland-Redmond Ry., Lt. & Pwr. Co. has completed surveys for an electric interurban between Kirkland and Monrovia, a distance of about 20 miles. W. P. Redmond is president of the project.

**QUINCY, WASH.**—The Western Valley Gas & P. Co. has applied for a 10-year franchise to supply electricity to operate the lamps and power. The company proposes to extend its transmission lines from Wenatchee to Quincy.



SEATTLE, WASH.—J. A. McQuaid has purchased the equipment and franchises of the Highland Park and Lake Burien Railway. Extensive improvements will be made to the system.

SPOKANE, WASH.—Application has been made to the City Council by Allen Van Rensselaer, of Victoria, B. C., Can., for a franchise to generate and distribute electricity for lamps, heaters and motors; also to install and operate a central steam-heating system in the downtown district in Spokane.

TOLEDO, WASH.—The property of the Toledo El. Co. has been purchased by the Independent El. Co., of Portland, Ore. It is understood that improvements are contemplated to the system.

ALBANY, ORE.—The City Council has indorsed the proposition of installing a cluster-lamp street-lighting system, plans for which were prepared by Louis C. Kelsey, consulting engineer, Selling Building, Portland, Ore.

HILLSBORO, ORE.—The installation of cluster lamps on Second, Third and Main Streets is under consideration.

PORTLAND, ORE.—The Portland Ry., Lt. & Pwr. Co. is making investigations in Pleasant Valley and Jennie Station on the Gresham electric railway, with a view of extending its electric-lighting service to that suburb.

PORTLAND, ORE.—Preliminary plans have been prepared by the Oregon El. Ry. Co. for the construction of a large hydroelectric power plant on the McKenzie River in Linn County. The equipment will consist of six pairs of 5000-hp tangential waterwheels driving six 6000-kva, 2300-volt generators. The transmission voltage will be 110,000. Active preliminary construction will begin in June. No contracts have yet been let and none are now pending. This year will be devoted to development work mainly. L. B. Wickersham is chief engineer and George S. Edmondstone, 536 Railway Exchange, Portland, Ore., is hydraulic engineer.

SPRINGFIELD, ORE.—Preparations are being made by the Oregon Pwr. Co. for the construction of a power plant on the headwaters of the McKenzie River, near Springfield. Bids are now being received for equipment.

COLUSA, CAL.—The Pacific Gas & El. Co., of San Francisco, is planning to extend its service to the south of Colusa in the near future.

LOS ANGELES, CAL.—The Bible Institute Building, located on Hope Street, near Fifth Street, will be equipped with a power plant. The purchasing department of the Union Oil Co. has charge of the purchases for the institute.

LOS ANGELES, CAL.—The Board of Public Works is asking for bids for the installation of ornamental lamp standards on Sixth Street from Alameda to Hill Street, Eighth Street between Main and Figueroa Streets, and Ninth Street from Main to Figueroa Street.

MARYSVILLE, CAL.—The Great Western Pwr. Co., of San Francisco, has applied to the Board of Supervisors of Yuba County for a franchise to erect transmission lines along certain streets and highways in Yuba County. Bids will be received by J. F. Eastman, clerk, until April 9, for the above franchise.

OAKLAND, CAL.—The Sierra El. Pwr. Co., Oakland, has applied for franchises to erect and operate distributing systems in Glenn, Plumas, Butte and Tehama Counties.

OCEANSIDE, CAL.—The Oceanside El. Co. has awarded the contract for extending its transmission lines into the San Luis Rey Valley to F. F. Foster Co., East Third Street, Los Angeles. The cost of the work is estimated at \$20,000.

OWENSMOUTH, CAL.—The Southern California Edison Co. will begin work at once on the construction of a substation here for the purpose of furnishing electricity for lamps and motors in Owensmouth. A large part of the distributing lines will be placed in underground conduits. Owensmouth has not a post office.

POMONA, CAL.—The Pomona Home Tel. & Tel. Co. is planning the installation of an exchange in San Dimas, near Pomona. D. S. Parker is general manager of the company.

REDDING, CAL.—Application has been made to the Board of Supervisors of Shasta County by Albert C. Agnew, of Oakland, representing the Sierra El. Pwr. Co., for a franchise to build an electric railway and erect transmission lines on the highways and roads of Shasta County. Sealed bids will be received by S. N. Witherow, clerk, until April 7 for the above franchise.

RIVERSIDE, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, is planning to extend its 10,000-volt transmission line through Riverside and San Bernardino into the city of San Diego, a distance of about 100 miles. Manifold & Pools are engineers.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, is reported to be considering extending its transmission lines into Imperial Valley. Extensions are contemplated, it is stated, by the company, involving an expenditure of about \$100,000.

SAN DIEGO, CAL.—The United Lt. & Fuel Pwr. Co. has applied to the State Railroad Commission for permission to issue \$100,000 in bonds.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co. is planning to enlarge the Bear River canal, increasing the capacity from 50 second-ft. to 350-second-ft. of water.

SAN FRANCISCO, CAL.—The Great Western Pwr. Co. has petitioned

the State Railroad Commission for permission to erect and operate an electric distributing system in Yuba County and Marysville.

WOODLAND, CAL.—The Oro Lt. & Pwr. Co., of Oroville, has applied to the Board of Supervisors for a franchise to erect transmission lines and supply electricity in Yolo County.

MALAD CITY, IDAHO.—The Evans Lt. Co., of Malad City, which recently purchased the property of the Idaho Lt. & Pwr. Co., will increase the power development as soon as the weather will permit by adding to its present conduit, thus gaining more head. D. L. Evans is owner of the plant and J. H. Campbell manager.

FARMINGTON, UTAH.—The Davis County Pwr. & Lt. Co., of Farmington, has sold its plant and holdings to the Utah Pwr. & Lt. Co., Salt Lake City, for \$27,000. The property includes the hydroelectric power plant in Farmington Canyon and the Layton and south to Centerville transmission lines, both lines connecting with others now owned by the Utah company.

CALABASAS, ARIZ.—The Borderland Mines Co. is contemplating the installation of a large power plant at Calabasas. A transmission line will be erected to Oro Blanco, a distance of about 20 miles. T. C. Woodworth is president of the company.

TUCSON, ARIZ.—The Kelvin Sultana Mining Co. has awarded contract for the erection of a power plant on its property.

BOULDER, COL.—The City Council has passed the ordinance authorizing the proposition to issue \$70,000 in bonds for the establishment of a municipal electric-light plant to be submitted to the voters at the April election.

SALIDA, COL.—The property of the Salida Lt., Pwr. & Utility Co. has been purchased by the bondholders' committee of the Central Colorado Pwr. Co., of Denver, Col. The price paid for the plant is said to be \$350,000.

BUCKHORN, NEV.—The Buckhorn Mines Co. is planning to build a power plant at Beowawa and erect a 30-mile 33,000-volt transmission line from the plant to Buckhorn to furnish electricity to operate its mill. Work on the proposed plant will begin in April. A. N. Voss, electrical engineer, will have charge of the electrical work.

FORT BAYARD, N. M.—Sealed proposals will be received until April 4 for furnishing three transformers and one motor at Fort Bayard. Further information may be secured on application to the quartermaster at Fort Bayard.

## Canada

CALGARY, ALTA, CAN.—The Calgary Pwr. Co. has decided to develop another water-power at Kananaskis Falls, located 2 miles above the present Horse Shoe Falls plant, at a cost of about \$1,000,000.

ABBOTTSFORD, B. C., CAN.—The Western Canada Pwr. Co., of Vancouver, expects to begin within 30 days the erection of a distributing system in the municipality of Matsqui. Transmission lines will be erected to the pumping stations at the government diking project soon.

VERNON, B. C., CAN.—Tenders will be received by D. G. Tate, city clerk, Vernon, B. C. until April 17 for furnishing and installing one 500-hp, Diesel engine and one 375-kw, 2300-volt, three-phase, 60-cycle generator with directly connected exciter and one 10-ton traveling crane. Specifications may be seen at the office of Mather, Yuill & Co., Ltd., Vancouver, B. C., consulting engineers.

ST. JOHN, N. B., CAN.—Preparations are being made by the New Brunswick Hydro-Electric Co. to begin work on a water-power development located about 50 miles from this city. It is estimated that from 15,000 hp to 20,000 hp can be developed. The charter of the company gives it the right to supply electricity in St. John.

AURORA, ONT., CAN.—L. H. Herdt, engineer, of Montreal, engaged by the Town Council to examine and determine the relative advantages to the town of the systems of the Hydro-Electric Power Commission and the Toronto & York Radial Ry. Co. for electrical service, has recommended to the Council the adoption of the Toronto & York Radial Ry. Co.'s offer.

ELMIRA, ONT., CAN.—Arrangements have been made between the Town Council and the Elmira Milling Co. whereby the town of Elmira will take over the electrical distributing system of the company, at a valuation of \$3,000, to be owned and operated by the municipality. Energy to operate the system, it is understood, will be secured from the Hydro-Electric Power Commission.

GLENCOE, ONT., CAN.—The installation of hydroelectric power is contemplated, energy to be obtained from the Hydro-Electric Power Commission of Ontario.

LONDON, ONT., CAN.—Electrical extensions are contemplated during the coming year involving an expenditure of about \$125,000, which will include new work shops, new substation equipment, including power transformers, lighting regulators and synchronous motor, electric generating plant at Springbank, substation No. 4, with equipment, line transformers, light and power meters, etc.

OTTAWA, ONT., CAN.—The erection of a new substation, to cost about \$75,000, is contemplated by the Ottawa El. Ry. Co.

OTTAWA, ONT., CAN.—Plans have been prepared by the Electrical Department for new equipment and extensions to municipal electric-light

plant, to cost about \$22,000. The purchase of lamp standards and lamps for the ornamental street-lighting system recently adopted by the Council is under consideration.

**PORT ARTHUR, ONT., CAN.**—Sealed tenders will be received by J. J. Hackney, commissioner of utilities, until March 31, for railway material as follows: Tender A—8 tons of 00 trolley wire and 6½ tons of No. 0000 flexible feeder wire (D. B. W. P.). Tender B—Miscellaneous track material, including rails, spikes, angle bars, bolts, etc. Tender C—Steel intersections, frogs, switches, etc. Further instructions as to specifications, blueprints and form of tender may be obtained from the city engineer and the commissioner of utilities.

**TORONTO, ONT., CAN.**—Tenders will be received by registered post only, addressed to the chairman of the Board of Control, City Hall, Toronto, until April 1, for overhead and pole line material, including trolley wire cable, suspensions, hangers, pull-overs, sleeves, ears, frogs, bolts, bonds, etc. Specifications and tender form may be obtained upon application at the office of the purchasing section, Department of Works, City Hall, Toronto. H. C. Hocken, Mayor, is chairman of board of control.

**WINGHAM, ONT., CAN.**—The electric light committee has recommended to the Town Council the installation of a duplicate generator to be installed at the municipal electric-light plant, at a cost of about \$6,000.

**MONTREAL, QUE., CAN.**—Tenders are being asked for supplies for an underground conduit system on St. Catherine Street from Guy Street to Papineau Avenue.

**MONTREAL, QUE., CAN.**—The Quebec Public Utilities Commission has ordered the removal of all poles from St. Catherine Street, Montreal. The city contemplates an expenditure of \$5,000,000 to place all wires underground.

**OXDOW, SASK., CAN.**—The installation of an electric-light plant, to cost \$12,000, is under consideration.

### Miscellaneous

**PANAMA.**—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until April 5 for furnishing reversing motor planer equipment, motors, structural steel, cast-iron pipe and fittings, etc., under Circular No. 766, copies of which may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing agent.

## New Industrial Companies

**THE C. & B. ELECTRIC SIGN & CONSTRUCTION COMPANY,** of Atlantic City, N. J., has been incorporated by H. Cullenbach, W. Each, Jr., and J. P. Johnson, of Atlantic City. The company is capitalized at \$100,000 and proposes to do electric light and power construction work.

**THE CENTRAL MOTOR SUPPLY COMPANY,** of Rochester, N. Y., has been incorporated with a capital stock of \$30,000 to deal in electrical and mechanical devices. The incorporators are: P. B. Barager, 19 Pacific Street; R. F. Close, 131 Lark Street; W. Wood, 17 Hanna Place, and C. W. Galliger, 641 Garson Avenue, all of Rochester, N. Y.

**THE HECCO DEVELOPMENT COMPANY,** of Portland, Maine, has been incorporated with a capital stock of \$2,500,000, for the purpose of doing a general electrical engineering business, etc. The officers are: A. F. Jones, president; A. A. Richards, treasurer, and A. F. Jones, clerk, all of Portland.

**THE NATIONAL REFILLABLE FUSE COMPANY,** of Chicago, Ill., has been chartered with a capital stock of \$50,000 to manufacture electrical appliances. The incorporators are: E. G. Woods, I. Grossman and L. Goldstein, of Chicago, Ill.

**SHOCKLESS ELECTRIC MANUFACTURING COMPANY,** of Kirkwood, Ill., has been incorporated with a capital stock of \$150,000 by C. E. Luberg, H. L. Conrad and F. N. Richardson, of Kirkwood. The company proposes to manufacture machinery.

## New Incorporations

**LOS ANGELES, CAL.**—The Midland Counties Pub. Ser. Co. has been incorporated with a capital stock of \$2,500,000 by Kasper Cohn, A. C. Balch, H. P. Baumgartner and B. R. Myers.

**CHICAGO, ILL.**—The Egyptian El. Co. has been incorporated with a capital stock of \$25,000 to operate electric light, heat and power plants.

The incorporators are: A. A. Rolf, A. E. Stern and M. J. Mears, all of Chicago.

**DECATUR, ILL.**—The Star El. Co. has been incorporated with a capital stock of \$3,000 by Richard B. Hall, James A. Goodale and D. M. Clifford. The company proposes to furnish electricity for lamps and to do a general electrical business.

**HAZARD, KY.**—The Hazard Lt. & Pwr. Co. has been incorporated with a capital stock of \$10,000 by W. E. Hemphill, B. P. Wooten and J. T. Lovelace.

**BOSTON, MASS.**—The American Lt., Ht. & Pwr. Co., has been incorporated with a capital stock of \$150,000 by L. H. Schneider, M. Ward and A. L. Whittier, of Boston, Mass.

**ST. LOUIS, MO.**—The Perry County Pub. Utilities Co. has been granted a charter with a capital stock of \$40,000 to generate and distribute electricity for lamps, heaters and motors. The incorporators are: Judson H. Boughton, A. D. Brinkerhoff and W. C. Morehead.

**BEAVER FALLS, N. Y.**—The Beaver Falls River Pwr. Co. has filed a certificate of incorporation with the Secretary of State. The company is capitalized at \$300,000 and proposes to engage in the manufacture of pulp and paper and to develop electrical power on the Beaver River to supply electricity for the present mill at Beaver Falls, owned by the J. P. Lewis Co. The incorporators are: H. S. Lewis and H. L. Van Ornum, of Beaver Falls.

**WOODLAND, N. C.**—The Woodland El. Lt. & Pwr. Co., has been incorporated with a capital stock of \$25,000 by E. G. Griffin, C. J. Parker and R. C. Bonthall. The company is now building a power plant at a cost of about \$4,000.

**WHEELING, W. VA.**—The Wheeling Valley Lt. & Pwr. Co. has been granted a charter with a capital stock of \$50,000 to do a lighting, heating and power business. The incorporators are: John W. Adams, M. S. Adams, Harry L. Bond and E. L. Bond, all of Wheeling.

**TORONTO, ONT., CAN.**—The International Lt. & Pwr. Co. has been incorporated with a capital stock of \$20,000,000. The charter of the company gives it power to construct and operate electric and hydraulic plants and to take over or consolidate with other companies and to operate subject to municipal and provincial regulations. I. S. Lovell, Madison Avenue, Toronto, and others appear as nominal incorporators.

## Trade Publications

**BUSHINGS.**—The Steel City Electric Company, Pittsburgh, Pa., has recently issued a leaflet on its bushings and lock-nuts, known as Bulletin A, which illustrates and describes these devices and gives the latest list prices.

**STAGE LIGHTING ACCESSORIES.**—The Universal Electric Stage Lighting Company, 238 West Fifth Street, New York, has issued a supplement to Catalog F, which in its twelve pages illustrates and describes a number of stage-lighting accessories, such as pockets and plugs, stage connectors, are connectors, connectors for dry batteries, chandelier connecting boxes, motion picture spot-lamps and other devices.

**FUSEETTE.**—The Electric Appliance Company, Chicago, is sending out a small folder telling about the Paiste fuseette. The fuse is carried in a small porcelain piece separate from the holder into which it fits when in use. When the fuse blows the small fuseette can be discarded and another substituted in the same holder, and the same holder can be used for many fuseettes, the cost of which is less than that of ordinary fuse plugs.

**BUILDING EQUIPMENTS.**—Bulletin No. 115, entitled "Electrical Equipment for Buildings," of the Spangue Electric Works of General Electric Company presents descriptions and excellent illustrations of electrical apparatus installed in some of the recently erected office buildings, hotels, theaters and other structures in different parts of the country. Numerous installations are shown, including in addition to the usual equipment a vacuumcleaning system, a refrigerating machine, dishwasher, laundry machine, condenser and other classes of apparatus.

**AUTOMOBILE CHARGING PLANS.** In a brochure recently issued by the Electric Products Company, 4300 Chicago Avenue, Cleveland, Ohio, the reasons why owners of electric automobiles should use the Wotton method of automatic charging are set forth in a clear manner. The Wotton automatic rectifier, automatic charger and automatic cut-out panels are illustrated, and their description, together with constructive features are given. The main features of the Wotton method of charging the automobile at night are automatic charging, saving produces.

**WIRES AND CABLES.**—The Atlantic Insulated Wire & Cable Company, 120 Liberty Street, New York, has issued a new list of prices and weights of cables for use in power, lighting, communication, wires and cables for railway systems. This list is a continuation of the universal code on the interior wiring systems, and contains the standard consumers' contracts and specifications for the use of the company's products incorporated in it. These cables and wires are made to order and are constantly being tested to a standard range of temperatures, excepting, of course, from the manufacturers of a new list each time the copper base changes.



## Business Notes

THE THOMPSON ELECTRIC COMPANY has moved its offices and assembling shop from 337 Superior Avenue, N. W., to 102 St. Clair Avenue, N. W., Cleveland.

THE GLOBE PORCELAIN COMPANY, which has been organized for the manufacture of electrical porcelain specialties, has established offices and factory at Mulberry Street and St. Joe's Avenue, Trenton,

N. J. The president of the company is Mr. Joseph Steinert, of the Joseph Steinert Machine Works, Trenton. Mr. W. R. Gaskill is the secretary.

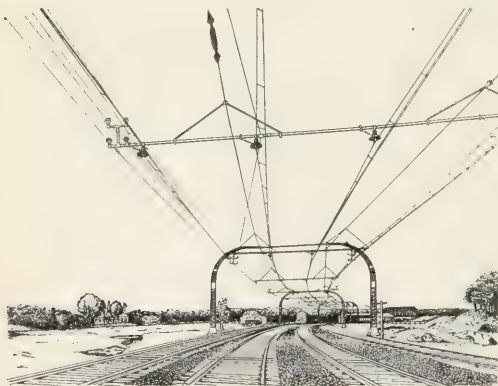
ELLIOT & BALL COMPANY—The advertising service which has been conducted for several years under the name of the Berton Elliot Publicity Service, at the Engineers' Building, Cleveland, has been incorporated under the title The Elliot & Ball Company, with Mr. Berton Elliot as president and Mr. E. H. Ball, who has been associated with the business almost from the start, as secretary and treasurer. The address remains unchanged.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 11, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,055,327. MEANS FOR PREVENTING CORROSION ON UNDERGROUND METALLIC STRUCTURES; C. Hering, Philadelphia, Pa. App. filed Nov. 27, 1908. The ground water is used as the return circuit.
- 1,055,331. APPARATUS FOR CARRYING OUT GAS REACTIONS PARTICULARLY FOR THE PRODUCTION OF OXIDE OR NITROGEN IN THE ELECTRIC ARC; W. Kochmann, Berlin, Germany. App. filed July 18, 1910. Uses a cone of arcs.
- 1,055,332. INSULATOR; H. A. De Long, Ephrata, Pa. App. filed Aug. 15, 1912. Grooved-pole line insulator.
- 1,055,361. ARC LAMP; R. Scott, Wilkes-Barre, Pa. App. filed Sept. 24, 1906. Electromagnetically deflected flaming arc.
- 1,055,362. ALTERNATING-CURRENT MACHINE; S. Senstius, Cincinnati, Ohio. App. filed April 11, 1908. Compensated repulsion motor.
- 1,055,366. ELECTRICAL ACCUMULATOR; P. K. Stern, New York. App. filed May 12, 1909. Non-conducting sectional casing for the grids.



1,055,782.—Overhead-Line Structure for Electric Railways

- 1,055,446. THERMOSTAT AND THERMOMETER; L. G. Copeman, Flint, Mich. App. filed July 28, 1911. For electric oven.
- 1,055,469. EXPRESSION DEVICE FOR AUTOMATIC PIANOS AND SIMILAR MUSICAL INSTRUMENTS; M. M. Kasner and C. Katz, London, England. App. filed Aug. 2, 1910. Accelerates the exhaust.
- 1,055,504. SALTING APPARATUS; A. Albrecht, Lubeck, Germany. App. filed July 30, 1912. Electric current is passed through the pickling salt.
- 1,055,512. MOUNTING FOR PRINTING ROLLS ON ELECTRO-DEPOSITING TANKS; H. R. Boissier, Great Neck, N. Y. App. filed Oct. 28, 1912. Bearings and electric connection.
- 1,055,530. DISPATCHER'S TRAIN-CONTROLLING DEVICE; J. Henri, Salda, Col. App. filed June 25, 1909. Electromagnetically controlled semaphore.
- 1,055,555. TELEPHONE ATTACHMENT; C. R. Phillips, Richmond, Va. App. filed Sept. 23, 1912. Disinfecting mouthpiece.
- 1,055,560. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed April 23, 1912. Loose copper-oxide scale electrode and zinc electrode.
- 1,055,561. GALVANIC BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed April 23, 1912. Wire-wound copper-oxide electrode.
- 1,055,562. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed May 3, 1912. Zinc electrode at the top and copper oxide at the bottom.
- 1,055,563. PRIMARY BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed May 3, 1912. Copper-oxide case at the top and zinc at the bottom.

- 1,055,570. ALTERNATING-CURRENT ELECTRO-MECHANICAL CONTROLLER; A. Sundh, Yonkers, N. Y. App. filed May 7, 1908. Starting, stopping, reversing and accelerating elevator motors.
- 1,055,578. CIRCUIT-CLOSER FOR INCANDESCENT-ELECTRIC-LAMP SOCKETS; R. H. Vickers, Fayetteville, Ark. App. filed May 27, 1912. Laterally receivable plunger.
- 1,055,591. ELECTRIC FLATIRON; E. F. Stegeman, Hollinsville, Col. App. filed Sept. 10, 1912. Heated supporting rolls.
- 1,055,598. DRIVING AXLE; D. Balachowsky and P. Caire, Neuilly-sur-Seine, France. App. filed July 12, 1909. Gearless motor mounting.
- 1,055,642. ELECTRIC DISTRIBUTION SYSTEM; E. N. Lake, Winthrop, Mass. App. filed Aug. 31, 1912. High-tension bus compartments.
- 1,055,652. ELECTROLYTIC PROCESS; C. J. Reed, Philadelphia, Pa. App. filed May 10, 1911. Receiving iron from a sulphate solution.
- 1,055,653. ELECTROLYTIC PROCESS; C. J. Reed, Philadelphia, Pa. App. filed May 10, 1911. Spongy lead anode for receiving cobalt from sulphates.
- 1,055,691. ELECTRIC LINE STRUCTURE; C. Aalberg, Wilkinsburg, Pa. App. filed April 21, 1910. Catenary-system flexible support.
- 1,055,762. STOPPING DEVICE FOR TRAINS; J. M. Kramlich, Philadelphia, Pa. App. filed Oct. 29, 1910. Throttle and train pipe controlled by the signal system.
- 1,055,776. SELF-WINDING ELECTRIC CLOCK; W. K. Menns, Chelsea, Mass. App. filed June 27, 1912. Electromagnetically wound.
- 1,055,782. OVERHEAD-LINE STRUCTURE FOR ELECTRIC RAILWAYS; W. S. Murray, New Haven, Conn. App. filed June 9, 1910. Hanger for curved double-trolley conductors.
- 1,055,793. CREAMING IRON; H. W. Pogue, Decatur, Ill. App. filed March 21, 1912. A heating member and a co-operating shoe.
- 1,055,802. MAGNETIC SWITCHING DEVICE; C. J. Rowe, California, Pa. App. filed May 4, 1912. For mine locomotives.
- 1,055,815. THERMOSTATIC ALARM; I. S. Shultz, Easton, Pa. App. filed Jan. 18, 1911. For incubators; damper rod works between two diverging adjustable contact arms.
- 1,055,850. HIGH-TENSION BLOW-OUT; T. Von Schweigbergk, Southampton, England. App. filed Nov. 9, 1909. Energy of magnetizing coil is increased as the arc is formed by separation of the contacts lengthens.
- 1,055,863. TELEPHONE SIGNALING DEVICE; W. G. Blauvelt, New York, N. Y. App. filed May 4, 1911. Ringing current is applied to the line before the interrupter comes into operation.
- 1,055,870. TELEPHONY AND TELEGRAPHY; S. G. Brown, London, England. App. filed Dec. 12, 1910. Microphonic resistance varying device.
- 1,055,873. DYNAMO-ELECTRIC MACHINE; J. L. Burnham, Schenectady, N. Y. App. filed Oct. 26, 1910. Effective magnetization of anti-sparking windings varied in accordance with differences of voltage from heel to toe of the brushes.
- 1,055,877. FUSE CUT-OUT; E. R. Carichoff, Schenectady, N. Y. App. filed Oct. 12, 1911. Fuse of reduced current-carrying capacity, at a plurality of points and ruptured portion between such points is ejected by blow-out coils.
- 1,055,881. PROTECTIVE DEVICE; E. E. F. Creighton, Schenectady, N. Y. App. filed July 15, 1910. Lightning arrester employing electrolytic condenser.
- 1,055,882. ELECTRIC HEATER; A. S. Cubitt, Pittsfield, Mass. App. filed Jan. 19, 1911. Thermostatic switch opens heater circuit before all the water has been evaporated.
- 1,055,907. STARTING DEVICE FOR ALTERNATING-CURRENT MOTORS; L. A. Hankins, Schenectady, N. Y. App. filed Sept. 24, 1907. For starting single-phase induction motors; circuit-changing switch cannot be moved to running position until motor has been brought up to running speed.
- 1,055,931. SPEED-LIMITING DEVICE; L. C. Marburg, Norwood, Ohio. App. filed March 9, 1905. For rotary converters; speed governed by change in frequency of alternations in the source.
- 1,055,963. CURRENT-COLLECTING DEVICE FOR DYNAMO-ELECTRIC MACHINES; J. G. Zimmerman, Milwaukee, Wis. App. filed May 17, 1912. Dust and spark-producing particles sucked from face of commutator through passageway in the brush.
- 1,055,985. CONTROLLING FROM A DISTANT POINT THE OPERATION OF A MECHANISM OR INSTRUMENT; C. Berger, Budapest, Austria-Hungary. App. filed Aug. 26, 1909. Sound waves effect operation of electrical devices at a distant point.
- 1,055,988. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed June 15, 1909. A common battery energizes the receivers at substations when the lines are united in conversation.
- 1,055,989. TELEPHONY; E. R. Corwin, Chicago, Ill. App. filed June 15, 1909. Specially compact receiver construction.



# Electrical World

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## Model Work on a Model Law

Broad-minded co-operation characterizes the work of framing the model public utilities bill drawn up by the

National Civic Federation's department of regulation of interstate and municipal utilities, under the chairmanship of Mr. Emerson McMillin. In addition to the time and study of Mr. McMillin and his associates, more than \$50,000 in money has been spent in the investigations made in connection with this work. Although it represented a broad consensus of views, as brought to virtual completion by the committee of which Mr. McMillin is chairman, the model utilities law will be all the more representative by reason of the fact that before it reached final form there were enlisted the aid and experience of the public policy committee of the National Electric Light Association, of which Mr. Arthur Williams is chairman, and of the corresponding committee of the American Electric Railway Association. It is likely that within a few weeks the joint sub-committee representing these associations will be ready, so far as it is concerned, to report the bill as being in shape for final approval. It is a good omen that the corporation representatives who have aided in the preparation of the bill have given the most painstaking support to the labors of Mr. McMillin's committee and, instead of holding back or denouncing the whole undertaking, have made available the benefit of their united practical experience in the conduct of public utilities business. Altogether no better example than this could be cited of the possibilities of broad, helpful co-operation, and the measure which is the result of this work and the spirit back of it should indeed be a model one.

## Transmission-Line Stresses

With the development of the high-tension transmission line, both electrically and mechanically, has come a marked

increase in its commercial and economic importance. Formerly the line construction received little attention from the engineer, but recently it has received more careful design and consideration. Not only have the initial dimensions and stresses during erection come in for measurement and analysis, but the stresses which are likely to be incurred in the event of a rupture of one or more conductors have also been studied. The latter question has already been outlined in our columns. In this issue is published a more detailed discussion of the subject by Mr. R. S. Brown. It is shown, among other things, that if the initial normal tension on the wire or wires is known and also the stiffness of the towers, the deflection of the towers following a rupture can be closely estimated, provided they do not exceed the elastic limit. In cases of this kind it is

important to make such predeterminations and take such precautions as will prevent an accident to a wire from wrecking a section of the tower line.

## For a Commission on Electrification

That a commission on steam-railway electrification, as proposed by Mr. Frank J. Sprague to the New York

Railroad Club last week, could accomplish work of great value is beyond doubt. This fact becomes all the more evident when it is noted that the proposal not only contemplates technical investigation to determine what systems are best suited to particular conditions, but also includes consideration of methods of enabling the railroads to finance electrification work and the purchase of electrical equipment. This latter problem is greater, in the minds of railway officials, than are the technical problems. Show them how to get the money, and the steam roads will be quick to carry out their own or the better plans that a commission may recommend. Electrical interests are willing to pay the expenses of an electrification commission and to aid the railways in financing plans that it may recommend. These are further reasons why Mr. Sprague's proposal is entitled to the approval of public opinion, as well as the hearty support of the railroad companies.

## A Hint to Association Secretaries

An opportunity to render the best kind of humanitarian service as well as to provide an interesting feature

for the ordinary technical program is afforded secretaries and other association officials in charge of meetings, if they will arrange to have some experienced physician demonstrate with a volunteer subject modern methods of resuscitation from electric shock. A Western association of central-station operators carried out this plan at a meeting last year, and following its example a number of electrical organizations, including state conventions, A. I. E. E. and N. E. L. A. sections, etc., have since taken advantage of the idea. At the session referred to the company operating in the large city where the convention was held donated the services of its regular physician to demonstrate the Schaefer one-man method of resuscitation. With the aid of a volunteer subject from the company's staff the physician went through the motions of a real heart resuscitation, meanwhile explaining to the interested audience the reasons for each movement, position of the hands, frequency of respiration pressure, etc. After the demonstration and lecture many pointed questions were asked. It is safe to say that every man present in that audience received a better understanding of the practical method of resuscita-

tion than he could ever have obtained from a printed explanation, however lucid. After the meeting the appreciative comment heard among the utility operators proved the profit and interest with which the physician's talk had been followed. As several managers freely declared, the instruction received was itself alone well worth the expense of coming to the convention from the extreme corners of the State, as these men had done. Aside from the incalculable humanitarian value of the demonstration, one man was heard to put a money figure on the information he obtained which would have defrayed the expenses of the whole convention. Many expressed regret that it could not be made mandatory for every central-station operator in the State to be present, although in point of fact the attendance was unusually large as a direct result of the notice the resuscitation feature had received. Right here is suggested a very practical plan for stimulating interest in state association affairs among the smaller cities and towns which are not ordinarily represented at the meetings. By suitable preliminary notices scattered broadcast to every prospective member, featuring the resuscitation demonstration and its money value alone to the small operator, interest will be created and attendance assured on a scale which it would be difficult and probably impossible to secure in any other way.

### A Remarkable Turbine Efficiency

The report on the test of a pair of 6000-hp turbines elsewhere in our columns is altogether so remarkable that it is deserving of thorough examination. Ordinarily speaking, water turbines seldom show efficiencies exceeding 85 per cent, and at anything but the most advantageous gate opening 80 per cent is not an uncommon figure. The wheels of the present test operate under the fairly good head of 49 ft. They are large vertical-shaft turbines and therefore obtain some advantage in the matter of friction. The performance shown by the wheels is from any standpoint very remarkable. The maximum efficiency rises to between 93 and 94 per cent and remains above 90 per cent from about 80 per cent load up to full load, after which it drops off rapidly. The rise in efficiency toward this maximum is extremely steady and the wheels pass 80 per cent efficiency at half load. Great care seems to have been taken in the test to eliminate sources of error in the weir measurement, so that while the figures given are so extraordinarily high as to require critical examination, there seems to be no good reason to hold them in question, particularly in view of the very excellent results obtained with a smaller model of the same type in the Holyoke testing flume where years of experience have taught the precautions necessary to exact measurements.

The results obtained seem to be attributable to very careful design and manufacture helped out by skill in placing the wheels. In arranging the draft tubes particular care was taken to avoid as far as possible the eddies which are known to have a serious effect on turbine efficiency. The importance of these minor details is shown in the slight but very plain difference observable in the tests of two similar turbines. The one that gave the lower efficiency discharged

slightly to one side of the tailrace, producing some eddies, and these seem to be apparent to the extent of 1 or 2 per cent in the efficiencies obtained. It is not at all unlikely that unsatisfactory efficiencies are the result of incorrect design of the approaches and exits quite as much as of any fault in the runner or its immediate casing. Be that as it may, the high value obtained for the efficiency shows clearly enough that extreme care pays in work of this kind, for the gain in efficiency is a permanent asset of the plant and well worth the bonus paid.

### Electromagnetic Induction and Relative Motion

Faraday showed some eighty years ago that when a permanent magnet in the form of a rod or cylinder is touched by a wire at two points, one at the center and the other at a polar extremity, an electric current will be produced in the wire. The device constituted not only the earliest form of rotative dynamo-electric machine but also the earliest form of commutatorless direct-current machine. A nice question forthwith arose as to whether the generated emf had its seat in the wire or in the magnet. That is, when the magnet was rotated about its axis, did it carry its magnetic field bodily with it, like an invisible brush fastened on each pole, so that the rotating brush of magnetic field cut the stationary wire, or did the magnetic field stand motionless in space, so that not the wire, but the substance of the rotating magnet, was cut? Faraday himself inclined to the latter view. The discussion has gone on ever since, and a large literature of controversy has been built upon the question. The question is not of merely theoretical, speculative or academic interest, because the various theories of action propounded have led their champions to experiment on a fairly large scale, with the result that much good apparatus has been wasted on the scrap-heap and many abortive machines have appeared in engineering, all of which would have been obviated if a sound and convincing underlying theory of the matter could have been formulated and generally accepted. Where theory is defective, all kinds of economic wastes and errors originate.

In an article recently published in the *Physical Review*, Prof. S. J. Barnett shows that not one of the experimental methods hitherto proposed for settling the question at issue is competent to furnish a decision. The results could always be explained on either hypothesis. A favorite proposed experiment has been to rotate the rod magnet about its axis, inside a concentric, stationary, cylindrical condenser or Leyden jar, the armatures of which could be momentarily joined by a short wire. It was argued that if the field rotated with the magnet the emf induced in the joining wire would charge the condenser, so that the charge thus bottled up would settle the question, because if the field remained at rest the wire would not be cut and the condenser would receive no charge. But the article shows that this reasoning is wrong. No charge should appear in the condenser on either hypothesis. In fact, when a magnetic field is moved through the air, or through a vacuum, an emf is induced in the air or vacuum during the motion, although no means present themselves for rendering the

emf apparent. It is only when the moving field cuts a wire or conductor that the emf can be rendered evident by means of a galvanometer or electrometer. When, therefore, the magnet is rotated inside a coaxial Leyden jar the emf induced by the motion of the flux through the glass, assuming that the field rotates, is exactly the same as that generated in the wire that connects the two tinfoil coatings and has the opposite polarizing tendency. Consequently, the resulting charge is nil, just as though the flux did not rotate. This conclusion was confirmed by actual trial, within the limits of experimental error.

We still need some experimental means of settling this time-honored question. Meanwhile, for engineering purposes, we shall not, perhaps, go wrong if we assume that the field rotates bodily with the magnet; so that the emf resides in the wire. Nevertheless, until the question is decided satisfactorily it will be well to regard all such questions with due circumspection.

### Minority Report on Patents

The minority report of the House patent committee, presented elsewhere and dealing with the Oldfield substitute bill, is essentially a negative document so far as constructive reform of our patent system is concerned. Although acting principally to obstruct efforts toward the solution of a problem affecting the national welfare, yet, it serves to emphasize the futility of such pernicious and piecemeal hacking at a great subject, without adequate preparation or consideration. Much emphasis is laid by the minority upon the testimony given at the hearings last fall and the alleged failure to disclose real evils or abuses under the present system. It should be remembered that throughout this whole period of agitation a strong lobby has been maintained in Congress in the interest of manufacturers who apparently want the present situation undisturbed. The members of this lobby were active in securing witnesses to appear before the committee who would present the strongest case against the Oldfield bill, particularly in relation to the proposed annulment of the right to fix resale prices. In other words, much of the testimony came neither voluntarily nor from non-partisan sources.

This incident once more emphasizes the need of competent, broad-minded, detached study of our patent system by a commission composed of men whose qualifications and positions are such that no taint of self-interest or partisanship could be attached to their conclusions. Furthermore, it is largely futile to sit in Washington and hold open hearings for all comers, when obviously there are many individuals living at great distances who are highly competent to discuss the subject and present a host of pertinent facts, but are prevented from doing so on account of lack of time or by reason of the considerable expense of appearing in Washington and waiting to be heard. Of all those who appeared in person before the committee, inventors themselves formed a very small proportion; lawyers and manufacturers were in the majority. It would be unfair to claim that any group or factor of interest in this complex situation should not have a full hearing, but we protest most emphatically against "padded returns."

Let all be heard, and let it be certain that all are heard. Then let such a commission as we have frequently suggested take the whole case under consideration and recommend the needed legislation, at the same time making an exhaustive report for the information of the public at large which shall command respect and bear the weight of eminent, disinterested, non-partisan authority.

### More Light on Transmutation

An interesting aftermath of the reputed transmutation of hydrogen into neon, on which we commented a few weeks since, now appears in the scientific journals abroad. Professors Collie and Patterson recently intimated that a suspiciously large number of coincidences appear between the spectra of neon and hydrogen when the secondary spectrum of the latter gas is examined. Twenty of the more intense lines of neon, in fact, fall within a quarter of an Angstrom unit of hydrogen lines, and including the fainter neon lines there are fifty-seven such cases. Three neon lines also fall very close to helium lines, and one neon line quite closely coincides with an oxygen line. The array of facts as marshaled by Messrs. Collie and Patterson is very striking to one unacquainted with the details of spectroscopic research, and while they did not in so many words say that such neon lines are commonly present as part of the secondary spectrum of hydrogen, the implication was quite unmistakable.

The challenge issued by Messrs. Collie and Patterson was promptly taken up by Professor Fowler, the well-known spectroscopic expert, who proceeded to outline a few facts, pointing out that within the range investigated the secondary spectrum of hydrogen has somewhat more than 700 lines while that of neon has 260, of which more than one-third are of considerable brightness. With this degree of complexity a large number of coincidences within a quarter of a unit ought to be expected. Furthermore, a quarter of a unit is a large gap in modern spectroscopy, particularly when variations are both plus and minus. There must be coincidence within a few hundredths of a unit before the question of identity can be seriously considered, and Professor Fowler shows that within a range of 0.05 unit there are only six nearly coincident lines out of the many hundreds of hydrogen and neon spectra, while within the same range there are thirteen near coincidences with the complex iron spectrum. Moreover, none of the near coincidences are made more striking by resemblance in the physical character, grouping or interrelations of the lines. Professor Fowler therefore concludes that the near coincidences are wholly casual, such as may be found over and over again in the spectroscopic study of the elements.

The Collie-Patterson-Fowler discussion is a valuable study in the nature of scientific evidence, and it points the moral of exceeding caution in trying to draw conclusions from loosely gathered data. It is to be regretted that a clear case of transmutation, of which extensive researches the possibility, has not yet been observed, but it looks very much as if the present instance must be added to the list of similar scientific mares' nests which have disclosed themselves in the past.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Damage to Omaha Electric Service Systems by Tornado

(By Telegraph.)

Although the tornado of March 23 which swept diagonally across the city of Omaha, Neb., did not touch the business district, electrical interests in the storm area suffered severely. Every house in the path of the tornado was either demolished or wrecked so badly as to prevent use of electricity until rehabilitation is commenced. It is estimated that at least 1500 homes of both rich and poor were destroyed or damaged, and at a conservative estimate at least 500 of these were consumers of electricity.

In the cyclone district the Omaha Electric Light & Power Company estimates the loss of about 20,000 incandescent lamps from its circuits. Not only will it be deprived of the resulting revenue, but lines, poles and even meters were stripped from their fastenings and carried away by the wind. In all, about 400 poles carrying overhead transmission lines were blown down. The tornado, which was limited to a path about four to six blocks wide, caused a direct loss of from \$25,000 to \$30,000 to the Omaha central-station company, not including the resulting loss in revenue.

The storm belt divided the city into east and west sections. The district on the west is supplied through two substations which are fed from the central station located on the east side. The substations were thus immediately cut off from the source of supply by the passage of the storm, and the west and north districts of the city were therefore left without service. All of the lines in the business district which were damaged or interrupted were in working condition, however, by noon of Monday, the following day. One substation was directly in the path of the storm but passed through unharmed, although buildings surrounding it were razed. Two large poles, each 36 in. in diameter, just outside of the substation building, which supported the incoming transmission line, were snapped off at the surface of the ground.

#### EMERGENCY METHODS USED TO RESTORE SERVICE

To Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, congratulations are due for so quickly re-establishing service despite the extent of the damage. The first repair work consisted of dead-ending feeders running across the demolished district, clearing up feeder circuits which were usable, and establishing new leader circuits to the west side of the city through the standing lines in the north and south ends. Fully two-thirds of the customers who were cut off from the central-station lines during the storm thus had service restored in twelve hours.

The suburban towns of Benson, Dundee and Florence, which were dependent on the two substations in the western district of Omaha, were supplied with power by Tuesday. South Omaha's electric service was re-established Sunday night. Ralston, a suburban town to the south of Omaha, which was supplied with electricity from the Omaha company's system, was completely demolished. The Nebraska Traction Company, running between Papillion and Omaha, suffered severe loss to its lines, but resumed operation as soon as connection was obtained with the Omaha Electric Light & Power Company's circuits.

An electric sign about 35 ft. square on the roof of a building at Fourteenth and Farnam Streets was whisked out of

sight in an instant by an eddy current from the tornado while Mr. I. B. Zimman, contract agent of the Omaha Electric Light & Power Company, was watching it.

#### STORM DAMAGE TO OTHER ELECTRICAL INTERESTS

The electric garage of Messrs. D. B. Barkalow and G. M. Redick, at Fortieth and Farnam Streets, was almost entirely demolished. It was a two-story structure 132 ft. wide and 90 ft. deep. About fifty Baker Electric and Rauch & Lang cars were being garaged at the time of the storm, and probably thirty of these cars were completely destroyed. The electric hoist in the garage building was also demolished, but the charging plant is intact and will be in operation in about a week under a temporary structure. Occupancy of this building was shared by the Orr Motor Sales Company.

Among Omaha electrical men who suffered personal losses in the tornado were Messrs. Waldemar Michaelsen, city electrician; F. A. Nash, president of the Omaha Electric Light & Power Company; W. W. Sherwood, an electrical contractor, and E. S. Schurig, who operates the Standard Electric Company. The houses of the latter two gentlemen were completely demolished and Mr. Sherwood's baby was killed.

Both the Postal and the Western Union telegraph companies suffered severe losses. Lines were down in all directions and messages were accepted only subject to indefinite delay. A special tribute should be paid to the telephone girls of the night shift at the Webster Exchange of the Nebraska Telephone Company for their heroic work on the night of the tornado. When the storm struck the district supervised by this exchange most of the lamps on the boards flashed up owing to permanent grounds. When these were removed the girls answered the calls the rest of the night while their own arms were slashed with flying glass. The public waiting room was meanwhile turned into a hospital, and the operators' retiring room was used as a temporary morgue with the operators themselves acting as nurses. Major Hartman, in charge of the Fort Omaha hospital corps, attended the patients here. Three telephones for public use were installed outside of the building with special supervision to avoid confusion of operators. This exchange building was in the center of the worst storm damage, but remained itself untouched except for having all its windows broken. About 550 telephones will be out of service in the two exchanges until rehabilitation commences.

Special construction men were imported from St. Louis, Kansas City and Sioux City to take charge of repairs to the outdoor plant. Pole lines and cables lay strewn around the streets. In places where cables emerged from underground conduits the tornado had pulled out long strands so that the extent of damage to the underground cables is unknown. Cross-arms were left fastened to wires in some instances, while the poles had disappeared. In other places junction boxes only were seen suspended from wires. Considerable progress had been made toward putting all available telephones in service by Tuesday. The telephone company also aided in bringing order out of chaos by advertising in all editions of the local papers asking persons without telephones to leave their addresses with the telephone company so that they could be reached by their friends if desired.

## Flood and Wind Damage in the Middle West

It is impossible at the present writing to give even an approximate estimate of the damage to electric equipment throughout Ohio, Indiana, Illinois, Iowa and Nebraska occasioned by windstorms and floods in these States on March 21 and 23. It is believed, however, that property loss in Dayton, Ohio, alone will reach several million dollars on account of a flood of water from 8 ft. to 20 ft. deep, starting on March 23. It is stated that as many as 9000 telegraph and telephone poles were broken as a result of the windstorm on March 21. This storm covered a territory extending southwest from Lake Erie to Kansas City, a distance of 1200 miles, and about 250 miles wide.

Transmission lines owned by the Public Service Company of Northern Illinois and used for supplying energy to the outlying districts of Chicago were damaged by the storm. North Shore districts, which are supplied with electricity by the Waukegan and Evanston generating stations, were cut off from both sources of supply for about seven hours by the failure of pole lines. A transmission line connecting two southern suburbs of Chicago was put out of service for twelve hours owing to fourteen poles having been blown down.

The Bell Telephone officials reported that the only line which was in service out of Chicago after the storm of March 21 was the underground route to Milwaukee. The telegraph and telephone companies had not fully recovered from the February 21 storm (see *Electrical World* of March 1 and March 22) when the storm of March 21 struck the Great Lakes district.

A still more severe storm was that of March 23. The first reports relative to the second storm indicated that it was characterized by a tornado of great violence and that there had been distressing loss of life and property in the States of Nebraska, Iowa, Illinois, Indiana and Ohio. The greatest loss of life has been reported in Dayton, Piqua and Columbus, Ohio, and in Peru, Indianapolis and Brookville, Ind., and Omaha, Neb.

In Milwaukee early on March 24 a terrific wind and rain storm did much damage. It is reported that the large "Gimbels" electric sign described briefly in the *Electrical World* of March 15 was blown down, the large steel frame, 160 ft. long and 77 ft. high, landing on top of a hotel.

In Terre Haute, Ind., many were killed and injured by the storm of March 23 and March 24. The storm was most violent during the night, and the city was further crippled by the interruption of electric-light and street-railway service.

## Maine Public Utilities Commission

A bill to create a board of public utilities has been ordered engrossed by the Maine Legislature. The bill closely resembles the Wisconsin public utility commission act. The board is to be composed of three members, with a clerk and an assistant. The first three members are to be appointed by the Governor and Council for terms of seven, five and three years, the Governor designating the chairman and succeeding members for seven-year terms. The present Board of Railroad Commissioners and the State Water Storage Commission will be abolished. The new commission will have the regulation of all public utilities in the State, including railroads, electric service and telephone companies, water companies and water districts. The chairman will receive a salary of \$5,000, the other two members \$4,000 each, the clerk \$2,500, and the assistant \$1,500. Before the bill reached its present stage a number of amendments were rejected, including those that cities, towns and corporations operating water and electric companies should not be included and that the commissioners should be elected first by the Legislature and after the first appointments by the direct vote of the people.

## Proposed Amendments to New York Insurance Laws

Three bills introduced by Assemblyman James J. Walker at Albany, N. Y., and referred to the committee on insurance, deal with subjects of much interest to electrical contractors and inspectors. Bill No. 89 would amend the insurance law in relation to organizations for assisting in establishing insurance rates. Bill No. 97 would amend this law in relation to organizations for assisting underwriters in insurance business generally. Bill No. 1716 would amend the insurance law by making it a misdemeanor to refuse to issue a fire insurance policy on property on the ground that the electrical installation at the premises has not been inspected in accordance with the requirements of any underwriters' association. Mr. Walker is chairman of the insurance committee of the Assembly.

## Co-operation in Railroad Electrification

In discussing the general subject of steam-railroad electrification before the New York Railroad Club on March 20, Mr. Frank J. Sprague outlined a plan for a technical committee to aid the steam railroads in choosing a proper system of electrification and in buying electrical energy and rolling stock.

The speaker stated that some two years ago he came to the conclusion, as a result of a study of the financial advantages of electrical operation, that the time had come when steps could be taken to remove the unnecessary asperities and soften the differences which had characterized the advocacy of systems and to determine in some authoritative way the lines along which the future development should or should not take place. At first it was thought that the American Electric Railway Association, or possibly the American Institute of Electrical Engineers, through suitable committees, could be instrumental in arriving at the necessary conclusions, but such committees would necessarily be composed of men absorbed in their individual affairs and their conclusions could not well indicate more than a general review of what had been accomplished; nor could any uncompensated group of men of the necessary ability and experience afford to give the time for radical studies or assume the great responsibility of decisions of far-reaching importance. If, therefore, this general problem could be referred to representative engineers who would occupy a confidential relation to the manufacturers, their engineers and to the railway companies, and who would be made the repositories of the technical advances and facts peculiar to the individual companies, as well as of the construction and operating facts of the railway installations already made, effective conclusions could be hoped for.

Even with a settlement of system and demonstrated ultimate economy of operation and increase of capacity denied to steam operation, the financial problem facing the railroad men is still a most serious one. Assuming, therefore, some general agreement as to standards, electrification would be materially advanced if the burden of reliable energy supply at a reasonable rate and with ample reserve and the possible provision of rolling stock on a basis of usage could be undertaken through the agency of outside capital, leaving the railroads only the minor burden of supplying fixtures along the right-of-way and cooperating with the electrical companies in the creation of general energy supply lines upon their own property.

In conclusion Mr. Sprague stated that the principal manufacturing companies are now favorably inclined to the creation of a technical commission to be composed of disinterested engineers of wide and varied experience who shall make a thorough study of the various systems of electrification as applied to such situations or situations as may be taken up, that they are prepared to hear a part, or if



necessary to meet the entire expense of such a commission; that they are in favor of some scheme of financial development which shall relieve the railroads of part of the burden of raising capital, and finally that they await only the necessary co-operation of railroad officials to make effective this joint effort to avoid the heavy costs of mistakes due to individual judgment on the threshold of a great electrical development in transportation.

### Changes in the National Electrical Code

The electrical committee of the National Fire Protection Association held its nineteenth annual meeting on March 26 and 27, 1913, in New York. The meeting, at which the attendance was about 200, was the largest ever held by the association.

The reports by the various committees had previously been printed in the association's bulletin, and at the meeting each item was acted upon separately. Some of the more important items discussed during the opening day are given herein.

Rule 3 (switchboards), Section b, was made to read as follows: "must be made of non-combustible material." This change eliminates all hard-wood construction, the use of which has previously been permitted under certain conditions.

In Rule 4, relating to resistance boxes and equalizers, provision was made for the use of incandescent lamps as resistors in series with other devices when mounted in porcelain receptacles upon non-combustible supports and so arranged that they cannot have impressed upon them a voltage greater than that for which they are rated.

Rule 8, Section a, referring to insulation of frames of motors operating at a potential of less than 550 volts, was so amended that permission can be given for the omission of such insulation, in which case, however, the frame must be permanently and effectively grounded.

The proposed changes in Rule 16, Section b, in regard to tie wires, were adopted with a slight change in wording so as to bring out clearly the true meaning.

Rule 17, Section d, had been changed by the committee to prevent any private generating plant supplying service to more than one building except by special permission. This amendment was referred to the pole-line committee.

Several slight changes were made in the tables of allowable carrying capacities of wires contained in Rule 18, Section a.

The use of metal moldings, referred to in Rule 26, Section 1, is now allowed for circuits carrying up to 1320 watts instead of 660 watts.

Rule 28, Section d, referring to armored cables, was amended to read: "must be equipped at every outlet with an approved outlet box or plate. At exposed ends of conduit (but not at fixed outlets), where wires pass from the conduit system without splice, joint or tap, an approved fitting having separately bushed holes for each conductor must be used. Departure from this rule may be authorized by special permission."

The report of the committee on sockets was presented and approved by the meeting as printed in the bulletin, except for some minor changes.

During the discussion of this report Mr. Joseph G. Swallow, superintendent of the United Electric Light & Power Company, New York, brought out some points in regard to the 250-watt socket commonly used on lighting circuits in ordinary interior house wiring, which points are of particular interest to the central-station industry. The speaker referred to the constantly increasing use of various heating devices consuming from a few watts up to 500 watts or more. These devices are sold without any instructions to the purchaser as to the proper socket to use for such devices, and the purchaser, usually ignorant of all

electrical matters, will take for granted that connections can be made to any lamp socket available. This fact has caused much trouble to the company represented by the speaker, and the cost to the company on account of such trouble has greatly increased during the last few months. Realizing the impossibility of educating the public as to the use of proper sockets the speaker suggested that the 250-watt sockets should be replaced by 660-watt sockets.

Though it was generally agreed that the matter is of utmost importance, it was doubted whether such a course would really remedy the defect. For ordinary lighting circuits No. 18 wire and 6-amp fuses are usually employed, and it would not under any circumstances be advisable to operate the larger heating devices on such circuits. A suggestion was made, however, that heating devices requiring over 250 watts should be furnished with plug receptacles, which would in a measure eliminate the present trouble.

The meeting considered the matter of too great importance to dispose of at the present conference and upon motion by Mr. W. H. Blood, Jr., it was referred to the socket committee for investigation. This committee will report on the subject to the electrical committee at a future meeting.

Among suggested changes in the code was one amendment to Rule 68, Section d, to the effect that the rule should read as follows: "The fuse casing must be sufficiently dust-tight so that lint and dust cannot collect around the fusible wire and become ignited when the fuse is blown. The fusible wire must be attached to the terminals in such a way as to secure a thoroughly good connection. The suggested change consisted of the omission of the following words: "and to make it difficult for it to be replaced when melted."

The recommendation of the electrical committee was to refer the matter to the switch and cut-out committee for consideration and report at the next biennial meeting. Mr. W. H. Merrill, of the Underwriters' Laboratories, pointed out that no member of this committee has had any field experience and all members are residents of the same city, in which city the matter is, owing to local rules, of no considerable interest. On this account the speaker moved that the switch and cut-out committee should be increased by one member from each of the cities of New York, Chicago, Philadelphia and St. Louis, where the matter is of utmost importance and interest and where various types of fuses are in use. An amendment to this motion was made by Mr. H. R. Sargent, of the General Electric Company, to the effect that the sub-committee should report to the electrical committee at the next biennial meeting. The amended motion was passed by the meeting. The matter is consequently suspended for two years with the object of getting the proper field experience so as to be able intelligently to judge the merits of the refillable fuse. No provision was made as to methods for obtaining this field experience by the sub-committee, no refillable fuse approved by the Underwriters now being available on the market.

The reports of other special committees and changes adopted during the closing sessions will be referred to in a later issue.

### The Gott Patent for Submarine Cable Signaling

Avoiding the use of the siphon recorder formerly required for submarine signaling, ocean cables can now be operated with telegraph sounders like ordinary land lines by the use of an invention of Mr. John Gott, of Brighton, England, engineer for the Commercial Cable Company, described in United States patent No. 1,056,533, issued to Mr. Gott March 18.

It is well known that reversed currents sent rapidly through a long submarine cable are the most effective in definition as received at the distant end, each successive impulse having the effect of neutralizing the preceding one.



In Mr. Gott's invention every unit of each letter is therefore formed by a reverse current so that in no case during transmission do impulses of the same polarity follow one another. At the receiving end these reversed units of the letters are so transformed that the alphabet reappears in Morse characters just as if received through a short land line, making the message easy to read and transcribe.

This reversal of polarity for each unit of the letter is obtained by means of the back-discharge of current from the cable itself, which, having considerable energy, is able to act upon a polarized relay and after each impulse reverse the polarity for the following signal. Another method of reversing the polarity for successive units employs a transformer whose primary is inserted in the grounded circuit of the split or double battery. Currents induced in the secondary actuate a polarized relay, insuring the successive reversal of the impulses. An advantage of the latter method is the fact that on making contact with the key to charge the cable the battery contact in the relay is reinforced at the moment the key is depressed, thus insuring perfect transmission. For manual sending an ordinary Morse key is used, while for automatic sending from a prepared perforated slip the Wheatstone transmitter takes the place of the key. Where it is desired to translate from a land line the usual receiving relay is connected to the polarized reversing relay and received Morse signals are translated into the cable in the form of the "reversed-current alphabet" described. The relay may also work a sounder relay in a local

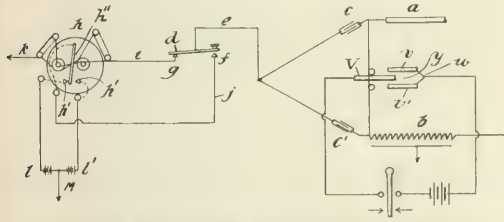


DIAGRAM OF CIRCUITS FOR SUBMARINE CABLE SIGNALING

circuit, transforming the Morse characters coming over the land line.

Referring to the circuit diagram, when the key is depressed the battery is connected to the cable. When the key is open a discharge path is afforded from the cable through back-contact *d* to the coils of the polarized relay *h* and to ground at *k*. The relay arm vibrates between the two contacts connected to the sides of the split battery, connecting one or the other terminal to the key lever in such fashion that the polarity thus obtained will be opposed to that of the preceding impulse. Owing to the considerable energy of the cable and the sending condensers, the resistance of the windings of the polarized relay may be negligible and still be effective for good signaling.

At the receiving end a pivoted contact moves between two plates so that motion of the tongue in either direction completes a relay circuit to the local sounder or other device.

## Second N. E. L. A. Analysis of New York Hydroelectric Plans

Reminding the New York State Conservation Commission that it has neither acknowledged nor attempted to answer any of the arguments contained in the former communication transmitted by the public policy committee of the National Electric Light Association (abstracted in the *Electrical World*, March 22, 1913, page 601), the committee, through its chairman, Mr. Arthur Williams, has now addressed a second open letter to the commission in which further analysis is made of the Murtaugh-Patrie bills and

their provisions for hydroelectric development at the Crescent and Vischer's Ferry dams.

As already pointed out, the fixed charges on such a project would alone amount to \$20 per hp-year, although the power developed has been promised to municipalities at a price of from \$7.50 to \$10 per hp-year. The provision of the proposed act permitting during the first two years of service the charging of all losses to capital expenditure, however, will, it is declared, allow the commission to keep the appearance of its promise during the earlier stages of the plant's operation, while concealing the real facts from the public. Thus for the time being the commission, it is pointed out, can make any price desired, and during this period it will be impossible for the facts to be made public. The letter further charges that the ultimate scheme is evidently one for building steam-power plants, since under the guise of natural-resource conservation the commission would erect a large auxiliary steam station to serve the water-power system during periods of limited water supply. The proposed legislation, it is also shown, would permit the Conservation Commission to dictate the prices at which energy might be sold, all regardless of the state public service commissions.

Charges of extravagance are also brought against the conduct of the Conservation Commission. For 1912, it is stated, the Conservation Commission cost New York State \$661,366.82, of which \$38,872 went for salaries and \$140,490 for traveling expenses. The remaining \$134,999 was devoted to the work accomplished. For 1913 the appropriation has been increased about 22 per cent, making the allowance \$809,260.

The complete hydroelectric plans of the Conservation Commission call for an outlay by the State and its municipalities of from \$300,000,000 to \$600,000,000, opening, it is suggested, enormous grafting possibilities.

The Conservation Commission, it is further declared, has greatly overestimated the power available. Recurring dry years, for example, will cut down the quantity. Such a low year as 1899 shows 12,000 hp available only 49 per cent of the time. The records for 1908, another low year, show 12,000 hp available only 175 days. During 1899 less than 3400 hp was available during a fifth part of the year. This amount of power at the generating station gives only 2380 hp for sale at the consumer's meter. Dividing by the total charges, it is evident that the fixed charge will be \$34 per hp instead of the \$7.50 to \$10 promised in the Murtaugh-Pattie bill. The low-water flow, of course, should determine the size of steam plant necessary.

Adaptation of the canal to power purposes might seriously endanger the interests of navigation by offering a tremendous temptation to draw on canal waters during dry seasons. Nor is this hydroelectric development needed, the committee continues, in order to supply lighting and power service for the Capitol and the educational buildings at Albany. The public buildings there are already furnished with energy from a state plant which cost \$777,000, although its equipment should have been purchased for \$150,000.

Proceeding next to consideration of the Sacandaga project at Hadley, which is to follow the capital district scheme the committee points out that storage dams there will cost \$5,000,000 and the power plant will cost \$200,000. This development will produce 25,000 hp, to cost \$80 per hp-year at the consumer's meter, omitting items of labor, repairs and transmission. The difference between actual return from investment at \$750 to \$10 per hp and the above cost will have to be met by taxation of the entire State in order to benefit a few interests.

In conclusion, the committee desires any desire to have these water-powers remain dormant and ineffective, but urges instead their full and proper development on a basis fair alike to all and without preferential treatment to any of the State's citizenship. It urges that the State formulate a constructive policy of leasing these powers under com-

petition to the highest bidders, subject at all times to state control and regulation, or that it adopt such measures as are to be followed by the national government in leasing the water-powers of the country.

Mr. Francis Blossom, an engineer of 52 William Street, New York City, representing the owners of the principal lighting plants in Albany and Troy, substantiates the statements made in Mr. Arthur Williams' analysis, pointing out both the small quantity and the great expense of developing the available water-power. The outcome of the proposed hydroelectric scheme, he declares, would ultimately mean the construction of steam-power plants to compete with existing private utilities furnishing adequate service.

The Merchants' Association of New York City has also filed an emphatic protest against the Murtaugh-Patrie bills, urging that not one-quarter of the people of the State can be supplied with this artificially cheap electric service. All the rest of the State and its people will be heavily discriminated against. By reason of the State bonus granted them (estimated at one-half the present cost of energy) manufacturers and merchants in the favored localities will have a great advantage over their competitors in non-favored districts in the cost of their products.

The Merchants' Association goes on to condemn the scheme as artificially causing inequality of competition for the advantage of favored districts and to the disadvantage of most of the people; as subjecting the State to the burdens and the risks inseparable from a great business enterprise, and as unjustly applying the State's resources for the benefit of the few and against the interests and the rights of the many.

### Minority Report of the House Patent Committee

During the closing days of the last Congress a report on the revision of the patent laws, representing the views of a minority of the House patent committee, was submitted by Representative Bulkley, bearing also the signatures of Representatives Morrison, Littleton, Currier, Henry and Wilder. The trend of the report is dissent from the majority report earlier submitted and opposition to the substitute bill, H. R. 23,417, favored by Mr. Oldfield, chairman of the committee. This bill, the minority state, has three main purposes:

- (1) The establishment of a compulsory license system.
- (2) Extinction of the right of the owner of a patent to treat license violations as infringements.
- (3) Amendment of the Sherman anti-trust law as applied to those doing business under the protection of patents.

The minority oppose all of these three main purposes, and the bill in general, except the first part of Section 1 and all of Section 3. They assert that the explicit statement by Mr. F. P. Fish that no specific evils have been shown to result from the practice of buying up patents and suppressing them went unchallenged, and also quote from Mr. T. A. Edison's statement as follows:

"I have heard and read numerous statements that many corporations buy valuable inventions to suppress them, but no one cites specific cases. I myself do not know of a single case."

The report declares that the majority rest their case for compulsory license, not on the testimony at the hearings, but upon comments and complaints in the public press, and upon alleged instances to be found in the reports of federal decisions. The decisions in the Columbia Wire case (71 Fed., 302), the threshing-machine case (148 Fed., 21), the National Harrow case (21 App. Div. N. Y., 290), the lock case (166 Fed., 555), and the paper-bag case (150 Fed., 741), cited in the majority report, are discussed in the minority report at some length, and the inference is drawn that these cases disclose no real suppression of a patent in order to avoid or restrain possible competition. Regarding the testimony the minority stated:

"A great many of the witnesses who appeared before the committee, men selected and invited to appear because of their peculiar fitness to discuss the problems involved, testified that widespread bad effects would follow upon the adoption of the proposed compulsory-license legislation; that it would be an extremely discouraging thing to invention and industry. Not only have the hearings shown that the compulsory license provision is uncalled for and dangerous, but the provision as contained in the bill demonstrates the impracticability of any such plan."

Considerable argument was advanced in the report to show that the procedure of obtaining a license under the provisions of the bill raises several serious questions, such as divided title, interpretation of the phrase "patented invention," reasonable royalty, whether a license shall be exclusive, etc. In other words, the minority advance the argument that such a feature would be unworkable as a practical matter and could not fail to lead to extended and costly litigation without satisfactory results.

The remainder of the report was devoted to arguments against the proposal to remove the patentee's right to fix the resale price of his patented invention.

On the score of the sections of the bill which are designed to amend the Sherman act, the minority has only to say that no hearings were had upon the subject and that the only suggestion made upon it came from Mr. Brandeis, who regarded the real issue as one broader than the domain of patented articles and embracing all commodities. The minority closed their report with the following remark:

"The House has a right to presume that matters favorably reported from its committees have been considered in committee. This presumption is absolutely not supported by fact in this case, so far as the proposed Sherman law amendments are concerned."

### Supplying Service to 202 New Jersey Municipalities

One of the most noteworthy developments of the day in the public-utility field, and one to which reference has been made frequently in previous issues, is the growing tendency toward the physical and financial consolidation of electric service properties in scattered communities into large operating units which are able to give to these small communities a far better service from large central stations operated by them than is obtained under individual operation.

An excellent illustration of the practical application of the unification idea is given in the fourth annual report which the Public Service Corporation of New Jersey issued this week.

This shows that through its three subsidiaries, the Public Service Electric Company, the Public Service Railway Company and the Public Service Gas Company, this corporation furnishes either gas, electricity or street-railway service to 202 municipalities, with a total population of 2,028,947, in the State of New Jersey.

There are 173 municipalities, having a population of 1,947,199 which are supplied with electric service; 153, with a population of 1,812,866, served with gas, and 136, with a population of 1,890,785, which receive street-railway service from the Public Service Corporation of New Jersey. Many of these communities are so small that only through the ability of the corporation to extend its service to them can they enjoy the benefits of electric service. It is claimed that in all of the communities the quality and continuity of the service is superior to that which might be obtained through a local enterprise.

On Dec. 31, 1912, the corporation had thirty-two generating stations in use. In these were 257 boilers and 201 generators, the aggregate rating of the latter being 147,408 kw. In the fifty substations were eighty-four rotary converters, with a total rating of 64,950 kw.



During the year 357,289,241 kw-hr. of electrical energy were sold. The total connected load on Dec. 31, 1912, was 180,942 kw. There were 12,297 street arc lamps and 20,347 street incandescent lamps in service on that date. The total length of transmission lines was 475 miles and the length of conduit was 101 miles. The total trackage amounted to 844 miles. During the year 9,637,555 cu. ft. of gas was sold.

Net earnings of the Public Service Corporation of New Jersey were \$14,875,436, an increase of \$691,219 over those in 1911. The gross earnings of the railway company increased 4.35 per cent, those of the gas company 8.50 per cent, and those of the electric company 12.19 per cent.

### Mr. Byllesby on the Rights of Public Utilities

Mr. H. M. Byllesby was to have been one of the speakers at the banquet of the Illinois Gas Association in Chicago on March 19. He was unable to be present, however, but sent a letter from Louisville, Ky., read by Mr. William H. Hodge, in which he said there was a popular tendency to misrepresent public-service corporations and their officers. It is difficult for these corporations and their representatives to obtain a fair hearing. Mr. Byllesby made a spirited protest against this tendency and, among other things, said: "We have a right to demand a calm and judicial consideration of the services we have rendered and that ordinary justice which we are entitled to. It is not right that the changes should be rung upon the mistakes and errors which have been committed in this industry, just as in all others, and the eyes and ears of the public blinded to the marvelous service and inherent merit and magnificent industry and courage which have carried the successful of these enterprises to success. It appears to me that the period of silence on the part of all of us must cease; that each in his own sphere of influence must do his part toward educating the public and toward the turning back of the tide of unfair and ill-considered legislation leveled against us."

### The Disintegration Theory of Radioactivity

The second of the series of four lectures which are being given under the auspices of the American Institute of Electrical Engineers on the subject of radioactivity by Prof. Edwin P. Adams, of Princeton University, was delivered in the Engineering Societies Building, New York, on March 26. In this lecture the disintegration theory of radioactivity, the distribution of radioactive substances and the age of the earth as determined by the presence of radium were discussed.

The first explanation of how radioactive substances emit the alpha and beta particles was advanced by Lord Kelvin. Experiments made by Sir William Crookes at a later date brought to light the fact that uranium might be separated by chemical means into two substances, one of which is radioactive and the other inert. The active substance, which was known as uranium X, lost its radioactive properties in a few weeks, while the residue, which at first was inactive, later acquired radioactive properties.

It remained for Rutherford to measure accurately the rate at which the activity of uranium X disappeared and the residue recovered its activity. He expressed these relations in the shape of simple exponential equations. The evidence brought out by these measurements led to the adoption of the disintegration hypothesis. Until the discovery of such changes it had been thought that the atom was unalterable, but according to this theory it is seen that certain atoms are unstable dynamical systems and do alter themselves and take other forms. Such changes differ from chemical changes in that they are not at all affected by the temperature of the surrounding medium, for they have been

found to be equally rapid whether surrounded by liquid air or subjected to the highest temperatures of the electric furnace.

The radium emanation, said Professor Adams, behaves very much like a gas. Air currents, for example, sweep it away. The radioactive series of uranium was then explained in detail. Beginning with the heavy atom of uranium, it was shown how the atomic weights of each of the various elements down through ionium, radium and its derivatives, polonium, and finally lead itself could be derived by disintegration, each succeeding atom being reduced in weight by the emission of an alpha or a beta particle, or both. The periods of time required for each product to decline to one-half its original value were also given.

Since the rapidly moving particles given off by radium possess kinetic energy which must be converted into heat when they collide with other particles and are stopped, radium must be at all times warmer than its surroundings. This has been found to be true. Calculation shows that 1 gram of radium will emit 132 gram-calories of heat in a year, also giving off 158 cu. mm of helium in the same period. By analysis of rocks containing radioactive substances, helium, etc., the age of the earth may thus be calculated.

In conclusion the speaker declared that the only conception which these discoveries and recently adopted theories would require to be changed is that regarding the stability of the atom.

### Louisville Electrical Contractors' Association

The annual banquet of the Louisville Electrical Contractors' Association was held at the Galt House, Louisville, Ky., March 19. Mr. C. C. Childers, of the contracting firm of Childers & Waters, presided as toastmaster. The first address was by Mr. Frank E. Good, superintendent of the electrical department of F. A. Clegg & Company and president of the association.

Mr. Good spoke on "Raising the Standards of Electrical Contracting" and made the points that a profit should be shown by every job; that no member of the trade should pocket losses simply to get the business; that the contractor cannot pay too much attention to data of preceding contracts and their comparisons; that there should be a minimum of mistakes due to items in the specifications being overlooked, and that dealings with a general contractor should be conservative.

"The Advance in Metal Construction" was discussed by Mr. Edward Thirlwell, of the Marine Electric Company. Mr. Thirlwell called attention to the greatly increased use of metal-conduit wiring in all modern jobs and produced examples to prove that the contractor cannot adhere too closely to specifications, as in the stipulated number of conductors to be drawn through a conduit of given dimensions. Mr. H. G. Wooten, of the Kentucky Actuarial Bureau, explained to the electrical contractors the relation which an electrical inspector employed by fire insurance rating organizations bears to the trade, and Mr. Jesse M. Vollmer, secretary of the Builders' Exchange, closed the evening's program with an address on "Organization" in which he graphically described the benefits of close co-operation in any one or any group of the allied electrical trades.

### American Railway Engineering Association

Mr. Charles S. Churchill, of Roanoke, Va., chief engineer of the Norfolk & Western Railroad, the president of the association, occupied the chair at the annual convention of the American Railway Engineering Association, held in Chicago, on March 18, 19 and 20. The attendance was large, including engineering and maintenance-of-way rep-



representatives from the leading steam railroad systems of the United States and Canada. Many colleges and universities sent engineering representatives. This year the University of Michigan was represented for the first time, Professors H. E. Riggs, H. B. Merrick and A. R. Bailey being the delegates.

In his annual address Mr. Churchill mentioned how study along lines of efficiency and economy of labor by the Norfolk & Western Railroad since 1905 has culminated in undertaking the electrification of 27 miles of its lines having the steepest grades and the densest traffic. The electrification is purely for handling more economically the freight trains in the heart of the Pocahontas coal field.

Several of the committees' reports submitted dealt with electrical engineering subjects. In the report on the effect of treated ties on track circuits opinions received from various railroads in this country agreed that track circuits a mile in length are rendered inoperative by the extensive use of zinc-treated ties. The greatest trouble is experienced in extreme dry weather or in wet weather. Careful study of the relative values of two methods of fractionizing coal-tar creosote has also been made in the last year by the committee on wood preservation.

A valuable report in the nature of information and a statement of progress were submitted by the committee on electricity, of which Mr. George W. Kittredge, of the New York Central, is chairman. It was urged that all companies conform to the clearance diagrams adopted by this association so that there might be a free interchange of electric equipment between various roads. However, as unanimity of opinion does not exist concerning the best methods for preventing electrolysis, no recommendations were offered for standard or preferred practice, but an account of the methods pursued in some of the most important localities was submitted.

The annual dinner given on March 19 was well attended. President Churchill was toastmaster, and speeches were made by Mr. B. A. Worthington, president of the Chicago & Alton Railroad; Rev. R. W. Dickie, of Montreal; Mr. George A. Post, president of the Railway Business Association, and Mr. P. G. Rennick, of Peoria, Ill. Mr. E. F. Wendt, assistant engineer of the Pittsburgh & Lake Erie Railway, was elected president of the association. Messrs. G. H. Bremner, engineer of the Illinois District of the Chicago, Burlington & Quincy Railway, and E. H. Fritch, 900 South Michigan Avenue, Chicago, were re-elected to the offices of treasurer and secretary, respectively.

### Mississippi Convention, Vicksburg-Natchez, April 21-23

The 1913 meeting of the Mississippi Electric Association will be held April 21-23 in connection with a boat trip on the Mississippi River from Vicksburg to Natchez during the first two days of the convention. The boat will leave Vicksburg at 12 o'clock noon Monday, April 21, next morning reaching Natchez, where the remaining sessions of the convention will be held. Among the papers to be read are: "Large Power Contracts," by Mr. A. B. Paterson; "Single-Phase Motors," Mr. J. F. Jones; "Lubricating Oils," Mr. W. A. McWhorter, and "Ornamental Street Lighting in Small Cities." Committee reports are also scheduled on the subjects of electric heating and cooking, meter testing, line construction, grounding of secondaries, membership, insurance, public policy, etc. A negro band will furnish music during the first night's trip down the river. On Tuesday evening, April 22, there will be a Jovian rejuvenation, followed by a reception and dance at the Prentiss Club, Natchez. The convention will close with a banquet Wednesday evening. Mr. R. B. Claggett, of Greenville, Miss., is president of the Mississippi Electric Association, and Mr. A. H. Jones, McComb, Miss., is secretary-treasurer.

### Electric Fire Engines Approved by Chicago Fire Chief

Answering a question at the meeting of the Electric Club of Chicago on March 20, Mr. Charles F. Seyferlich, chief of the Chicago Fire Department, spoke in favorable terms of electric fire engines. He referred more particularly to portable electric pumps rather than to electrically operated vehicles with storage batteries. His point was that electrically operated pumps obviate heavy boilers with the necessity of keeping a fire constantly going. Suitable outlets could be arranged near fire hydrants and the electric pumps connected to them. This would necessitate, of course, an unfailing source of electrical energy. The speaker at the meeting was Mr. J. C. McDonnell, assistant fire marshal and chief of the Bureau of Fire Prevention and Public Safety. Mr. McDonnell said that the steam fire engine is becoming a thing of the past. The gasoline motor-operated engine is more efficient and economical, but it in turn is only a stop-gap; the ultimate desideratum is a high-pressure water system. The speaker emphasized the point that much of the energy used in fighting fires might be spent to better advantage in preventing fires. However, efficient fire departments will always be needed, because when all reasonable means of prevention are exhausted there will still be fires due to carelessness or to causes beyond ordinary prudence and foresight.

### Louisville Merger Now Probable

The situation in Louisville, Ky., is rapidly shaping itself favorably to the consummation of the merger project which has been proposed by H. M. Byllesby & Company, who now control the Louisville Lighting Company, the Louisville Gas Company, the Campbell Electric Company and the George G. Fetter Light, Heat & Power Company. The concerns to be taken over are the Kentucky Electric Company and the Kentucky Heating Company, and the consummation of the merger project will remove competitive conditions in the local electric and gas fields. In return for this the Byllesby interests have offered lower rates for electricity to both private consumers and the city, and also lower gas rates, made possible by bringing natural gas to Louisville from West Virginia. The city will retain the power to regulate the consolidated company and to create additional franchises. Some of the local commercial organizations are opposing the merger on the ground that competition is the best safeguard for low rates, but sentiment generally favors the plan. The Commercial Club has appointed Mr. C. A. Tripp, of Indianapolis, to investigate the situation. Meanwhile the electric companies have indicated that they will in any event abandon their policy of cut-throat competition, and have accordingly withdrawn their solicitors from the field.

### Public-Service Regulation as Exemplified by Wisconsin Commission

Mr. Halford Erickson, a member of the Railroad Commission of Wisconsin, addressed a representative audience at the joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers held in Chicago on March 24, his subject being "The Regulation of Public Utilities in Wisconsin."

Mr. Erickson described in outline that part of the work of the commission which is involved in enforcing adequate service, reasonable rates and sound financial methods and practices. In relation to service, one result of the commission's work has been a marked improvement in the regulation of the voltage of electric-service utilities. The speaker described the cost basis of making rates as adopted in Wis-

consin and the uniform accounts and reports for both privately owned and municipally operated companies, and then devoted some attention to the subject of capitalization. The evils of over-capitalization were pointed out. One of these is the unnecessary and economically unwise consolidation of public-utility plants under one management, which is encouraged by the unlimited right to issue securities. Consolidations of operating properties are sometimes prudent and economical, but there are times when consolidations of this kind are effected solely with a view to the profit of promoters and with a disregard of the rights of the public. The opportunity to combine two corporations and issue securities exceeding the combined value of the two is so tempting that sometimes, in the absence of regulation of security issues, the possibility is taken advantage of in a manner detrimental to the interests of the public. Another function of the commission is the prevention of duplication and waste in the establishment of public-utility plants. This is accomplished by the regulation of capital expenses in the case of privately owned enterprises and by the use of the indeterminate permit in the case of municipal utilities. On the whole, the regulation of public utilities has been of direct benefit to the public, but the operations of the state commission have not brought about the millennium. However, complaints against regulation are more frequently actuated by personal or political interests than by unselfish regard for the public welfare.

Mr. Bion J. Arnold, consulting engineer, who opened the discussion at the request of Mr. A. Reichmann, president of the Western Society, said that Mr. Erickson had laid down the fundamentals of public regulation. He praised the Wisconsin commission for its bravery and broad-mindedness in its interpretation of the law. The record of the Wisconsin commission has caused confidence to be felt in the work of all state public-utility commissions.

Mr. Edward W. Bemis, public-utility expert, spoke of the good work of the Massachusetts commission, but said that the Wisconsin commission has certainly marked a great epoch in the interpretation of the commission idea, particularly in relation to the municipally owned utilities. Mr. Bemis praised the Wisconsin commission's system of accounting and asked several questions about its method of controlling capitalization, particularly capitalization of early losses.

Mr. Erickson, answering some of the questions put to him, said that it is only during the last two years that the commission has had entire control of capital issues. The plan is working fairly well, and he believed that it has reduced the rate of interest on capital needed for utilities in Wisconsin by making the securities safer. As to capitalization of early losses, the Wisconsin method is not understood, perhaps. The commission tries to find out what the early losses were, and from all the facts available it fixes the value of the plant and the business. The Wisconsin commission controls the rates for municipally operated utilities. These utilities need regulation much more than do privately owned plants. The commission has received twice as many complaints relating to discriminating rates made by municipal plants as in the case of privately owned plants. There are very few municipally operated utilities that have not been hauled up at least once before the commission. Their accounts are mixed and it is hard to ascertain the exact facts. This is particularly true of the smaller municipal plants.

Mr. K. B. Miller, consulting engineer, spoke of the amount of overhead charges to be allowed in determining plant values. He said this amount is usually underestimated. Only very small properties can be built with an allowance of 12 per cent for overhead. As a matter of fact, engineers usually underestimate costs. In the usual run of utilities, Mr. Miller thinks that the overhead will average from 25 per cent to 50 per cent.

Mr. G. T. Seely, assistant general manager of the Chi-

cago Elevated Railways, also spoke of the overhead expense. In the case of an elevated railroad it takes four years, perhaps, after construction is begun before final operation is accomplished. The overhead expense will surely reach 25 per cent or more.

Mr. Harold Almert, manager of the department of examinations and reports of H. M. Byllesby & Company, discussed the term "used and useful" as applied to the valuation of properties of public utilities and as found in the Wisconsin law and laws patterned after it. It is not difficult, he said, to make an unjust ruling in relation to capital accounts under the authority of this phrase. He spoke of the value of water rights, for instance, which has been a bone of contention in the case of some investigations before Western commissions. It seems to be unfair, for example, not to allow a company what it has actually paid in acquiring water rights and permit it to earn a fair rate of return on its investment.

Mr. W. B. Jackson, consulting engineer, remarked that the Wisconsin commission, while availing itself of the precedents of the good work of older commissions, had still broken virgin soil to a large extent. It would be strange if publicists could agree with the commission on all points.

Mr. R. F. Shuchardt, electrical engineer for the Commonwealth Edison Company, praised the commission and Mr. Erickson because they have tried to ascertain facts and not to demonstrate theories.

### Kirkwood Municipal Plant Situation

An application for an injunction to prevent the consummation of the sale of the municipal electric-lighting plant of Kirkwood, Mo., a suburb of St. Louis, to the Suburban Electric Light & Power Company, or its successor, was made to the Circuit Court on March 17. The Board of Aldermen has adopted a resolution favoring the sale of the plant for \$3,000 and the assumption of an indebtedness of \$17,000. This total is said to be \$12,000 less than was paid for the plant. The petitioners assert that it is illegal to sell the plant without authorization by vote of the citizens of the municipality. The Kirkwood municipal plant was constructed in 1900. The Mayor of Kirkwood is reported to be strongly opposed to the proposed sale.

### Protest Against "Home Rule" Utility Regulation in Ohio

A number of men interested in public-service corporations called upon Governor Cox of Ohio recently to protest against the enactment of what is known as the administration public-utilities bill in its present form. Surrendering to the pleas of Mayor Newton D. Baker of Cleveland and certain Cincinnati politicians, this bill has been amended to grant those municipalities which have adopted the home-rule form of government absolute control over public-service companies, with the exception of accounting matters. About all that is thus left for the Public Service Commission is the supervision of interurban railways. It is understood that Governor Cox did not favor this idea in the beginning, but he held out against all arguments when changes were advocated that would put utilities under the state commission and make their operation as nearly uniform as possible. It was argued that instead of the uniform regulation that has been exercised by the state for two years there will be local regulation under about 600 commissions, representing as many cities and villages.

Judge E. P. Matthews, of Dayton, asked the Governor if he had any objection to incorporating in the bill a provision that municipally owned plants shall not furnish service below cost. Governor Cox refused to consider this suggestion and said that the people will see to it that their



properties are not losing ventures because of too low rates.

Mr. J. C. Martin, president of the Ohio Electric Light Association, also attacked the bill. He charged the Governor with submitting to the demands of Mayor Baker of Cleveland and with failing to carry out the promises made in his inaugural address. Amendments to the bill strip the state commission of every vestige of power over utilities in municipalities adopting their own form of government and establish in each a utilities commission having all the powers it was intended the state commission should have. He declared that this bill does nothing it pretends to do, but does legislate out of office the present commission and repeals a good law. Mr. D. L. Gaskill, Greenville, secretary of the Ohio Electric Light Association, suggested that if the corporations accept indeterminate franchises the state commission should control the rates, but the Governor objected to this also. He claimed that this would be a restriction of the home-rule idea.

It was the general opinion when Governor Cox took office that he would recommend strengthening the public-service laws and would select three experts to act as commissioners, with other experts at the heads of the various departments of the office.

### Indemnity for Pole-Line Right-of-Way Strip

That the Louisville & Nashville Railroad Company, of Louisville, Ky., may be indemnified by the Western Union Telegraph Company only for the use of the ground actually occupied by the poles, guy wires and other line apparatus of the telegraph company as a right-of-way is the substance of a recent decision of Judge Walter Evans, of the United States Court in Louisville. In fighting to oust the Western Union from its right-of-way, since it has determined to establish its own telegraph equipment for private and commercial service, the Louisville & Nashville has sought compensation for the use of a strip of ground hundreds of miles in length and a couple of feet in width, measured between the poles of the Western Union throughout the length of its right-of-way.

### Municipal Regulation in Illinois

At the instance of Mayor Harrison, the City Council of Chicago has asked the State Legislature to enlarge the city's power of regulating the rates and service of electric service, gas and telephone companies. The city has this power now to some extent, but to clear up some doubtful points the Mayor and City Council ask for more clear and specific legislation. If the authority asked is conferred on Chicago, it may be given also to all the municipalities in the State.

### Public Service Commission News

#### MICHIGAN COMMISSION

The Michigan Supreme Court on March 20 confirmed the action of the Circuit Court of Ingham County in dismissing the case of the Grass Lake Telephone Company against the State Railroad Commission as relating to the consolidation of the Home Telephone Company and the Michigan State Telephone Company of Detroit. In the suit the power of the Railroad Commission to authorize the consolidation was questioned, as was the constitutionality of the law under which the action was taken. The allegations made by the Grass Lake Telephone Company were that the consolidation would interfere with and injure its business and operate to the detriment of innocent parties. Judge Wiest of the Ingham Circuit Court dismissed the case, and it was taken to the Supreme Court on appeal by the company.

Several important telephone bills have been introduced

in the Michigan Legislature and referred to the committee on private corporations. Most of them refer to the authority held by the State Railroad Commission to supervise the business. The Bayless bill was presented for the purpose of re-enacting the Giles law which is now before the Supreme Court on a question of constitutionality. The bill gives the Railroad Commission authority to supervise telephone operation, regulate rates and hear and decide upon applications for consolidations and similar questions. It also makes obligatory that companies produce proof before increasing service rates.

The committee appointed to probe rates is working on a plan to combine the Giles law with the Martz bill, which makes the companies common carriers, provides for fixing toll rates according to distance and removes from the commission the power to prevent the organization of new companies. It also provides that patrons may make complaints regarding the service, overcharges and other things of that kind before justices of the peace, or police justices in cities.

#### WISCONSIN COMMISSION

The city of Kenosha, Wis., has filed a general complaint against the Kenosha Electric Railway Company and the Wisconsin Gas & Electric Company before the Railroad Commission of Wisconsin. It demands an investigation of the utilities supplied to the people of Kenosha by the companies named. It is alleged that the supply of gas and electricity is inadequate and that the operation of the local street railway is unsatisfactory.

#### MASSACHUSETTS COMMISSION

A bill has been reported in the Massachusetts Legislature by the judiciary committee which greatly extends the powers of the Massachusetts Gas and Electric Light Commission over the public-utility corporations under its supervision. By its terms the board is to have authority to examine books, accounts and papers of all kinds and to obtain information regarding the organization and administration of holding companies, voluntary associations or trusts which such companies may form. Several weeks ago the board, as a component of a joint commission established to investigate holding companies, issued an exhaustive report favoring the regulation of these organizations and analyzing their influence in the field of public-utility service.

#### GEORGIA COMMISSION

The Georgia Railroad Commission has ruled that the minimum rate set by the electric lighting companies of Macon, Ga., in the competition in which they are engaged will become the legal rate and cannot be increased except upon the authority of the commission. The Macon Railway & Light Company and the Georgia Public Service Company have reduced prices materially in their competition and citizens have inquired of the commission whether these rates can be increased again if the competition ceases. The commission has ruled that no increase whatever can be made from the minimum price fixed unless the commission grants permission.

#### CALIFORNIA COMMISSION

Reference has already been made in these columns to tests to be conducted by the California Railroad Commission in connection with a complaint made by the Pacific Telephone & Telegraph Company as to interference with the operation of its telephone lines by high-tension transmission lines in proximity to its wires. The joint committee on inductive interference now working under the authority of the Railroad Commission has appointed a subcommittee to investigate interference caused by the circuits of the Coast Gas & Electric Company in Santa Clara Valley. The joint committee, consisting of five members from transmission companies, five from telephone and telegraph companies, four from the Railroad Commission and one from railroad companies, has received liberal support from



all of the interests concerned. It will continue to analyze the information submitted to it by companies experiencing difficulty from interference, with the hope that the results thereby obtained will serve as the basis of recommendations to the Railroad Commission.

#### MARYLAND COMMISSION

Mr. Victor G. Bloede has asked permission of the Maryland Public Service Commission to sell his electric properties to the Consolidated Gas, Electric Light & Power Company of Baltimore. The commission will designate Mr. Osborne I. Yellott, people's counsel, to make a careful investigation of the subject in the interest of the public, from the standpoints of whether the sale is fair and whether the price proposed is reasonable. With the granting of the application would go the complete surrender of Mr. Bloede to the Consolidated in his fight against them. For some years he has contended that his plants could generate and distribute electricity more cheaply than the Consolidated was selling its energy, and he made strong but fruitless efforts to get a franchise from the city. At present his plants sell service in the territory between Catonsville and Ellicott City. Should the commission decide that a sale of the Bloede properties would be in the interest of the public service a question may be raised as to price. In the application it is set forth that the Consolidated has agreed to pay for the properties (the Patapsco Electric & Manufacturing Company of Maryland and the Patapsco Electric & Manufacturing Company of Delaware) a final sum of \$425,000 upon May 1, 1916. In addition, there is to be paid by the Consolidated \$18,000 annually upon the first day of May in 1914, 1915 and 1916.

#### NEW YORK COMMISSIONS

On the day following the signing of the New York City subway contracts, as reported last week, the Public Service Commission for the First District approved the mortgages filed by the Interborough Rapid Transit Company and the New York Municipal Railway Corporation and gave to each permission to issue bonds needed for the carrying out of the new agreements. The Interborough mortgage, to the Guaranty Trust Company of New York, is for \$300,000,000, and the bonds authorized amount to \$160,957,000. The mortgage of the New York Municipal Railway Corporation, to the Central Trust Company, is for \$100,000,000, and the bonds authorized are for \$40,000,000. Neither company may issue further bonds without the consent of the commission.

Commissioner Milo R. Maltbie, who has been opposed to the new contracts, cast the only vote against the approval of the mortgages and bonds. Both bond issues are to run for fifty years, the Interborough issue from Jan. 1, 1913, and the New York Municipal Railway Corporation issue from July 1, 1912. Each will bear 5 per cent interest. The Interborough bonds must be sold for not less than 93½ and the New York Municipal Railway Corporation bonds for not less than 97 per cent of their par value. The Interborough bonds are to be redeemable before maturity at 110 and the New York Municipal Railway bonds at 107½, with accrued interest.

The new rapid-transit system provided by these contracts will have more than 600 miles of single track and will cost for construction and equipment about \$325,000,000. The cost of construction will be borne jointly by the city of New York and the companies, and all the new roads, other than the extensions of privately owned elevated lines, will be owned by the city, but each company will get a lease of the roads allotted to it for forty-nine years. After the payment of operating expenses and other charges, the companies must share profits equally with the city. For the construction of city-owned lines the city will contribute about \$163,000,000, the Interborough Rapid Transit Company \$58,000,000 and the Brooklyn company \$14,000,000. The companies must bear the entire cost of equipment.

## Current News Notes

**PROBABLY NO MINNEAPOLIS SHOW THIS YEAR.**—It seems likely that there will be no electrical show in Minneapolis this year, although there may be one in 1914.

\* \* \*

**EASTER LILIES AND ARTIFICIAL REFRIGERATION.**—By means of artificial refrigeration florists were able to control the flowering of last week's stock of Easter lilies and other plants, first holding back their growth until the Easter season and then by artificial heat forcing them into bloom for the Easter demand.

\* \* \*

**NEW STATE PUBLIC-SERVICE COMMISSIONS.**—The number of state public-service commissions is increasing rapidly. Very recently Indiana, Missouri and West Virginia have passed laws creating commissions to supervise and regulate public utilities. In addition Congress has passed a similar law for the District of Columbia, and one of President Taft's last official acts was to sign this bill.

\* \* \*

**WILL INVESTIGATE REPORTS OF ELECTRICAL FIRES.**—Vowing to inaugurate a campaign against the indiscriminate attribution in newspaper reports of blame for fires to "crossed wires," the Sons of Jove of Pittsburgh, Pa., have started a movement to make thorough inspections of all fires which are declared to have started from electrical causes. At a recent meeting of the order, the members also voted in favor of legislation requiring that all electrical contractors be licensed.

\* \* \*

**ST. LOUIS ELECTRICAL MEN DISCUSSING CLUB-HOUSE PROPOSAL.**—The St. Louis League of Electrical Interests, Jovian Chapter, has taken under consideration plans for the erection of a club house with meeting rooms for the use of electrical and allied societies. It is hoped that subscriptions amounting to \$100,000 may be secured. Mr. George D. Rosenthal, manager of the St. Louis office of the General Electric Company, is chairman of the club house committee, and Mr. A. C. Einstein, general manager of the Union Electric Light & Power Company, is also reported to be much interested in the project.

\* \* \*

**FARM-HOUSE LIGHTING FROM AUTOMOBILE OUTFIT.**—Mr. H. J. Murch, who lives near Northboro, Mass., lights his country home with energy taken from the storage battery of his gasoline automobile. When the cottage was wired an extension was carried to the garage. Central-station service not having been installed on the premises, however, a plug connection was made to this line, using it as the feeder back from the automobile battery set to the house. During the day, while the owner is driving, the car's electric system, which furnishes energy for starting, ignition and lighting, is storing electricity in the battery. At night the energy thus generated is declared to be sufficient for running 100 10-cp electric lamps in the house.

\* \* \*

**NEW SUBMARINE CABLE FOR THE FAR EAST.**—In accordance with the statements made by Sir John W. De Rivaz at the last general meetings of the Eastern Telegraph and Eastern Extension Australasia & China Telegraph Companies, the directors of these two concerns have decided to lay a new cable from Aden to Hong Kong, via Cebu and Singapore, covering a distance of about 6,000 miles, at a cost of approximately \$5,000,000. The policy of expansion now being adopted by these companies is particularly striking in view of the growth of wireless telegraphy during recent years, and it is evident that the respective boards do not regard their sphere of activity as having been curtailed by the development of the latest system of long distance communication.

**HOTEL ARRANGEMENTS FOR CHICAGO CONVENTION.**—The hotel committee of the National Electric Light Association has issued a circular giving a list of thirty-three Chicago hotels, with their rates, and a map showing their location, also a mailing card on which out-of-town members planning to attend the convention of June 2-6 may make requests for reservations. Mr. P. Junkersfeld is chairman of the committee, and Mr. E. A. Edkins 120 West Adams Street, Chicago, is secretary.

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**TELEPHONE SERVICE BETWEEN ENGLAND AND GERMANY.**—Experiments on long-distance telephony between England and Germany have been carried on for some time by the British Post Office. On March 5 a five-minute conversation was conducted between the office of a newspaper in London and the office of a newspaper in Frankfurt. On the preceding day connection was established with a Berlin newspaper office. There are certain difficulties to be overcome before a regular public service can be established. The British Post Office does not possess exclusive rights over the cable from St. Margaret's Bay to Lapanne on the coast of Belgium, and this cable can be used for yeoman traffic only when it is clear. German authorities have been discussing with a British Post Office official the laying of a new submarine cable from England to the German coast.

\* \* \*

**NEW-BUSINESS AGENT'S RUSE CAUSES BOMB SCARE.**—Considerable excitement was caused in the residence section of an Eastern city last week when a mysterious man appeared, rang the bell of a first-floor apartment, and, handing the little girl who answered the door a suspicious-looking package 10 in. by 6 in. by 6 in. and weighing about 5 lb., withdrew without a word. The mother of the household recalled ordering no article of such dimensions and at once voiced her suspicions that a bomb outrage was about to be perpetrated. After an excited family conference, the fear-some parcel was carefully conveyed to the bathroom, and then, frightened lest it might go off at any minute, the family fled the premises. Fearing the terribly destructive powers of 5 lb. of dynamite, the children were sent all through the five-story building to warn the other families, and soon an excited group had collected on the sidewalk. By the afternoon the bomb was the topic of neighborhood discussion. Finally the police were notified. A bold detective was assigned to the case. Pressing through the shuddering crowd on the sidewalk, he fearlessly entered the building and penetrated to the bathroom. After a look at the grim package he too retreated and telephoned to the city bureau of combustibles. Two hours later an expert explosivist arrived. First he filled the bathtub with water. Next he placed the infernal machine in the tub. Then he waited. Finally the water-soaked wrappings were opened. Outside the crowd cheered. Inside the inspector found a nice, new but very wet electric iron, complete with attachment plug and cord. A card attached explained that the iron came with the electric company's compliments, that its agent would call in a day or two, and that no home should be without one; would the recipient give it a thorough trial?

\* \* \*

### SOCIETY MEETINGS

**BALTIMORE JOVIANS.**—Mr. Robert G. Wall, of Chicago, was the speaker at the weekly luncheon of the Sons of Jove of Baltimore at the Hotel Emerson, March 20. He took as his subject "The Human Element in Business."

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**PORTLAND SECTION, A. I. E. E.**—At the March meeting of the Portland (Ore.) Section of the American Institute of Electrical Engineers Mr. C. O. Brill, district plant engineer for the Pacific Telephone & Telegraph Company, of Portland, presented a paper on long-distance telephone transmission on the Pacific Coast.

**SASKATCHEWAN JOVIANS REJUVENATE.**—At the first rejuvenation of the Saskatoon Jovian Order, held at the King George Hotel, Saskatoon, Sask., last month, Mr. Edward Hanson, city electrical engineer of Saskatoon, was elected statesman of the local order. Twenty-eight members were also initiated into the Jovian organization.

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**WESTERN PENNSYLVANIA ENGINEERS' SOCIETY.**—Mr. C. Luin Bradley in an address before the Western Pennsylvania Engineers' Society at Pittsburgh on the subject of smoke abatement by means of electric precipitation of the suspended dust particles referred particularly to the Cottrell process, his talk being illustrated with lantern slides.

\* \* \*

**NEW YORK SECTION, I. E. S.**—At a meeting of the New York Section of the Illuminating Engineering Society on April 9 two papers will be read, one, entitled "Light in Art," by Mr. M. Luckiesh, of the National Electric Lamp Association; the other, "Color Photography; an Examination of Screen Plates by Microscope and Spectroscope," by Mr. J. B. Taylor, of the General Electric Company, Schenectady, N. Y.

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**N. E. L. A. CONVENTION EXHIBITS.**—At a meeting of the assignment committee of the exhibition committee of the National Electric Light Association, held on March 20, it was announced that practically two-thirds of the exhibition space in Medina Temple, Chicago, had been allotted to applicants. According to the present outlook, it may become necessary to secure additional space to take care of the exhibits of Class D members.

\* \* \*

**DEMONSTRATION OF EDISON PICTURES.**—Through the courtesy of Mr. Thomas A. Edison and the American Talking Moving Picture Company a private demonstration of the Edison talking moving pictures will be given to the members of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers in the Engineering Societies Building, New York, on Friday evening, April 4, at 8:15.

\* \* \*

**COLORADO ELECTRIC CLUB.**—Mr. J. W. Kelly, assistant general attorney for the Denver & Rio Grande Railroad Company, addressed the Colorado Electric Club recently on "The Need of a New State Constitution." The need of a good public utilities measure enforced by really competent commissioners was strongly urged. The club indorsed a movement for a new state constitution with an extension of civil service requirements and protection for most of the administrative positions.

\* \* \*

**COMMONWEALTH EDISON SECTION, N. E. L. A.**—A lecture by Prof. F. R. Moulton, of the University of Chicago, on "The Wonderful Heavens" was the feature of the meeting of the Commonwealth Edison Company Section of the National Electric Light Association on March 20. The talk was illustrated by exceptionally fine lantern-slide pictures. Dramatic and musical numbers rounded out a pleasant evening for the 560 persons who attended. The girls of the company served doughnuts and cider.

\* \* \*

**PHILADELPHIA JOVIANS.**—On Thursday evening, March 13, the Jovians of Philadelphia held their annual theater party in the Forrest Theater. Two hundred and ninety Jovians, together with their families, were in attendance. Among the guests of the evening were Juno and Jupiter Watts, who were entertained by Statesman Bartlett, Mrs. Bartlett and Miss Rosenthal, Mr. and Mrs. Gilbert Smith, Mr. James Vaughn, Mr. and Mrs. Devereux, Mr. Maxwell, Mr. and Mrs. Hallstrom and Mr. Frank Stout.



## Mount Hood Hydroelectric Developments—II.

**Electric features of station on Bull Run River, transmission system to Portland, Ore., and terminal station. By W. P. Brereton and R. H. Mulock**

**I**N the previous article the hydraulic and mechanical features of the Mount Hood Railway & Power Company's system, from the dam to the generating station on the Bull Run River, were described. Continuing the subject from that point, the electrical features of the development are discussed in what follows:

### GENERATING EQUIPMENT

There are at present installed three main units, each rated at 3750 kva, 60 cycles, three-phase, 6600 volts and 514 r.p.m. Each generator was built by the Westinghouse Electric & Manufacturing Company and is directly connected to a turbine of 6400-hp rating. Two turbines were built by the Platt Iron Works, with Lombard type NS governors, and the third by the Wellman-Seaver-Morgan Company, with Lombard type R governor.

The exciter generators are rated at 150 kw each and are compound-wound, interpole machines, each directly connected to a 300-hp Platt Iron Works turbine controlled by a Woodward governor.

Each main unit is supplied by a 72-in. diameter pipe, two being reduced at their lower ends to 60 in. in diameter and two to 54 in. in diameter to meet designs of the Platt Iron Works and the Wellman-Seaver-Morgan Company respectively. Between this reduced section of each pipe and each turbine is located a hydraulically operated gate valve. The two 60-in. hydraulically operated valves were built by the Platt Iron Works and the two 54-in. valves by the Crane Company.

On the reducing section of each feeder pipe is connected the 16-in. drain to a tailrace, in which is located the bursting plate. Each exciter, or both, may be supplied from one of two 72-in. pipes. These supply pipes are 24 in. in diameter reduced to 18 in. in diameter at the turbines. Each main turbine is provided with a synchronously operated relief valve. The draft tubes of the main units are built of concrete and those for the exciter units are built of steel plate.

Bronze runners are provided on each machine. The guaranteed efficiencies are as follows: Full gate, 82 per

cent; seven-eighths full gate, 84 per cent; three-quarters full gate, 86 per cent; one-half full gate, 80 per cent. The speed regulation guarantees are as follows: Full load thrown on or off, 20 per cent speed change; 50 per cent full load thrown on or off, 9 per cent speed change; 20 per cent full load thrown on or off, 4 per cent speed change—these figures being for the Wellman-Seaver-Morgan turbine. Data on the generator are given in the table printed on page 668.

The exciter switchboard, which has mounted on it all the direct-current circuit-breakers and control and station

service circuit-breakers, is located on the main floor directly in front of the exciters.

This board is complete for five exciters which may ultimately be installed. Immediately above the exciters is located the switchboard gallery. At the front the benchboard, on which is placed the remote control for all switches, is located, and directly above is the indicating-instrument switchboard, a space of 2 ft. being left between them to allow the operator a clear view of the main floor. On the upper panel are mounted indicating instruments for the complete power house. To the left and in full view from any point on the gallery is placed an instrument pedestal having mounted thereon the synchroscope, frequency meter and busbar voltmeter.

At the back of the gallery is located the graphic recording instruments, relay and Tirrill regulator board, on which are mounted the recording instruments and all relays for the complete power house. All generator-field rheostats are motor-controlled and placed on the rear wall of the power house directly behind the exciter switchboard.

### TRANSFORMER BUILDING

The transformer building is a separate structure from the low-tension switch room. The main line of the railway passes between the two, an other location for rails track being available. The two structures are on a common center line which is at right angles to that of the power house. The low-tension switch room is built immediately adjacent to the power house, and communication

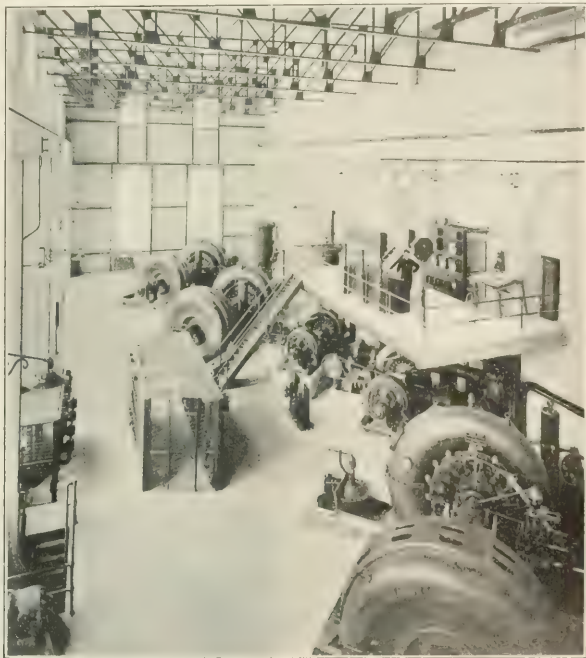


FIG. 1—GENERATING STATION ON BULL RUN RIVER



between this room and the transformer house is provided by spacious passages under the railroad.

The transformer building, of reinforced concrete with structural steel roof trusses, is 88 ft. long, 49 ft. high and 53 ft. wide. It consists of two stories. The lower floor has transformer pockets and transfer track; the upper floor contains no partition and has the high-tension switches,

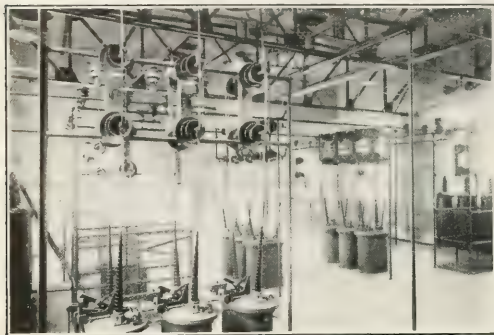


FIG. 2—HIGH-TENSION BUSES AND CIRCUIT-BREAKERS

arresters and busbars. All lines enter the building through roof cones. A railway spur runs into the north end of the transformer building, and above this at an elevation of 36 ft. there is a 40-ton crane. This crane may be used for handling transformers from the flat cars to the transfer track which runs up the middle of the transformer building or may be used for dismantling transformers. In the transformer building as it now stands there are four pockets on each side of the transfer track. Each pocket is large enough to hold one three-phase, 60,000-volt, 3750-kw transformer. At present there are installed seven single-phase, 3000-kva, oil-insulated, water-cooled transformers, stepping up the tension from 6600 volts to 57,000 volts, one transformer being a spare unit.

All transformers are on wheels and all transformer pockets have rails laid in them. In this way it is an easy matter to slip a transformer in or out of the pocket onto the transfer track, thence down the middle of the transformer building until the transformer can be handled by the crane. All transformer pockets have emergency drains in the rear, and the floors of the transformer pockets are sloped so that in case of bursting tanks the hot oil will run into the rear of the pocket and thence out by the drains.

The high-tension leads of the transformers are carried through holes left in the high-tension-room floor to the high-tension busbars, which are carried on pipe framework in this room. From these bars leads drop down to Westinghouse type GA line switches, from which lines rise vertically through the choke coils and roof cones, thence to the transmission line.

The horn-gaps are tapped in on the roof, from which a separate lead is carried through another set of roof cones and directly down to the electrolytic lightning arresters, which are placed on the main high-tension switch-room floor. The high-tension star connection of the transformer is made directly on the busbars, so that any transformer bank may be cut out by simply opening the oil switch controlling that particular section of the bus on which the transformer bank is connected.

The low-tension switch building of similar construction to the transformer building is 53 ft. long, 25 ft. high and 33 ft. wide. It is built of sufficient size to take care of the present as well as of the future generating equipment. On the lower floor all the 6600-volt leads and all series and shunt instrument transformers for the 6600-volt leads are placed in concrete barriers. On the floor above are located

all the 6600-volt switches, this being the switch room proper. The 6600-volt busbars are carried between concrete barriers in the switch room.

At present two bus structures are built, each structure controlling two generators and one transformer bank, so arranged that they may be thrown together by a tie switch or operated separately. In the switch room on the side of the wall adjacent to the generator room is a fuse board, on which all series, shunt potential and operating circuits terminate and are either fused or tied in with links from which the leads go to the operating switchboard. Space is provided under the track for filters and a storage battery for operating the switches.

The wiring system is so laid out that every two generators may be used as a single unit and may be excited by any

GENERATOR PERFORMANCE DATA

Power-Factor, per Cent	EFFICIENCIES AT					Regulation, Full Load, per Cent
	1/2 Load	1/2 Load	1/2 Load	Full Load	1/2 Load	
100	85	91 1/2	94	95	96	9
80	82	90	92 1/2	94	94 1/2	20

exciter. The present arrangement is such as to allow of additions to the generating machines until the final equipment will consist of practically four separate power houses—that is, eight machines tied together to a common busbar in pairs—and each of these units will have a separate exciter. Any number of exciters may be paralleled together if necessary and thus take the place of any broken-down machine. Any of the four units may be paralleled together or operated separately.

Three single-phase transformers, or one three-phase transformer, form a single unit for the transformers. These may run directly onto a high-tension line or may be paralleled together through the high-tension busbars. Two units form the first installation, which may be run together or separately, and complete provision is made in every detail for carrying out in the future the original idea of a four-unit power house. The future machines may be tied onto the busbars without interfering with the service in any way.

Switchboards are standard Westinghouse black-slate

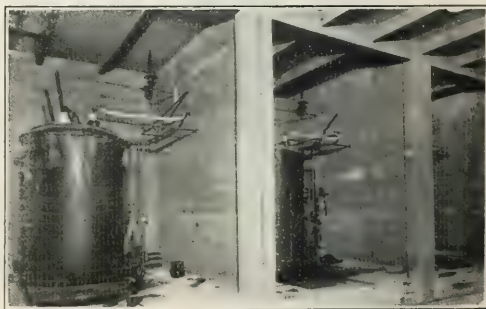


FIG. 3—TRANSFORMERS IN CONCRETE CELLS

boards. All instruments are the very latest pattern, round dial for the indicating instruments and a square meter for recording. Two Tirrill regulators are installed and so arranged that they control the voltage of the present two units if isolated from each other. Either regulator may be used if two units are tied together. All 6600-volt switches comprise type C oil circuit-breakers, and all ex-

citer switches and field switches are of the carbon-brake, solenoid-operated pattern.

The building is lighted by tungsten lamps, either single or in clusters, all lighting wiring being carried in conduit and so arranged that in case of trouble an emergency system of lighting may be operated throughout all parts of the building from the storage battery. All 6600-volt leads and exciter leads are carried in fiber conduit. All other leads throughout the building are carried in steel conduit. Conduit is provided to care for future needs.

There is a complete oil and water system supplied for the transformers. The water system is so arranged that by means of valves duplicate service is obtained and a break in any part of the system whatsoever will not cause a shut-down of the supply to the transformers. The oil system is so arranged that there are two oil pipes to every transformer. On of these is an emergency pipe and used only in case of accident; the other may be used either for draining the transformers or for filling them.

#### TRANSMISSION LINE

The transmission line at present consists of two circuits, one running from Bull Run power house to the terminal station in Portland, 27.5 miles long, and a second running from the power house to the intersection with the Oregon Water Power Railway, 14 miles long. Each line carries 57,100 volts and consists of No. 3/0 aluminum cable (nineteen strands), supported by Ohio Brass Company No. 6895 insulators, and is carried in general on 45-ft. cedar poles, each having two cross-arms with provision for a third. The poles are spaced forty to the mile on stretches, and the butt of each pole is painted with one coat of carbolineum avonareus, excepting at railroad crossings, where the butts are buried in concrete. At road crossings and on curves each pole is double-armed and guyed. Every tenth pole is guyed in four directions, all hardware is galvanized, and all cross-arm braces are through-bolted to the cross-arms and lag-bolted to the poles. Special structures were provided for all railroad crossings.

On leaving the power house the transmission line follows the penstocks to the top of the bluff, thence passing along the west side of the reservoir, crosses the Big Sandy River and continues across fields in the shortest direction to the county road, thence to the railroad right-of-way at a point where it emerges from the Sandy River Canyon. From this point on the lines follow the railroad, one on each side, until near the city limits, when the line goes north along a country road until it intersects Columbia

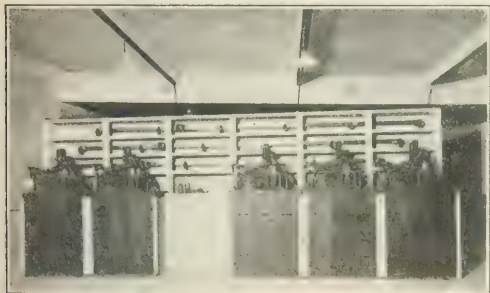


FIG. 4—OIL-SWITCH AND BUS STRUCTURES

Boulevard, which it follows to the terminal station. Provision is made in the design both of the transformer houses and pole structures for two additional lines similar to those constructed at present.

The three cables forming a line are arranged to form a right angled triangle with two cables on the top cross arm at 4.5 ft. centers and two on one side of the pole, both at

the same vertical plane at the same spacing. On one pole line an additional cross-arm is placed to carry the telephone circuit. This cross-arm is placed 6 ft. below the future position of the lowest main-line cross-arm to be added later. No. 12 copper clad wire is used for the telephone service and is transposed on Pierce brackets every third pole.



FIG. 5—HIGH-TENSION BUILDING

#### TERMINAL STATION

Terminal "A" is the main step-down station for the system. It is a reinforced-concrete building with structural steel roof trusses, 56 ft. wide by 48 ft. high by 72 ft. deep, consisting of two stories and a basement. In the north end of the building is a spur track which runs beneath a 20-ton crane. Any cars of material may be shunted in on this track and handled by an overhead crane. Down the center of the lower floor of the building is a transfer track; on the east side of this track are the concrete transformer pockets; on the west, separated by a concrete wall, is the switchboard room. The whole of the upper floor is one large room without pillars and is used for the 11,000-volt and 57,100-volt equipment.

The high-tension lines are led to the roof of the building and dead-ended on a steel structure. From this structure leads go through roof cones to Westinghouse type line switches. Another lead is tapped in on the lines on the roof and brought through horn-gaps, thence through another set of roof cones to the electrolytic lightning arresters, which are located on the second floor of the building.

The high-tension busbars consist of copper tubing supported on pipe framework without barriers. The current is led from the high-tension bars to the transformers through openings left in the floor. All transformers are mounted on wheels and can be rolled in the pockets on rails, and the pockets drain to the rear.

At present there are installed two 3300-kva oil-insulated, water-cooled Westinghouse transformers, lowering the tension from 57,100 volts to 11,000 volts. The 11,000-volt leads from the transformers are taken through conduit to the 11,000-volt bus structure in the basement of the building. This consists of two sets of busbars, all separated by 10 ft. and 10 ft. apart.

On the second floor, the busbars are arranged in a similar fashion to the first floor, but the busbars are all parallel, so that a collector may be instantly cut over from one busbar to the other without changing the circuit.

On the second floor, the busbars are arranged in a similar fashion to the first floor, but the busbars are all parallel, so that a collector may be instantly cut over from one busbar to the other without changing the circuit. This comprises a method of changing all circuits with 11,000-volt busbars. The busbars are arranged in a line, which is connected to the transformer house by the different substations in turn and back to the terminal station again, making a completely closed circuit.



is so arranged that it may be either tied in on the 11,000-volt busbars or left separate therefrom. The structure is duplicated in all main substations and so arranged that a break in any 11,000-volt line will not interrupt the service, as energy may pass either way around the circuit.

If the high-tension line is broken so that the ring feeder cannot be kept alive through the terminal station busbars, it is arranged that energy shall be available from the steam plant. Thus the ring feeder can be disconnected from the terminal-station high-tension busbars and the whole distribution system kept alive from the steam plant. The ring feeder structure is built in practically the same way as the main structure, all wires on the switchboard being separated from each other by 2-in. concrete barriers. All 11,000-volt switches are of the Westinghouse type C remote-controlled pattern, and all 11,000-volt lines that leave

are controlled mechanically through bell-crank mechanism.

All 57,000-volt leads are made of  $\frac{3}{4}$ -in. copper tubing, and all 11,000-volt connections between the transformers and the bus structures are of lead-covered, paper-insulated cable. The connections from the ring feeders to the line outlets are carried in the open and are made up of hard-drawn copper wire. The connections from all 11,000-volt switches to the line outlets are made in lead-covered cable carried in steel conduit.

The 2300-volt leads are of hard-drawn copper. The 57,000-volt leads are carried through roof-type Locke No. 504 insulators, set on 3-ft. concrete cones on the roof of the building, and the 11,000-volt outlets are carried through twenty-four No. 661 outlets.

A complete oil and water system for the transformers is installed, there being a double oil system so that the bad oil

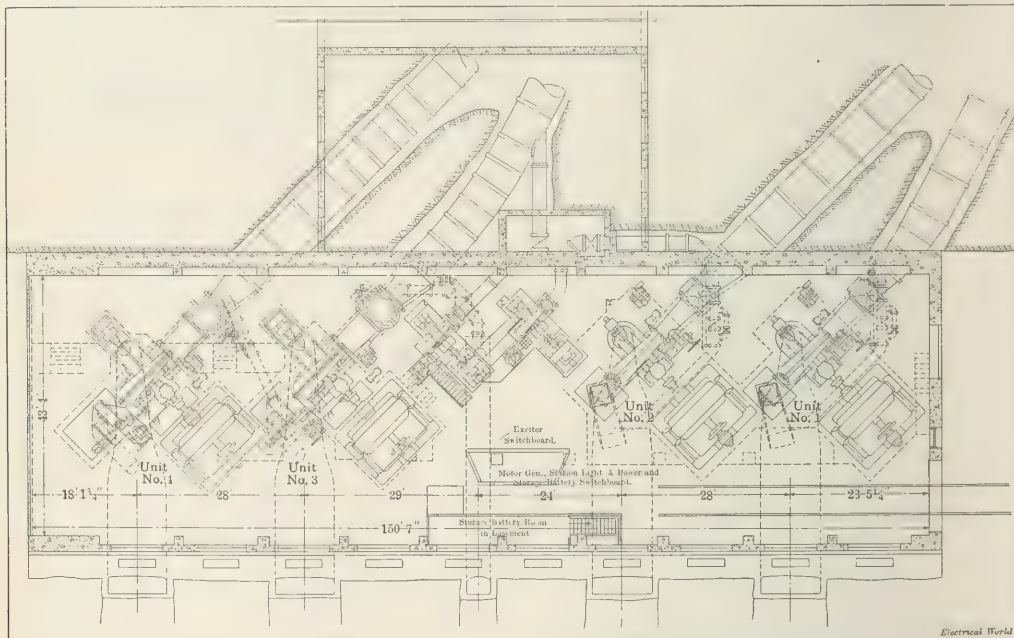


FIG. 6—PLAN VIEW OF GENERATING STATION

the building are protected by electrolytic lightning arresters and choke coils.

There are two 11,000-volt cables leading from the 11,000-volt busbars to two 750-kva, three-phase, oil-insulated, water-cooled Allis-Chalmers transformers, which lower the tension from 11,000 volts to 2300 volts. The 2300-volt leads on these transformers are taken to the 2300-volt double busbar structure in the switchboard room. This structure is located about 8 ft. behind the switchboard and consists of an iron pipe frame on which are mounted two sets of busbars and a double set of 2300-volt oil switches. All transformer leads and feeders from the 2300-volt structure are tied to the busbars through two oil switches in parallel. In this way any line or transformer may be immediately cut over to the other busbar in case of trouble without shutting that feeder down.

The switchboard is formed of standard Westinghouse black-slate panels and has all instruments, indication, inter-grating and graphic meters mounted thereon. All 11,000-volt switches and 57,100-volt switches are controlled from this board by secondary circuits, and all 2300-volt switches

and good oil do not have to run in the same pipe. There are two tanks in the basement capable of handling 2000 gal. of oil each. With the pumps and filters installed, this oil may be filtered or dried, as the case may require. A water-cooling system for the transformers is installed and is so arranged by a set of valves, strainers and pumps that there is a double water supply to each transformer, and a break on any part of the system will not necessitate cutting off any transformer.

At present only one 57,100-volt line is connected in the building. However, the switching equipment, roof cones, arrester equipment, etc., are complete for tying in another line. There is also a spare pocket for a 3300-kva, 57,100-volt, three-phase transformer. There is also provision for an extra 11,000-volt line and another complete ring feeder and six extra 2300-volt lines.

#### SYSTEM DESIGN

The foregoing is a short account of the system to the city limits, including the step-down transformation as completed, but a slight idea of the city scheme for distribution



may be interesting. The original scheme and final lay-out will necessitate two large terminal stations, one situated in the north of the city and designated as terminal "A," which is finished as far as required by the present demands. The other terminal station is to be located in the south of the city and designated as terminal "B." Each of these stations would be fed by at least two high-tension lines and

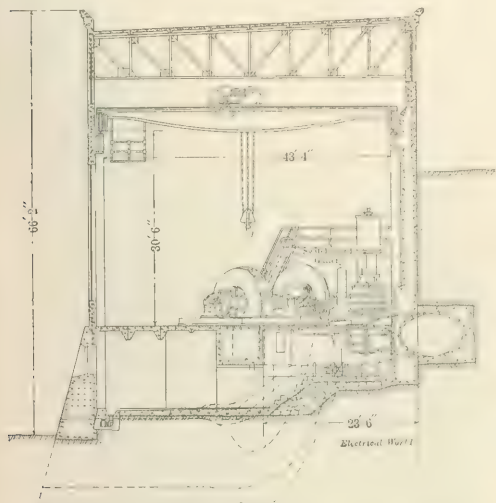


FIG. 7—SECTIONAL VIEW THROUGH POWER HOUSE

would transform all the energy to 11,000 volts, at which pressure it would be used either locally or distributed to the substations of the system.

The city lying between these terminals was to be fed by a number of substations, for the most part arranged in a loop or circle and each being tied to the terminal by the ring feeders. The scheme calls for two ring feeders complete. These rings would then act as tie lines between the



FIG. 8—THE TERMINAL STATION

terminal and also as substation feeders. Of course, when a substation was not near the loop or had not a very important load connected to it, it would be fed by a single or double feeder, as the case demanded. These substations are all designed to transform the voltage down to 2300 when it goes to the primary circuits of the distribution system.

The auxiliary steam plant was built adjacent to a substation and generates at 11,000 volts. It is tied in to the system through the ring feeders. The substations are tied together by 11,000-volt overhead circuit and submarine cable, and with the exception of the steam plant all distribute energy to the distribution system at 60 cycles, 2300 volts.

The engineering and construction were carried on under the direction of Messrs. Smith, Kerry & Chace, engineers, with the late C. B. Smith as general manager of the Mount Hood Railway & Power Company. The system is now owned and controlled by the Portland Railway, Light & Power Company.

### Efficiency Test of 6000-Hp Turbines of the Appalachian Power Company

Tests of waterwheels in Development No. 2 of the Appalachian Power Company on the New River, Virginia, showed them to be remarkably efficient. Use was made of a sharp-crested weir for measuring the flow of water and the conditions were very favorable for obtaining accurate results. According to the contract with the manufacturer of the turbines, a large bonus is to be paid for efficiencies above the guarantee, so that the tests were made with great care.



FIG. 1—82-FT. WEIR IN LAIRAGE CHANNEL

and the results are believed to be correct within a very small percentage of error.

In the station there are four units, each consisting of a 4000-kw vertical-shaft generator, driven at 116 r.p.m. by a single-runner Francis-type turbine, rated at 6000 hp at 49-ft. head. There are also two vertical-shaft 430-hp water-wheel driven exciters running at 400 r.p.m. The rotating part of each unit is carried on a roller thrust bearing on top of the generator. Each of the main turbines requires about 1200 cu. ft. of water per second at full load. On account of this large quantity, it was considered that the only satisfactory method of measuring the water was by a weir and that only one turbine could be tested at a time. The tailrace is 12 ft. deep, 60 ft. wide and about 250 ft. long, excavated in solid rock. The concrete wing wall which is shown in Fig. 1 separates the tailrace from the river. A sharp-crested weir was built across the tailrace about 200 ft. downstream from the power house. This extends from the concrete wing wall on one side to the solid rock bank on the other side and is about 82 ft. long in all. As it was necessary to take good measurements at each end of the weir, the standard part was made only about 82 ft. long in the middle of the tailrace channel.

The weir is practically of standard dimensions in all respects. The face is vertical on the upstream side for about half the depth of the channel. It was necessary to have

a structure which could be easily erected and easily removed after the tests were finished. During the ordinary operation of the station the pressure on the weir corresponded to as much as 6 ft. On this account it was necessary to batter the lower half of the face in order to make the structure stable. However, the vertical portion is thicker than is generally considered necessary for a standard weir, and this batter can have no real effect on the discharge. The crest proper consists of a steel plate planed on one edge. The deck of the weir consists of two thicknesses of plank with tar paper between, and there is a concrete footing along the toe and each side against the solid rock, and hence the structure is very tight.

Still-boxes were erected on each side of the channel about 30 ft. upstream from the weir. These were tight wooden boxes in which the hook gages were placed. In each a 1-in. hole was bored through the outstream side below the crest level to admit the water. The hook gages, which read to 0.001 ft., were set up in these boxes, and their zero reading was carefully established at the elevation of the crest by an engineer's level.

To test the weir for water tightness, the whole station was shut down, all the headgates were tightly closed, and the drain valves in the wheel chambers were opened. The

In order to hold the load steady, the governor was blocked and hand control was used on the turbine. The generator was put on the commercial load and care was taken to maintain its power-factor at unity. The load was measured by precise wattmeters with the necessary instrument transformers and checked against precise voltmeters and ammeters.

In order that the loss of head through the racks and gate might not be charged against the wheel, the head acting on the turbine was measured by a piezometer, or rather by two piezometers, one leading from each side of the intake chamber. These were 1-in. pipes threaded into a steel plate flush with the side of the chamber. They connected with glass tubes on the power house wall at the proper elevation for reading the level. The velocity head in the intake chamber at this point was added to the head observed by the piezometer. The tail-water level was measured by a gage on the downstream wall of the power house in the tailrace.

Turbines No. 2 and No. 3 were tested separately at different gate openings varying from one-third to full load. In making the tests the turbine gates were set at a given opening, conditions were allowed to become stable, and then readings were taken every minute on the hook gages at the

weir, on the wattmeters and electrical meters, and on the head and tail-water gages. This was kept up for about ten minutes for each particular gate opening tested. The average of the readings was used in making the computations. In computing the flow over the weir, use was made of Bazin's formula, correcting for the end contractions by the Francis method, and also correcting for the fact that the channel is somewhat wider than the length of the crest of the weir, which would slightly affect the velocity of approach factor by increasing the height of the weir by the ratio of the width of the channel to the length of the crest. From the observed flow

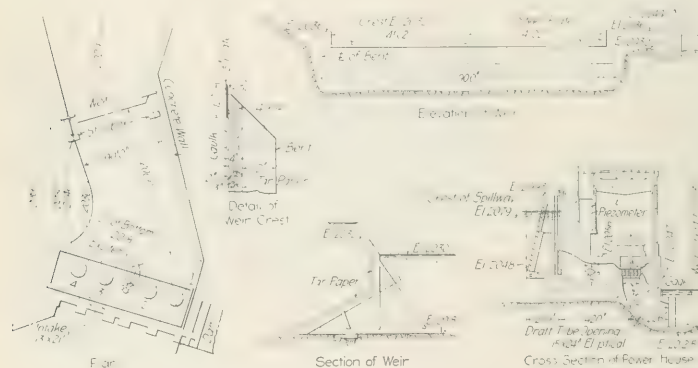


FIG. 2 DETAILS OF WEIR AND ARRANGEMENTS FOR TESTS

headgates are remarkably tight, but in order to measure the leakage through them the drain valve in one of the intake chambers was closed and observation was made of the time required to fill the intake chamber a certain depth with the leakage through the gate. It was found that this leakage amounted to about 0.14 cu. ft. per second. There were a few other small leaks, so that it was assumed that the total leakage through the power house amounted to about 1 cu. ft. per second. When the station was shut down the water in the tailrace fell to the level of the crest of the weir and stayed there for over two hours, showing that the leakage through the weir was practically equal to the leakage through the power house.

The crest of the weir is about 2 ft. above the level of the water downstream from it, and, as during the test the maximum head over the weir amounted to about 2.5 ft., the leakage through the weir would be increased in the ratio of the square root of 4.5 to the square root of 2, or by 50 per cent. To be conservative, 1 cu. ft. per second was added to the discharge over the weir as observed, to correct for this small difference.

It was necessary to excite the generator from one of the turbine-driven exciters, and the flow required for this had to be corrected for. The flow through the exciter for different gate openings at normal speed was measured by the weir, and the flow necessary to excite one alternator was found to be from 26 cu. ft. to 28 cu. ft. per second.

over the weir the correction for the water used by the exciter was deducted, and the excess leakage through the weir added. The observed load was increased by the loss in efficiency in the generator as taken from tests made by its manufacturer in his shops. The head was taken as the difference between the piezometer readings and the tailrace gage readings, the velocity-head correction being added.

Fig. 2 shows the average of the efficiencies of the two turbines at different loads. The maximum is 93.7 per cent. It will be noticed that all the points for turbine No. 2 are slightly lower than the points for unit No. 3. This is probably due to the fact that turbine No. 2 discharges to one side of the tailrace. This caused an appreciable eddy—so much so that during the test the observed head on the weir was about 0.02 ft. higher at the right-hand end than at the left-hand end. This would naturally decrease the discharge over the weir, or, rather, the apparent discharge would be greater than the actual discharge. During the test of No. 3 turbine, however, the flow approaching the weir was uniform, there were no eddies, and the level was the same at each side of the channel. On account of these better conditions, the results from No. 3 turbine should be more nearly correct than those from No. 2. No baffles were erected in the approach channel to the weir as they would have interfered too much with the operation of the station. The velocity of approach was low, being only about 0.8 ft. per second, and any eddies would show a flow apparently





$A$  = area of conductor section, square inches.

$d$  = density of conductor, pounds per square inch = 0.321 for copper, 0.0967 for aluminum.

$M$  = modulus of elasticity of conductor, pounds per square inch =  $16 \times 10^6$  for copper,  $9 \times 10^6$  for aluminum.

$c$  = ratio of apparent wire density due to loading to actual density.

$h$  = sag, feet.

$P$  = percentage change in span length =  $\frac{\Delta L}{L}$ .

$R$  = length of suspension insulator, feet.

$I$  = weight of suspension insulator, pounds.

$W$  = weight of one span of wire =  $12 dALc$ .

$p$  = force in pounds required to deflect insulator 1 ft.

$s$  = force in pounds required to change the length of normal span 1 ft.

$N$  = number of conductors.

$\frac{p}{Ns}$

$D$  = deflection of the insulator from its normal position.

$S$  = length of conductor per span, feet.

The relation between change in span length and tension in the conductor is derived from the parabolic equations of the curve formed by a span of wire:

$$T = \frac{3dL^2}{2h} \text{ and } S = L + \frac{8h^2}{3L}$$

The tension will not change more than 2 or 3 per cent within the span and is assumed to be the same for all parts.

Eliminating  $h$ ,

$$S = L + \frac{6d^2L^3}{T^2}$$

If  $S_0$  is the length of wire and  $T_0$  is the tension in the span when  $\Delta L = 0$ ,

$$S_0 = L + \frac{6d^2L^3}{T_0^2}$$

If  $L$  increase to  $L + \Delta L$ , and tension to  $T$ , then,

$$S = L + \Delta L + \frac{6d^2(L + \Delta L)^3}{T^2}$$



FIG. 2—FORCES ACTING ON SUSPENSION INSULATOR

and the stretch will be,

$$L \frac{T - T_0}{M}$$

The original length plus the stretch must equal the final length, therefore,

$$L + \frac{6d^2L^3}{T_0^2} + L \frac{T - T_0}{M} = L + \Delta L + \frac{6d^2(L + \Delta L)^3}{T^2}$$

As  $\Delta L$  is small compared with  $L$ , it may be neglected in

the expression  $(L + \Delta L)^3$ . Therefore the percentage change in span length is,

$$P = \frac{\Delta L}{L} = \frac{6d^2L^2}{T_0^2} - \frac{T_0}{M} - \frac{6d^2L^2}{T^2} + \frac{T}{M}$$

The curves in Fig. 1 were plotted from this equation, using the constants for copper. The numbers on the abscissa have no significance other than to give a scale of percentage. It will be noticed that  $dL$  occurs as a product in this

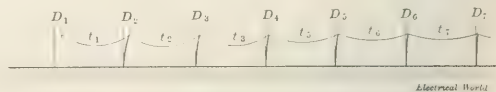


FIG. 3—DEFLECTIONS DUE TO BROKEN CONDUCTOR

equation, hence the performance, when covered with sleet to such an extent that the apparent wire density is  $c$  times the true density, will be the same as the performance of a bare span  $c$  times as long as the actual span.

The relation between the deflection,  $D$ , of a suspension insulator from the vertical position and the side pull,  $\Delta t$ , on the bottom of the insulator is derived as follows (see Fig. 2.) Taking moments about the point  $O$ ,

$$(t_2 - t_1) R \cos \varphi - \frac{1}{2} IR \sin \varphi - WR \sin \varphi = 0$$

$$\tan \varphi = \frac{t_2 - t_1}{H + 0.5 I} = \frac{\Delta t}{H + 0.5 I}$$

But

$$\tan \varphi = \frac{D}{\sqrt{R^2 - D^2}}$$

Therefore

$$\Delta t = (H + 0.5 I) \sqrt{R^2 - D^2}$$

The curve in Fig. 4 is plotted from this equation.

The relation between  $\Delta t$  and  $D$  for rigid insulators is practically a straight line. It may be calculated for any special type of construction from the dimensions of the poles, cross-arms and pins but will involve the modulus of elasticity for the timber, which is a rather uncertain quantity. The best way to determine this relation is by actual test of a pole or tower. For wooden poles it may be calculated approximately by means of the equation,

$$\Delta t = \frac{kB^4}{H^3} D$$

where

$B$  is the diameter of the base of pole in inches.

$H$  is the height of the pole in feet.

$k$  is a constant depending upon the kind of wood (about 500 for cedar).

For small values of deflection the slope of the force-deflection curve for spans and for insulators is sensibly constant. The value for spans is:

$$s = \frac{dT}{dP} \frac{A}{L}$$

for suspension insulators,

$$p_1 = \frac{d\Delta t}{dD}$$

for poles,

$$p_2 = \frac{kB^4}{H^3}$$

Substituting for the derivatives their values as obtained from the equations of the curves,

$$s = \frac{A}{L} \frac{1}{M} \frac{1}{12 d^2 L^2} \text{ when } T = T_0;$$

$$p_1 = \frac{H + 0.5 I}{R} \text{ when } D = 0.$$

Proceeding on the above assumption, the following sets of equations may be written applying to a long line of spans of single conductor at some point of which a deflection,  $D_2$ , occurs. See Fig. 3.

Set A

$$t_1 = t_0 - s(D_1 - D_2)$$
$$t_2 = t_0 - s(D_2 - D_3)$$
$$t_3 = t_0 - s(D_3 - D_4)$$
$$t_4 = t_0 - s(D_4 - D_5)$$

Etc.

Set B

$$pD_2 = t_2 - t_1$$
$$pD_3 = t_3 - t_2$$
$$pD_4 = t_4 - t_3$$
$$pD_5 = t_5 - t_4$$

Etc.

Assume the deflection,  $D$ , to be a geometrical series of

FIG. 4—RELATION BETWEEN  $y$  AND DEFLECTION OF SUSPENSION INSULATOR IN PER CENT OF  $R$

common ratio  $r$ , and the drop in wire tension below  $t_0$  to be a geometrical series with the common ratio  $a$ . If this assumption be true, values of  $r$  and  $a$  will be found which will be functions of  $s$  and  $p$  and will satisfy all the equations of set A and set B.

Let

$$D_n = rD_{n-1}$$

and

$$t_0 - t_n = a(t_0 - t_{n-1}).$$

Adding all the equations in set B,

$$p(D_2 + D_3 + D_4 + D_5 + \dots + D_n) = -t_1 + t_n$$
$$pD_1(r + r^2 + r^3 + r^4 + \dots + r^{n-1}) = -t_1 + t_n$$

If the line is very long, the  $r$  series will approach the limit  $\frac{r}{1-r}$ ,  $r$  being less than 1, and  $t_n$  will approach the limit  $t_0$ .

Hence,

$$pD_1 \frac{r}{1-r} = t_0 - t_1$$

From set A,

$$t_0 - t_1 = sD_1(1-r)$$

Hence

$$p \frac{r}{1-r} = s(1-r)$$

Let

$$v = \frac{p}{s}$$

Then

$$v = \frac{(1-r)^2}{r}$$

and

$$r = \frac{1}{2} (2 \pm \sqrt{v} - \sqrt{v^2 + 4v})$$

From set B,

$$pD_2 = (t_0 - t_1) = (t_0 - t_2)$$

From set A,

$$sD_1(1-r) = t_0 - t_1$$

Dividing,

$$\frac{p}{s} = \frac{r}{1-r} \cdot \frac{1-r}{1-r}$$
$$\frac{p}{s} = \frac{r}{1-r} \cdot \frac{1-r}{1-r}$$

Hence

$$a = r$$

In the case of a line of  $N$  conductors  $s$  will be  $N$  times as great as for one conductor and,

$$s = \frac{f}{Ns}$$

The curve in Fig. 5 shows the relation between  $r$  and  $v$ . Consider now a long pole line at some point of which  $b$  per cent of the conductors have broken. Let  $t_1$  be the tension in each of the remaining conductors in the broken span,  $t_2$  the tension in each of the conductors of the spans adjoining the broken one, and  $D$  the deflection of the poles adjoining the break. The following equations may then be written:

$$t_2 = t_0 - s(1-r)D$$
$$t_1 = t_0 + 2sD$$
$$Nt_2 = N(1-b)t_1 = pD$$

The result of their solution is as follows,

$$\frac{t_1}{t_0} = \frac{4 + v + \sqrt{v^2 + 4v}}{4(1-b) + v + \sqrt{v^2 + 4v}}$$
$$\frac{t_2}{t_0} = \frac{4(1-b) + v + \sqrt{v^2 + 4v}}{4(1-b) + v + \sqrt{v^2 + 4v}}$$
$$D = \frac{t_0}{S} \frac{2b}{4(1-b) + v + \sqrt{v^2 + 4v}}$$

The locus of the first two equations is plotted in Fig. 6.

FIG. 5—RELATION BETWEEN COMMON RATIO OF DEFLECTIONS AND  $v$

It will be noticed that for each value of  $b$  there is a minimum value of  $t_1$  below which the tension will not fall no matter how flexible the poles. The value of  $t_1$  may rise to such a value that the remaining wires of the span will break.

If in Fig. 2 the deflection of the insulator has been caused, not directly by an unbalancing of  $t_1$  and  $t_2$ , but by a

movement of the point of support  $O$ , a distance  $X$  out of its normal position and a resulting movement of the point  $E$ , a distance  $m$  out of its position of equilibrium.

$$l = X - m$$

and

$$\Delta l = \frac{W}{R} \left( \frac{1}{1 + \frac{1}{2} \frac{l}{X-m}} \right) \quad \text{or} \quad \Delta l = \frac{W}{R} (X - m)$$

If the deflection is small,

$$\Delta l = \frac{W}{R} \left( \frac{1}{1 + \frac{1}{2} \frac{l}{X-m}} \right) \approx \frac{W}{R} (X - m)$$

$$\Delta l = p (X - m)$$

$$l = l_0 + s (1 - r) m$$

$$l = l_0 - s (1 - r) m$$

$$\Delta l = 2s (1 - r) m$$

$$2 (1 - r) m = p (X - m)$$

but

$$2 (1 - r) = \sqrt{1 - 4r} = \sqrt{1 - 4r}$$

Hence

$$X - m = \frac{1}{1 + 4r}$$

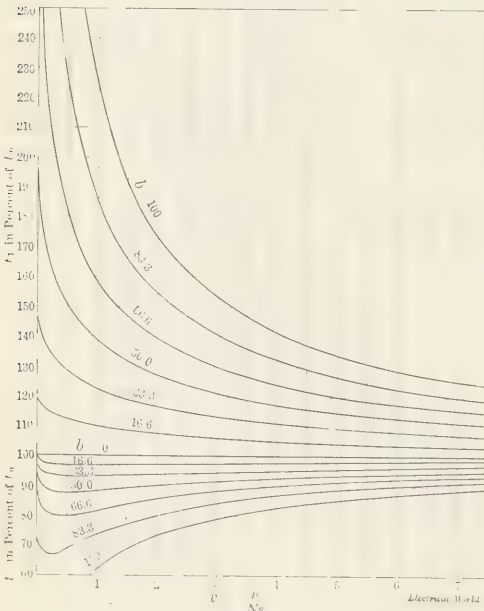


FIG. 6—CURVES SHOWING LOCUS OF EQUATIONS

The complete expression for  $v$  is, for rigid insulators,

$$v = \frac{p l}{A} \left[ \frac{1}{1 + \frac{1}{2} \frac{d l}{T}} \right]$$

and for suspension insulators,

$$v = \frac{W \left( \frac{1}{1 + \frac{1}{2} \frac{d l}{T}} \right) l}{R A} \left[ \frac{1}{1 + \frac{1}{2} \frac{d l}{T}} \right]$$

where  $W$  is the weight of a loaded span of wire.

The sag for any tension is given by

$$h = \frac{3cdL}{2T}$$

The tension in a span at any temperature may be found from the fact that every degree rise in temperature is equivalent to an increase of 0.00096 per cent in  $P$ , 0.0000096 being the temperature coefficient for copper.

To find the tension in the span adjacent to a break when suspension insulators are used, assume the deflection of the end insulator to be  $R$ . The error introduced by assuming this insulator to be horizontal will be largely neutralized by the fact that the tower itself will deflect a small amount. Calculate  $v$  and read  $r$  from the curve in Fig. 5. For the second insulator,

$$\Delta l = sR(1 - r)$$

From Fig. 4

$$\Delta l = \frac{sR}{R p} \left( \frac{1}{1 + \frac{1}{2} \frac{l}{X-m}} \right) = \frac{\Delta l_2}{R p}$$

$$\frac{sR}{R p} (1 - r) = r$$

Find the value of  $D_2$  corresponding to  $y = r$ . Then the percentage increase in span length due to the first two insulators swinging over will be

$$P = \frac{R - P}{L}$$

Applying this value to the curve in Fig. 1 will give the final tension.

For example, a transmission line with 1000-ft. spans is strung with copper of 0.1 sq. in. section. Suspension insulators, 3.5 ft. long and weighing 60 lb., are used, the wire being drawn to a tension of 15,000 lb. per sq. in. when the temperature is 80 deg. Fahr.

What will be the pull on a tower if a wire breaks after the temperature falls to 20 deg. below zero Fahr. and the wind and ice loading is sufficient to make the apparent wire density double its real value?

A drop in temperature of 100 deg. Fahr. is equivalent to a decrease in  $P$  of 0.096 per cent. From Fig. 1 it is seen that the conductor was at a tension of 17,700 lb. per sq. in. before loading and (from the  $L = 2000$  curve) 30,000 lb. per sq. in. after loading.

$$v = \frac{(770 + 30) 1000}{3.5 \times 0.1} \left[ \frac{1}{16 \times 10^6} + \frac{12 \sqrt{2^2 \times 0.321^2 \times 1000^2}}{30,000^2} \right]$$

$$v = 0.562 \quad r = 0.48 \quad y_2 = 0.48$$

From Fig. 4,  $D_2/R = 0.43$  and  $D_2 = 1.50$  ft.

$$P = \frac{3.5 - 1.5}{1000} = 0.2 \text{ per cent.}$$

From Fig. 1,  $T = 23,700$ .  $t = 2370$  lb. pull on the tower. The sag will be  $h = 40.6$  ft.

Also,  $X = m \sqrt{1 + 4/r} = m \sqrt{1 + 4/0.562} = 2.85 m$ .

Hence before the conductor broke, 2.85 in. movement of the point  $O$  (Fig. 2) would produce 1-in. movement of the point  $E$ .

## Commercial Interests Indorse Scientific Research

President Theodore N. Vail of the American Telephone & Telegraph Company, in announcing to Dr. Richard C. MacLaurin, president of the Massachusetts Institute of Technology, that his company will establish an endowment to be devoted to research, called attention to the growing feeling on the part of large commercial interests that it is good judgment to invest in scientific researches of broad scope. This presents an aspect of the matter of commercial research versus research in educational institutions which is not always fully appreciated. In the great corporation the atmosphere of commercialism is inevitably present, and the young man engaged there may readily absorb ideas that will cause him to abandon research to engage in the battle for dollars, whereas in the university laboratory the scientific atmosphere prevails and research is carried on for its own sake. With greater responsibilities the college laboratory may hold out to research assistants opportunities and advantages which thus far have been possible only in other lands where research has become a principle.



## Electrolytic Action on Reinforced Concrete

A portion of the instructive exhibit of the National Bureau of Standards at the Cement Show held recently in Chicago was devoted to a display of the effect of electrolytic action on reinforced concrete as determined by experiments made under government supervision at Washington. In most cases of reinforced-concrete construction local currents are set up due to moisture and impurities in the iron that cause the formation of iron oxide, and this reaction is greatly increased by the presence of stray currents. The iron oxide occupies a much larger volume than the iron from which it is formed, and when the pressure thus created exceeds the bond strength of the concrete cracking follows and more surface is exposed to disintegration.

The possible extent of the reaction was determined by an experiment in which a steel rod 1 in. in diameter, used as a core, was placed concentrically within a hollow steel cylinder, 1.5 in. in internal diameter, the space between being filled with cement which was allowed to set. The whole was then immersed in water and the iron core made the anode terminal of an electric circuit. The maximum pressure caused by the oxidation of the iron core and tending to break the cement was found to be 4700 lb. per square inch, the pressure being measured by the expansion of the outer cylinder.

In cases where salt is used, as is often done in cold weather to prevent freezing, the reaction is much hastened, as the salt solution forms a more active electrolyte than moisture alone.

One experiment was performed in which a test column of concrete was used, 1 ft. long and 6 in. in diameter, reinforced by an iron core. The mixture of the concrete was of the following proportions: Cement, 1; sand and gravel, 2.5; stone, 4, and salt, 3 per cent, measured by weight of cement. The column was then immersed in water and 50 volts applied across it, with the iron core as the anode. The specimen cracked longitudinally in three hours. Other experiments of a similar nature were made. In one instance the core formed the cathode in a circuit with 15 volts applied across the test piece. The breaking took place in three months.

Experiments showing the effect of electrolytic action on the bond strength of concrete were also performed. Specimens of reinforced columns were tested for bond strength and then placed for one year in a circuit of 30 volts potential difference, with the iron core as cathode, and tested again. The bond strength was found to have decreased one-fifth of its original value owing to the disintegration of the cement.

The National Bureau of Standards is preparing a bulletin for distribution which will contain detailed information concerning the experiments of this character which it has been conducting, with remedies suggested for reducing the effect of electrolytic action on concrete. This bulletin will give the results of many interesting tests.

## Solid Timber Arch Dam

By R. A. LUNDQUIST

A short time ago while engaged in some engineering work the writer observed a type of small dam that, in view of its unusual construction, is worthy of mention. This is a solid-timber arch dam across a small creek at Melrose, Wis. It was built by a local milling company to develop power for flour and feed mill.

The structure is built up of 12-in. by 12-in. pine timbers drift-bolted together to form an arch of about 65 ft. span with a rise of 10 ft. or 12 ft. Its height is 36 ft. above the creek bed, giving normally a net head of from 33 ft. to 34 ft. The ends of the dam are thrust into a sandstone ledge on each side.

built in four 9-ft. sections, the bottom quarter being the width of four 12-in. by 12-in. timbers, the second section the width of three, the next a two, and the last one a single thickness of the timbers. A wooden box-flume, extending at the west abutment, supplies the water to vertical turbines at a downstream location.

The opening employed in construction, this being, as it were, the "ghost inhabitant," was also very ingenious. The stream itself being quite shallow at this point, the men worked in the water and cleared the creek bed of loose rock, etc., roughly taking off the bottom at the same time to a width of about 4 ft. Holes were then drilled for 1-in. anchor bolts spaced about 2 ft. apart the length of the dam. After these bolts had been cemented in and had set solidly, the bottom layer of 12-in. by 12-in. timbers, trimmed to conform to the rock bottom, was bolted down securely, leaving out, however, a length of the sills at the middle of the dam to keep down the depth of the water until all the other bed timbers were in place and calked so as to make a tight joint at the bottom.

Also, before the gap in the bottom layer was closed, the second layer of timbers was drift-bolted to the sills as far as the opening. The bottom layer was then completed, leaving the second layer open at the same point, and the third course was begun. This was laid in the same manner as the preceding course, a section at the middle being left out pending the placing of the one next above. This sequence was adhered to until the dam had been raised to such a height that the water behind it rose only slowly, whereupon the courses were carried straight across. The timbers had all been framed up in advance and the erection work was consequently carried on very rapidly.



This dam has been in service for about twenty-five years and appears to be in quite good condition to-day, the timbers being generally sound and in looking shape. No sluiceways were provided for discharging surplus water, so that such water has to be spilled over the top of the dam, as will be noted from the accompanying illustration.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Dictagraph for Central-Station Offices

The Rochester (N. Y.) Railway & Light Company has just completed an installation of twelve dictagraphs in its business offices. One of the two master stations is in the office of Mr. R. M. Searle, vice-president, and the other is on the desk of Mr. James T. Hutchings, general manager. From either master station conversation can be carried on with four or five of the ten branch stations. In this way conferences may be held among the several departments without need for any of those taking part to leave his desk or room. The microphone transmitters are so sensitive that whispered words spoken at a distance of several feet from the instruments can be clearly understood. With the aid of a loud-speaking attachment conversational tones uttered at a distance of even 20 ft. from the dictagraph are distinctly reproduced. An assistant, for example, can cross the room to consult a filing cabinet and report the result of his findings without returning to the instrument.

## Small Texas Ice Plant Earns 13.75 per Cent on Investment

With a 10-ton ice plant, which it operates for six months in the year, an electric-light company in a town of 2000 inhabitants in the northern part of Texas, about on a line east and west with Dallas and Fort Worth, disposes of 2000 tons of ice each season. The company which operates the plant purchased it for \$16,000 as a going business. With the purchase was included an excellent well which affords an abundant supply of cooling water. Distilled water is used for ice making.

Daily operating costs amount to \$30.42, which comprises \$12.50 for fuel, \$13.42 for labor, including office help; \$3.50 for delivery, and \$1 for miscellaneous expenses.

Delivered at the station platform the cost per ton of ice to the company is \$2.742. At wholesale \$4 per ton is obtained and on a retail basis, delivered, the ice is sold at the rate of \$9.50 per ton.

A total gross revenue of \$12,000 is received and the total operating expenses are \$9,800, leaving a balance of \$2,200, which is equivalent to 13.75 per cent on the investment. The company expresses itself as highly satisfied with the ice business as an adjunct to the electric service which it furnishes.

## Extension Work in Electrical Engineering at Minnesota

Carrying out the idea of extension work which the University of Minnesota, St. Paul, has conducted during recent years, the electrical engineering department has during the present winter undertaken instructional work on a larger scale than ever before, especially with evening classes. At present there are eight of these evening classes on general engineering subjects, meeting one or two evenings per week and each attended by from twelve to forty-two men. The "general course in electricity," conducted by Prof. F. W. Springer, on Thursday evenings, is attended by forty-two men, who are studying general principles with the stimulus of experiments, showing how the important laws were dis-

covered and applied. The course on "dynamoes, motors and auxiliaries," in charge of Prof. W. T. Ryan, on Friday evenings, is attended by thirty-eight men, studying the fundamental principles governing the construction and operation of electrical machinery. This course has been especially designed for men operating electrical machinery in central stations or isolated plants. The inquiries already received indicate the desirability of increasing the number of courses to be offered next year, and it is the intention to offer more advanced subjects if there is sufficient demand for them.

## Results of Meter Tests in Brooklyn

The Brooklyn Edison Company now has 40,000 electric meters in service, an increase of about 17 per cent over the number at the same date last year. During a recent thirty-day period the company installed 1700 meters, more than doubling its former record for any month's new business.

In 1912 approximately 35,000 meters were in active service. The number of tests averaged one for each meter during the year, with the result that, considering the meters as a whole, 83 per cent were found correct, 2.25 per cent were found fast and 14.75 per cent were found slow. These figures include all tests for whatever purpose—periodic tests, complaint tests, and special tests.

Referring to complaint tests, where every meter is presumed by the consumer to be fast, said Mr. S. D. Sprong, of the Brooklyn company, in addressing a recent dinner given to the local electrical contractors, of the 600 meters tested, 80 per cent were found correct, 4.5 per cent fast, and 15.5 per cent slow. Complaints received on non-recording meters were zero, although the company's inspectors found during the year 142 cases of stalled meters. "Apparently," remarked Mr. Sprong, "these were entirely overlooked on the part of our consumers." The high average efficiency of present-day meters, he added, is surely remarkable, subjected as they are to every possible kind of interference, including vibration, wide fluctuations in temperature, local short-circuits and intermittent and possibly unbalanced loads.

## Expense Less in Proportion to Increased Income

"Since installing ice machinery in connection with our electric plant we find that our expenses are much reduced in proportion to our income," writes the superintendent of a combination ice-electric station in an Arkansas town of 2700. The 12-ton ice machine which he operates now produces 1500 tons of ice during its seven-month season.

"Operating expenses," he continues, "are very little more than when we had only the one plant. The one engineer now operates both machines, and the same fireman serves both departments. About the only extra expense we have is our fuel bill. We find that combination operation has also solved the problem of furnishing plenty of condensed water for making ice. Our office expenses, too, are very little more than in the average small central station doing a purely electrical business, for one man can do the office work for both departments.

"To small central stations contemplating installing new ice-making machinery we should advise the choice of a

motor-driven ammonia compressor about one size larger than the customary rating for the desired capacity, so that the ice machine may be shut down, if necessary, during the peak of the load, for about two hours per day.

"We find ice-electric operation a very satisfactory combination and would advise others to try it."

### Ice-Storage Facilities and Full-Load Operation

The manager of a combination ice-electric plant in western Kansas writes: "We have storage room for about 175 tons of ice. As a rule the ice-making machinery is put into operation about March 15 and is run at full output from the start. The storage room takes care of the surplus ice until we can readily dispose of the entire daily output. During the hot weather in the midsummer months the stored ice augments the daily output, which is at that time insufficient. In the latter part of November when the business drops off we continue full-load operation until about Dec. 1, when the surplus ice has completely filled the storeroom. This supply of ice is sufficient to enable us to meet the light demand during the three and a half months of winter weather, so that it is unnecessary to operate the plant during that season."

In conclusion the manager of this 10-ton plant says: "In regard to our advice concerning the installation of ice-making machinery in connection with central stations, we think it is the only satisfactory solution of the problem of making a plant pay in a town such as ours, with a population of approximately 2600."

### Special Lighting Provisions for a Central-Station Office

The Athens Railway & Electric Company, of Athens, Ga., recently opened a new downtown sales office that probably

best corner in the city, and, as shown in Fig. 1, everything possible has been done in the way of electrical displays to draw attention to it.

The front of the "Electric Shop" has been designed with particular reference to the needs of a central-station office. The heavy, massive door fitted with beveled plate glass is



FIG. 2—SHOWROOM WINDOW OF ATHENS RAILWAY & ELECTRIC COMPANY

located at one side of the front, leaving a clear window space of 19 ft. Over the window on the small panes is painted in transparent letters the legend, "If It's Modern It's Electrical." Hanging from the transom bar is a cream-colored silk curtain.

Practically all the stores in the city are painted green or red, and for that reason and to make the "Electric Shop" distinctive, it was decided to paint the front a light cream color and to finish it in French enamel. This color scheme brings the location into great prominence. The window has no bench, the lower sill being on the floor level. A movable background can be made with screens which match the interior finish, so that any size display can be exhibited. It is thus an easy matter to install model kitchens, living rooms, machine shops or other large displays.

Woodwork and furniture are dark oak, the cushions are of red Spanish leather, and the wainscoting is finished to match. The cashier's cage is at the rear and the display tables are so arranged that every one coming in to pay bills or exchange lamps must pass the entire display. No desks are used, it having been thought best to depend on plain writing tables and a good filing cabinet.

The main lighting of the room is furnished by seven 500-watt tungsten lamps in Veluria and Urnolite fixtures. The window is lighted by twenty 100-watt tungsten lamps in X ray scoop reflectors installed along the transom bar. The total connected load is thus 5500 watts over only 1300 sq. ft. Two 16-in. oscillating fans are permanently attached to each side wall, the connections being made under the base, and openings are available for other fans in various parts of the room.

Along each side wall above the wainscoting are receptacles spaced 5 ft. apart so that electric devices can be plugged in anywhere. The other receptacles are mounted in the baseboard at the window for connecting window displays. In the ceiling above the main area are also four outlets for electric lighting fixtures. In general all the wiring is so laid out that it is believed it will not be necessary to run any exposed or temporary wiring for any future purpose. A 10-kw transformer supplies the store and decorative lighting.



FIG. 1—CENTRAL-STATION NIGHT DISPLAY, ATHENS, GA.

has few equals among other cities of its size. The old office of the company was found to be just so far out of the line of travel that few people called unless actually necessary. On this account it was difficult to show new appliances to advantage or to get as close to the customers as was thought desirable. The new location occupies the



# Illumination and Wiring

## Postal Car Illumination Tests by Baltimore & Ohio Railroad

The visual work performed in a railway postal car requires a high quality of illumination, while the long hours of service make difficult the problem of furnishing a reliable and economical supply of light.

Tests were made comparing (a) Pintsch gas and electricity, (b) different types of reflectors and diffusers, (c) types and arrangements of lighting units. Studies were made of both illumination results and the visual intensities necessary for various kinds of work.

Two important conclusions brought out by the tests were that: (1) Adequate illumination can be provided with present light quantities if sources are properly arranged and reflectored. (2) The intensity of illumination required

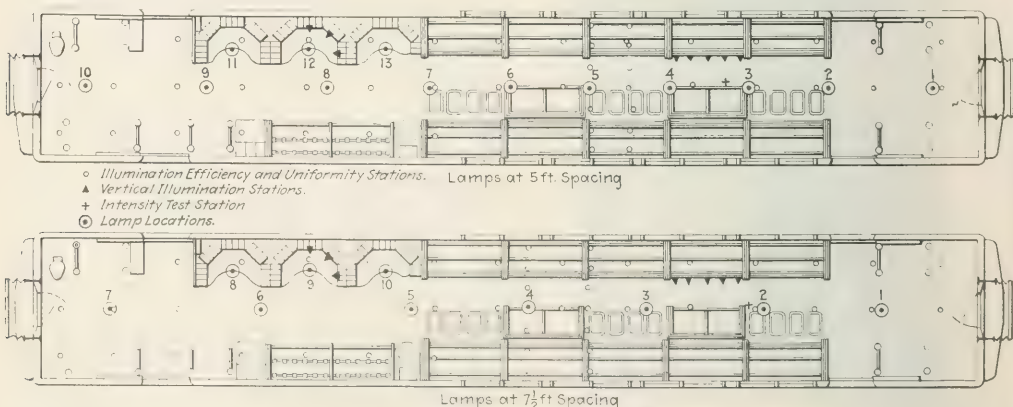
AVERAGE RESULTS OF ILLUMINATION TESTS IN POSTAL CAR

Installation	Foot-Candles	Entire Car, per Cent Useful Lumens	Foot-Candles Center of Car	BAG-RACK SECTION		LETTER-CASE SECTION		Storage Section, Foot-Candles
				Foot-Candles Mouth Bags	Foot-Candles Vertical on Paper Box	Horizontal Foot-Candles	Vertical Foot-Candles	
Mirrored glass (5-ft. spacing).....	6.03	62.3	12.04	3.77	3.74	10.75	4.67	3.84
Prismatic clear (5-ft.).....	5.28	54.6	8.18	3.45	1.93	7.87	4.48	3.65
Prismatic clear (7.5-ft.).....	3.97	53.4	6.13	2.47	1.17	6.94	4.48	2.92
Heavy-density opal (5-ft.).....	5.00	51.8	8.33	3.59	2.75	7.69	5.05	3.42
Heavy-density opal (7.5-ft.).....	4.20	56.4	5.87	2.76	1.74	7.83	...	3.04
Medium-density opal (5-ft.).....	4.14	42.8	6.31	3.43	4.01	5.36	3.01	2.96
Prismatic satin finish (5-ft.).....	3.78	39.0	6.07	2.89	2.52	5.51	3.16	2.74
Aluminized metal (5-ft.).....	4.28	44.2	5.86	3.35	2.66	5.42	3.95	3.03
Aluminized metal (7.5-ft.).....	3.38	45.3	4.37	2.50	1.46	7.64	3.95	2.43
Medium-density opal (5-ft.).....	3.98	41.1	5.84	3.39	3.34	5.19	3.31	2.96
Medium-density opal (7.5-ft.).....	3.10	43.0	4.26	2.45	1.89	3.46	3.31	2.36
Enameled metal (5-ft.).....	3.86	39.9	5.78	3.12	2.88	3.62	4.09	2.74
Enameled metal (7.5-ft.).....	2.23	43.4	4.39	2.38	1.47	5.44	4.09	2.52
Heavy-density opal (5-ft.).....	3.73	38.5	5.51	3.14	4.27	4.98	3.63	2.84
Medium-density opal (5-ft.).....	3.81	39.4	5.54	3.12	2.13	5.11	3.46	2.87
Reflecting and diffusing (5-ft.).....	1.06	31.6	4.79	2.45	4.14	4.34	...	2.18
Bare lamps (5-ft.).....	2.71	28.0	5.79	2.46	4.35	2.72	1.94	2.10
Aluminized metal, 15-watt (5-ft.).....	2.28	44.6	5.63	2.16	2.34	2.28	1.69	1.72
Mirrored glass, 50-watt indirect (10-ft.).....	2.57	26.1	5.34	1.8	1.46	1.90	1.49	2.12

To obtain further data on the subject of postal-car lighting the Baltimore & Ohio Railroad, through its electrical engineer, Mr. J. H. Davis, has been carrying out an extensive series of tests, using one of the latest 60-ft. steel postal cars of the company's equipment. A number of illuminating experts and manufacturers' representatives assisted in making the tests. To insure the greatest accuracy of results the instruments and lamps used were calibrated by the National Bureau of Standards, which also made photometric curves of the light units tested.

for postal-car work has been overestimated. With direct lighting it was shown that the avoidance of shadows determines the correct location of the units.

In studying reflectors the four qualities considered were: Effect of resultant illumination on the eye (0.44), relative efficiency (0.30), cleaning considerations (0.18) and liability to breakage (0.08), values being assigned in the proportion of the decimals above given. On this basis the relative suitability of the various types of reflectors for postal-car lighting was found to be as follows: (1) Heavy-



FIGS. 1 AND 2—LAMP SPACING AND TEST STATIONS IN CAR

The investigation was confined particularly to the question of providing proper and adequate illumination, such matters as maintenance, operating problems and most desirable illuminants not being considered further than with respect to their influence on the quality of illumination furnished.

density opal glazed reflecting surface (specially designed for car-lighting service), (2) medium density opal glazed reflecting surface, (3) porcelain-enameled metal, (4) medium-density opal depolished reflecting surface, (5) indirect lighting with enameled reflectors for gas lighting, (6) mirrored glass (direct lighting), (7) prismatic clear,

(8) prismatic satin finish, (9) reflecting and diffusing globes.

Tests to determine the intensities required for comfortable reading indicated marked differences between the illumination afforded by different equipments. In one class the specular element predominated, as in direct-lighting systems employing mirrored glass, porcelain-enamelled, heavy-density opal reflectors, etc. In the other class the illumination was largely diffuse, coming from diffusing globes, opal reflectors, aluminized metal and prismatic reflectors. This latter class of diffuse reflectors required, it was found, approximately 80 per cent of the illumination needed with the first class.

A minimum intensity of 2.25 ft.-candles on the reading plane was found to be a safe value for continuous close visual work under lighting units of the diffused class. In the same way, 3.5 ft.-candles was found "ample," while higher values were shown to be unnecessary for adequate service. One-half or less of the minimum intensity was required at the mouths of the mail bags in the bag racks, on the faces of letter cases and in the storage sections.

The average results of illumination tests, with the principal electric reflector units and arrangements, are given in the table, while Figs. 1 and 2 show the arrangement of the test car, giving the location of the lighting units and the test stations. The efficiency of the system is taken as the ratio of the light falling on the working plane to the total light flux generated by the lamps.

The effectiveness of proper reflectors is shown by the increase of 220 per cent thus obtained, compared with the intensity projected on the working plane by bare lamps alone. When this observation was made the car ceilings had just been painted a dead white, thus favoring the bare lamps in contrast to the reflectored units. Further, the glare obtained from the bare lamps is found to render the eye less efficient and more susceptible to strain.

The minimum and maximum initial illumination values, as well as the service illumination value, required under the Post Office Department's specifications, were determined as a result of the comprehensive tests above cited.

## Wiring of Large Buildings

In a paper recently presented by Mr. W. K. Stacy before a meeting of engineers and scientific men in Spokane the general considerations to be dealt with in wiring large buildings were discussed.

The author stated that the first and chief consideration in the wiring of a large building is to provide adequate specifications; next that these specifications be submitted to reputable contractors for bids, and last that a competent inspector keep a watchful eye upon the work to see that no material or workmanship is allowed to enter the installation which does not conform with the specifications.

The scope of specifications submitted to the contractors varies at present from the ludicrous statement that "the wiring shall conform to the National Electrical Code; the wire shall have a conductivity of 0.008 Matthiessen standard and be as good as Smith and Brown's" to a complete and effective set of written specifications accompanied by diagrams of circuits and drawings showing the location of apparatus, conduit runs and the sizes of wire for each part of the circuit.

A case was cited by Mr. Stacy wherein a set of so-called specifications was submitted to six electrical contractors. The specifications were incomplete and contained conflicting paragraphs. Each contractor spent about \$200 worth of time in placing his interpretation on these specifications and obtaining figures for his bid. The result was that the architect received six bids according to six different

specifications at six different prices. He then realized that he had no comparative basis upon which to let the contract. All bids were returned and a complete set of specifications was prepared, the labels on each unit were numbered, and the contractors then knew upon what they were to bid and the negotiation was clear-cut and businesslike. The process saved time for all concerned and obviated possible conflicts with the city and insurance inspection departments.

Assuming that the contract for electrical equipment is to be let independently of other building construction, it should be stated in the first paragraph of the electrical specifications that the work is to be done and the material is to be furnished in conformity with the following: First, American Institute of Architects' "Instructions to Bidders," second, National Electrical Code, and, third, the ordinances of the city in which the work is to be done. Consideration should also be given to the central-station company's requirements to secure the best operating and maintenance conditions.

In addition to including the architect's instructions, the National Electrical Code and the city ordinances, the specifications should enumerate and explain the following:

A. General considerations applicable to any installation: General conditions, drawings, record drawings, measurements, material and workmanship, samples, and appliances, co-operation with other contractors, foremen, disputes, repairs and renewal of material, wire current densities and potential drop.

B. A description of the installation in question, including a list of drawings and enumeration of approved materials, such apparatus as outlets, conduits, wire and switches.

C. The requirements of final inspection, tests, furnishing of auxiliary apparatus and mention of terminal equipment.

It was stated that the depreciation of wiring in a large installation is so small that interest alone enters materially to offset, from a financial viewpoint, the lower fire hazard and lower insurance resulting from the increased cost of superior equipment. This statement, together with the fact that the annual fire loss in the United States is \$2.47 per capita as against 32 cents for Europe, was used as an argument in favor of better wiring installations more carefully planned.

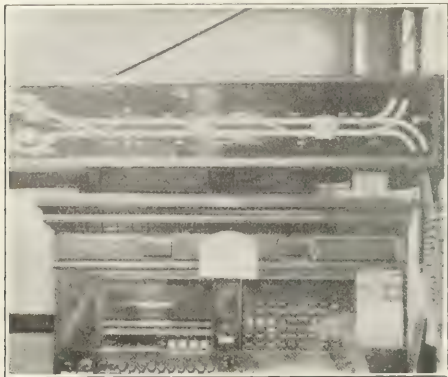
The speaker said that the satisfactory installation must be convenient, efficient, economical and flexible, but that these terms are interdependent. In this connection he discussed the type of switchboard best fitted for this class of work and commented upon the suitable location of such a board to facilitate the work of the attendant.

Another important consideration not to be overlooked is voltage variation. Nothing repels a tenant so strongly as fluctuating or unsteady light. An increase or decrease of 1 per cent in the voltage will cause a modern incandescent lamp to increase or decrease 4 per cent in brilliancy. How great the change must be to be noticeable to the eye depends on the intensity of the light, the individual and on the colors reflecting the light. In general, 1 per cent should be the maximum allowable variation in voltage in any part of the system. The National Electrical Code specifies minimum sizes of wire and gives currents for these sizes. In considering only the limitations of better wiring, the potential drop. Hence this factor should be carefully calculated or satisfactorily identified.

In conclusion the speaker said that a satisfactory set of specifications should be prepared by the architect and engineers of the owner, the architect and the electrical engineer. The specifications should be complete and should describe what is to be done and what the desired results are. It is not possible to give a complete list of limitations. It is therefore necessary for the three parties to understand the limitations of each other's work and to make a complete and correct application of the limitations of each other's work.

## An Electric Bulletin for Elevated Trains

In the train dispatcher's office at the Sullivan Square station of the Boston Elevated Railway the attention of the visitor is attracted by an automatic train annunciator board about 6 ft. long, mounted above the telephone exchange desk. This device is a track model showing the location of all signals on the elevated line from the Charles River



ELECTRIC TRAIN ANNUNCIATOR

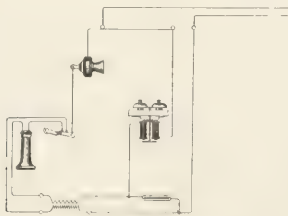
drawbridge, about 1.5 miles south. It also shows signals at the terminal and intermediate stations. The miniature track targets consist of 3-cp, 10-volt, 6-watt incandescent lamps, connected with the main signals so that the passage of every train through the blocks can be followed by the dispatcher.

One of the lamps serves to show when the drawbridge is closed or open, while others indicate when trains are standing at the unloading and loading platforms. The device thus completely visualizes operation and is a great convenience in the prompt and regular handling of traffic in the busy Sullivan Square station.

## Recent Telephone Patents

### SUBSCRIBER'S INSTRUMENT CIRCUIT

From time to time there have been presented many different circuits for common-battery subscribers' instruments, the usual difference being in the arrangement of the essential parts, namely, the bell, condenser, induction coil, transmitter, receiver and hook switch. In an arrangement made



INSTRUMENT CIRCUIT

by Mr. H. P. Clausen, of Chicago, the transmitter and one winding of the induction coil, together with one set of contacts of the hook switch, are bridged across the line. The condenser and bell in series are also connected as a straight bridge of the line. The receiver and the remaining winding of the induction coil are then connected in series, one end of the coil being connected between the bell and con-

denser and the free pole of the receiver being connected to the remaining contact of the hook switch. The arrangement of the circuit is shown in the illustration which is reproduced herewith.

Mr. Clausen has assigned the patent granted to him for this device to the Stromberg-Carlson Telephone Manufacturing Company, of Chicago.

### SELECTIVE LINE SWITCH

Under this title Mr. J. H. Swanson, of Minneapolis, has patented a device for connecting or disconnecting a branch line to a main line at the will of the operator. The connection is effected by means of a special relay, two of the contacts of which are permanently wired to the branch-line circuit and the registering contacts of which are correspondingly wired to the main line. The relay is double-wound and has two armatures. The main armature is permanently magnetized and drives the line contacts, while the auxiliary armature operates a circuit including one of the relay windings and a local battery. The main winding of the relay is bridged across the main line and has associated with it a short-circuited winding to prevent response to alternating currents. An application of direct current to the main line operates the auxiliary armature of the relay, thereby closing the actuating coil of the relay, which is energized by the local battery. The main armature of the relay is thus pulled up and held up, attaching the branch line to the main line. The main armature will remain in this position when once the circuit has been closed, as the armature is a permanent magnet and will adhere to the pole. The application of alternating current to the line disturbs the magnetic balance and causes the main armature to be released.

## Letters to the Editors

### Transmission-Line Construction

*To the Editors of the Electrical World:*

SIRS: The article on the effect of the sleet storm on distributing lines at Rochester, N. Y., in your issue of Feb. 22, 1913, conveys what seems to the writer an incorrect impression, or, in any event, an impression not justified by the data furnished.

It is clearly evident, both from the photographs and the text, that a very large part of the failure of the lines was due to loads other than the wind and ice upon the wires. It would appear from the views shown that the wires, insulators and pins survived the test fairly well. This may not be true in fact, nor has the writer any information as to the wire stringing, which, as is frequently the case, may have been too tight.

It was stated that the maximum wind velocity was 36 miles per hour and the maximum thickness of ice 1.5 in. Even assuming that 1.5 in. was the thickness of ice all around the wire—that is, a total diameter of 3 in. plus the wire diameter—the transverse load on this diameter of ice-covered wire at the pressure corresponding to 36 miles per hour would be less than the loading of the National Electric Light Association specifications, and not more, as might be inferred from the article.

Again, it may be doubted whether "ice and snow load"—which incidentally is a vertical compression—was or could be imposed upon the wires in sufficient amount to cause failure of the poles.

It would appear, therefore, that the line failure was primarily due to lack of tree trimming, guying and, possibly, to poles of insufficient strength for a high and fairly heavy line. There is no conclusive argument given to indicate that an entirely satisfactory line could not be built without recourse to underground construction.



There are throughout our cities many lines of equal or even greater height and weight which are successfully serving their purpose, and it would appear unjust both to those lines and to the standard specifications to suggest that aerial construction cannot be successfully maintained in a city of the size and character of the one in question.

New York, N. Y.

R. D. COOMBS.

## Possibilities of Society for Electrical Development

To the Editors of the Electrical World:

SIRS:—The newly formed Society for Electrical Development represents one of the most encouraging movements in the electrical industry that have taken place for some time. From the personnel of its officers and membership it is obvious that great results will be obtained. Among the objects stated, that of educating the public in the use of electricity for domestic and rural purposes is likely to prove of the greatest importance. Having been in contact with all phases of the subject, I may, perhaps, be pardoned for offering a few suggestions as to the most effective methods of progress in this direction.

Undoubtedly the most effective means of reaching the farmer is through the canvasser who goes from farm to farm and personally explains the advantages of what he is trying to sell. Such canvassers by utilizing electric automobiles could readily make use of a small outfit of representative equipment, which, operated from the storage batteries carried, would afford the farmer and his wife a decisive object lesson in the advantages of electricity. Such a canvasser would also supply the farmer with comprehensive and handsomely illustrated literature to be considered at leisure.

Supplementing the canvasser's activities, the central stations should have model showrooms, fitted with all kinds of electrical apparatus, located within easy distances of farming communities, and at intervals special lectures could be given on the subject to which the farmers should be invited. Such lectures should be arranged not only for the purpose of selling apparatus but also for the educational effect as well.

Manufacturers of isolated-plant equipment should follow the same course and should be able to advise the farmer what equipment to adopt for the source of energy available, whether water, coal, gas, oil, gasoline or wind.

In order to promote the use of electricity on the farm, the farmer must be dealt with fairly and served honestly; the apparatus being simple, convenient and reliable in operation. He should be supplied with equipment specially suited to his purposes and should not be misguided into buying standard equipment originally designed for other purposes which may prove a handicap instead of an advantage.

Valuable lessons are to be learned from German practice, where electric farming has been carried on successfully on a wide scale for more than fifteen years, using among other apparatus electric plows of from 40 hp to 100 hp. It is strange indeed that the first furrow is yet to be turned by an electric plow in the United States. A leading feature of German agricultural electricity is the use of narrow-gauge field railways for moving crops to the barns. Refrigerating and ice-making plants and by-product factories also augment German agricultural prosperity. Farming in Germany is conducted along the same lines as industrial and manufacturing undertakings and is just as much of a science. Competent engineers are employed and improvements are constantly being made.

It should be among the duties of the Society for Electrical Development, and especially also of the National Electric Light Association, to assist in bringing rural and domestic electricity in the United States to the high point of

development attained in Germany, for not only will this redound to their own benefit and to that of the farmer but it will also be of material assistance to the general public in the reduction of the cost of living. Indeed, the rapidly increasing use of electricity by the farmer is one of the most important developments now taking place in this country.

Electricity is undoubtedly the greatest agent of agricultural progress and the great emancipator of the toiler. A motor of even diminutive size does the work of a man at far less expense, while larger units economically supplant farm draft animals, whose consumption of farm produce is an enormous item. Thus in supplanting labor electricity has a profound effect upon agriculture since agriculture demands a large amount of labor compared with the skill involved.

The variety of uses to which electricity may be put on the farm is surprising. It is used for lighting, heating, cooking and ironing, and other results are accomplished, while the uses of motors are manifold. The latter can be employed in almost every operation from plowing to the delivery of the finished product, including harvesting, lumbering, irrigation, laundering and dairy and various other domestic uses.

Electric farming provides for central-station concerns one of the best methods of establishing a good load-factor. It opens up an enormous market for new machinery and consequently works a new era in electrical industry.

New York, N. Y.

FRANK KOESTER.

## Skin Effect

To the Editors of the Electrical World:

SIRS:—In regard to the question of skin effect in cylindrical conductors, on which there has been some discussion recently in your columns, I wish to call attention to another formula for the calculation of alternating-current resistance of cylindrical conductors. This formula, which is not used very extensively, though it is perfectly general and very suitable for numerical calculations, is as follows:

$$R = R_0 r(ma)$$

where

$R$  = alternating-current resistance

$R_0$  = direct-current resistance

$$r(ma) = \frac{ma \operatorname{ber}(ma) \operatorname{ber}'(ma) + \operatorname{bei}(ma) \operatorname{bei}'(ma)}{2 \operatorname{ber}^2(ma) + \operatorname{bei}^2(ma)}$$

$$m = 2\pi \sqrt{\frac{f\mu}{c}}$$

$f$  = frequency.

$\mu$  = permeability.

$\rho$  = specific resistance.

$a$  = radius of conductors.

To obtain the value of  $r(ma)$  from the above formula is a laborious process, but Professor Pedersen has recently worked out a very valuable table giving the values of  $r(ma)$  for values of  $ma$  from 0 to 6 for intervals of 0.1. This discussion will be found in the *Jahrbuch der Drahtlosen Telegraphie*, Vol. 4, pages 310-315, under the title "Wirbelstromverluste in und effektiver Widerstand von geraden, runden Metallzylindern," by P. O. Pedersen.

For values of  $ma > 6$  the expression  $r(ma)$  can be put to a high degree of approximation in the following simple form:

$$r(ma) = 0.35355 \frac{1}{\sqrt{ma}}$$

With the aid of the table given by Prof. Pedersen one can compute very readily by this simple formula the alternating-current resistance of any size of wire at any frequency. The formula is perfectly general and may be used for iron as well as for copper wires.

Washington, D. C.

LOUIS COHEN.

# Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Remote Control of Two-Rate Meters for Off-Peak Service

The Jefferson Electric Company, of Jefferson, Ia., employs a two-rate schedule of commercial charges which is applied to many installations in the local business district besides being extended to residences in which electric ranges are in use.

The rates for this service are 8 cents per kw-hr. for energy used during the hours included in the accompanying table, and  $3\frac{1}{2}$  cents per kw-hr. for all used during any other hours. In addition to these charges for energy consumed, the company also makes a service charge of 40 cents per month, which is its only minimum charge.

In connection with the double system of charging above outlined, a number of two-rate meters have been improvised

feeder. The accompanying diagram gives a general outline of the system of connections. The number of meters that could be supplied with potential through a ground connection would, of course, depend on the resistance of the ground and the degree of accuracy required. If necessary the grounded sides of different secondary systems could be joined together, preferably making connections at transformers and not at extreme ends of secondaries.

The computation of bills with this system, is, according to the local management, simplicity itself. The kilowatt-hour consumption registered simply need be multiplied by the 8-cent rate and the result added to the service charge of 40 cents, at once giving the monthly bill.

SCHEDULE OF JEFFERSON ELECTRIC COMPANY, RATE 8 CENTS PER KW-HR.

May, June and July	7.00 p.m. to 10.00 p.m.
February and August	6.30 p.m. to 10.00 p.m.
March and September	6.00 p.m. to 10.00 p.m.
January and October	5.30 p.m. to 9.30 p.m.
November, December and January	5.00 p.m. to 9.00 p.m.

The meter thus ceases to be a watt-hour meter, but becomes an aid in computing a fair charge. Some objection may be offered to the company's lack of knowledge of the actual kilowatt-hours the customer has used, but this should be more than offset, it is declared, by the fact that he has been charged the proper rate at the proper time regardless of the service for which the energy was used.

While the exact accuracy of this two-rate meter system is open to question, admits Mr. Percy Gray, manager of the Jefferson company, he declares that for practical purposes it is quite correct.

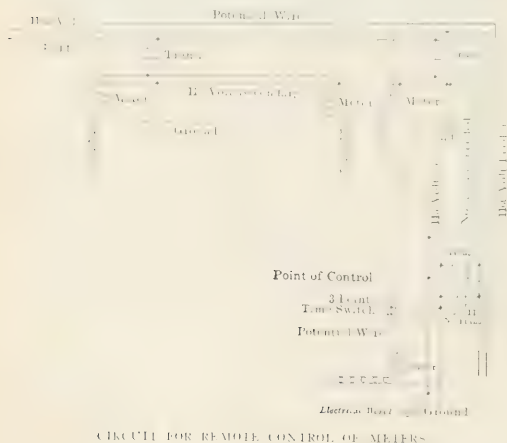
The potential applied to the two-rate meter must of necessity be independent of the potential of the circuit on which the meter is registering, and the resulting accuracy of the meters will be affected as this difference varies.

This inaccuracy may be minimized, however, (1) by careful designing of the secondary distribution systems with a view to close regulation, (2) by applying the potential service to the grounded side of the secondary at the transformer so that one-half of the potential drop from transformer to meter will be applied to the potential service itself, and (3) by taking the potential service from a transformer which carries a load of average character.

## Precautions in Shutting Down Economizers

Following an investigation of the fatal explosion of the economizers in a large Eastern power plant, in which it was shown that the principal damage resulted from the economizer unit idle at the time, the investigators give some pointed advice for observance in shutting down economizer units when not in service.

Two theories were brought forward to explain the present accident. According to the first an explosive mixture of coal gas and tar might have been confined in the idle economizer, although this presupposes both poor combustion conditions in the furnace itself and some manner of firing the explosive gas after it was entrapped in the economizer chamber. The other and more probable view advanced considers that the idle unit may have been fully or partly filled with water which was then so shut off that internal pres-



from ordinary single-phase induction-type meters by applying across the potential coils either the full rated voltage or a reduced voltage. This requires, of course, three service wires for each installation, but the third potential wire may be installed much more cheaply than the others, a No. 12 or No. 14 triple-braid weatherproof iron wire being sufficient for outside use.

The Jefferson company employs a 1100-volt, single-phase distribution system with secondaries operated as 110-volt two-wire circuits, one side grounded. For the two-rate meters the grounded side of the secondaries is connected to the series coils, so that the earth can be used, if desired, as one conductor on the potential service to the meters.

A special transformer connection furnishes the reduced potential, about 50 volts, necessary to make the speed reduction, in the ratio of 8:3.5 on the two-rate meters. A 1-kw transformer, arranged for 1980 volts primary and 110 volts secondary, is connected to the 1100-volt feeder. The resulting secondary of about 60 volts is then connected in series with a 110-volt circuit and at opposite polarity so that the resulting pressure is about 50 volts.

The change from 50 volts to 110 volts on the potential wire is accomplished by a three-point time switch which can, if necessary, control all the two-rate meters on one

tures generated could find no way of escape. Leakage in the flue dampers might have admitted hot gases to the economizer chamber, raising the temperature and pressure of the confined water until destruction occurred.

To prevent the bursting of idle economizers, either from gas explosions or from the accumulation of water, it is important, therefore, when putting them out of service, to open up the soot clean-outs and any other openings that there may be into the gas chambers and to close the dampers as tightly as possible. When dampers become warped, or do not fit properly for any other reason, they should be promptly repaired. It is also highly important to maintain the safety valves on economizers in good condition, at all times. If they leak they should be repaired at once, instead of being screwed down tighter. In fact it would be well to adopt lock valves for economizers, so that they cannot be tampered with by irresponsible or thoughtless persons. To guard against the accumulation of steam or water within the idle economizer, its blow-off valve and air vent should be left open, so that no harm will result if the inlet should leak and admit water. If these precautions are taken in every case, according to the inspection division of the Travelers' Insurance Company, of Hartford, Conn., which made the investigation, the two causes of explosion that have been suggested in connection with this accident will be avoided, and safety in the use of economizers will be greatly promoted.

### Ice-Making Operating Practice at Durham, N. C.

The Durham Traction Company, which has recently been taken over by H. L. Doherty & Company, operates a combination lighting, railway and ice-making plant at Durham, N. C. The generating equipment comprises an 800-hp Hamilton Corliss cross-compound engine operating condensing and directly connected to a 600-kva, 2300-volt, 60-cycle General Electric alternator; a 500-kw Westinghouse turbo-alternator set of the same characteristics as the other unit; two 200-kw machines used as reserves, and a 200-kw rotary-converter set for the railway.

The boiler equipment comprises two 250-hp Stirling and three 125-hp Aultman & Taylor boilers, which are hand-fired with run-of-mine coal costing \$3.30 a ton delivered. Water for boiler feed and other purposes is purchased from the city at the rate of 12.5 cents per 1000 gal. net, so that for economy cooling towers are employed. Two types of tower are installed, one a natural-draft and the other a forced-draft tower—the latter not being used except in emergency.

The ice-making equipment consists of a 50-ton York machine operating non-condensing, and at the present time the company is installing a 50-ton York condensing machine and redesigning the ammonia condensers and tank rooms. The Shipley double-tube condensing system of the York Manufacturing Company is being installed and an accumulator for pre-cooling the water. When the installation is completed the older machine will be used only as a spare unit, since 50 tons of ice a day is more than ample to supply the present demand. The new unit will enable a great saving to be effected, inasmuch as the old unit required from 30 lb. to 32 lb. of steam per hp-hr. while the new unit is guaranteed to operate on 16 lb. of steam per hp-hr.

### ECONOMY OF RECIPROCATING UNIT

Surprising as it may seem, the turbine unit is not regularly operated, ordinarily, the company claiming that the Corliss unit is more economical. Or, as expressed by the general manager of the company, a saving of \$10 a day in coal is effected by using the reciprocating engine set instead of the turbo-alternator set. The former is guaranteed by the builder to operate on 13.25 lb. of steam per hp-hr. when supplied with steam at 145 lb. pressure at the throttle and working on a vacuum of 26 in. The engine, however, is

operated on a boiler pressure of 160 lb. and it is connected to a 29-in. vacuum. The turbo-alternator, according to Mr. R. L. Lindsay, general manager, was bought on a guarantee of 15 lb. of steam per brake hp-hr.

The natural-draft cooling tower, aside from the fact that it requires no motor, is said to give an average lower temperature to the water than can be obtained with the forced draft tower. Some time ago the breaking of the city water main necessitated the shutting down of the station for a number of hours until the city fire department ran a temporary hose connection from a hydrant beyond the break. This experience resulted in the building of a 60,000-gal. reservoir under the natural-draft cooling tower so that interruption from such a cause would not occur again. Even with all the precautions taken to save water not used in making ice, the water bill of the plant in a hot season is \$100 a month.

## DISTILLED WATER SUPPLY FROM 4 NOZZLES

The condensation from the ice machine and the cooling water will be sufficient to make 100 tons of ice a day. The water from the reboiler is forced through four coolers and then through a set of three cloth filters. It passes thence through a set of York charcoal-brick filters and then through three batteries (two in a battery) of charcoal and silica-sand filters, whence it reaches the pre-cooler. The latter is a double-pipe arrangement in a tank, wherein ammonia is expanded directly so that the water on its way to the freezing cans reaches a temperature of 40 deg. Fahr. or lower. There is a 6-ft. by 6-ft. by 14-ft. storage tank which is also piped with coils sufficient to maintain the temperature of the water a few degrees above freezing before it reaches the cans. A new tank room is being installed so that there will be 1295 cans in the whole system, making it possible to manufacture 100 tons of ice a day if necessary.

The storage room is provided for 150 tons of ice without stacking. The storage room is piped for direct expansion and is insulated with 4 in. of cork covered with cement. The cork is laid in 2-in. layers, between which is a 1/2-in. coating of cement, while the cork on the ceiling and floor is laid in asphalt.

Ice is handled by means of a pneumatic hoist and hand-operated crane. The steam from the Corliss engine is first passed through a 36-in. Triumph self-dumping oil trap or separator, which is said to be effective in removing the oil from the steam.

No data are available on the cost of manufacturing ice other than that it can be manufactured for less than it can be delivered. The ice is retailed by the manufacturer at the rate of 40 cents per 100 lb. in small pieces and 30 cents per 100 lb. in cakes. If two cakes are sold at one time, the rate is 25 cents per 100 lb.

### Function of Kicking Coils

We were able to identify a significant difference in the mean number of positive responses occurring in the two conditions in males, but not in females. The mean number of positive responses was significantly higher in the male group in the strike condition (mean = 1.9, SD = 1.0) than in the control condition (mean = 0.9, SD = 1.0). The mean number of positive responses in the female group was not significantly different in the two conditions (mean = 0.9, SD = 1.0).

The current which traverses a line following discharge is of very high frequency. For this reason the induction coil which is placed in the circuit offers a high impedance to the passage of this current through it. The result is the creation of high potential drop in the coil across the gap of the arrester and the subsequent breaking down of the sodium tubes. These tubes once broken pass the charge to ground. Hence it will be seen that a large part of the charge really does pass the arrester to the coil and later is backed up and escapes through the lightning arrester.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Three-Phase Series Motor as a Generator.**—L. BINDER AND E. DYHR.—The conclusion of their long, illustrated article on the generation and suppression of self-excited current in three-phase series machines. The physical conditions which produce self-excitation are experimentally investigated with a three-phase series motor of the Siemens-Schuckert type. When the brushes are displaced for operation of the motor as a generator the rotor current increases the excitation. For this reason one phase circuit, if connected alone, excites itself as a direct-current series generator due to the residual and produces a field in the stator, this field being stationary in space. In this way a voltage is impressed also in the two other phase circuits, and they also excite themselves when they are closed. The currents produced in them act in such a way on the field of the first phase circuit that this is weakened and then reversed so that the direction of the self-excited current is reversed. Finally, each phase circuit excites itself with alternating current and for reasons of symmetry a rotary field is produced. This is, therefore, finally due to the residual, and to prevent its formation it is necessary to employ a resistance above a certain limiting value which can be found by formulas well known from direct-current practice.—*Elek. Zeit.*, Feb. 27, 1913.

**Separation of Leakage Reactance and Direct Magnetizing Effect.**—C. S. WALL.—A note on the separation of the leakage reactance and direct magnetizing effect of the armature of a star-connected three-phase synchronous machine. One phase of the armature is short-circuited to the star point, and the machine is driven at a known speed and excited until the short-circuit current has a convenient value. The short-circuit current  $I_0$  and the exciting cur-

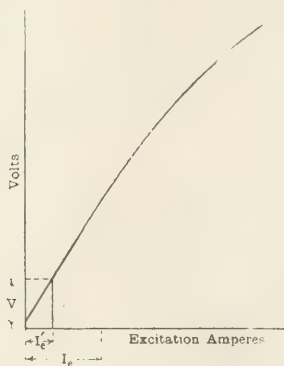


FIG. 1.—DIAGRAM SHOWING USE OF OPEN-CIRCUIT CHARACTERISTICS

rent  $I_e$  are read, and also the star volts  $V$  for one of the phases which are not short-circuited. Then, if  $L$  is the coefficient of leakage self-induction for one phase, and if  $f$  is the frequency,  $V = 2\pi f L I_0$ . The value of  $L$  is thus obtained by means of a single reading of the short-circuit current  $I_0$  and of the corresponding star volts for one of the open phases. In order to obtain the direct magnetizing

effect, the volts  $V$  are marked off on the open-circuit characteristics, as shown in Fig. 1. The corresponding exciting current  $I_e$  is subtracted from the exciting current  $I_0$ , and the difference thus obtained is the direct magnetizing effect due to the one phase in terms of the field current. When the three phases are short-circuited the direct magnetizing effect is three times that due to one phase alone, and hence the total direct magnetizing effect of the armature can readily be determined.—*London Electrician*, Feb. 28, 1913.

**Theory of Commutation.**—C. L. R. E. MENGES.—A long letter, illustrated by diagrams, in which the author explains his views on the neutral commutation zone with reference to a recent paper by G. W. Worrall.—*London Electrician*, Feb. 28, 1913.

### Generation, Transmission and Distribution

**Lauffen.**—BÜGGELN.—An account of the new energy transmission plant which has just been opened at Lauffen on the Neckar, in Germany. The old historical plant from which energy was transmitted twenty-two years ago to the electric exhibition in Frankfurt has been dismantled and the equipment rating has been increased from 1500 hp to 1800 hp. Part of the energy is used in a cement factory and part for transmission to Heilbronn.—*Elek. Zeit.*, Feb. 27, 1913.

**Electric Pumping in Mines.**—R. HERZFELD.—A paper in abstract read before the (British) Institution of Mining Engineers. A description is given of the electrical pumping plant installed at the Dover Collieries. Among other features of the installation are described a method of varying the output of the pumps, a method of increasing the load of the alternators by means of fans, a fool-proof switch-gear, and the drying of high-tension motors by means of low-tension current.—*London Electrician*, Feb. 28, 1913.

**Dangerous Rises of Voltage.**—W. PETERSEN.—In a continuation of his very long article the author takes up protective devices against dangerous increases of voltage on transmission lines. The author divides them into three classes—protection against traveling waves, protection against atmospheric disturbances, protection against rises of voltage due to interruptions. The paper is to be concluded.—*Elek. Zeit.*, Feb. 27, 1913.

**Trollhättan Plant.**—The conclusion of the long, illustrated description of the power plant at Trollhättan, Sweden. The author gives details of the construction of the insulators and of the circuit-breakers. Oscillograms are given showing the operation of the circuit-breakers.—*London Electrician*, Feb. 28, 1913.

### Installations, Systems and Appliances

**Gas Engine Ignition by High-Tension Oscillations.**—M. E. GRABER.—An abstract of an American Physical Society paper. The principal problem in electromagnetic wave propagation is the storing up of the maximum of energy in the aerial with the minimum heat loss in the spark-gap. The inverse problem presents itself in the application of high-tension oscillatory systems to gas-engine ignition. Here it is necessary to produce a spark of high calorific quality by using smaller capacities and a short spark-gap. In the present investigation of ignition systems the primary source of energy was a magneto with an armature wound to

generate from 7 volts to 100 volts at from 80 r.p.m. to 700 r.p.m. After testing a number of high-tension oscillatory systems, a modified Tesla transformer was found to give the best spark for ignition. The diagram of connections for this system is shown in Fig. 2. The armature *A* of the magneto supplies current to the main circuit, which is made and broken by the interrupter *K* once in every rota-

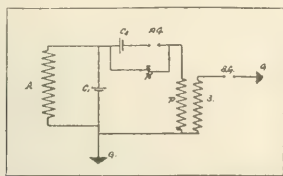


FIG. 2—DIAGRAM OF CONNECTIONS

tion of the armature. The oscillatory discharge across the spark gap *PG* serves as an interrupter for the secondary of the Tesla transformer *S*. When *C*<sub>1</sub> and *C*<sub>2</sub> are properly adjusted, the secondary *S* responds strongly to the oscillations set up by each primary spark-gap discharge and the potential difference of its terminals reaches very high values. For the best spark at low speeds the primary spark-gap was from 0.0015 in. to 0.0025 in. At higher speeds the primary spark-gap was from 0.0025 in. to 0.0035 in. The high-tension oscillatory discharge seems impracticable for automatic ignition because (1) the hot spark requires adjustments of capacity and spark-gaps for the transition from high speed to low speed in order that the two systems may have the same oscillation constant; (2) the secondary condenser insulation breaks down under the high potential stress to which it is subjected; (3) undoubtedly the high calorific quality of the spark at the high speeds was due to arcing, as the hot spark differed materially from the ordinary Tesla spark. The system was tested on two cars with satisfactory results for high speeds but indifferent success for low speeds.—*Physical Review*, March, 1913.

**Electric Cooking and Heating.**—T. P. WILMSHURST.—An illustrated paper in abstract read before the (British) Institution of Electrical Engineers at Birmingham. The revenue per service has been reduced by the introduction of metallic-filament lamps; for this the cultivation of a cooking and heating load is mentioned as the remedy, the example of gas cooking being quoted. Electric cooking and heating are considered in detail and their advantages pointed out. Three forms of water heater are described. Finally, methods of charging for energy as influencing cooking and heating loads are discussed.—*London Electrician*, Feb. 28, 1913.

### Wires, Wiring and Conduits

**Wiring Rules.**—Some proposed modifications of the standardization rules for isolated conductors of the German Association of Electrical Engineers. An account is also given of the work of the different committees of this association during the year 1912.—*Elek. Zeit.*, Feb. 27, 1913.

### Traction

**Gearing Versus Driving Rod.**—An anonymous article starting with a discussion of the usual system of single gearing and pointing out the advantages of double gearing, especially for electric locomotives. The question of gearing versus driving-rod transmission for electric locomotives is discussed with respect to structural and commercial considerations.—*Elek. Zeit.*, Feb. 27, 1913.

### Electrophysics and Magnetism

**Excitation of Gamma Rays by Alpha Rays of Ionium and Radio-thorium.**—J. CHADWICK AND A. S. RUSSELL.—The work on the excitation of gamma rays by alpha rays, shown first by Chadwick in the case of the alpha rays of

radium C, has been extended to ionium. A preparation of ionium and thorium equal in alpha-ray activity to 3 milligrams of radium, after purification from all other radioactive bodies which emit beta and gamma rays, was found to emit a small but easily detectable amount of gamma radiation. This radiation is shown to be excited by the alpha rays, either in the ionium itself or in the thorium with which it was mixed. It is a mixture of three types of radiation differing widely in penetrating power. The first of these has a value of absorption coefficient divided by density ( $A \div D$ ) in aluminum of 400 cm<sup>-1</sup>; the second of about 8.4 cm<sup>-1</sup>, and the third of 0.15 cm<sup>-1</sup>. The energy of the radiation is mainly confined to the softest type. These results, in light of Rutherford's theory of the origin of the beta rays and gamma rays of radioactive substances, point to the probability that the three types of radiations are characteristic radiations of ionium of different series. It has been found also that radio-thorium emits a small quantity of gamma radiation, but a detailed study of its nature has not been made.—*London Electrician*, Feb. 28, 1913.

**Chemical Properties and Relative Activities of the Radio Products of Thorium.**—H. N. MCCOY AND C. H. VIOL.—An account of an experimental investigation in which numerous chemical reactions of the radioactive products of thorium were studied. It was found that each product has its own characteristic chemical properties. From a knowledge of these properties methods were worked out for the separation of the various products from inactive substances and from one another and for the preparation of several of these products completely free from radioactive impurities. The relative activities of thorium  $B+C+D$  and thorium  $X$  + emanation + *A* were determined by preparing thorium *X* entirely free from  $B+C+D$  and determining its change of activity with time. Knowing the periods of each of the substances, the activity of  $B+C+D$  was found to be 0.427 of that of thorium  $X$  + emanation + *A*. By determining the initial activity of pure radio-thorium and its change of activity with time, it was found that the products of radio-thorium are 5.23 times as active as the radio-thorium itself.—*Phil. Mag.*, March, 1913.

### Units, Measurements and Instruments

**Charging the Needle of a Quadrant Electrometer.**—HENRY A. ERIKSON.—An abstract of an American Physical Society paper. To obtain a

conducting quartz fiber of high sensitiveness is difficult. The method here described obviates this difficulty and has been found very satisfactory. An insulated ionization chamber *A* (Fig. 3) is placed above the quadrants and is separated from them by a metallic plate *B*, which is connected to the case of the instrument and prevents any direct induction effect from *A* on the quadrants. The supporting stem of the needle passes through the center of the chamber *A* and forms a central electrode. The air inside the chamber *A* is ionized by means of the rays from a small polonium plate *P*. The chamber *A* is connected to a battery, giving the desired potential. The ionization current set up charges the needle to the potential of *A*. Experience thus far has shown that the action of an electrometer with the needle charged by this method is the same as when the needle is charged by means of a conducting fiber.—*Physical Review*, March, 1913.

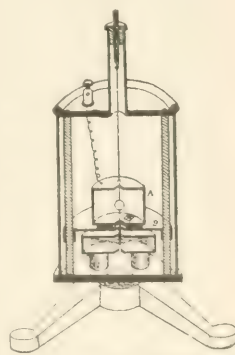


FIG. 3. IONIZATION CHAMBER QUADRANT ELECTROMETER

*Photographic Recording of Ballistic and Physical Phenomena with the Aid of the Direct-Current Quenched-Spark Gap.*—C. CRANZ AND B. GLATZEL.—It was first suggested by Mach that the photographic recording of phenomena which run their course in an extraordinarily short space of time—for instance, the motion of a projectile or the explosive effect of some substance—could be effected

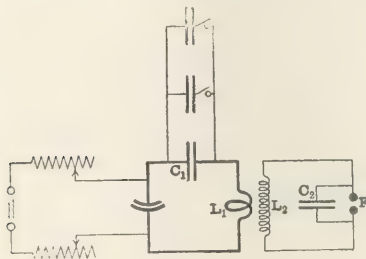


FIG. 4—CIRCUIT DIAGRAM

by means of the momentary illumination obtained from an electric spark. The authors describe the work done by others along this line. In their own arrangement, in order to produce the sparks, high-frequency oscillations were set up by a "quenched-spark" gap and oscillatory circuit connected to direct-current supply mains. Fig. 4 shows the scheme of connections.  $C_1$  is a capacity, consisting of a mica condenser variable from 25,000 to 600,000 cm. The self-induction  $L_1$  is chosen very small, in order to obtain as pure an aperiodic impact in the primary circuit as is possible. For the gap a Scheller alcohol spark-gap was used. The secondary circuit, consisting of the self-induction  $L_2$  and the small capacity  $C_2$  (1800 cm), is coupled to the primary, and in order to obtain the closest possible coupling both primary and secondary inductances are made in the form of flat (pancake) spirals, laid directly the one over the other. The spark-gap  $F$  is placed in parallel with  $C_2$  and serves for illuminating (as can be seen from the optical arrangement shown in Fig. 5), being placed near a concave mirror of short focus. This mirror casts upon the objective  $O$  a picture of the gap, which in turn records upon a rotating film the phenomena that are visible at the point  $P$ . The film is laid upon a drum, having a circumference of 89 cm and which could be driven at a maximum speed of 9000 revolutions per second. The best electrical connections to be given to the circuit are discussed and photographs are reproduced showing experimental results in photographing shots from a pistol. The photograph shows clearly that with steel-coated bullets the sealing of the rifled barrel by the bullet is by no means complete, but that as a result of the high pressure some of the powder gases pass between the bullet and the bar-

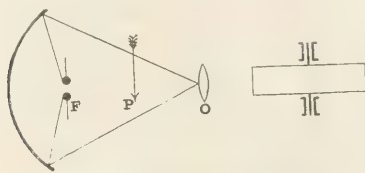


FIG. 5—OPTICAL ARRANGEMENT

rel and in consequence leave the barrel earlier than the bullet. Only after a certain interval does the bullet follow, after which come the powder gases. At the same time, the records show quite well the different velocities or propagation possessed by the gases and the bullet.—*London Electrician*, Feb. 28, 1913.

*Comparing Nearly Equal Low Resistances.*—S. W. MEY-

ER. An illustrated account of an investigation carried out in the (British) National Physical Laboratory on a simple Kelvin double bridge for comparing two nearly equal low resistances. The engineering standards committee's specification for ammeters and voltmeters specifies that the shunts to be used with first-grade moving coil ammeters should be adjusted to give a drop, at their maximum current, of 0.075 volt within limits of  $\pm 1$  per cent. A description is given of a simple form of Kelvin bridge which was designed for the purpose of testing ammeter shunts or other resistors, the resistances of which are set nearly to a given value and which do not require to be determined to a very high degree of accuracy. It consists (see Fig. 6) of two ratio arms,  $P = 99.5$  ohms, and  $Q$ , the resistance of which can be set by means of plugs to 98.5, 99.5 or 100.5 ohms, the arms being joined by means of a slide wire having a resistance of 1 ohm. The arms  $p$  and  $q$ , used to bridge over the connecting piece between the low-resistance resistors  $R$  and  $X$ , are of a similar resistance material. The coils are of manganin wire. When comparing two nearly equal resistances the arms  $Q$  and  $q$  are set by the plugs to be 99.5 ohms each. Thus, when the slider is at  $O$  (in the center of the scale) the arms  $P$ ,  $p$  and  $Q$ ,  $q$  are exactly 100 ohms each, a movement of the slider from the center to either end of the wires representing a difference

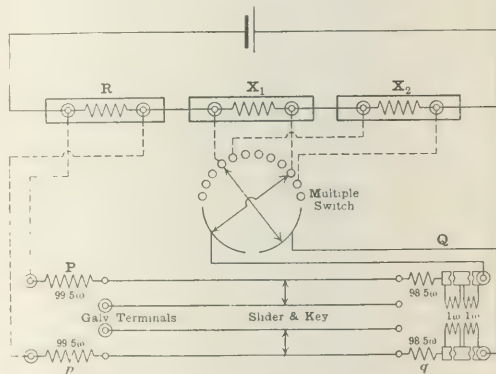


FIG. 6—BRIDGE FOR COMPARING LOW RESISTANCES

of 1 per cent between the resistances of  $R$  and  $X$ . Should the resistance  $X$  prove to be more than 1 per cent either high or low, a further 1 per cent in either direction can be added by changing the ratio  $Q$ ,  $q$  to 98.5 or 100.5, as may be necessary. The multiple switch shown in the diagram is arranged so that six shunts can be tested at the same time. The limit of error aimed at in designing the bridge was 0.1 per cent. When six shunts are connected for test at the same time, the error with the bridge coils adjusted to be equal to within 1 part in 10,000 does not exceed this amount. It is possible, however, to work to a considerably higher degree of accuracy if only one or two shunts are under test at the same time. The resistance of the leads connecting the resistors  $X$  to the bridge is immaterial so long as they are equal to those used for connecting the standard. The standard resistances for use with the bridge are made to cover all the ranges given in the specification and are constructed of a number of manganin wires.—*London Electrician*, Feb. 28, 1913.

*Determining the Period of Electrical Oscillations.*—J. C. HUBBARD.—An abstract of an American Physical Society paper. The method consists in starting a train of damped oscillations and in determining the times between successive nodes. Let the inductor  $L$  (see Fig. 7) and the capacity  $K$  be connected in parallel, and let a battery  $B$  be connected in series with the inductor and resistor  $R$ . A lever  $I$  is in



the circuit and when struck by a falling weight breaks the circuit and starts a series of damped oscillations. The drop chronograph of Webster has been used as the circuit-breaker. A carriage moved vertically by a micrometer screw carries levers 2 and 3 and their stops shown in the figure. The falling weight, after striking 1, descends through a measured distance and strikes 2. Lever 2 turns on its axis in the center and lifts lever 3 from the screw which is connected to the quadrant electrometer. The switch at *a* was opened in advance, leaving the quadrants of the electrometer free and at zero potential. It will be seen that connection has been established between the electrometer and the oscillating system only during the instant that lever 2 was lifting lever 3 from the supporting screw, for no sooner has lever 3 moved than connection with the electrometer has been broken. Thus, the latter has been connected across the condenser terminals for a very brief instant and at a time after the starting of the train of oscillations which is controlled by the vertical height of lever 1 above lever 2. If the electrometer reading is zero, connection has been made at a node of potential. The method of procedure consists in finding the first five nodes, then in calculating approximately and ascertaining exactly by trial the positions of the tenth, fifteenth, twentieth, twenty-fifth, fiftieth and one hundredth. Or, if the period is very large, sufficient accuracy may be reached with the determination of as few as five consecutive nodes. The height of fall of the projectile may vary from a few centimeters to 100 cm, depending upon the frequency to be measured. The greater the height the greater the distance between successive nodes and the greater the accuracy with which they are determined.—*Phys. Rev.*, March, 1913.

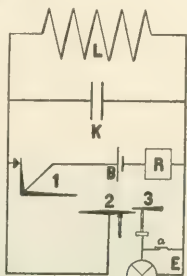


FIG. 7.—DEVICE FOR DETERMINING PERIOD OF OSCILLATIONS

found books by Sumec, Rudenberg and Emde. It is with great pleasure that we comment on this admirable catalog of this great publishing house, which has aided men of science so much in the printing and publishing of their writings.

STABILITÄT, LABILITÄT UND EINTELLUNGEN IN DER ELEKTRO-TECHNIK. By Dr. Hans Busch. Leipzig: S. Hirzel. 246 pages, 69 illus. Price, 7 marks.

It seems to us as if it were hardly possible to select a more attractive field than that which the author has chosen, and we are a little disappointed that he has not treated the subject entirely in accordance with our expectations. A subject so replete with interest and so full of applications as that of electric oscillations and their stability must be treated with extraordinary skill and ingenuity in order to satisfy the student. The great tendency to generalization so characteristic of the average mathematical treatment of any subject is really a grave fault. Even if numerous examples are given, as the author of this book has done, yet too general a treatment has always the fault that it is difficult to follow it and to enter into a thorough understanding of the phenomena.

ELEMENTARY PRINCIPLES OF ELECTRICITY AND MAGNETISM FOR STUDENTS IN ENGINEERING. By Robert Harbison Hough, Ph. D., and Walter Martinus Boehm, Ph. D. New York: The Macmillan Company. 234 pages. Price, \$1.10.

This book is an interesting text with numerous good examples. It is written clearly and comprehensively, and, while the methods chosen are rather formal and indirect, it is not altogether objectionable for the student to reach a solution from different angles. We prefer to follow in the treatment of electrodynamics the principles of Faraday and Maxwell, which are so admirably presented in a thorough and comprehensive form by J. J. Thomson, and, to cite an instance, it is hard for us to commend the use of the law of Biot-Savart. The writing of a textbook is more difficult than the writing of any other treatise, and in reviewing it one is too apt to draw comparisons with J. J. Thomson's master treatise. The book may be commended.

## Book Reviews

AMERICAN CIVIL ENGINEERS' POCKET BOOK. Second edition, enlarged. New York: John Wiley & Sons. 1474 pages, over 1000 illus.

This book, published under the editorship of Mr. Mansfield Merriman and other eminent engineers, is a useful compilation. The electrical engineer will be interested particularly in the chapter on electric railway construction and numerous other sections which must interest him because of the intimate alliance between the fields of the electrical and the civil engineer.

VERLAGS KATALOG AUF DEM GEBIETE DER MATHEMATIK NATURWISSENSCHAFTEN TECHNIK NEBST GRENZWISSENSCHAFTEN. Leipzig and Berlin: B. G. Teubner. Frontispiece engraving of Leonhard Euler. 232 pages.

The catalog of publications of this great publishing house is a most interesting volume, replete with the works of the great mathematicians and physicists. One must marvel in these modern days at the altruism of a firm which publishes works the circulation of which is so small that a heavy loss must be incurred by the publishers. Besides the original works of great German scholars, there are translations from the English and French among which we may cite Lord Kelvin's "Baltimore Lectures on Light," Love's "Elasticity," Perry's "Applied Mechanics," Poincaré's "Mathematical Physics," and others too numerous to mention. In the field of electrical engineering there are to be

THE STOCK EXCHANGE FROM WITHIN. By William C. Van Antwerp. New York: Doubleday, Page & Company. 460 pages. Price, \$1.50.

All those who are interested in the affairs of commerce and industry of this country must recognize in the stock exchange a part of the mechanism of modern industry. It has long been understood that the function of the stock exchange, besides being a marketplace for the securities of the most important corporations of this country, consists in forecasting the future. There are no keener minds than the minds of the captains of industry whose capital is invested in the business of the country. These men are concerned, not with the past and the present, but with the business of the future, and their keen outlook upon coming events is invariably foreshadowed in the prices which are established on the stock exchange for the securities of big business corporations. Thus it has long since become an established fact that the barometric readings of the stock exchange are the weather forecasts of the business future. If there is a great fall in the prices of securities, it is sure that there will be a reduced volume of business; if there is a great rise in prices on the exchange, better business, or even a boom, is thereby foreshadowed. This it behooves every careful student of affairs to familiarize himself with this barometer of business, and he can find no more useful guide than this book, which is written with a remarkable frankness by a member of the stock exchange. All those who are interested in investments and in business enterprises of magnitude will find it useful and suggestive.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Conduit Fittings

The H. T. Paiste Company, Philadelphia, has recently made some changes in its line of pipe taps in order further to standardize these conduit fittings and to minimize the amount of stock required by dealers. As now arranged the smallest size of fittings and covers fits all  $\frac{1}{2}$ -in. and  $\frac{3}{4}$ -in. pipe taps; the second size fits all 1-in. and  $1\frac{1}{4}$ -in. taps and the third size all  $1\frac{1}{2}$ -in. and 2-in. taps.

These changes do not affect in any way the size and design of the opening in the  $\frac{1}{2}$ -in. and  $\frac{3}{4}$ -in. sizes and these still fit the standard receptacles and rosettes used in wooden-molding wiring.

### Two-Motor Equipment for Variable-Speed Printing Press

A fire recently destroyed the United States Express Company's power plant at Jersey City, which plant furnished direct current to about thirty motors ranging from 1 hp to 25 hp. An agreement was entered into with the local central-station company for emergency service by means of a motor-generator set, it being understood, however, that this service could be had for a short time only. The express company was thus confronted with the problem of either installing a new plant or utilizing the local power company's two-phase, 220-volt, 60-cycle, four-wire system. The latter course was decided upon, the building was wired and two-phase motors were ordered for the various machines.

In changing the motors a situation arose which caused considerable trouble. A rotary printing press was equipped



FIG. 1—GENERAL VIEW OF PRESS

with a 10-hp slip-ring induction motor operated through a drum-type controller. It was found that when the resistance of the controller was such as to give the motor the required starting torque it produced almost maximum printing speed of the press. On the other hand, if the resistance were increased to allow for the proper speed regulations of the press, the motor would not start, and conse-

quently it was necessary to give the press a "kick-off" in order to start it. For "inching" the press or setting the plates it was necessary to bar the press over by hand. This equipment was not satisfactory to the printers, and when

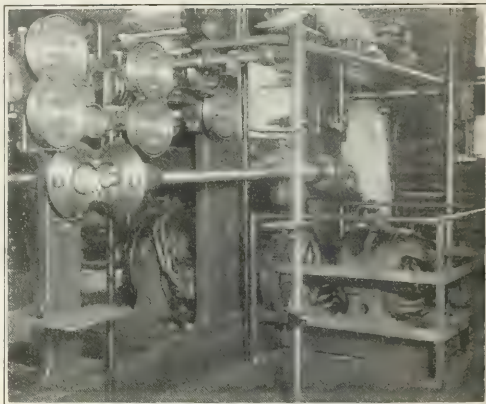


FIG. 2—VIEW SHOWING DRIVING MOTORS

a new press was subsequently ordered the specifications were drawn so as to eliminate this trouble.

In the new press the main driving shaft was to run at 20 r.p.m. for the threading-in speed and at an operating speed of from 120 r.p.m. to 220 r.p.m. in steps of not more than 20 r.p.m. The press was to be controlled from a number of stations, each station having start, stop and safe points, threading-in and operating speeds. The operating speed was to be controlled by a lever on the control panel so arranged that it could be locked at any operating speed.

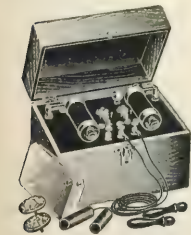
A system was devised and installed by the Monitor Controller Company, Baltimore, Md., using two Wagner motors for the purpose. A master controller mounted on the wall is controlled from any one of seven control stations installed about the press. These control stations are a combination lever and push button, the lever controlling the starting, stopping and safety points and the button governing the acceleration of the press. Raising the lever starts the small motor which operates the press at low speed. At this speed the press can be "teased" or "inched" along for any part of a revolution with perfect control and safety. Moving the lever in the down position stops the motor and brings into play a solenoid break which retards the press without jar or strain. The down position of the lever is also the safe point, and consequently it is necessary for the operator to move the lever from the stop or safety position up to neutral position before the press can be started from any other station. Pressing the button disconnects the small motor and connects the large motor in circuit. The motion of the press is then accelerated to the operating speed as set by a lever on the control panel. The rate at which the speeding up is accomplished is governed automatically by the controller which is so arranged that the acceleration is uniform no matter at which speed the regulating lever on the panel is set.



It is said that the new press can be plated in from one-half to one-third of the time taken with the old press and that only a single operator is required instead of three.

### Portable Medical Battery

In the small battery outfit, suitable for medical purposes and for massage treatments, manufactured by the Lindstrom, Smith Company, 218 South Wabash Avenue, Chicago, the energy is obtained from two ordinary dry cells through two coils which can be connected in various ways so as to give any current that may be desired for the purposes stated. One coil is provided with a very rapid interrupter, while the other coil is provided with an interrupter giving from 100 to 1000 interruptions per minute, the latter one being suitable for massage treatments. An arrangement is made for gradual increase of current



PORTABLE MEDICAL BATTERY

when this is desired. The connection of the cells is simple and replacement can be made by anyone.

### Pneumatic Conduit Threader

The pneumatic conduit threader is a device for threading wires into conduit with the aid of compressed air, by this means accomplishing easily in a few seconds the threading of long runs with several bends, etc., which would be difficult if not impossible by the ordinary fish-tape method. A hand pump and an air tank make up the equipment as shown in the illustration. From the tank extends a flexible tube for connection to the conduit. The string is introduced into this air line from a reel as shown, being hitched to a "traveler" made up of a series of washers loosely fitting the interior diameter of the pipe.



FIG. 1—PNEUMATIC CONDUIT THREADER

To thread a conduit the tank is first filled by means of the pump with air at 20 lb. pressure. Connection is then made by the conduit, and the traveler, drawing the spring, is forced through the tube by the air. This cord may be used directly for pulling in ordinary wires, or for heavy cables a heavier wire may be first drawn through.

As an example of the machine's operation it is reported that a 100-ft. length of 0.75-in. conduit containing five elbows and four offsets was threaded in three seconds, per-



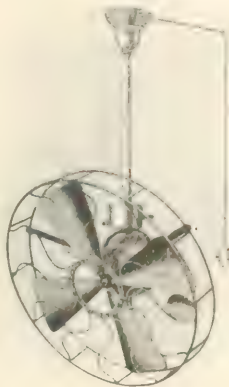
FIG. 2—TRAVELER PASSING THROUGH CONDUIT WITH STRING

forming a service that would otherwise have been almost impossible without tearing out the walls. The tank can be filled, it is said, by fifteen seconds' work. Complete, the tank, pump and hose weigh 40 lb. and may be readily moved from place to place. The device is made by the Pneumatic Conduit Threader Company, Inc., 12 North Eighth Street, Richmond, Va.

### Rotating Electric Fan

The rotating electric fan shown herewith is being placed on the market by the D. L. Bates & Brother Company, Dayton, Ohio. In this fan the motor is suspended in a hanging yoke which provides for the horizontal adjustment of

the fan. The yoke is suspended on a ball-bearing support and revolves in an oilless bearing. This bearing prevents oscillation of the motor and insures noiseless operation. The motor revolves about the supporting stem at the rate of 12 or 15 r.p.m. This rotating action provides an even distribution of the air and removes the objectionable air blast from the top of the head of the person who sits beneath the fan. The motor leads are conducted to the commutator or to the slip-



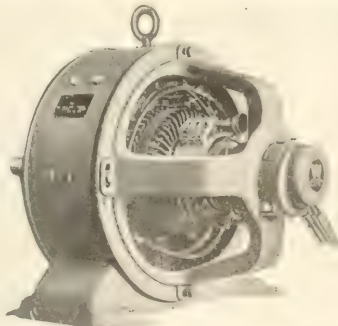
ROTATING FAN

rings through the supporting tube. The air blast itself is utilized to rotate the fan as it blows against the small sail shown in the illustration herewith. The motors are manufactured for use on both direct-current and alternating-current circuits. The direct-current fans are made with 16-in. or 20-in. blades, and those equipped with alternating-current motors carry 16-in. blades.

### Direct-Current Compound-Wound Motor

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a commutating-pole motor which is especially designed for driving bending rolls, raising the cross rails of planers and boring mills, moving the tailstocks of large lathes and similar service requiring motors with special torque characteristics.

Its special feature is a heavily compound-wound field,



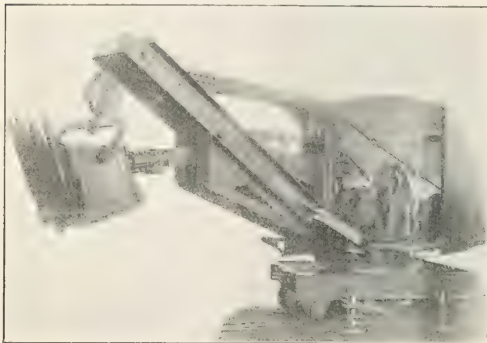
DIRECT-CURRENT COMPOUND WOUND MOTOR

most of the excitation being due to the series coils. The torque, therefore, increases rapidly as the current input increases, the characteristic that is necessary in starting a cross rail or taking a plate through bending rolls. The shunt-field winding limits the no-load speed to approximately twice the full-load speed, so that racing is impossible.



### Electrically Operated Shovel

The electric shovel is becoming more and more popular for use in places where energy is available because of its simplicity, reliability and economy of operation. The elimination of the boiler does away with considerable attendance and maintenance expense, and the ruggedness of the



ELECTRICALLY OPERATED EXCAVATOR

modern electric motor makes it well adapted for the rough work which a power installation is called upon to meet in service of this nature.

The shovel illustrated herewith, which is of a comparatively new type, is operated by a 35-hp Westinghouse induction motor and is designed for lifting 1 or 1 1/4 cu. yd. The motor runs continuously while the shovel is in use, the various motions of the shovel being controlled mechanically by means of levers placed within easy reach of the shovel operator.

The clearance height of the boom is 12 ft. from the rail. The clearance sweep of the boom is 18 ft. and that of the rear end 8 ft. The shovel has a horizontal crowd of 7 ft. Three trips a minute can be made by the shovel, but the average rate, owing to delays in waiting for cars, moving up the shovel, etc., is about one trip a minute. This shovel is made by the Thew Automatic Shovel Company, Lorain, Ohio.

### Electric Gear-Shifter for Automobile

Taking the place of the ordinary gear-shift hand lever on the S. G. V. gasoline automobiles exhibited at the recent Boston automobile show, the visitor's attention was directed to an electric gear-shifter in the form of a small circular dial on the steering wheel.

On this dial is a button for each of the four forward speeds, the reverse, and a neutral button. Pressure of a finger on the desired speed button is all that is required. When the change is to be made the clutch is disengaged with the customary foot pedal, and as it comes to the point of disengagement the electric circuit is completed and the gear change is instantly effected.

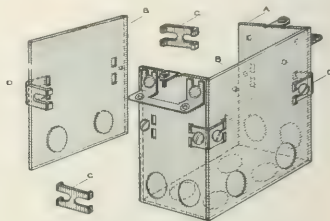
Gear box and shifter arms remain the same as in the hand power shift. A set of electric solenoids replaces the hand-operated lever, and when the electric circuit is completed through the disengagement of the clutch the current exerts a direct and instant pull of 150 lb. on the proper shifter arm, and the change of gears is then accomplished automatically.

Use of the electric gear-shifter leaves the operator with both hands free to drive. On account of its ease of operation, many women have expressed great interest in the device, which is the invention of Dr. Alfred Weiland, chief engineer for the S. G. V. Company at its Reading (Pa.)

plant. In fact, a gasoline car equipped with this gear-shifting attachment is declared to be "as simple to drive as an electric automobile."

### Sectional Switch Boxes

Sectional wall boxes which can be installed in single units or joined together in any number often prove of convenience, particularly in undertakings where it would be necessary to provide a large variety of sizes. The box shown herewith, which is made by the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., is



DETAILS OF SECTIONAL WALL BOX

furnished in two sizes, 3 in. deep and 2.5 in. deep. The latter has beveled corners and is particularly adapted for rewiring of old houses and cannot be used for rigid conduit work.

These boxes have reversible and sliding ears and can be adjusted to any thickness of plaster. They are finished with a coating of black insulating enamel, making them thoroughly rust-proof.

### Metal Meter Board

Wood has been for many years the standard material on which to mount meters, and naturally so, since wood molding was mainly used. Wood molding has gradually passed out of use, however, and May 31, 1913, is the last date on which its use in the city of New York will be permitted. When buildings were of wood it was considered consistent and good practice to incase wires in wood molding. As the wood-frame building gave way to the fireproof structures exposed molding gave way to concealed conduit, and mold-

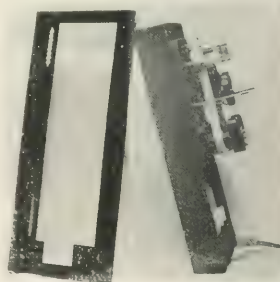


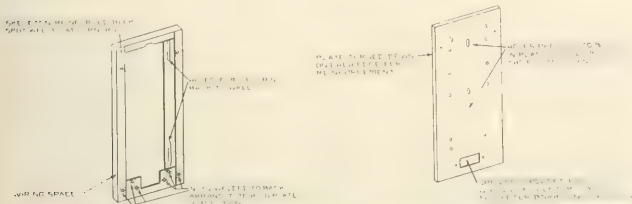
FIG. 1—METAL METER BOARD WITH METER

ing frames around the meter to metal frames, completely incasing the wires where the latter were not contained in conduit.

A metal meter board has recently been placed on the market by the Metropolitan Engineering Company, Brooklyn, N. Y. This board can be called universal as it will accommodate a large variety of types of meters and also

variously rated cut-outs. The board itself consists of a skeleton frame construction, giving the advantages of strength and light weight and providing ample wiring space behind the meter, with practically the same space available for wiring behind the board. One point taken advantage of in its design is the absolute tamper-proofing possible with

difference of which is to be recorded is applied to the interior of this tube through pipe 24 and the other pressure is applied to the exterior of this tube through pipe 25. The movement of the pressure tube will be in proportion to the difference between these two pressures, and this motion is transmitted to the recording pen arm 12 by means



FIGS. 2 AND 3—DETAILS OF METER BOARD

the metal board. Every screw and holding device the removal of which would make it possible to obtain un-metered energy and every wire entrance are under seal.

### Recording Differential Pressure Gages

The Bristol Company of Waterbury, Conn., has developed a line of recording differential pressure gages designed for use in connection with Venturi meters, Pitot tubes, orifices, combinations of orifices and Pitot tubes, etc., and thereby to record velocities and volumes of air, gas, steam, water and other liquids flowing through mains and pipes. These recorders may also be used to advantage for recording differences and varia-

tion of liquid level in steam boilers, pressure tanks, filter beds, process kettles, etc.

of shaft 26 through the long tubular sleeve 27. The capillary action of the oil or liquid between the sleeve and shaft makes this patented joint frictionless and pressure-tight.

In Fig. 4, 22 is the pressure-tight casing inclosing the diaphragm pressure tube 14. One pressure communicates with the interior and the other pressure with the exterior of this tube, and its motion is transmitted by means of the rotating shaft 20 through the sleeve 21 to the recording pen arm 12. The length of this sleeve is many times the diameter of the shaft passing through it, differentiating it from an ordinary bearing.

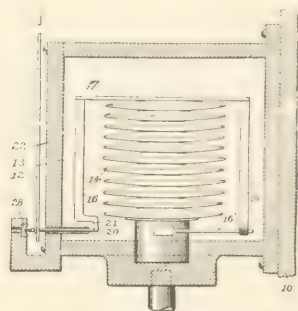
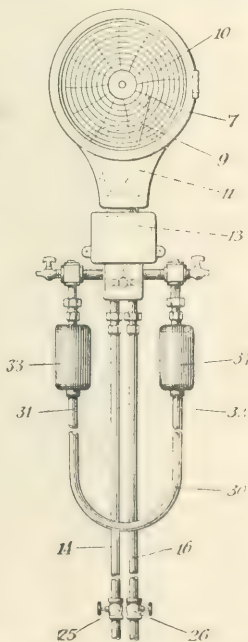
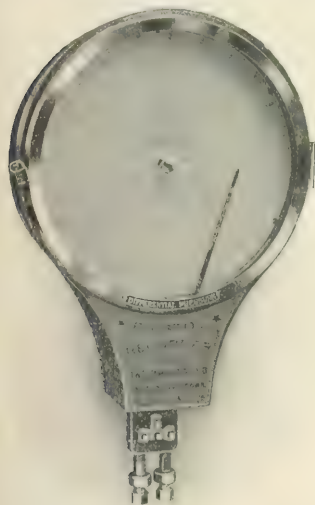
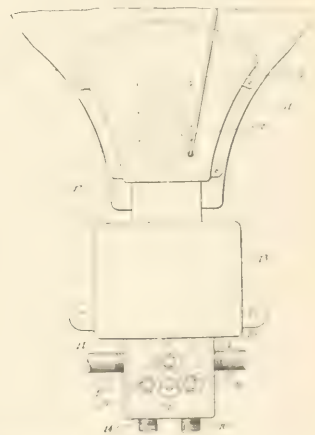


FIG. 4—INTERIOR OF DIAPHRAGM PRESSURE TUBE



FIGS. 1, 2 AND 3—EXTERIOR VIEW AND DETAILS OF RECORDING GAGE



tion of liquid level in steam boilers, pressure tanks, filter beds, process kettles, etc.

Fig. 1 shows the exterior of one type of these recorders. Figs. 3 and 4 show part of the interior construction of the spring-tube type differential recorder. Referring to Fig. 5, pressure tube 15 is of the hollow helical type and is inclosed in a heavy casing 22. One of the pressures the

This patented device permits of the recording of extremely small differences between the pressure existing inside and outside of the pressure tube respectively. It has been found that the simple frictionless sealing sleeve through which the pen-arm shaft passes does not produce appreciable resistance to the rotation of the shaft, and at the same time capillary attraction and adhesion prevent

the occurrence of leakage from the casing even at high pressures.

In Fig. 3 diaphragm tube 8 is shown in the pressure chamber of the casing 11 directly connected to one end of the rotating shaft passing through the pressure seal and having its other end directly connected to the recording pen arm 9.

This diagram also shows a set of interlocking valves 17, 18 and 23, which constitute a device for adapting recording differential pressure gages to practical operating conditions. Cross-valve 22 is shown in an open position connecting the two pressure pipes. Valves 17 and 18 in the pressure pipes are shown closed. Both of these valves 17 and 18 can be opened, allowing the static pressure from either pipe to be applied simultaneously to the inside and the outside of the pressure tube of actuating mechanism. The interlocking member 21 can then be turned through an angle of 90 deg., thus making it possible to close valve 22, which completes the connections so that the instrument will record the difference of the two pressures.

Fig. 2 shows a patented safety device consisting of a U-shaped tube 30 partly filled with a suitable liquid such as mercury or water, this tube having enlargements 33 and 34, each of sufficient volume to accommodate the quantity of liquid contained in the U-shaped tube. The length of the

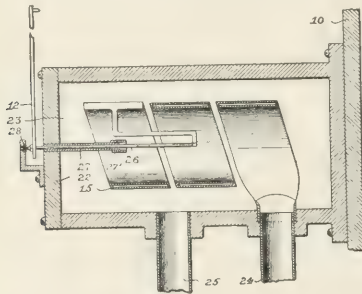


FIG. 5—INTERIOR OF HELICAL PRESSURE TUBE

tube varies with the range of the gage so that the greatest possible head of the liquid contained in the tube corresponds with the total range of differential pressure that the gage is designed to record. Should the full static pressure by accident be admitted to either side of the differential gage, the liquid contained in the safety U-tube would instantly be forced up into one of the enlargements, thus allowing the static pressure to be applied simultaneously to both inside and outside of the pressure tube and protecting it from being destroyed. These gages are built under patents recently issued to Prof. William H. Bristol, president of the Bristol Company.

## Electrical Exhibits at Boston Commercial Truck Show

The second annual exhibition of commercial motor vehicles was opened at the Mechanics' Building, Boston, Mass., on March 19, under the auspices of the Boston Commercial Motor Vehicle Association, continuing for one week. About 130 exhibitors were registered, including a number of builders of electric trucks and delivery wagons and electrical supply dealers.

The Eldridge Manufacturing Company, Boston, exhibited a new application of the couple-gear motor drive in a 2-ton front-wheel-drive dump cart designed to replace the single horse dump cart widely used in coal and ash handling. This equipment is driven by a motor in a single wheel at the front of the wagon, and it is steered and controlled by a

wheel located immediately above, the turning radius of the equipment being the wheelbase itself. The outfit is specially adapted to operation in narrow alleys and in places where a horse-drawn truck could not be manipulated and will ascend an 8 per cent grade with little difficulty. Another new equipment shown was a 5-ton bottom-gravity dumping wagon for contractors' service, with detachable battery box and two batteries, the hauling distance being from 40 to 50 miles per day with 5-ton loads. Other exhibits were a 5-ton front-drive motor truck for brewery service, a 5-ton coal truck representing the sixth order of a prominent dealer in Boston, a 5-ton truck for a fire-proofing firm and a four-wheel drive couple-gear tractor for lumber haulage. The company now has thirty-seven trucks of the electric type in the Greater Boston district in addition to those exhibited, and it is hauling about 1000 tons per day in this region, about half the traffic being coal haulage. Twenty-four of the trucks are owned by coal dealers, and it is said that these are transporting more coal than all the other gasoline and electric trucks of the district combined. The trucks shown are equipped with U. S. Light & Heating Company batteries.

The General Vehicle Company, Boston, exhibited a 5-ton chassis, a 1-ton industrial truck arranged for single-ended operation, a 2000-lb. emergency wagon for the Fall River Electric Light Company, a 2000-lb. delivery wagon for plumbing supply service and a 4000-lb. chassis with driving gear in operation. A new departure is shown in the display of a butcher's cart mounted on a 1000-lb. chassis and equipped with General Vehicle batteries for service in the Cape Ann district of Massachusetts. The outfit is capable of running 15 miles per hour and is said to be the first of its kind to displace the old-time horse delivery in rural butcher service in New England. The battery will be charged by the Gloucester (Mass.) Electric Light Company.

The General Motor Truck Company, Boston, showed a 1000-lb. chassis and a 2-ton electric car body.

The Atlantic Vehicle Company, New York, represented by Mr. A. E. Carpenter, Boston, exhibited a recently designed "long-distance" electric truck chassis for a 5-ton car. The designers made use of long Krupp spring suspension, the motor being placed lower than in other makes to give a lower center of gravity and the car being provided with unusually large driving wheels. The makers contend that increased mileage per charge results from these features, which tend to eliminate vibration and cut down friction.

The Waverley Company, Indianapolis, represented by the J. W. Bowman Company, Boston, exhibited a 3.5-ton truck chassis and a 1000-lb. delivery-wagon chassis, arranged for shaft drive. The company emphasized the recent purchase of its product at the beginning of service in the governmental parcel-post delivery, several machines of this make being in operation at Indianapolis.

The Buffalo Electric Vehicle Company, represented by the Dodge Motor Vehicle Company, Boston, showed a 2000-lb. delivery wagon equipped for operation with shaft drive.

Other exhibitors, mainly in the accessory field, were the Electric Storage Battery Company, Philadelphia; Edison Storage Battery Company, East Orange, N. J.; Diamond Rubber Company, Akron, Ohio; Joseph Dixon Crucible Company, Jersey City, N. J.; Gray & Davis, Inc., Boston, Mass.; Heinze Electric Company, Lowell, Mass.; Marburg Brothers, Inc., New York; Remy Electric Company, Anderson, Ind.; Spliford Electrical Company, Newark, N. J.; U. S. Light & Heating Company, New York, and the Willard Storage Battery Company, Cleveland, Ohio, the last-named house showing motor-cycle storage batteries for 2-volt or 6-volt service and standard cells of this make equipped with improved screw terminal posts and adjustable connections.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**150-Ton Raw-Water Ice Plant to Use Brooklyn Edison Service.**—Contracts for the erection of what will be one of the largest raw-water ice plants in the country, if not the largest, have been signed in Brooklyn, N. Y. The new plant, which is to have an initial rating of 150 tons, will be owned and operated by the Bay Ridge Ice Manufacturing Company, a new Brooklyn concern, whose personnel includes many men of long connection with the ice business of that city. The entire equipment is to be furnished by the Powmell Arctic Company, of Canton, Ohio, and the plant, which is to be motor-driven, will be furnished with electrical energy from the mains of the Edison Electric Illuminating Company of Brooklyn. Fifteen motors will be installed at the outset, as follows: One 300-hp motor for operating a 100-ton compressor; one of 150-hp rating for operating a 50-ton compressor; three 7½-hp motors for running brine agitators; one 20-hp motor which is to drive a water pump; three 5-hp motors for operating a brine pump; one 10-hp motor for driving an ammonia pump; three 5-hp motors for driving air pumps, and two 1-hp motors which will be used to operate electric hoists, making a total connected load of 527.5 hp. All of the motors will be furnished by the General Electric Company through the Powmell-Arctic Company. The latter, after installing the plant, will operate it for fifteen days and then turn it over to the owners, if satisfactory. According to Charles H. Stevens, manager of the motor-service department of the Edison Electric Illuminating Company of Brooklyn, that company will furnish 6600-volt, three-phase, 25-cycle energy for operating the ice plant. This energy will be stepped down by the consumer's own transformers to 440 volts for motor-service and 110 volts for lighting purposes. To insure certainty of operation, two separate feeders, either of which will be large enough to carry the load alone, will be run from the Bay Ridge station of the Edison company to the ice plant. These will be carried in a subway built specially for this installation. It is the intention of the promoters to double the capacity of the ice plant at the end of a year, and all the equipment which is to be installed and the dimensions of the building to be erected are being arranged with that end in view.

**Decatur (Ill.) Railroad Shops to Be Electrically Equipped.**—A contract was closed recently by the Decatur Railway & Light Company for furnishing electrical energy to the extent of 1300 kw to the Wabash Railroad shops at Decatur, Ill. The entire shops will be equipped with electric drive and will probably be in operation under the new equipment in June. Electricity will be transmitted across the town to the shops at 13,200 volts, 60 cycles, three phase, on overhead lines. This is rather unusual, as many municipalities will not grant a franchise for the transmission of such a high voltage on overhead lines in city streets. The transmission line will be carried on wooden poles ranging in height from 40 ft. to 60 ft. To furnish adequate means for taking care of the increasing motor-service business of the Decatur Railway & Light Company a new steam-driven 1200-kw generating unit will be installed soon, with the necessary boiler equipment and piping to take care of it. It has not been decided yet whether a reciprocating or turbine unit shall be selected.

**Electric Cooking at Home and Abroad.**—One branch of the electrical industry of the United States in which the export business plays a conspicuous part is the manufacture of electric cooking devices. Considerable apparatus of this description, such as electric stoves, coffee pots, toasters, disk heaters, water heaters and the like, is sent to foreign countries from the American republic. The over-sea colonies of Great Britain afford an important market for this class of appliances and South Africa and India are

important customers. The demand nearer home is greater in the western part of the United States and Canada than in the eastern portions of those countries. This is perhaps owing to the greater possibilities of electric cooking where cheap electricity is available, as from water-power developments. Where electricity can be sold to the domestic consumer at 3 cents or 4 cents per kw-hr. electric cooking, it is asserted with confidence, can be made to give the gas-stove man a "run for his money."

**Generating Station at Venice, Ill., to Have Rating of 18,000 Hp.**—The 5000-kw turbo-generator which is being installed in the generating station of the Madison County Light & Power Company at Venice, Ill., will increase to 18,000 hp the normal rating of the station when it is put in operation in a few weeks. Electricity generated at this station is supplied to the local railway operating between St. Louis, Granite City and Madison, as well as to the southern division of the Illinois Traction System. It is also used for commercial light and power in Madison, Venice, Granite City, Alton and Edwardsville. The increased demand for electric-motor service is due to the natural growth of industries in this section of Illinois near St. Louis.

**More Boilers for Merchants' Heat & Light Plant, Indianapolis.**—With the continual growth in the demand for its heating and electric service, the Merchants' Heat & Light Company, of Indianapolis, which is a subsidiary of the American Public Utilities Company, has found it necessary to increase its station equipment. At the present time the boiler room of the plant on West Washington Avenue contains sixteen 510-hp Stirling boilers. These are equipped with Roney automatic stokers. There are also overhead coal bins, of concrete, holding 1300 tons. The boiler room is now being extended for housing eight more boilers, which are to be identical with the present equipment and are to be ready for service in September.

**Flaming-Arc Lamps for New York's Municipal Offices Building.**—The H. M. Hirschberg Company, 39 East Twentieth Street, New York, agent for Plania electrodes and Siemens flaming-arc lamps, is installing twenty-four—these lamps of the nineteen-hour Alba type at the new Municipal Offices Building, New York City, now nearing completion. The forty-two flaming-arc lamps for the armory of the Twenty-second Regiment, N. G. N. Y., and the thirty-eight for the armory of the Seventh Regiment, the order for which was referred to in the issue for Dec. 14, 1912, have been installed.

**Wire Company Opens More Canadian Offices.**—The Imperial Wire & Cable Company, Ltd., Montreal, Que., is opening a branch office in Toronto, Ont. A. J. Soper, formerly connected with the sales department in Montreal, has been appointed district sales manager for Ontario. The same company is also opening an office in Winnipeg, Minn. W. F. Uhl, formerly in the sales department of the Northern Electric & Manufacturing Company, Winnipeg, has been appointed district sales manager for Manitoba, Saskatchewan and Ontario as far east as Port Arthur.

**Water-Power for Maine Paper Mill.**—A hydroelectric station is being erected at Dundee Falls on the Presumpscott River, Maine, by the S. D. Warren Company, paper manufacturer. Three 4500-hp S. Morgan Smith water wheels, each direct-connected to an 800-kw General Electric generator, will be installed.

**American Gas & Electric Acquires Ohio Properties.**—Controlling interest in the Peoples Electric Light & Power Company, of Shawnee, the Electric Company of Coshoctonville, and the New Lexington Electric Light Company, New Lexington, all of Ohio, has been acquired by the American Gas & Electric Company.

**Florida Public Utility Merger Nearing Completion.**—As was stated in the issue for March 15, the Southern Utilities Company is being organized to take over and operate a number of water, ice-making and electric-service properties in Florida towns. Negotiations through which about thirty properties in fifteen towns will be consolidated are going forward rapidly, and it is expected that all details for the merger will be completed at a very early date. Among those interested in the plan are J. G. White, George D. Baker, J. A. Clark, John A. Griswold, Marion McMillin and others, of New York, and Frank Battles, with associates, of Philadelphia. Enlargements and improvements are to be made and estimates already prepared call for an expenditure of \$300,000 for this purpose. The financing for the project is being arranged by the Engineering Securities Corporation, 43 Exchange Place, New York, of which J. G. White is president. H. C. Adams, formerly of West Palm Beach, is to be general manager of the consolidated companies. The Florida properties to be taken over include the following: Arcadia, electric-light, power and ice plants; Bradentown (including Palmetto and Manatee), electric-light and power plants; Fernandina, ice plant; Fort Lauderdale, electric-light, power and ice plants; Fort Myers, electric-light, power and ice plants; Lake City, ice plant; Live Oak, electric-light, power and ice plants; Miami, ice plants; Palatka, ice plants; Pensacola, ice plants; Punta Gorda, ice plant; St. Augustine, ice plant and steam laundry; Sanford, electric-light, power, gas, ice and water plants; Tarpon Springs, electric-light, power and ice plants, and West Palm Beach, electric-light, power and ice plants. Properties in other states may be taken over by the new company.

**New Kansas City Grain Elevator to Be Electrically Operated.**—Electric drive will be used throughout in the new 1,000,000-bushel addition to the grain elevator of the Chicago, Rock Island & Pacific Railway Company in Kansas City, Kan. Belt conveyors, elevator legs, grain shovels, car puller, cleaning machines, etc., will be driven by about twenty 440-volt, 60-cycle, three-phase induction motors ranging in size from 5 hp to 75 hp. The cleaning machines will be group-driven, but in the case of the other machinery individual belt drive will be used. Energy will be supplied by a 360-kw generator in a power house to be built on the premises. The old elevator is steam-driven, and the reciprocating engine will be used to drive the generator in the new power house. The electrical machinery will be mainly supplied by the General Electric Company. Work is under way for the new elevator, which was designed and is being built by the Macdonald Engineering Company of Chicago, the sub-contractor for the electrical work being the Freeman-Sweet Company of Chicago.

**Changes in Pennsylvania Companies.**—At a meeting of the directors of the Lehigh Valley Transit Company on March 20 various electric light and power companies controlled by that corporation were merged into a new company, to be known as the Lehigh Valley Light & Power Company, with a capital of \$1,000,000. The constituent companies merged are the Allentown Electric Light & Power Company, the Halcyon Electric Light & Power Company, of South Bethlehem, and the Whitehall, Emaus, Slatington, Hanover, South Allentown, Salisbury, Fountain Hill, Northampton Heights and Sancon companies. The reason for the consolidation was facilitation of operation. It was announced that the surplus of the Lehigh Valley Transit Company for February was \$11,000 and for the past three months \$54,700, in each case a gain of 50 per cent over the same period last year.

**Allis-Chalmers Assessments.**—The reorganization committee of the Allis-Chalmers Company has given notice that the properties of the company having been purchased on behalf of the committee and the sale having been confirmed by the courts, the Allis-Chalmers Manufacturing Company, to which reference appeared in these columns last week, will take over the properties and begin operation at an early date. Notice has also been given by the committee to holders of certificates of deposit for the preferred and common stock that it has called for the payment of the balance due on the assessments levied under the reorganization plan. On the preferred stock \$4 a share is payable on or before April 24 and the same amount is payable on or before May

15. Two payments, each of \$2 per share, are payable on each of these dates on the common stock.

**Frederick (Md.) Utilities Merged.**—Stockholders of the Frederick Railroad Company, Frederick Gas & Electric Company, Myersville & Catocin Railway Company, Hagerstown Railway Company, Hagerstown & Boonsboro Railway Company, Hagerstown & Myersville Railway Company, Hagerstown & Northern Railroad Company and the Frederick & Hagerstown Power Company have approved a merger of these companies, and their action has been ratified by the directors. The consolidation will be known as the Hagerstown & Frederick Railroad Company. It will have a capital of \$3,000,000, of which \$2,000,000 is common and \$1,000,000 is preferred stock. Emory L. Coblenz is its president.

**Plan Expenditure for Canadian Telephone Extensions.**—The city of Edmonton, Alberta, will spend about \$1,000,000 during 1913 on extensions on its telephone system, the greater part of which will be upon cable work. It is the intention of this municipal department to install a lot of underground conduit both in South Edmonton and North Edmonton, and there will also be considerable underground cable and aerial cable work. Very little open wire construction is used except in the very sparsely settled districts. Last year this department built two new branch exchanges, giving it four exchanges in all. W. R. Griffith is superintendent of the Edmonton telephone department.

**One Hundred and Ten Thousand-Volt Transmission for Tennessee.**—It has been announced at Chattanooga, Tenn., that upon the completion of the proposed merger of public utilities at Louisville, Ky., by H. M. Byllesby & Company, of Chicago, a 110,000-volt transmission line between Louisville and Nashville, Tenn., will be built. After passing Nashville the line will terminate at the Ocoee River plant of the Tennessee Railway, Light & Power Company. The preliminary plans provide that the line shall traverse all the principal cities on the Louisville & Nashville Railroad between Louisville and Nashville. A future line is under consideration for Clarksville, Tenn.

**Great Western Power to Spend \$4,000,000 on Improvements.**—The Great Western Power Company has been authorized by the California Railroad Commission to issue \$4,411,000 bonds, the proceeds of which are to be used for improvements and extensions in part as follows: New distribution lines, \$709,195; transmission lines, \$362,602; extension of power house, \$639,627; completion of Big Meadows dam, \$1,607,635; additional land, \$200,000; substations, \$66,900; and other extensions, \$79,200. The balance will be used for general improvements on the system.

**Storage-Battery Equipment to Replace New York's Horse-Car Line.**—The Belt Line Railroad, of New York, formerly the Central Park, North & East River Railroad, which was recently sold to the Third Avenue system, has submitted to the New York Public Service Commission for the First District plans for substituting storage-battery cars for the horse cars now operated on its lines on the west and east sides of the city south of Fifty-ninth Street.

**Electrical Sign Manufacturer Doing Record Business.**—Norman B. Hickox, treasurer and manager of the Greenwood Advertising Company, Knoxville, Tenn., manufacturer of electric signs, said this week that conditions in the sign trade at this time are excellent. "Our business," he said, "is three times better than it ever has been before at this time of the year, and all the prospects point to a record-breaking business in 1913."

**Electrical Energy for the Philippine Islands.**—According to newspaper reports, a number of native capitalists in the Philippine Islands are financing a plan through which electric service for industrial and domestic purposes will be installed in all of the towns of Albay Province, P. I. Negotiations for obtaining a franchise from the government and for purchase of all the station and line equipment needed are said to be in progress.

**San Antonio (Tex.) Companies to Make Improvements.**—The San Antonio Traction Company and the San Antonio Gas & Electric Company are planning to spend \$300,000 during the present year on improvements to their systems. In addition to improvements to the electric service, expenditures will be made for extension of gas mains and for cars.



**Western Electric's Net Earnings Increased Over \$1,000,000 Last Year.**—The Western Electric Company has issued its report for the year ended Dec. 31, 1912. As stated in these columns Jan. 8, the gross sales in 1912 were in excess of \$71,000,000, the actual figure being \$71,727,329. This compares with \$66,211,795 in the preceding year. The surplus after deduction of manufacturing costs and other expenses was \$4,853,265, which compared with \$3,280,292 in 1911, and is equivalent to 32.36 per cent on the \$15,000,000 capital stock, against 21.87 per cent in the previous year. The surplus for the year was \$1,067,410, as compared with \$890,292 for the year ended Dec. 31, 1911. Discussing the report, H. B. Thayer, the president, said in part: "The sales to the companies of the Bell telephone system did not differ materially from those of 1911, the increase being in sales to other domestic customers and to foreign customers. There has been no marked change in conditions affecting our business and the increased sales may be therefore attributed directly to the increased efficiency of the company's personnel and methods. Our products are distributed through twenty-eight houses located in the principal cities of the United States and thirty-seven houses located in foreign countries. We now have 32,000 customers on our books, of which about 8000 are telephone companies and governmental telephone departments. From these customers we received 932,182 orders during 1912 as compared with 881,331 for 1911, the average value of an order for 1912 being \$79, as compared with \$77 for 1911. During the past year additions to the factory plant have been authorized at Antwerp and London, and additional buildings providing 186,000 sq. ft. of floor space are in process of erection at Hawthorne."

**Henry L. Doherty & Company Buy North Carolina Property.**—The Durham Traction Company, which provides the street-railway and electric-lighting service in Durham, N. C., and manufactures ice, was taken over recently by Henry L. Doherty & Company, New York. A new company, the Durham Light & Traction Company, with a capital stock of \$1,000,000, has been organized by the purchasers to succeed the Durham Traction Company. When all details are completed the newly organized company will be taken over by the Consolidated Cities Light, Power & Traction Company, which was organized by the Doherty interests some time ago. No changes are contemplated at this time in the personnel of the Durham company and no expenditures are to be made upon improvements or changes in the system. A new business department, however, will be established. Data on the ice-plant appear on page 685.

**Farmers and Merchants' Telephone & Electric Company Formed.**—Stockholders of the Farmers & Merchants' Telephone Company, which controls the telephone service in Caroline, Talbot and Queen Anne Counties, Maryland, and of the Peninsular Light & Power Company, which supplies the electric service in Denton, Greensboro and Ridgely, in the same State, have organized a new corporation to take over both of these concerns. The new corporation is known as the Farmers & Merchants' Telephone & Electric Company. H. M. Thompson, of Hillsboro, manager of the former telephone company, has been elected president of the new company and Rev. G. S. Rairigh, who was president of the old telephone company, has been made vice-president. The capitalization of the Farmers & Merchants' Telephone & Electric Company is \$175,000.

**Electric Storage Battery Company's Annual Report.**—The annual report of the Electric Storage Battery Company for the year ended Dec. 31, 1912, shows gross sales of \$1,536,190, which compares with \$1,479,453 in 1911. Net earnings were \$1,023,825 as against \$1,026,747 in the preceding year. The total net earnings were \$1,125,279, which is equivalent to 6.25 per cent on \$18,000,000 capital stock and compares with \$1,263,608, or 7.02 per cent on the same amount of stock in 1911. Dividends were \$699,004, leaving a surplus of \$175,315, which compares with \$613,644 in 1911. After adjustments, the total surplus stood at \$2,855,525 as of Dec. 31, 1912, comparing with \$3,318,080 at the close of 1911. The balance sheet as of Dec. 31, 1912, shows assets and liabilities of \$21,872,593. Of the latter common stock amounts to \$17,825,000 and preferred stock to \$175,000.

**Consolidated Gas, Electric Light & Power Debenture Stock.**—Stockholders of the Consolidated Gas, Electric Light & Power Company of Baltimore have received notices

of the special meeting of the company which is to be held on April 8 for the purpose of authorizing an issue of debenture stock in connection with new financing which the corporation has been contemplating for months. James E. Aldred, president of the company, is now in Europe arranging for the sale of such stock and, notwithstanding the unfavorable market conditions now prevailing abroad, it is stated that the present financing plan of the company will be carried out at this time. At the time Mr. Aldred went abroad it was intimated that the amount of debenture stock to be sold would be between \$8,000,000 and \$10,000,000.

**Two Southern Utility Companies Sold.**—Through an agreement which has been filed with the Maryland Public Service Commission by Victor G. Bloede, representing his stock holdings and those of associates, the two Patapsco Electric & Manufacturing companies, one of which is a Maryland corporation and the other a Delaware corporation, have been sold to the Consolidated Gas, Electric Light & Power Company, of Baltimore. The agreement, if approved by the commission, will be effective as of May 1, 1913, on which day the directors and officers of the Patapsco companies will resign. These two companies own property and franchises near Catonsville, Md., and have water-power rights on the Patapsco River.

**Indiana Company Building New Station.**—Work is going forward on a new station for the Northern Indiana Gas & Electric Company, Hammond, Ind. The new station has been found necessary to meet the great increase that has taken place in the demand for electrical energy in the company's territory. Two units of about 5,000 kw each are to be installed at the outset.

**Canadian General Electric Made Large Gains in 1912.**—The annual report of the Canadian General Electric Company for the year ended Dec. 31, 1912, shows net profits of \$1,396,483 as compared with \$889,745 in 1911, a gain of \$506,738, or more than 56 per cent.

**Missouri Utility Sold.**—The Poplar Bluff (Mo.) Light & Power Company, owned by the Light & Development Company of St. Louis, has been transferred to the Missouri Public Utilities Company, of St. Louis.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	Mar. 19	Mar. 20
Allis-Chalmers, t.r., 3d pd.	\$15,501,800			34	34*
Allis-Chal., pf., t.r., 3d pd.	14,115,500			118	118
Amalgamated Copper	15,887,900	14	Q	68 1/2	71 1/2
American Tel. & Tel.	344,096,000	2	Q	51	51
Electric Storage Battery, c.	16,074,425	2	Q	51	51
General Electric	101,254,100	2	Q	136	137
Mackay Cos., c.	41,380,400	14	Q	81*	81*
Mackay Cos., pf.	50,000,000	1	Q	67 1/2*	67 1/2*
Western Union Tel.	99,116,000	4	Q	69 1/2	69 1/2
Westinghouse E. & M., c.	33,863,450	1	Q	60	60 1/2
Westinghouse E. & M., pf.	3,998,700	11	Q	117	117*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

	March 18		March 22	
	1911	Asked	1912	Asked
Copper	14.00	14.75	14.00	14.75
Standard spot	14.00	14.75	14.00	14.75
London, standard, spot	64	64	64	64
Prime lake	14.85	14.95	14.85	14.95
Electrolytic	14.85	14.95	14.85	14.95
Casting	14.85	14.95	14.85	14.95
Copper wire, base	16.00	16.25	16.00	16.25
Lead	4.35	4.35	4.35	4.35
Nickel	40.00	45.00	40.00	45.00
Sheet zinc, f.o.b. smelter	8.25	8.25	8.25	8.25
Spelter, spot	6.10	6.20	6.10	6.20
Tim. spot	46.50	46.50	46.50	46.50
Aluminum				
Prompt delivery	26.75	26.75	26.75	26.75
Future	26.75	26.75	26.75	26.75
OLD METALS				
Heavy brass	9.00	9.00	9.00	9.00
Brass, heavy	7.00	7.00	7.00	7.00
Brass, light	7.00	7.00	7.00	7.00
Lead, heavy	4.15	4.15	4.15	4.15
Zinc, sheet	5.25	5.25	5.25	5.25

## COPPER EXPORTS IN MARCH

Total tons to March 22, 1913, 34,116



## Personal

**Mr. J. F. L. Clock** has succeeded **Mr. T. G. Lomax** as manager of the Portales (N. M.) municipal electric-lighting plant.

**Mr. A. H. R. Jackson** is manager of the Jefferson City (Mo.) Light, Heat & Power Company, succeeding **Mr. P. A. Bertrand**.

**Mr. Walter C. Duncan** has succeeded **Mr. R. J. Irvine** as manager of the Moberly Light & Power Company, of Moberly, Mo.

**Mr. E. H. Caller** has been made superintendent of the lighting department of the Missoula Light & Water Company, Missoula, Mont.

**Mr. E. A. Theile** has been appointed contract agent for the Roswell Gas & Electric Company, Roswell, N. M., succeeding **Mr. D. B. Phillips**.

**Mr. D. F. Foote** is the successor to **Mr. B. F. Proctor** as local manager of the Missouri Valley Light & Power Company, Eldorado Springs, Mo.

**Mr. M. R. Buchanan** is the new president and general manager of the Silver City (N. M.) Power Company, having succeeded **Mr. J. B. Downey**.

**Mr. Clay Moneyhan** has been appointed superintendent of the municipal electric-light plant at Augusta, Ky., succeeding **Mr. Jacob B. Walker**, resigned.

**Mr. H. L. Bailey**, formerly superintendent and chief engineer of the Kettle River Power Company, Sandstone, Minn., has been appointed manager of the plant.

**Mr. G. M. Schmick** has been appointed manager and contract agent of the American Light & Power Company, Union, Mo. **Mr. A. E. Reinhard** was the former manager.

**Mr. Charles Guckel** has been appointed general manager of the Springfield Gas & Electric Company, Springfield, Mo., which is controlled by the Federal Light & Traction Company.

**Mr. E. M. Cutting** has been appointed manager of the Edison Storage Battery Supply Company in the California district and will have his headquarters at 818 Mission Street, San Francisco.

**Mr. William S. Kuhn**, president of the West Penn Traction & Lighting Company since its organization, has been elected president of the First-Second National Bank of Pittsburgh, Pa.

**Mr. Everett Morse**, president of the Simplex Wire & Cable Company of Boston, Mass., has been elected a life member of the corporation of the Massachusetts Institute of Technology.

**Mr. Oscar Sorensen** has been appointed superintendent of the Cass Water, Light & Power Company, of Cass Lake, Minn., succeeding **Mr. H. Hartley**, who retains the secretaryship of the company.

**Mr. C. Edmiston** has been appointed manager of the new-business department of the Iowa Railway & Light Company at Marshalltown, Iowa. **Mr. Edmiston** was formerly superintendent and contract agent for the Quincy (Ill.) Gas, Electric & Heating Company.

**Mr. F. H. Eddy**, formerly vice-president of the Farmington Electric Light & Power Company, Farmington, Minn., has added the duties of contract agent and superintendent to those of manager and engineer, which he previously held as an officer of the company.

**Mr. E. W. Cabaniss** has been appointed secretary of the Macon Railway & Light Company, Macon, Ga. For the last five years **Mr. Cabaniss** has been connected with the Central Georgia Power Company, and for the last two years he has been assistant secretary of that company.

**Col. D. C. Jackling** has been elected president of the Utah Power & Light Company of Salt Lake City, which recently purchased the Telluride Power Company, the Utah-Idaho Sugar Company's Bear River system and other plants. **Colonel Jackling** has been active in the affairs of the new company since its organization.

**Mr. Horace H. Esselstyn**, engineer for Westinghouse, Church, Kerr & Company at Detroit, Mich., has resigned after twelve years' service with that company to become

construction engineer with the Detroit Edison Company. **Mr. Esselstyn** has been stationed at Detroit during the past two years while extending the Delray station, installing the large boilers, etc.

**Mr. Samuel B. Thompson** has resigned as mechanical superintendent of the British Columbia Electric Railway, Ltd., Vancouver, B. C., and has become associated with **Mr. James A. Roosevelt**, formerly of the Third Avenue Railway, New York, N. Y., under the firm name of Roosevelt & Thompson, to investigate and report on electric railway and light properties. **Mr. Thompson** was formerly with the Consolidated Railway, Baltimore, Md., Sanderson & Porter, New York, N. Y., and was also consulting engineer in connection with various Pacific Coast properties.

**Prof. Vladimir Karapetoff**, of the department of electrical engineering of Cornell University, accompanied by **Mrs. Karapetoff**, will start March 29 on an extensive lecturing tour in the Southern States. **Professor Karapetoff** will address students at four Southern colleges, namely, the Clemson College, of South Carolina, April 2; the Georgia School of Technology, Atlanta, Ga., April 4; the Alabama Polytechnic Institute, Auburn, Ala., April 7, and the University of Tennessee, Knoxville, Tenn., April 10. At each of these institutions he is scheduled for three events—a lecture for electrical students on electrostatic and magnetic circuits, a general address on the development of personality, and a lecture-recital on musical expression.

**Mr. Albert T. Walcott**, formerly general manager of the Guarantee Electric Company, Chicago, has joined the staff of the Gregory Electric Company, Chicago. **Mr. Walcott's** experience in the electrical field began with the old Thomson-Houston Company at Lynn, Mass., in 1881. Afterward he went to Chicago for the company, and after the consolidation with the General Electric Company, served as erecting engineer in the West. In 1893 he was made superintendent of the repair shops of the Chicago Edison Company, where he remained until 1897, then becoming superintendent of the Guarantee Electric Company. He served the latter fifteen years, finally as general manager. **Mr. Walcott** has also had much central-station experience.

**Mr. George B. McGinty**, assistant secretary of the Interstate Commerce Commission, has been appointed as secretary to succeed **Mr. John H. Marble**, who recently became a member of the commission. **Mr. McGinty** was born on Sept. 8, 1878, in Monroe County, Ga., and was graduated at Emory College, Oxford, Ga. He left the study of law to enter railroad work and served the Atlantic Coast Line, the Georgia Railroad, the Southern Railway and the West Point Road. In November, 1908, **Mr. McGinty** became connected with the division of statistics and accounts of the Interstate Commerce Commission and later served as confidential clerk to Commissioner Clements. When **Mr. Marble** was appointed secretary of the Interstate Commerce Commission on Feb. 10, 1912, **Mr. McGinty** was appointed assistant secretary.

## Obituary

**James Brown**, president of the James Brown Electrical Manufacturing Company, Pittsburgh, Pa., died at his home in that city last week. **Mr. Brown** was fifty-three years of age and came to this country from England about thirty years ago, at which time he entered the electrical business.

**Henry E. Adams**, for years manager of the Stockton (Cal.) Gas & Electric Company, died March 14 of a paralytic stroke while on a visit to San Francisco on business connected with the Railroad Commission. He was born at Sacramento, Cal., in 1863, and his father, **Henry Adams**, was superintendent of the first gas company in Stockton. Upon the latter's death his son was chosen to manage the affairs of the company, and he did so in a manner showing rare good judgment until the absorption of the Stockton Gas & Electric Company in 1910 by the Western States Gas & Electric Company, when he retired. Later when the Oro Electric Corporation decided to attempt an entry into Stockton the services of **Mr. Adams** were obtained to advise and aid in securing local contracts. **Mr. Adams** leaves a widow and four children.



**EVANSVILLE, IND.**—Sealed proposals will be received by the Board of County Commissioners of Vanderburg County, Evansville, Ind., until April 8 for furnishing and installing electric wiring and lighting fixtures in the county jail and the heating plant, located in the rear of the jail, also for erection and completion of new concrete steps at the four entrances of the court house, Evansville, according to plans and specifications now on file at the office of Charles P. Beard, county auditor.

**LOGOOTE, IND.**—The Petersburg El. Lt. & Pwr. Co., of Petersburg, has secured a franchise to install an electric-light plant here. George E. King, of Petersburg, secretary and manager, will have charge of the work.

**ROCHESTER, IND.**—The County Commissioners of Fulton County have granted the Rochester El. Lt., Ht. & Pwr. Co. a franchise to erect transmission lines to Argos, Fulton and Kewanee for the purpose of supplying electricity to those towns. The town of Argos has accepted the proposition submitted by the company to furnish electrical service there. The local plant at Argos supplies electricity for lamps only.

**ANNA, ILL.**—Sealed bids will be received by the Illinois State Board of Administration, Springfield, Ill., until April 21 for furnishing and erecting complete, near Anna, Ill., a new water-works system, including a brick and reinforced-concrete pumping station, equipped with electrically driven machinery; filter plant, exclusive of filter equipment; earthen dam with concrete spillway; 2,000,000-gal. reinforced-concrete storage reservoir; electric transmission line, and a 10-in. and 12-in. pipe line about 3½ miles long. Plans and specifications may be examined at the office of Dabney H. Maury, 1137 Monadnock Block, Chicago, Ill., consulting engineer, or copies will be furnished on receipt of deposit of \$25, which will be refunded upon return of same. Frank D. Whip is fiscal supervisor.

**ARMINGTON, ILL.**—The village of Armington is negotiating with the Illinois Trac. System, of Champaign, for the purpose of securing electrical service for Armington.

**AURORA, ILL.**—The Western United Gas & El. Co. is planning to install additional equipment in its power plant in Aurora.

**BROADWELL, ILL.**—Negotiations are now pending with the Illinois Trac. System, of Champaign, for furnishing electricity for lighting this village.

**LEWISTOWN, ILL.**—Theodore Bass, of Farmington, representing the People's El. Ser. Co., of Farmington, is making investigations here with a view of asking for a franchise to supply electricity in Farmington.

**MOUNT CARMEL, ILL.**—E. S. White, manager of the Consolidated Factories Co., is promoting a project to install an ornamental street-lighting system on Main Street.

**MOUNT PULASKI, ILL.**—Steps have been taken by local citizens for the installation of an ornamental street-lighting system in the business district. It is proposed to use cluster lamps.

**NAPERVILLE, ILL.**—Sealed proposals will be received by Albert J. Ory, city clerk, until April 4 for furnishing and installing one 125-hp engine, one 75-kw generator, switchboard, wiring, piping, foundations, drilling of well and furnishing deep-well pump. Fred J. Postel & Co., 342 Dearborn Street, Chicago, Ill., are engineers.

**SPRINGFIELD, ILL.**—Plans are being prepared by Commissioner W. J. Spaulding for the installation of a 750-kw generator and the erection of a transmission line from the water-works plant to the city. The cost of the generator is estimated at \$20,000 and that of the transmission line at about \$2,000, appropriations for which were included in the budget for 1913. This is the first step toward the removal of the municipal electric-light plant to the water-works, to be operated in conjunction with the municipal plant on the river. The plant in the city will be used as a distributing station.

**ALLOUEZ, WIS.**—Improvements will be made to the power plant of the Great Northern Railroad at Allouez and a transmission line erected to the new buildings at Barton Avenue. Electricity needed for the new buildings will be generated at the company's plant.

**CARLTON, MINN.**—The Cloquet El. Co., of Cloquet, has submitted a proposition to the City Council offering to install a new street-lighting system. The plans submitted provide for the installation of 35 Mazda lamps of 60 cp, with constant-current transformer, regulator and switchboard. The new system is to cost about \$200 per annum more than the present system, consisting of 25 street lamps.

**MINNEAPOLIS, MINN.**—Petitions have been presented to the City Council for extension of the ornamental street-lighting system on Central Avenue, N. E., from Eighteenth to Twenty-seventh Avenue. It is estimated that 78 ornamental lamps would be required to cover the district named.

**MINNEAPOLIS, MINN.**—Sealed proposals will be received by the State Board of Control, State Capitol Building, St. Paul, until April 14, for the erection and completion of the chemistry building, University of Minnesota, Minneapolis, including the general contract work, heating and ventilating, plumbing and electrical work and fixtures, in accordance with plans and specifications furnished by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately. Copies of plans and specifications may be seen at the Builders' Exchange, St. Paul; Builders' Exchange, Minneapolis, and at the office of the Board of Control, State Capitol Building, St. Paul. Extra copies of plans may be obtained on application to the architect on payment of cost of duplication.

**THIEF RIVER FALLS, MINN.**—The City Council has decided to furnish electricity to maintain the ornamental street lamps, provided the property owners on Main Street will pay for the cost of the installation. The plans provide for the installation of 60 ornamental standards, each carrying five-lamp clusters, to cost about \$6,000. Leonard Peterson is superintendent of the municipal electric-light and water plant.

**VIRGINIA, MINN.**—The City Council has authorized the city clerk to advertise for bids for the extension of the ornamental street-lighting system. Standards will be erected on Central Avenue from the Great Northern depot to South Park, a distance of 12 blocks; and on Mesaba Avenue from Oak to Poplar Street. A levy of \$9,000 has been made for the lamps on Central Avenue. The improvements on Mesaba Avenue will be paid out of the general fund.

**WAVERLY, MINN.**—The Central Minnesota Lt. & Pwr. Co. has been granted a franchise to furnish electricity for lamps in Waverly.

**CEDAR FALLS, IA.**—At a special election held March 10 the proposition to issue bonds to establish a municipal electric-light plant in Cedar Falls was carried.

**FAIRFIELD, IA.**—The installation of ornamental street lamps around the public square is under consideration.

**HOLSTEIN, IA.**—At a special election held recently the proposition to grant a franchise to Henry Jess, Glenn M. Gracey, H. A. Dessel, J. C. Wohlenberg, J. D. Greve, F. D. Thielman and J. C. Kuchel was carried.

**MUSCATINE, IA.**—Improvements involving an expenditure of from \$80,000 to \$100,000 are contemplated by the Muscatine Ltg. Co. and the Davenport & Muscatine Ry. Co. The railway will be extended to the northwest part of Muscatine during the summer and other improvements made to the local system.

**STANWOOD, IA.**—A temporary organization has been formed to investigate the cost of installing an electric-light plant. A. D. Clancy is president.

**VALLEY JUNCTION, IA.**—At an election held March 14 the proposition to issue bonds for an electric-light plant and water-works system was carried. The Chase Engineering Co., Clinton, Ia., has charge of the work.

**KANSAS CITY, MO.**—Mayor Jost has submitted a message to the City Council dealing with a municipal electric-light plant for the city for which he proposes to submit bonds at a special election this spring. The message requests a joint Council committee to take up his report on a proposed plant and fix a date for the special election. Two locations are named, one near the wharf house on the river front and the other at the Turkey Creek pumping station. A bond issue of \$3,000,000 will be asked.

**ST. CHARLES, MO.**—At a special election held March 8 the proposition to grant the Mississippi River Pwr. Distributing Co. a franchise to supply electricity in St. Charles was carried. The company was also given a contract for street lighting. Energy for operating the system will be secured from the power plant at Keokuk, Ia.

**LA MOURE, N. D.**—The City Council has granted I. I. Bennett, of Sioux Falls, S. D., a franchise to construct and operate an electric-light plant here. Mr. Bennett has also been granted a franchise to operate an electric-light system in Lisbon.

**MAYVILLE, N. D.**—Plans are being prepared by the Oscar Clausen Engineering Co., of St. Paul, Minn., for the installation of a new municipal electric-light plant next summer. C. O. Vangen is city auditor.

**STANLEY, N. D.**—Sealed bids will be received at the office of W. C. Gibb, county auditor, Stanley, N. D., until April 8, for construction of court house for Mountrail County at Stanley, according to plans and specifications prepared by Buechner & Orth, architects, 500 Shubert Building, St. Paul, Minn. Separate bids will be received as follows: (A) For general work; (B) plumbing; (C) heating and ventilating; (D) electric work; (E) vault doors and vault shutters. Plans and specifications may be seen at the office of the county auditor, Stanley, N. D., and at the office of the architects, and also at the Builders' Exchange, Minot, N. D.

**BEAVER CITY, NEB.**—Bids will be received by the Mayor and City Council until April 4 for the construction of an electric-light plant in Beaver City.

**BENKELMAN, NEB.**—The proposition to issue \$5,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

**KEARNEY, NEB.**—At an election held March 11 the proposition to grant the Kearney El. Lt. & Pwr. Co. a 25-year franchise was defeated.

**LINCOLN, NEB.**—The State Legislature has passed the bill amending the charter of the city of Lincoln allowing it to issue bonds to the amount of \$300,000 for a municipal lighting plant and extensions. This will allow the city to engage in commercial lighting if it desires to.

**ABILENE, KAN.**—The city of Abilene has signed a contract with the Riverside Pwr. & Lt. Co. for the installation of a complete street-lighting system for the town. Ornamental standards carrying five-lamp clusters will be erected on four business blocks, and about 300 street lamps will be placed in the residential districts. The town has also awarded the company a contract for pumping the city water.

**DODGE CITY, KAN.**—The Midland Wtr. Lt. & Ice Co., of Dodge City, is planning practically to rebuild its plant here this summer. A new power house will be erected and many of the transmission lines reconstructed. Otto Theis is manager of the company.



**TURON, KAN.**—The plans for the proposed municipal electric-light plant provide for the following equipment, contracts for which will be awarded April 3: One 70-hp boiler, one 50-hp steam engine, one 37½-kva, 2300-volt generator, one panel combination switchboard, 30-kw transformers (small sizes), 80 25-ft., 6-in. top; 65 35-ft., 6-in. top, and 2 35-ft., 7-in. top white cedar poles; about 50 lamp alternating-current meters and 19 incandescent lamps of 80 cp. Rollins & Westover, Mollard Building, Kansas City, Mo., are engineers.

## Southern States

**ROCKFISH, N. C.**—The Raeford Co. contemplates the installation of an electric-light plant in Rockfish to supply electricity in Lumberton.

**WILMINGTON, N. C.**—The Tidewater Pwr. Co. is planning to erect a substation at Winter Park and install a 500-kw rotary converter and transformer in its Wrightsville Beach station.

**WINSTON-SALEM, N. C.**—The Southern Pwr. Co., of Charlotte, N. C., is reported to have secured the controlling interests of the Fries Mfg. & Power Co., of Winston-Salem, which operates the light and power plants and street-railway system here. W. S. Lee, of Charlotte, is vice-president and general manager of the Southern Pwr. Co.

**CUYTUN, GA.**—At an election to be held April 15 the proposition to issue \$15,000 in bonds, the proceeds of \$10,000 to be used for the installation of a water-works system and \$5,000 for an electric-light system, will be submitted to the voters.

**LA GRANGE, GA.**—The Columbus Pwr. Co., of Columbus, contemplates the construction of a substation and distributing system in La Grange, to cost about \$35,000.

**WAYCROSS, GA.**—The Ware County Lt. & Pwr. Co., of Waycross, has applied to the State Railroad Commission for permission to issue \$180,000 in bonds, of which the proceeds of \$50,000 will be used for the purchase of a 500-kw steam turbine, with battery of three boilers, the remainder to be used to pay outstanding indebtedness.

**BRADENTOWN, FLA.**—The Southern Utilities Co. is being organized to own and operate 30 electric, ice, gas and water properties in 15 Florida towns as follows: Arcadia, electric-light, power and ice plants; Bradentown, including Palmetto and Manatee, electric-light, power and ice plants; Fernandina, ice plant; Fort Lauderdale, electric light, power and ice plants; Fort Myers, electric light, power and ice plants; Lake City, ice plant; Live Oak, electric light, power and ice plants; Tarpon Springs, electric light, power and ice plants; West Palm Beach, electric light, power and ice plants; Miami, ice plant; Palatka, ice plant; Pensacola, ice plants; Punta Gorda, ice plant; St. Augustine, ice plant and steam laundry; Sanford, electric light, power, ice and water plants; Tarpon Springs, electric light, power and ice plants; West Palm Beach, electric light, power and ice plants, all in Florida. The company contemplates extensions and improvements, those already approved being estimated to cost about \$300,000. Financial arrangements are being made by the Engineering Securities Corp., of New York, N. Y. J. G. White, 43 Exchange Place, New York, N. Y., president. H. C. Adams, recently of West Palm Beach, will be general manager of all properties.

**ORLANDO, FLA.**—Plans are being considered for the construction of an electric line from Orlando to Kissimmee. Part of the funds for this project will be supplied by the municipalities of Orlando and Kissimmee.

**PENSACOLA, FLA.**—The City Council has adopted a resolution calling for an election to vote on the proposition to issue \$100,000 in bonds for the installation of a municipal electric-light plant to furnish electricity for lighting the streets of the city. The proposed plant is to supply energy for municipal purposes only.

**WEST PALM BEACH, FLA.**—The local electric light and power plant, owned by the Ariston Ice & El. Co., has been sold to a corporation of which H. C. Adams is general manager.

**HENDERSON, TENN.**—At an election to be held March 28 the proposition to issue \$50,000 in bonds, the proceeds to be used for the installation of an electric-light plant and water-works system, will be submitted to the voters.

**MEMPHIS, TENN.**—Application has been made to the City Council by S. H. Trezevant and G. C. Alban for an electric-light franchise in Memphis.

**NASHVILLE, TENN.**—The board of engineers officers charged with the consideration of the improvement of the Muscle Shoals section of the Tennessee River for the purpose of navigation combined with water-power has prepared plans and estimates of cost of the structures necessary for securing both results. The plans selected by the board involve the construction of three dams between Florence and Decatur, Ala. The first is to have an available head varying from 64.5 ft. at low water to 45.5 ft. at extreme high water; the second from 35 ft. to 29.5 ft., and the third from 35 ft. to 28 ft. The plans provide for a power house at each dam and propose to utilize for primary power the first 10,000 second-ft., and for secondary power the next 10,000 second-ft. of discharge. The plans provide locks necessary to lift navigation between Florence and Decatur, with provision for ultimate deepening to 9 ft. It is estimated that the three dams combined will develop at the stretch board of the power house approximately 105,000 hp electrical energy for

primary power and heat energy for navigation. The project is now prepared to receive proposals for parties who are willing to co-operate in this combined water-power and navigation development, for which proposals will be received until June 24 at the United States engineer's office at Nashville, Tenn., where further information may be obtained.

**EUCLATA, ALA.**—The City Council is considering a proposition to install electrically driven pumping machinery in the water-works station.

**GALVESTON, TEX.**—The contract for installing the ornamental street-lighting system on the boulevard has been awarded to Mac Lenn for \$14,000. The contract provides for the erection of 17 ornamental lamp standards, carrying five-lamp clusters, complete.

**KYLE, TEX.**—The City Council has granted a franchise to J. W. Tompkins and associates to erect a plant to supply electric light plant in Kyle.

**LUBBOCK, TEX.**—The two plants owned by the Lubbock Electric Co. has been purchased by the Lubbock Electric Co. of Dallas, and John R. Cullinane, of St. Louis, Mo., has been named as manager and operator of the plant. It is reported that the two plants will be connected and electricity will be supplied for lamps and motors in Abernathy and Hale Cante and to the territory between Pharrmyer and Lubbock.

**MERCEDES, TEX.**—The City Council has granted S. A. Roberts, of San Benito, a franchise to install and operate an electric-light plant and water-works system here. Mr. Roberts has proposed to establish a large ice plant in Mercedes.

**MOUNT PLEASANT, TEX.**—The Robert M. McCandlish Engineering Co., of Kansas City, Mo., has been engaged to take charge of the engineering work in connection with the proposed improvements to the local electric-light plant, which was recently purchased by the Albert Emanuel Co., of Dayton, Ohio.

**QUANAH, TEX.**—Extensive improvements are under way at the plant of the Acme Cement Plaster Co., of Quanah. The plans, it is stated, provide for a new power house, equipped with Diesel engines. It is proposed to discard steam power entirely and operate the machinery in the various buildings by electricity.

**TIMPSON, TEX.**—The City Council has entered into a contract with P. W. McKittick, owner of the local electric-light plant, to light all the streets of the city for a period of five years.

## Pacific States

**OLYMPIA, WASH.**—Application has been made to the City Council by Wilbur Foshev, of Portland, Ore., and Millard Lemon, of Olympia, for a franchise to construct and operate an electric-light plant and steam-heating system.

**SPOKANE, WASH.**—The Des Chutes Pwr. Co., recently organized, has nearly completed the construction of its power plants on the Des Chutes and Crooked Rivers. The equipment of the plants include three 1300-hp "Samson" Lefell waterwheels equipped with Leonard gear-motors, General Electric and Westinghouse generators, General Electric switch board and transformers. About 50 miles of transmission lines have been erected connecting Prineville, Ore., Redmond, Ore., Metolius, Ore., Madras, Ore., Culver, Ore., and Crooked River Valley, where substations have been erected. T. M. Simpson is general manager.

**WENATCHEE, WASH.**—Wilbur B. Foshev, of Portland, Ore., has applied for a franchise to install and operate an electric-light plant and steam-heating system in Wenatchee.

**NEWPORT, ORE.**—Arrangements are being made by the Newport El. Co. to enlarge its plant in Newport and install new machinery at a cost of about \$3,500. A new 150-hp boiler will be installed.

**PORTLAND, ORE.**—The Portland, Eugene & Astoria Ry. Co., of Portland, will equip the old steam road at the southern Pacific R.R. station for electrical operation. Paul Lechman, electrical engineer of the company, will have charge of the work.

**PORTLAND, ORE.**—It is stated that the Portland Electric Co. has been granted a franchise to construct and operate an electric-light plant and steam-heating system in Portland. The company is owned by the Pacific Pwr. & Lt. Co., of Portland, and the Walla Walla Valley Pwr. Co., of Walla Walla, Wash., and make extensive and necessary improvements to their systems, involving an expenditure of \$1,000,000. G. W. Foss, of Portland, is president of the three companies.

**YUBA, CAL.**—Surveyors have been made on the Yuba El. & Pwr. Co. plan for the construction of a power plant and station on the Yuba River near Yuba to Balboa Park, to the city of Yuba.

**BEAUMONT, CAL.**—The Southern California Electric Co. has been granted a franchise to construct and operate an electric-light plant and steam-heating system in Beaumont. Construction will begin in May.

**LINDSAY, CAL.**—The Lindsay Electric Co. has been granted a franchise to construct and operate an electric-light plant and steam-heating system in Lindsay. The company is owned by the Lindsay Electric Co., of Lindsay, and the Walla Walla Valley Pwr. Co., of Walla Walla, Wash., and make extensive and necessary improvements to their systems, involving an expenditure of \$1,000,000. G. W. Foss, of Portland, is president of the three companies.

**LOS ANGELES, CAL.**—The City Council has granted a franchise to construct and operate an electric-light plant and steam-heating system in Los Angeles. The company is owned by the Los Angeles Electric Co., of Los Angeles, and the Walla Walla Valley Pwr. Co., of Walla Walla, Wash., and make extensive and necessary improvements to their systems, involving an expenditure of \$1,000,000. G. W. Foss, of Portland, is president of the three companies.

**OAKLAND, CAL.**—The City Council has granted a franchise to construct and operate an electric-light plant and steam-heating system in Oakland. The company is owned by the Oakland Electric Co., of Oakland, and the Walla Walla Valley Pwr. Co., of Walla Walla, Wash., and make extensive and necessary improvements to their systems, involving an expenditure of \$1,000,000. G. W. Foss, of Portland, is president of the three companies.

PASADENA, CAL.—Steps have been taken by property owners and residents on Lincoln Avenue for the installation of ornamental street lamps on that thoroughfare from Fair Oaks Avenue to the northern city boundary. The Lincoln Avenue and North West Improvement Association is interested. Property owners on Marengo Avenue are circulating a petition for the installation of ornamental street lamps on that avenue. Ornamental lamps will be installed on Los Robles Avenue from California Street to Woodbury Road this spring.

SAN ANDREAS, CAL.—The Board of Supervisors of Calaveras County has awarded two franchises, one to the Oro El. Corp., of San Francisco, and the other to Desire Fricot, of Fricot City, permitting the grantees to construct and operate electric transmission lines along the highways of the county.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Great Western Pwr. Co. permission to issue bonds to the amount of \$4,411,000 to be used for general improvements, extension and development work, principally on the Feather River, including new distribution lines and service connection to consumers in Alameda, Contra Costa, Sacramento, Solano, Sonoma and Napa counties and the cities and towns of San Lorenzo, Oakland, Berkeley, Oak Park, Sacramento, Sebastopol, Napa Junction, Suisun, Fairfield, Napa, Santa Rosa and Dixon, to cost \$709,195; construction of 15 miles of transmission lines from Noraga Valley to the south side of Carquinez Straits, a substation at the Carquinez end of the line, transmission line between Valona and Richmond, transformer sets at Richmond, 6 miles of secondary circuit on Richmond feeder, primary extensions and transformers at Oakland, regulators at Oakland substation, an armored cable beneath the waters of San Francisco Bay, auxiliary line from Napa to Santa Rosa, secondary circuit from Carquinez Straits to Napa, additional armored cable beneath the waters of Carquinez Straits, condenser at Oakland, and generator set at Fruitvale, to cost \$362,602; extension of Big Bend power house by completing installation of units Nos. 5 and 6 to increase the output from 40,000 kw to 60,000 kw, at a cost of \$639,627; completion of Big Meadows dam and reservoir, \$1,607,635; acquisition of lands in Big Meadows reservoir site, \$200,000; Antioch substation, \$46,000; Sacramento substation, \$20,900; Balfour-Guthrie extension, \$16,200; Antioch-Bowers tie line, \$10,000; Antioch-Sherman Island tie line, \$9,000; Antioch-Nichols circuit, \$9,000, and Island division extension, \$35,000, the balance to be used for general improvements.

SUISUN, CAL.—Plans are being prepared by the Pacific Gas & El. Co. for the erection of a large substation, 32 ft. by 80 ft., near Suisun.

TURLOCK, CAL.—Bids will be received by A. G. Elmor, city clerk, for furnishing a two-stage centrifugal pump, one 100-hp induction motor and 10-in. pipe for the city water-works system.

VENICE, CAL.—Bids will be received by the Board of Trustees of Venice for the installation of an ornamental street-lighting system, including ducts and posts complete. C. S. Thatcher is clerk of board.

WOODLAND, CAL.—The Pacific Gas & El. Co. will soon begin work on the erection of an electric transmission line in northwestern Yolo County, right-of-way for which is now being obtained.

OGDEN, UTAH.—The city of Ogden has surrendered its option on the plant of the Merchants' Lt. & Pwr. Co., of Ogden. The city commissioners have adopted a resolution legalizing the proposed deal between the Merchants' Lt. & Pwr. Co. and the Utah Pwr. & Lt. Co., of Salt Lake City, whereby the latter will take over the property of the former.

GREAT FALLS, MONT.—The Secretary of the Interior has signed a contract with the Great Falls Pwr. Co. for furnishing electrical energy for operating machinery on the Big Sun River reclamation project. Work on the erection of the transmission line from Great Falls to the various points in the Sun River Valley will begin within 30 days, surveys having been completed. Max Heben, of Butte, is general manager of the company. H. N. Savage is supervising engineer of the Reclamation Service for Montana.

HELENA, MONT.—Bids will be received by City Clerk Mettson until April 7 for ornamental lighting in the district, which includes Main Street, Park Avenue and Warren Street and all intersecting streets from State Street north to Helen Avenue with the exception of Wood, plans and specifications for which may be obtained from the city clerk.

COLORADO SPRINGS, COL.—The County Commissioners are contemplating the installation of an electric-light and heating plant to furnish light, heat and power for the court house, county jail and detention home.

TUCUMCARI, N. M.—The City Council has entered into a contract with the Tucumcari Lt. & Pwr. Co. for furnishing electricity to operate the municipal water-works plant.

## Canada

STRATHMORE, ALTA.—The Strathmore Lt. & Pwr. Co. is planning to install an electric-light plant in Strathmore. The equipment of the plant will consist of two 65-hp producer gas engines, two 35-kw alternating-current generators, eight transformers (220-110-volt), 30-ft., 6-in. top poles and about 5 miles of wire, about 200 meters, 20 arc lamps and 1500 25-watt tungsten lamps. The granting of a franchise to the company is now pending. A. B. Bowman is engineer in charge.

NEW WESTMINSTER, B. C.—The merchants on Sixth Street will

present a petition to the City Council asking for an ornamental street lighting system on the business portion of the street.

VANCOUVER, B. C.—Plans are being considered by the civic authorities and the British Columbia El. Ry. Co., Ltd., for placing wires in underground conduits in the business section of the city.

VANCOUVER, B. C.—The British Columbia El. Ry. Co. is planning to build three two-story steel frame concrete substations soon, to cost about \$450,000. Two will be located in Hastings and one near Sapperton.

VICTORIA, B. C.—The Canadian Northern Pacific Ry. Co. contemplates the construction of a 50,000-hp power plant near Yale. The company has applied for permission to take 150 cu. ft. of water per second from the Nicolum River, near Hope.

WANETA, B. C.—The Waneta Devel. Co. contemplates the construction of a hydroelectric plant at the junction of the Salmon and Pend Oreille Rivers, near Waneta. The initial installation will develop 2500 hp and provision will be made for extensions as needed. It is proposed to erect a transmission line to Sheep Creek to furnish electricity to the mines there, and possibly it may be extended to Salmo. David Walmley, of Nelson, B. C., is one of the directors.

BRADFORD, ONT.—The ratepayers have passed a by-law requesting the Ontario Hydro-Electric Power Commission to submit a report on the cost of supplying Niagara power in Bradford.

NAPANEE, ONT.—The El. Pwr. Co., Toronto, is considering the erection of three additional rural distribution lines, work on which will begin in the near future. One line will extend from Lindsay to Mariposa and Oakwood, a distance of 12 miles; one from Whitby to Pickering, 12 miles, and the other from Belleville to Foxboro, 5 miles.

ST. THOMAS, ONT.—Plans are being prepared for a new power house for the Michigan Central R. R. Co., to be erected in St. Thomas, in connection with a large machine shop and other improvements. The total cost of the work is estimated at \$150,000.

TORONTO, ONT.—Announcement is made by Hon. Adam Beck, chairman, that the Ontario Hydro-Electric Power Commission will at once advertise for tenders for the construction of the transmission line from Dundas to Windsor. Four routes have been located between the Grand Trunk and Pere Marquette Railway tracks, but the route of the line has not yet been decided upon. This extension will cost several million dollars, and all towns along the transmission line, including St. Thomas and Chatham, will be supplied with electricity. It is announced that the commission will at once call for tenders for material for the construction of transmission lines from Cannington to Beaverton, from Berlin to Elmira, from Clinton to Goderich, and from Brantford to Paris. The cost of material for these extensions is estimated at \$2,000,000.

REGINA, SASK.—Sealed tenders will be received by the city commissioners, Regina, Sask., until April 30, for furnishing one 1200-kw synchronous motor-generator or motor-converter set, complete with panel for the control of alternating-current motor and generator panel and equalizing pedestal for the control of direct current generator. Specifications may be obtained upon application to E. W. Bull, superintendent of light and power, of Regina.

## Miscellaneous

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until April 12, for furnishing sheet iron or steel, wire cable, chain, babbitt metal, yellow metal, sheet brass tubing, bronze wire cloth, valves, etc. Blanks and general information may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until May 14 (extension of date from April 14) for furnishing and erecting coal-handling machinery and accessories for two coaling plants. Blanks and general information relating to this circular (No. 763) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

## New Industrial Companies

THE BAILEY ELECTRIC COMPANY, of Grand Rapids, Mich., has been incorporated to manufacture automobile starters, lighters and ignition outfits. Prof. B. F. Bailey, of the University of Michigan, is interested in the company.

THE BEHR ELECTRICAL CONTRACTING COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of \$6,100 to manufacture and deal in electrical machinery, appliances, etc. The incorporators are: Charles B. Aaron, A. and Rose B. Behr.

THE R. O. BIERDMANN COMPANY, of Chicago, Ill., has been in-



incorporated by R. C. Biedmann and Christian and Paul C. Meier. The company is capitalized at \$7,500 and proposes to manufacture and deal in electrical machinery, appliances, etc.

**THE BUSBY-TEMPLETON COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$5,000 for the purpose of doing electrical construction work, specializing in conduit and power installation. J. H. Busby and P. M. Templeton, Jr., are incorporators. The company is located at 73 Shelby Street, Detroit.

**THE CHICAGO ELECTRIC TIME SWITCH COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$2,500 to do a general manufacturing and merchandising business. The incorporators are: Israel S. Berkman, Leo J. Neeson and Jay H. Brown.

**THE CRANE ELECTRIC SPECIALTY COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$1,000 to manufacture electrical specialties. The incorporators are: George Nelson, Henry Jamoli and Frank B. Crane, Jr.

**THE ELECTRICAL & MECHANICAL MANUFACTURING COMPANY**, of Los Angeles, has been granted a charter with a capital stock of \$75,000. The incorporators are: W. W. Billings, G. F. Shields, G. A. Boden, S. T. Wolfe and J. F. Poole.

**THE F. & P. AUTO TRANSPORTATION COMPANY**, of Brooklyn, N. Y., has been incorporated with a capital stock of \$70,000 to manufacture and deal in vehicles propelled by gas, electricity, etc. The incorporators are: W. O. Goddard, F. K. Fairchild and G. A. Logan, of Brooklyn, N. Y.

**THE FOULKES ELECTRICAL COMPANY**, of Los Angeles, Cal., has been incorporated with a capital stock of \$25,000 by R. E. Floyd and R. T. L. Foulkes.

**THE PETER SHOCK ABSORBER CORPORATION**, of New York, N. Y., has been chartered with a capital stock of \$50,000 to deal in shock absorbers, etc. The incorporators are: C. A. Stein, N. Meyer and M. L. Strauss, of New York, N. Y.

**THE TACOMA ELECTRICAL MACHINERY COMPANY**, of Tacoma, Wash., has been incorporated with a capital stock of \$20,000 by John W. Holmes, J. C. Hill and others.

## New Incorporations

**PHOENIX, ARIZ.**—The Arizona Lt. & Pwr. Co. has been incorporated by C. Frank Doebl, William H. Hicken and Michael F. Fenton. The company is capitalized at \$40,000.

**HILO, HAWAII.**—The Hilo Trac. Co. has been incorporated with a capital stock of \$2,000,000, of which \$56,000 has been paid in, to equip and operate a street-railway system in Hilo. The incorporators are H. V. Patten, Letland S. Conness, W. H. Johnson, C. E. Wright and Delbert E. Metzler.

**BEARDSTOWN, ILL.**—The Beardstown Pub. Ser. Co. has been incorporated with a capital stock of \$200,000 to do a general public utilities business. The incorporators are: Thomas K. Condit, Floyd M. Condit and Robert B. Glenn.

**GILCHRIST, ILL.**—The Edwards River Pwr. Co. has been incorporated with a capital stock of \$10,000 by J. W. and E. C. Walsh, Jr., and Paul Wagner. The company proposes to do a general-utility business. Post office address, Gilchrist; R. F. D., Viola.

**PORTLAND, MAINE.**—The Southern Public Utilities Co. has been granted a charter under the law of the State of Maine with a capital stock of \$5,000,000 to generate and supply power and also to manufacture and deal in railroad cars of all kinds. A. F. Jones is president and A. A. Richards, treasurer, both of Portland.

**LAMB, MICH.**—The Lamb Ltg. Co. has been organized with a capital stock of \$2,000 for the purpose of supplying electricity in Lamb.

**MINNEAPOLIS, MINN.**—The Great West Power Co. has been incorporated with a capital stock of \$50,000 by Arthur W. Stevens, Harold C. Gage, Edward J. Peters, Thomas E. Hanson, all of Minneapolis, and Foster B. Scager, of Cannon Falls.

**PORT JERVIS, N. Y.**—Articles of incorporation have been filed for the Eastern Pwr. Co., of New York, Inc., with a capital stock of \$100,000, by W. P. Gregg, D. R. Thomas, of Port Jervis, and C. P. Wright, of Susquehanna, Pa. The company proposes to generate and distribute electricity.

**HARRISBURG, PA.**—Charters have been granted by the State Department for 25 electric companies to operate in Allegheny and Beaver Counties as follows: Crescent, Coraopolis, East Deery, Edgeworth, Fawn, Forward, Glenfield, Harmar, Hays, Letsdale, Oakdale, Osburn, Albin, Ambridge, Baden, Conway, Daugherty, East Rochester, Economy, Harmony, Freedom, Hopewell, Hudson, Bulwer and Iola Electric companies. Each company is capitalized at \$5,000 and all with same incorporators. The incorporators are Herman Halberer, Arthur B. Dampman and William L. Miller, all of Pittsburgh.

**SALT LAKE CITY, UTAH.**—The Central El. Co. has been incorporated with a capital stock of \$5,000. The officers are: Joseph Nelson, president; J. G. McAlister, vice-president, and T. E. Johnson, secretary and treasurer.

## Trade Publications

**WATT-HOUR METERS.**—Bulletin No. A4092 of the General Electric Company describes its Thomson watt-hour meter.

**LUBRICATION.**—The lubrication of pneumatic tools is made the subject of Bulletin No. 130 issued by the Chicago Pneumatic Tool Company, Chicago, Ill.

**COPPER-CLAD WIRE.**—The Duplex Metals Company, Chester, Pa., has added another to its series of periodical leaflets giving a short advertising talk on its copper-clad wire.

**MOTOR-STARTING PANELS.**—The General Electric Company has recently issued Bulletin No. A4087, which illustrates and describes its direct-current motor-starting panels for heavy service.

**LIGHTING FIXTURES.**—The F. W. Whitfield Brass Company, Vermilion, Ohio, in a recent folder illustrates two new parts shown in use together with a new two-lamp square pendant in both straight and chain designs.

**STEEL BOXES.**—The Allsteelquip Company, Aurora, Ill., has issued Bulletin E-2, containing prices of steel boxes for all wiring purposes. The boxes are electrically welded and conform in all respects to the National Electric Code.

**MOTORS.**—In Bulletin 1010, which the Triumph Electrical Company, Cincinnati, Ohio, has recently issued, a comprehensive, illustrated description of its adjustable speed motors is given, and the operating characteristics are set forth.

**STAGE LIGHTING APPARATUS.**—The Klieglight arc lamp for taking motion pictures, photographing in studios, etc., is the subject of a bulletin being distributed by the Universal Stage Lighting Company, 240 West Fifth Street, New York.

**GAS AND OIL ENGINES.**—Bogart & Company, Ellicott Square, Buffalo, N. Y., have issued a folder showing a number of good illustrations and sectional views of gas and oil engines. These engines are built to operate on all the various fuels.

**DIESEL ENGINE.**—In an eight-page pamphlet issued by the Busch-Sulzer Brothers-Diesel Engine Company, the results of an exhaustive test of a 225-hp Diesel oil engine built for the Hugo (Ohio) Ice & Light Company are given. A number of tables and curves add value to the publication.

**STARTING SWITCHES.**—Bulletin B-84 issued by the Allen-Baillie Company, Milwaukee, Wis., refers to its Type H resistance starting switch for induction motors. This apparatus is designed for starting motors of from 1 hp to 50 hp, switching them into and out of the circuit and protecting them against no-voltage and overload.

**PUMPS.**—Bulletin No. 133, issued by the Goulds Manufacturing Company, Seneca Falls, N. Y., illustrates and gives specifications of the Gould rotary pumps, which can be adapted to almost any service where the required capacity and pressure are within their ratings. Their characteristic features of construction and operation are described.

**ELECTRIC WASHING MACHINE.**—The Hurley Machine Company, 29 South Clinton Street, Chicago, Ill., has issued a circular telling of its new "Red Electric Junior" washing machine and the "Red Electric" washing and wringing machine. The latter machine is equipped with a special two-roll reversible wringer and a motor which will operate the washer and wringer at the same time.

**STEAM TURBINES.**—"A Little Journey to the Home of the 'Economy' Turbine" is the title of a booklet written by Elbert Hubbard after a visit to the works of the Kerr Turbine Company, Wellsville, N. Y. It is written in an attractive manner and includes interesting information on steam economy from the time of James Watt up to the present day. The booklet is printed in the usual style of Roycroft publications.

**GRINDING MOTORS.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in a leaflet recently issued gives information with respect to its polishing and grinding motors, which are adapted for use by dentists, jewelers, opticians, hotels, restaurants, machine shops, garages and homes. Their advantages are briefly set forth. Brief mention is made of a 0.33-hp motor suitable for dental use at home.

**CARD INDEX OF SPECIALTIES.**—The Clark Electric & Manufacturing Company, 147 Broadway, New York, has issued a card index of index cards of standard size for the convenience of purchasing agents. The reverse side illustrates some of the specialties indexed. Insulator clamps, splicing sleeves, split tinned connectors, overhead clamping switches and ground-pieces are among the specialties included. All conditions are being made.

## Business Notes

**THE ELECTRIC PRODUCTS COMPANY**, a corporation of the Western automatic battery-charging company, has moved to its new headquarters from 6516 Carnegie Avenue to 1014 Haines Avenue.

**HOWARD J. CURTIS**, Pacific Coast representative of the Pacific Storage Battery Co. Company and agent for Edison storage batteries, have moved their offices from the Metropolitan Bank Building to the new Sharon Building, 35 New Montgomery Street, San Francisco, Cal.



# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 18, 1913.

[Prepared by Robert Starr Allen, 10 Exchange Place, New York.]

- 1,056,045. PROCESS OF MANUFACTURING GAS; M. W. Murray, New York, N. Y. App. filed June 6, 1912. Dry steam introduced under pressure into a chamber where it is subjected to the heat of an electric arc in the presence of a catalytic agent.
- 1,056,051. AUTOMATIC RAILWAY DANGER SIGNAL; H. A. Osborn, St. Joseph, Mo. App. filed March 27, 1911. Roller on the engine engages and operates a circuit-controlling switch.
- 1,056,061. PROCESS FOR WELDING DISSIMILAR METALS; F. W. Rogers, Beaver Dam, Wis. App. filed Dec. 26, 1911. Metal of lower melting point is partially or wholly fused by applying heat thereto through the medium of a welding plate of higher melting point, pressure being preferably applied.
- 1,056,064. SELECTING APPARATUS; C. E. Scribner, Jericho, Vt., and A. H. Adams, Sparkill, N. Y. App. filed Nov. 28, 1911. Combination of polarized and neutral relays.
- 1,056,104. MEANS FOR THE REGULATION AND CONTROL OF RAILWAY AND LIKE TRAFFIC; H. v. Kramer, Birmingham, England. App. filed April 11, 1912. Inductive system with live wire along track and coil on train.
- 1,056,118. METHOD OF ELECTROLYZING STREAMING ELECTROLYTES; J. G. Paulin, Landskrona, Sweden. App. filed April 7, 1911. Causes a current of fresh electrolyte to flow toward and past one electrode and a solution of the product formed at the other electrode to flow toward and past said latter electrode.
- 1,056,119. ELECTROMECHANICAL PROPULSION SYSTEM FOR TRAINS; H. Pieper, Liege, Belgium. App. filed June 8, 1912. Combination of heat motors, electric machines coupled thereto and batteries working in conjunction with the electric machines.
- 1,056,124. ELECTROMAGNETIC REGULATING OR CONTROLLING MEANS FOR VALVES OR THE LIKE; T. J. and E. Rorke, Barnes, England. App. filed Dec. 6, 1910. Thermostat controls relays which operate the valves.
- 1,056,154. LAMP SOCKET; I. Darby, Summit, N. J. App. filed Oct. 12, 1910. Full-sector circuit commutator reciprocated on a straight guide by an actuator reciprocating on a straight guide parallel to the first guide.
- 1,056,181. ELECTROLYTIC CELL AND METHOD OF MAINTAINING THE EFFICIENCY THEREOF; W. M. Jewell, Chicago, Ill. App. filed Dec. 17, 1911. Horizontal type, preserving stratification of electrolyte by maintaining cathode liquor at a lower specific gravity than anode liquor.
- 1,056,205. ELECTRICAL WATER HEATER; A. P. Nichols, Seattle, Wash. App. filed June 24, 1911. Tortuous water passage with resistance device in the normal water-containing part of said passage.
- 1,056,220. ELECTRIC CIRCUIT CUT-OFF; H. M. Scheibe, Wilkesburg, Pa. App. filed June 9, 1910. Fuse is held under tension.
- 1,056,239. ELECTRIC BOX CONNECTION; E. H. Ward, Brooklyn, N. Y. App. filed March 2, 1911. Adapted for being secured upon a gas pipe.
- 1,056,242. AUTOMATIC COMPENSATING MAGNETIC CLUTCH; A. W. Whitcomb, Worcester, Mass. App. filed July 3, 1911. Forward and reverse at different speeds.
- 1,056,243. DOUBLE-ACTING CLUTCH; A. W. Whitcomb, Worcester, Mass. App. filed July 24, 1911. Combined magnetic and friction.
- 1,056,257. BURGLAR AND FIRE ALARM; F. Carlson, Monessen, Pa. App. filed July 5, 1911. Has a wax pot for holding a contact member out of engagement with a contact.
- 1,056,269. POLICE-SIGNAL-CODE BOX; W. E. Fastnacht, York, Pa. App. filed Dec. 8, 1911. Rotary carrier with circuit-closing devices and a plurality of selecting devices.
- 1,056,299. BATTERY-PLATE SEPARATOR; H. E. Pratt, New York, N. Y. App. filed March 25, 1912. Made of wood veneer so as to be pervious, with a perforated sheet of hard rubber on each side of this pervious plate.
- 1,056,300. RELAY SYSTEM; E. W. Preston and G. L. Nickerson, Sioux City, Ia. App. filed Jan. 25, 1912. Relays automatically controlled by speech currents from a telephone transmitter.
- 1,056,310. ELECTRIC SWITCH; H. J. Wiegand, Milwaukee, Wis. App. filed March 24, 1910. Rectilinearly movable operating member directly engages contact member, said members having parts to cause quick movement of contact member prior to the direct engagement by the operating member.
- 1,056,318. APPARATUS FOR MAGNETICALLY SEPARATING MATERIALS; S. Bruck, Berlin, Germany. App. filed May 17, 1911. Material is raised through a contact magnetic field of uniform strength by means of some external force, such as compressed air or water.
- 1,056,334. ALTERNATING-CURRENT RELAY; J. F. D. Hoge, New York, N. Y. App. filed Sept. 23, 1910. Lagging and leading currents produced in the circuits of the different magnets.
- 1,056,335. ELECTRIC STERILIZER FOR LIQUIDS; H. Howard, Corvallis, Ore. App. filed May 23, 1912. For attachment to a faucet.
- 1,056,336. BIPOLAR INTRASTOMACH ELECTRODE; A. G. Hurdman, Denver, Col. App. filed Sept. 24, 1909. Separated slug-shaped electrodes in contact with wall of stomach provide flow of current there through.
- 1,056,337. RECTIFIER COMPOUND; N. Fallek, Denver, Col. App. filed June 17, 1912. Consists of sodium phosphate, asbestos, sodium silicate and water.
- 1,056,350. TRANSMITTER; R. S. M. Mitchell, Syracuse, N. Y. App. filed March 29, 1912. Has a series of spirally formed electrodes which, through leverage connections, are compressed by the diaphragm.
- 1,056,354. INCANDESCENT-LAMP-SECURING MEANS; R. W. Morgan (deceased), Bronville, N. Y. App. filed Sept. 19, 1908. Helical spring carried by and secured at one end to lamp base.
- 1,056,360. IGNITION GENERATOR FOR IGNITION PURPOSES; T. E. Podlesak, Brooklyn, N. Y., and H. J. Podlesak, Chicago, Ill. App. filed Sept. 25, 1901. Permanent magnet with special pole construction.
- 1,056,388. METHOD OF PRODUCING LEAD HYDRATE; T. G. Timby, Chicago, Ill. App. filed March 3, 1912. Method consists in electrolyzing a cast anode of lead sulphide ore in a neutral hydrous solution of a nitrate of an alkaline base.
- 1,056,383. METHOD OF RECOVERING LEAD AND SILVER; T. G. Timby, Chicago, Ill. App. filed March 2, 1912. Electrolyzing in a bath of suitable electrolyte a cast antiferrous lead-bearing ore anode in a filtering screen, precipitating the silver within the screen and collecting lead liberated by the electrolysis of the anode.
- 1,056,392. INSULATOR; C. A. Barr and J. H. Koren, Chicago, Ill. App. filed Dec. 18, 1911. Spring clasp secures the insulator in place in the beam, etc., in which it is seated.
- 1,056,402. ELECTRIC-RAILWAY SIGNALING APPARATUS; W. J. Cook, Denver, Col. App. filed July 24, 1909. Wheel flange operates circuit-controlling devices for the signals.
- 1,056,423. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed May 22, 1911. Station first taking the line for use may have the use of the line to the exclusion of other stations.
- 1,056,424. TELEPHONY; M. L. Johnson; Chicago, Ill. App. filed May 22, 1911. Calling party at a party-line station is enabled to cause application of signaling current to signal receiver at another station on same line; apparatus interfering with transmission of signaling current is removed from line.
- 1,056,425. TELEPHONY; M. L. Johnson, Chicago, Ill. App. filed May 22, 1911. Calling party at a party-line station may appropriate his line to the exclusion of other stations upon the same line.
- 1,056,456. ELECTRIC FURNACE FOR MELTING AND LIQUEFYING FERRO ALLOYS; W. Schemmann and J. Bronn, Rombach, Germany. App. filed Dec. 14, 1910. "Contact-resistance" heating.
- 1,056,459. AUTOMATIC FIRE-PROTECTION SIGNAL SYSTEM; J. S. Shepherd, Flint, Mich. N. Y. App. filed June 20, 1908. Unaffected by atmospheric changes in temperature; alarm given only upon sudden heating occasioned by fire.
- 1,056,482. ELECTRIC CUT-OFF FOR MARINE AND OTHER STEAM ENGINES; R. Zoppa, Montclair, N. J. App. filed Dec. 30, 1912. For preventing "racing" when screw leaves the water, etc.
- 1,056,483. TAP FOR MULTIPLE-CONDUCTOR METALLIC SHEATH CABLES; H. Adams, Pittsburgh, Pa. App. filed Jan. 29, 1912. Split conduit with housing fitting over same.
- 1,056,498. OUTLET-BOX SUPPORT; C. C. Buckels, Chicago, Ill. App. filed Nov. 6, 1911. Outlet box is slidably adjustable on a supporting bar which is adapted to be secured between contiguous joists or studs.
- 1,056,533. WORKING SUBMARINE CABLES; J. Gott, Brighton, Eng. App. filed March 18, 1912. Polarity of the line current is automatically charged after each operation of the sending key.
- 1,056,545. ELECTROMAGNETIC CLUTCH; W. C. Huebner, Buffalo, N. Y. App. filed Sept. 23, 1912. Armatures movable radially inward to form magnetic bridges between magnetic strips on the magnet member.
- 1,056,584. SWITCH AND RECEPTACLE BOX; E. Rosenkranz, New York, N. Y. App. filed Feb. 18, 1911. Has removable side plates to facilitate fastening of the cables or conductors.
- 1,056,637. COMBINED TELEPHONE AND FIRE-ALARM SYSTEM; W. V. Dean, Chicago, Ill. App. filed Aug. 15, 1903. Uses auxiliary currents with a receiving device responsive to such currents and unaffected by telephonic currents.
- 1,056,638. THERMOSTAT; W. V. Dean, Elyria, Ohio. App. filed May 20, 1905. Spiral contact spring normally held compressed in non-contacting position by being embedded in a fusible material.
- 1,056,641. PROCESS FOR THE MANUFACTURE OF METALLIC FILMS; F. Demel, London, Eng. App. filed May 1, 1911. Relates to production of goldleaf.
- 1,056,651. ELECTRIC CABLE CONNECTOR; E. H. Faile, New York, N. Y. App. filed March 31, 1911. Socket receives stranded cable in one end and solder is introduced into the opposite end.
- 1,056,655. LOCKING DEVICE FOR TELEPHONES; A. Fornander, New York, N. Y. App. filed July 11, 1912. Hinged clasp locks upon the column of the instrument and interlocks with the receiver hook.
- 1,056,671. ELECTRICALLY OPERATED CONTROLLING MECHANISM; J. C. Heintz, Cleveland, Ohio. App. filed Jan. 15, 1912. For lighting and extinguishing lamps, operating furnace dampers, etc.
- 1,056,677. SWITCH BOX; R. Hipple, Williamsport, Pa. App. filed May 19, 1909. Has a pivoted arm, with cam provided with arcuate end flaps, adapted to operate magnetically with corresponding pole pieces.
- 1,056,679. CEILING-BLOCK CONNECTOR; L. F. Hopfer, Clearfield, Pa. App. filed Feb. 6, 1912. Lamp terminals on a detachable member interlock with line terminals on the base member by a partial rotative movement of the detachable member.
- 1,056,711. CROSS-OVER INSULATOR FOR ELECTRICAL CONDUCTORS; F. Schaub, Jersey City, N. J. App. filed July 9, 1908. Material is raised through a contact magnetic field of uniform strength by means of some external force, such as compressed air or water.
- 1,056,725. JUNCTION BLOCK FOR MAKING ELECTRICAL CONNECTIONS; A. K. Andriano, New York, N. Y. App. filed Oct. 20, 1910. Base having an insulating support carrying outstanding arms to which the individual wires of the cables are secured, for telephone work.
- 1,056,739. TRANSFORMER OF ELECTRICITY; J. W. Davis, St. Clair, Mo. App. filed May 8, 1911. Commutator having segments of special construction.
- 1,056,742. RETRIEVING MECHANISM; J. Hollis, Canton, Ohio. App. filed May 24, 1911. A retrieving spring is wound up by the unwinding of the trolley rope; slack-absorbing spring keeps trolley rope under proper tension.
- 1,056,759. SWITCH BOX AND SUPPORT; W. H. Mallory, Youngswood, Pa. App. filed Feb. 19, 1912. Made of sheet metal with plurality of lugs to engage in slots in supporting bars.

# Electrical World

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No. 14

## Why Was Dayton So Isolated?

Not by way of finding fault with anybody in this period of distress and disaster caused by record floods, but simply in the search for information, we rise to inquire in the name of civilization and invention why Dayton was allowed to be so utterly cut off for days from the rest of the world? To be a little more explicit—for it is easy to say what we mean—why in these days of the wireless telegraph should Dayton be even more isolated than was the *Titanic*? Anybody would think that the wireless telegraph had never been heard of in Dayton or Ohio. Why, when they know that their wires are breaking all the time, do telegraph and telephone companies so persistently neglect adding the wireless to their standby emergency forces? If we were finding fault, we should say that such neglect of an obvious and cheap remedy is scandalous and reprehensible. We simply ask, why? We shall be glad to hear from some of our readers on the subject, and particularly from the companies. And, then, again, why should Dayton, birthplace of the modern aeroplane and a leading home of its manufacture, go without any resort to that useful device at such a juncture? It should have been the easiest thing in the world to fly into Dayton or out of it at any time last week, even when the floods were at their worst, either by aeroplane or hydroplane, or flying boat. Why did not somebody do it? Again, we say, this is all by way of inquiry; but when modern civilization has such resources at its instant command it does seem most mysterious that they should not be ready and waiting to be availed of at the very instant such emergencies arise.

## Driving the Entering Wedge

Those who sat through the six busy and teeming sessions of the recent convention of the Society for Electrical Development profited by hearing much practical commercial talk and many excellent dollar ideas. One of the most important lessons there driven home pertained to the ways—and the number and diverseness of them—in which the central station can make its start in converting a local field or industry to the use of electrical service. With one such entering wedge driven the rest of the battle is easy with mere routine methods. The difficulty, it has seemed, has always been in making the start. Yet to make this start the astute commercial man has the whole gamut of human motives on which to play. He can direct such arguments as those of originality, modernity, safety, economy and simplicity on the most likely candidate for electrification, sometimes bringing personal influence to bear through mutual connections. A new factory is to be built or a new hotel equipped. Consider the numerous and effective arguments which can be urged for electrifying it completely, especi-

ally if such equipment constitutes a point of originality compared with others of the same class. And with such an example once established in the locality or the industry the conversion of the rest becomes the province of simple routine sales work. With a fair share of imagination and a grasp of human nature, the way of the new-business man, then, should not be hard in making these initial sallies in advance of the battle-line of electricity-selling effort.

## Raw-Water Ice-Making

The phenomenal consolidation of small central-station plants into interconnected transmission systems which is taking place has a significant sequel in the problem of combination ice-electric operation. With the shutting down of steam-boiler plants in remote communities and their replacement by chimneyless transformer substations, the local combination ice-plant operator must look elsewhere for his supply of distilled water and of steam power for ammonia-compressor operation. He can, of course, drive his ice machine by an electric motor, but without distilled water can he depend on producing clear, clean ice which will be attractive to the consumer? Fortunately, the refrigerating industry stands ready with the answer—two answers, in fact, each vigorously affirmative and each proved by years of successful operation. Beautifully clear and flawless ice can be produced without a steam plant. Dozens of boilerless plants are freezing a perfect and transparent product, but in the ice business, as in some of the other older industries, prejudice and preconceived impressions die with difficulty and plenty of practical men can still be found to deny all virtue to any ice-making outfit not equipped with a roaring furnace, boiler plant and steam-eating compressor. The operator who encounters the problem of making ice from raw water and electrical energy can secure one of several successful raw-water systems in which the water is agitated by air during freezing, the concentrated impurities being drawn off with the core water. Or if he prefers he can install a system of re-evaporators in which a very little heat is employed with multiple effect to distil successively several times the original quantity of water, thus securing the maximum of thermal economy. And as for the old idea that distilled water makes purer ice than raw water, it must be evident upon the brief study that with proper removal of the core liquid, raw-water ice, obedient to Nature's law, "freezes itself pure," pushing foreign matter ahead to be drawn off with the core water. In the boilerless ice the core impurities remaining in the water are likely to be frozen into the center, so that it is not clear but that the raw-water folk have the best of the argument even on this point.

## High-Powered Radio Signaling

Within the past two months a scout cruiser has for the second time been sent some 3500 miles to sea for the sole purpose of determining the possibilities of communication by radio telegraphy. In 1910 the United States cruiser *Birmingham* crossed to Liberia, working by "wireless" with the plant at Brant Rock, Mass., for a large part of the trip; and on Feb. 15, 1913, the cruiser *Salem* left the League Island Navy Yard, proceeding to Gibraltar. Throughout almost the whole of the cruise she was able to receive from the new naval radio station at Arlington, Va., complete messages by daylight being read from a distance as great as 2600 miles and very loud signals occurring nightly while the ship lay at Gibraltar.

In this issue we present an article, by engineers closely identified with the work, describing in detail the equipment placed aboard the *Salem* and at Arlington and giving many new data as regards the test itself. One of the most interesting points brought out is the extreme compactness of the entire Arlington installation, as contrasted with the large space used by other modern radio stations of approximately the same signaling range. This seems to be due in a large measure to the employment of a high-tension condenser design quite novel in wireless transmitters. Metallic plates supported close together in air at atmospheric pressure are known to form a condenser having practically zero losses at any frequency but limited in its power-storing ability for a given bulk on account of the relatively low dielectric strength and specific inductive capacity of air. However, when the entire condenser group is placed in a tank and the air pressure within is brought up to some 300 lb. per square inch the rupturing voltage becomes so high that large amounts of energy may be stored in quite low capacities, and the bulk for a specified rating of condenser is remarkably small. The entire condenser bank at Arlington (including spares) covers a floor space only about 10 ft. by 15 ft., yet each unit is instantly accessible for alteration of connections.

A further striking point of the installations is that they are the first made by the government which are described as having the heterodyne receiver. Those familiar with Professor Fessenden's description of this receiver, as given at the A. I. E. E. convention in Atlantic City some years ago, will recollect that its performance depended upon the interaction of two persistent high-frequency currents—one locally generated at the receiver and the other set up by the received wave energy—to produce an amplified audible or other response. This device has now been developed to the point at which it is said to give increased indications over those normally had on the receipt of fairly well sustained waves, yet, because of its requirement of a considerable degree of persistence for amplification, it does not add to the false signals produced by highly damped atmospheric disturbances. The fact that messages were sent in daylight from the *Salem*, with only 10 kw of transmitting power available, and received at Arlington by two operators simultaneously over a distance of 1300 miles, seems to indicate that a practical solution of many difficulties in radio work has been made by the adoption and development of this type of receiver.

Consideration of the distances communicated across during the trials at once leads to the question of what distance could be covered between two large stations of the Arlington type. If another plant similar to that near Fort Myer should be erected at some distant point it would have two great advantages, as compared with the ship, in receiving from Arlington, since not only would the effective height of the receiving antenna be increased from 130 ft. to 450 ft., but it would be possible to make efficient use of very long waves and thereby minimize the daylight absorption. It does not seem improbable that by using waves 6000 m in length transmission might be effected over 500 miles. The distances over which actual daylight transmission of messages was made during the test are a matter of congratulation within our navy and indicate a distinct national achievement in radio signaling.

## A Study in Heterochromatic Photometry

It is somewhat disconcerting after recent investigations had given one a somewhat comfortable feeling about the comparison of lights of different colors to find a new illuminant turning up which seems to upset all precedents and to defy all customary procedures. A recent paper by Broca, La Porte and their colleagues dealing with the photometry of neon tubes casts a bombshell into the photometric camp and demands prompt study and confirmation. The neon tube, as our readers will remember, is the latest development of vacuum-tube lighting. It gives a light of a beautiful deep orange at high efficiency and at low intrinsic brilliancy and therefore gives good promise of commercial usefulness. In attempting to establish the luminous value of such a tube Broca and his colleagues fell into unexpected and extreme difficulties. The color of the light seemed to interpose an insurmountable obstacle in the path of precision. The light from a meter length of the neon tube was balanced against that from a 4-watt-per-candle carbon standard lamp on a photometer provided with a Ritchie prism as indicator. The results were startling and disconcerting, for ten observers found values for the neon tube scattered without any appearance of regularity between 62 cp and 205 cp.

There was nothing out of the ordinary in the intensities at which the balances were made, the values of the illumination on the prism faces ranging between 1 ft.-candle and 3 ft.-candles. The investigators go so far as to say that while with all the usual commercial sources of light one can get an average value of the illumination by the work of several observers, for the neon lamp the mean of the various determinations has no practical value whatever. Here is a pretty mess indeed, if the statements are borne out by other investigators.

For some reason as yet undiscovered, the red sensation seems the one most subject to abnormalities, and Rayleigh found some years ago that a certain proportion of eyes are hypersensitive to red just as another proportion are subsensitive. It is, however, a stretch of the doctrine of probabilities to suppose that most of the ten observers concerned in this case had abnormal red vision, although some of them may have been thus afflicted. Another cause, however, may



have contributed to the confusion. It has been pretty well established that the cause of the ordinary abnormalities in comparing lights of different colors is the very powerful simultaneous contrast which tends to throw the colors apart in spectral range and to substitute correspondingly false subjective values of the luminosities. The effect of simultaneous contrast varies from eye to eye and from one condition of adaptation to another, so that it is quite easy to see that considerable variations due to this cause are possible. In addition to the purely photometric difficulties, the investigation of M. Broca and his colleagues showed a marked Purkinje effect for the neon tube and also a somewhat enhanced visual acuity, as might be expected from the quasi-monochromatic character of the neon spectrum. The intrinsic brilliancy of the neon tube proved to be about 0.3 cp per square cm, a figure obviously very favorable from the point of view of illumination, and, as one might suppose, the after images produced were relatively brief.

M. Broca and his colleagues speak highly of the neon tube as producing very slight ocular fatigue, but its photometry from their experiments presents a discouraging problem. It is certainly desirable that these experiments be repeated and that the discrepancies observed be explained or eliminated in so far as it is possible to do so. Unhappily, the flicker photometer does not lend itself readily to the work on account of the oscillatory nature of the discharge in the tube. The whole affair is somewhat mysterious and should be examined by other photometrists without delay.

### Cyclic Variation in Candle-Power

That the candle-power of an incandescent lamp fluctuates cyclically when operated with alternating current has long been known and in a broad sense is self-demonstrating, the only question being as to how great the fluctuation may be. Naturally, on low-frequency circuits, with thin high-voltage, high-efficiency, high-temperature filaments, the fluctuation will tend to be the greatest. It has been measured in the past by observing the cyclic change in the ohmic resistance of the filament, as determined by potentiometer and cyclically rotating contactor. From the cyclic change in filament resistance, the corresponding cyclic change in candle-power has been inferred.

In the *Digest* of this issue appears an account of an interesting series of stroboscopic tests by Prof. A. Larsen on a 9-cp, 220-volt Osram lamp operated with 50-cycle current. The candle-power was found to vary cyclically between 70 and 134 per cent of normal; that is, the candle-power at the peak of the wave was not far from double that at the zero. This was the most marked case. Other Osram lamps, either of larger filament and candle-power or of lower voltage, showed less fluctuation.

A second important result reported in the article is that the candle-power of a 9-cp, 220-volt Osram lamp is appreciably greater with alternating-current than direct-current supply of equal voltage. The increase is stated to be 1.6 per cent at 50 cycles per second and 3.7 per cent at 30 cycles per second. Here again the result is attributable apparently to the very thin filament needed in a 220-volt,

9-cp lamp. So far as we are aware, no definitely appreciable difference in candle-power has been reported in American 110-volt lamps of 10 cp on direct-current and alternating-current equal-voltage supply. According to the results given in the article, such differences should, however, become perceptible with 25-cycle supply. A third interesting result mentioned in the article is that, owing to a nearly two-to-one range in cyclic candle-power of a 9-cp, 220-volt Osram lamp, at 50 cycles, such a lamp may be used in slip-frequency stroboscopic measurements, on induction motors, without resorting to the usual alternating-current arc lamp.

It is noteworthy that at equal candle-powers the tested Osram lamp showed no perceptible difference in power consumption, at terminals, whether operated from alternating-current or direct-current mains. With an appreciably perceptible difference of candle-power on equal-voltage alternating-current and direct-current mains, as reported, it would be reasonable to expect that such thin-filament Osram lamps would show distinctly different lifetimes in the two cases. It would be interesting to find whether the expected change in lifetime would correspond to the change in candle-power on a direct-current circuit. Let us hope that someone will undertake such tests on an elaborate scale, because unless they include the behavior of at least fifty selected lamps in each tested batch, not much reliance can be placed on the results.

### Mercury-Arc Rectifiers for Energy Distribution

The mercury-arc rectifier has taken a well-recognized position in modern electric industry for charging storage batteries for alternating-current mains and also for supplying series arc lamps from alternating-current constant-current transformers. Its development in this country has been largely due to the work of Dr. Peter Cooper Hewitt. The original discovery of the rectifying action of a carbon-mercury arc has recently been claimed in *La Revue Electrique*, by M. Daniel Berthelot, for two French physicists—Messrs. Jamin and Mauclair—in 1882, with reference to their publication of the discovery in the *Journal de Physique* for that year.

Important as the use of the mercury-arc rectifier has already become, it is perhaps insignificant compared to what might be expected to develop if a reliable and comparatively expensive rectifier of the same type could be developed for larger currents and powers. Experiments in this direction have been going on for years in the large manufacturing establishments of this country and of Europe, and with at least a fair measure of success. In Germany some of the 100-kw rectifiers are reported as operating on 22,000-volt circuits. The structural difficulties to be overcome are manifestly very considerable, because glass vacuum chambers have to be abandoned when large currents are used, and metal vacuum chambers are hard to maintain at the under wide ranges of temperatures. It is certainly to be hoped, however, that the efforts of the electricians engaged in this work will be successful, as their success might mean the elimination of revolving machinery in substations.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Damage by Floods to Electrical Properties

"We are undismayed; we are still optimists" is the cheering message received from the president and manager of the Dayton Power & Light Company, Mr. Frank M. Tait, president of the National Electric Light Association, who was lost to the outer world for two days and three nights, while marooned with his family on the second floor of their home.

Swollen by heavy rainfall and spring freshets to levels which in many instances were the highest in local history, the Muskingum, Scioto, Miami, Wabash and many other rivers of less importance, which with their tributaries drain vast portions of Ohio and Indiana and empty into the Ohio River, burst their banks last week and spread over the surrounding territory.

Rising waters in Illinois, Kentucky, West Virginia, Tennessee and parts of Virginia, Pennsylvania and upper New York also swept across portions of these States, and as this issue goes to press many sections in the Southern States are beginning to feel the devastating effects of the deluges that are pouring in upon them from above.

As is already known, many of the most prosperous cities, towns and smaller communities, possibly fifty in number, in Ohio and Indiana, having extensive manufacturing and agricultural interests, have suffered heavy damage from the floods. These seemed to reach their greatest heights between March 25 and March 28. Estimates that have been made of the loss of life and property in the stricken districts are naturally inaccurate at this time owing to widespread interruption of railroad, telegraph and telephone service in these sections, and full details are difficult to ascertain.

Thousands of people have been made homeless, however, several hundred lives have been lost, property damage is estimated at several hundred millions of dollars, and the transaction of business has been rendered impossible in wide areas.

In the Ohio, Indiana and northern New York districts the waters are receding rapidly and information obtained concerning the extent of damage indicates that first reports contained many exaggerations.

Help in the form of money, food and clothing has poured into the relief stations established in all of the large cities for the benefit of the flood sufferers and offers of assistance have been received from abroad. Considerable headway is now being made in the work of rehabilitation.

Electrical interests suffered extensively in the floods, but not to any such degree as was first supposed. Generating stations and substations were partly submerged in a number of localities. Overhead poles were undermined or washed away or torn down by floating debris; lines of wire crossing bridges went down with the latter in many instances, and the swift action of the water undermined foundations and carried away the ballast of street railway and interurban lines.

It is believed that never before in the history of the

United States has there been such a general prostration of telephone and telegraph wires as existed in the flood-swept districts on March 27. That the loss of public utility property was not greater was due to the resourceful and heroic measures followed by managers of electric-service properties and the loyalty with which these men and their subordinates, with the waters rising about their plants, torn by anxiety for relatives, friends and personal property, stuck to their posts in the interest of their employers and thousands of fellow-townpeople.

Dayton, Ohio, is one of the chief victims of the flood. Electrical men all over the country expressed keen anxiety when reports from that city brought no word as to the safety of Mr. Frank M. Tait, president of the National Electric Light Association and also president of the Dayton Power & Light Company. Word was received in New York on the afternoon of Saturday, March 29, that Mr. Tait and his family were safe, and his message to the electrical industry at large, through the *Electrical World*, is given above.

Telegrams from members of the staff of the *Electrical World*, describing electrical conditions as seen by them in the flooded districts, dispatches and letters from managers of public-utility properties appear below.

#### Ohio

DAYTON, OHIO (*By Telegraph*).—"We are undismayed; we are still optimists," was the spirited declaration of Mr. Frank M. Tait to a representative of the *Electrical World* who visited the stricken city with the first resumption of railroad communication after the crest of the flood had subsided. Mr. Tait, with his wife and child, was for two days and three nights marooned in the upper story of his house, while grave fears were being entertained for his safety among his electrical friends throughout the country. After getting his family to safety, he himself set an example to his organization by working day and night, and began giving street-lighting service Sunday evening, March 30.

The response of outside interests in coming to the aid of the Dayton central-station company has been fine and is deeply appreciated, declared Mr. Tait. No more electrical apparatus need be sent, however, unless requested, he added. If further assistance is required, the nearest source will be called upon. The company's own organization is well in hand and everything is moving ahead.

#### RESUMPTION OF CENTRAL-STATION SERVICE

By the end of the present week the central station expects to have full service restored to all except the submerged districts. The Fourth Street direct-current station was in partial operation by Wednesday, while the large Third Street station was meanwhile being dried out. The death of one lineman constituted the only loss of life among the company's employees. For fifty hours the plants were under water, which was 12 ft. deep over the engine-room floor at the Fourth Street plant and 6 ft. at Third Street. Adding to the difficulty, the receding waters left a foot of mud covering everything.

Dayton has displayed indomitable spirit in coping with its great calamity. The flood caused nearly 100 deaths and millions of dollars' worth of property damage. Half a million of this loss will be borne by the electrical interests. Every business establishment in the central district sustained

serious damage. While it is likely that every electrical concern is crippled, the electrical men of Dayton remain courageous and cheerful.

#### HELP FROM OTHER CITIES

Without waiting for an appeal for aid, electrical interests in other cities began rushing men and material to Dayton at the first news of the disaster. Twenty electrical engineers were dispatched from the New York Edison Company, and ten came from the Commonwealth Edison Company, Chicago. The Dayton company operated its own commissary during the days of the flood emergency, impressing the services of its stenographers to peel potatoes and aid in preparing food for the workers.

Dayton has long held the well-earned title of "The Electric City," and the great dependence of the community on its central-station service required that operation be restored at the earliest possible moment. Probably 85 per cent of the city's available industries are on the company's circuits. Telephone and fire-alarm systems also depended for their power supply on central-station service. Of the special ornamental street-lighting posts for which the down-

ager of the New York Edison Company, while in Detroit last week, received word from Mr. Anthony N. Brady of the situation in Dayton and left immediately for that city to give such aid as he could to the public-utility men there in establishing the electrical service.

At Cleveland he met Mr. S. C. Phillips of the New York company, in accordance with business plans made before the disaster, and together they went on to Dayton, reaching there at sunrise on Friday morning, March 28.

At 4 p. m. on March 29 Mr. Lieb telephoned to his New York office, by way of Springfield, Ohio, that Mr. Frank M. Tait, president of the Dayton Power & Light Company and of the National Electric Light Association, from whom no word had been learned, had been found.

On March 30 sixteen men from the staff of the New York Edison Company were sent to Dayton to render any assistance within their power. These men were from the electrical construction, underground, overhead and meter departments.

With the party went Messrs. W. Hill, electrical superintendent; W. T. Dempsey, superintendent of the arc-lighting department; Alexander Maxwell, chief of the electric labor-



FIG. 1.—TYPICAL GENERAL VIEW IN THE FLOODED DISTRICT—JOINTOWN, IND., AFTER WATER HAD RISEN TO FLOOD

town streets of the city were notable, 125 were broken off or twisted out of shape by the force of the waters.

#### FIRST USES FOR CENTRAL-STATION ENERGY

With the resumption of electric service energy was furnished to the relief headquarters, the local newspapers, and to a mattress factory to make mattresses for the sufferers. A few street cars began running early in the week but no fares were accepted. The interurban line from Dayton to Xenia also started, the passengers being required to cross the Little Miami River by a small foot-bridge.

With assistance from other cities, the Dayton company soon had twenty-five experts at work making every effort to restore operating conditions. High-class engineers aided in cleaning mud out of the plants, while volunteers did heroic work. Shortage of coal, however, remains a menace to many utility plants in the flood-devastated districts. Important first-aid service rendered by the Dayton central-station company was in emergency lighting and the pumping of basements.

Among Dayton electrical interests, nearly all the local manufacturers and supply dealers suffered more or less, among those bearing the heaviest losses being the Dayton Electrical Laboratories, William Hall Electric Company, Gibbons Fixture Company, Platt Iron Works, Globe Electrical Company, and others.

Mr. John W. Lieb, Jr., vice-president and general man-

ager of the New York Edison Company, while in Detroit last week, received word from Mr. Anthony N. Brady of the situation in Dayton and left immediately for that city to give such aid as he could to the public-utility men there in establishing the electrical service.

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Mr. John T. Greene, superintendent of the fire-alarm and police-telephone service of Toledo, left for Dayton early on the morning of March 31, accompanied by two linemen, to assist in rehabilitating the fire and police-alarm service of Dayton, which was put out of commission by the floods.

Dayton is one of the important interurban-railway centers of the United States, seven traction lines radiating from it. It is said that these electric railways have a combined mileage of 700 miles.

**COLUMBUS, OHIO** (*By Telegraph*).—The Erner & Hopkins Company's electrical supply house, Columbus, is completely flooded and burned out. Electrical supplies have been started from this city to Dayton.

Under normal conditions, electrical energy is supplied in Columbus principally by the Columbus Railway & Light Company. In addition, there is the municipal lighting plant in the penitentiary, which supplies the State House and other state institutions. All of these plants were more or less damaged by the flood, as they are located on low lands near the junction of the Olentangy and Scioto Rivers.

The flood came up very quickly on the morning of March 25. Owing to excessive rainfall it is said that the water rose 15 ft. in three hours. By 8:30 a. m. there was 6 ft. of water on the floor of the principal central-station plant. Fortunately, the old Edison plant on high ground in the center of the city was in service, and by starting up three old plants usually held in reserve the Columbus Railway & Light Company was able to give lighting service and partial railway service with comparatively slight interruption.

In accomplishing this the storage-battery reserve was very useful. The output was 220-volt and 500-volt direct current only during the first few hours of the flood. It was the old plants that saved the day in Columbus. The company is proud of the fact that the old Edison station has a record of service of never being without energy in the bushars.

By 6 p. m. on March 25 some cars were running in the higher portions of the city. The alternating-current supply was off for a short time, but nearly all lighting demands were supplied by the night of the 25th. Industrial service was restored practically by March 31. The factories in the flooded district could not very well have used energy before that time. To be as economical as possible, users of electric signs were requested not to light them at first.

On the West Side of Columbus about seventy persons lost their lives owing to the floods. The central-station company procured boatmen from Buckeye Lake and sent them to the relief of its employees. The greatest damage was done by the breaking of the levees after they had held until the water had risen above them. The breaks then caused a difference of head which permitted the water to sweep over the inundated districts with terrific force. There was a panic on March 26 owing to an unfilled report that the storage reservoir had gone out.

As a matter of fact, it is unlikely even if this added calamity had happened that greater damage would have been done than by the breaks in the levees occurring in the manner described above.

In the main power house of the Columbus Railway & Light Company the alternating-current board was abandoned for a week. This plant contains nine 500-volt alternating-current units. By March 30 a 1500-kw turbo-alternator was in operation, the energy being controlled from temporary structures outside the power house.

To dry out the units, they were boarded up and hot air was circulated through them by means of temporarily gas-heated furnaces. The machines were also run under their own power on short-circuit to dry them out, the application of heated air expediting the process.

The municipal plant supplying arc and incandescent street lighting and some power customers was out of commission for nearly a week. The state penitentiary plant

suffered loss merely from damaged transformers. For a time it was not able to give electricity to the State House. The central-station company was able to give emergency service to the offices of the Governor and Adjutant General.

Under trying conditions, the local company managed to get a telephone message through to the General Electric Company. Connection was broken off before the message was completed, but the manufacturers sent all spare parts thought necessary without waiting for instructions. Mr. E. P. Waller and three men were sent from Schenectady to Columbus and their services and the prompt help of their company were greatly appreciated. Mr. J. R. Lovejoy, of Schenectady, who happened to be in Columbus, was marooned there during the flood. Messrs. S. G. McMeen, president of the local company, and M. S. Hopkins, of E. W. Clark & Company, were in charge of the emergency rehabilitation and they worked like Trojans. Mr. W. A. Hopkins was in charge of the boat relief service of the company. All employees and their families were saved except the wife and child of one man.

Telephone and telegraph service was interrupted for several days. The Jeffery Manufacturing Company's plant was not injured and was of great service to other interests. The plant was thrown open for emergency work, and the vacuum drying ovens especially were very useful. Street-railway motors and other machinery that could be carried were dried out in this way. The Columbus Buggy Company, manufacturer of automobiles, sustained some damage.

**AKRON, OHIO.**—At this place the basements of the Northern Ohio Traction & Light Company's power houses were filled with water, interfering with operation for a short time. The company's tracks in the lowlands were covered with water, necessitating the transferring of passengers.

Officials of the company stated this week that the flood was the worst ever known in their section of the country. They estimate the losses at this time not to exceed \$10,000 in property and \$15,000 in revenue. They expected to be in full operation by April 1.

**CHILLICOTHE, OHIO.**—At Chillicothe, Ohio, on the Scioto River, on March 28, the city was without electricity, gas or water supply. The river was falling at the time, however.

**CINCINNATI, OHIO.**—Newspaper reports state this week that the public utilities had suspended operations and that no electric service was being furnished.

Representatives of A. B. Leach & Company, New York, who are interested in the Columbia Gas & Electric Company, operating in Cincinnati, said this week that they knew of no difficulties experienced by that company from the floods. The stage of the river reached 68.6 ft. on the night of March 31.

**CLEVELAND, OHIO.**—The Western Ohio Railroad Company, Cleveland, had a 160-ft. two-span bridge washed out at Lockington, Ohio, and its train service was interrupted on March 25. Its other losses will not exceed \$1,000. There was no interruption of its power and lighting service.

The plant belonging to the Cleveland Electric Illuminating Company on the Cuyahoga River bank was flooded last week for several days. One of the feeder switchboards, located underground, was entirely submerged and much of the apparatus in the basement was in the same condition. Finally the large turbines were also submerged. By Saturday, however, they had been dried out and put into operation again.

To take care of the demands for service the feeders were connected up with the new central station and, by having all the light and power load possible cut off in the large office buildings and factories, the company managed to maintain service in all parts of the city, except for a short period when the West Side was in darkness.

**COSHOCTON, OHIO.**—The station at Coshocton was flooded and during the high-water period the town was in darkness.

DEFIANCE, OHIO.—Properties of the Auglaize Power Company, Defiance, which has a hydroelectric plant on the Auglaize River, near Defiance, Ohio, and a 60,000-volt transmission line running to Lima, Defiance and Toledo, did not suffer greatly in the floods, according to Mr. R. R. Livingston, Jr., New York, chief engineer of the company.

Part of the river bank back of the dam was washed away, but no other damage was done. The tailwater backed up considerably, causing loss of head and necessitating a temporary shut-down. While the plant was shut down service was secured from the steam plant of the Defiance Gas & Electric Company, but other places usually furnished by the Auglaize plant were not as fortunate. In the heavy windstorm of the week previous to the flood a few of the transmission towers of the Auglaize company were blown down. Altogether the properties withstood the troubles in a satisfactory manner.

DELAWARE, OHIO.—Water supply and electric service in Delaware were cut off on the night of March 24 and restored on the night of March 28.

EAST LIVERPOOL, OHIO.—From Thursday, March 27, until Saturday, March 29, the entire 60-mile trackage of the Tiffin State Railway Company, East Liverpool, Ohio, was tied up on account of floods.

Traffic from Midland, Pa., to Wellsville, Ohio, a distance of 10 miles, was opened up on Saturday morning. By Monday evening, March 31, the line was opened to Steubenville, Ohio, a distance of 30 miles, and later on to Beaver, Pa., 26 miles further.

ELYRIA, OHIO.—The dam and plant of the Doherty company at Elyria were swept away, but as it had been planned previous to the flood to abandon this plant, the loss was immaterial.

FREMONT, OHIO.—Advices from Fremont, Ohio, dated March 31 are to the effect that the Schott Construction Company, which is building the Ballville hydroelectric plant, will suffer loss to the extent of about \$200,000. This is possibly exaggerated.

MANSFIELD, OHIO.—High water got into the wheel pits of the Mansfield (Ohio) Railway, Light & Power Company, causing suspension of railway and lighting service from 2.30 a. m. on March 25 until 6 p. m. on March 28. The interurban track between Mansfield and Shelby was damaged to the extent of \$500 to \$1,000.

MASSILLON, OHIO.—At Massillon, where the Massillon Electric & Gas Company is located, service was interrupted for about three days.

One of the walls of the Massillon plant crumbled and part of the generating equipment was flooded. The damage was very slight and there was nothing but the drying out of equipment needed to restore service.

NEWARK, OHIO.—A letter received by the American Gas & Electric Company, New York, from H. L. Montgomery, manager of the Licking Light & Power Company, Newark, Ohio, one of its subsidiaries, describes conditions in that section as follows:

"We have just received a report from Mount Vernon that they think they will be able to start the plant some time to-day (March 27), as the water has dropped considerably and is out of the boiler room. As soon as they get the mud and rubbish cleared away, they will be able to start up.

"I understand all of the outside buildings in connection with the plant have been carried away, also all of the poles, and the coal pile is completely gone. We were fortunate enough to get a car of coal from the railroad company, and that will carry us along for a day or two. The water has not dropped sufficiently as yet so that we can find out whether any damage has been done to the building or not, but from what can be seen it is in very good shape. All railroad and wagon bridges have been washed out, and traffic is at a standstill.

"I understand two of our linemen narrowly escaped be-

ing drowned and were in the water for over two hours, holding on to one of our poles until they could be rescued. They are now in the hospital in a very serious condition. It will probably be a day or two before I shall be able to get to Mount Vernon.

"From what I can learn, it is the most disastrous flood the State of Ohio has ever known. The conditions at Newark are not serious, although the water has reached a very high mark. It has done some little damage around our new plant, but nothing that cannot be repaired."

SANDUSKY, OHIO.—The overhead wires at Sandusky went down under a heavy load of snow Thursday morning, and both telephone and telegraphic communication was impossible. At that time the linemen were unable to get the service would be restored. The condition was such that the light plant could not furnish service.

TIFFIN, OHIO.—Mr. A. J. Bull, of the Ohio Light & Power Company, Tiffin, Ohio, an American Gas & Electric subsidiary, wrote to Mr. George N. Tidd, vice president and general manager of the latter company, on March 25, as follows:

"Mr. Frank B. Espy (manager at Tiffin) has requested me to write you a report about the conditions here in Tiffin



FIG. 2. PUMPING WATER FROM POWER HOUSE AFTER WATER HAD FALLEN 22 IN. MARTIN, IN.

since the flood. Mr. Espy has been busy all the time since the plant was flooded and has been working night and day in order to straighten out things. The water continued to rise until Wednesday night. It was then 3 in. in 4 in. under the engine-room floor. The water started to go down on Thursday morning, and by Friday morning it was down so far that we could get access to the back of the plant.

"Mr. Espy then got hold of a gasoline engine and pump and started to pump out the water from the boiler-room and engine-room basement. Last night the water had been pumped out of the plant. Fire was started under one of the boilers and we had steam up last night. Mr. Espy had, however, afraid to start up the engines yesterday and turn on the current because the distribution system was not in order. Very likely some of the wires in the damaged houses in the neighborhood are short circuited and we should have risked starting too to test the voltage had been turned on.

"In the old engine room apparently no harm has been done other than that the bolts have been soaked with water and the splices of the belts are somewhat loose and need tightening. In the new engine room the pressure on the Massillon engine has been soaked with water and the apparatus will have to be tried out before the engine can be started. The old basement of the engine room is full of mud and will have to be cleaned out. The turbine generator can probably



be started up to-night. The water did not come high enough to spoil any of the apparatus in the switchboard, nor have any of the direct-current machines been touched by the water.

"The boiler room is full of mud and debris from outside. When the water started to run into the boiler room the two boilers on the west side were working. The cold weather has frozen up the coal pockets, but the ice will probably thaw as soon as the temperature rises in the boiler room. The coal-handling apparatus is intact. There was a large pile of coal in the back of the plant when the flood started, and about one-third of this coal has been washed away by the flood and the rest has been largely mixed with mud and gravel. The river has washed out the whole retaining wall around the pump house, but the pump house itself is not damaged. The whole alley from the plant and down to the pump house is still full of debris, and most of our poles in that neighborhood have been broken. All the crossings over the river have been broken and all poles in the neighborhood of the river banks are down. All connections to the damaged houses and to the section where the poles are broken have been cut off so that the direct-current system on this side of the river now is clear. It is very hard to say how many of the transformers have been lost. It will probably take some days before we can start the street lighting. In the office the water came up about 5 ft. In Fostoria no damage has been done. The plant was running all the time and the distribution system is in perfect order.

"From Fremont we have had very few reports. All we know is that the plant itself was working all the time, as was also the heating system. In the office the water came up about 7 ft. It is very probable that all the records have been lost. We have been trying to get telephone connection with Fremont to-day.

"In Tiffin very much damage has been done. About twenty private houses have been washed away by the flood. The water-works are out of commission. The gas supply is, however, intact on this side of the river. In the upper section of the town there was no interruption in the gas supply."

No damage was done to American Gas & Electric properties at Canton, Fremont, Fostoria or Logan.

**TOLEDO, OHIO.**—A letter reaching New York this week from Mr. H. S. Swift, secretary of the Toledo Railways & Light Company, outlined conditions in Toledo as follows:

"In so far as this company is concerned it has suffered no property loss by reason of high water. There has been no interruption to the service furnished the public by our transportation, electric, heating and artificial gas departments.

"For three days, however, our main power house on Water Street was completely surrounded by water to a depth of some 3 ft., which rendered the operation of our plant very difficult, and the result might have been serious had not our people bricked up windows and surrounded the machinery operated in the basement with brick walls to keep out the water. The use of powerful pumps enabled us to remove the water which leaked in.

"High water at our artificial gas plant made it necessary to abandon some of our retorts, and the retort house and coke-shed were flooded with water.

"Our operating expenses will be greatly increased on account of this flood, but we are thankful there has been no more serious result. Our only apprehension is that on account of the inability of the railroads entering from the coal fields to operate through service, we may be short of coal.

"Fortunately, we have enough coal in Toledo to operate for a number of days, and we trust that even if it is necessary to detour shipments our wants can be supplied before our stock is exhausted."

**TROY, OHIO.**—Newspapers listing the flood losses at Troy

Ohio, include the Hobert Electric Company and estimate the damage to this concern at \$35,000.

**WARREN, OHIO.**—Most of the damage to Doherty properties was done at Warren, Ohio. There the water rose to a height of 4 ft. on the floor of the generating room of the Trumbull Public Service Company, which operates in that city. On this account the plant was shut down for the night of Tuesday, March 25, until the afternoon of March 29.

At the plant of the Warren water company the filtration tanks were wrecked and unfiltered water was being supplied to the city up to March 31. Advertisements calling attention to this and urging the public to boil their drinking water were placed in the local papers.

Service at the Warren gas plant was shut down in an unusual way. This plant is located on the Mahoning River just below a bridge of the Baltimore & Ohio Railroad Company. Under the pressure of the high water, this bridge finally gave way, but instead of going into the river was swung around and deposited directly in front of the gas plant, preventing access to it.

**YOUNGSTOWN, OHIO.**—A man who arrived in Chicago on March 27 declared that Youngstown was under 8 ft. of water and that the Mahoning River had risen 10 ft. above any previous record. The electric lighting plant and the water-works were out of service, according to this informant.

Owing to its location on high ground, no serious damage was suffered by the plant at Youngstown. The boiler room was flooded, and after this had been pumped out service was restored. City fire engines were used to fill the boilers with water for starting.

Mr. Oren Root, president of the Republic Railway & Light Company, New York, issued the following statement to the stockholders on March 29:

"Mr. Norman McD. Crawford, president of the Mahoning & Shenango Railway & Light Company and other subsidiaries, states that the direct damage to the property will be less than \$6,000; that no dams and only one small county bridge affecting the operations of the subsidiary companies have given way, and that practically the only loss will be from the interruption of the service for three or four days. Mr. Crawford states further that the property of none of our large power customers has been damaged, and that he is communicating with electrical manufacturers for prompt delivery of commercial motors to assist prospective power users whose plants have been badly damaged and who are requesting electric power installations."

### Indiana

**INDIANAPOLIS, IND. (By Telegraph).**—Electric light and power plants in Indianapolis did not suffer from the recent flood to anything like the degree that the telephone, telegraph and electric traction systems did.

None of the generating stations was submerged except those belonging to the Indianapolis Traction & Terminal Company. The traction company's generating station on West Washington Street, which was the first to be put in service after the recession of the flood, supplemented by outside interurban stations, furnished enough energy to keep a large percentage of the street cars in operation. Generating stations owned by the lighting companies were more fortunate in being located on higher ground and out of reach of the river.

Business districts and the greater portion of the residence districts were unaffected by the flood, except in being deprived of the normal water pressure and outside communication.

About ten electrically operated wells in various parts of the city, owned by the Indianapolis Water Company, were put out of commission by the motors being submerged. The Merchants' Light & Heat Company came in at the opportune moment and connected a large centrifugal boiler-



feed pump with the city's water mains and supplied about 2,500,000 gal. per day for use in case of emergency for fires and flushing purposes.

Most of the damage done by the flood in the immediate vicinity of Indianapolis was on the North and West Sides. Practically all of the railroad bridges at Indianapolis were carried away except the Big Four bridge and the Pennsylvania Railroad bridge across the White River. Telephone and telegraph cables were severed in practically every place where the bridge was demolished.

It is remarkable that the eighteen or twenty heavy railway feeders supported on poles on the West Washington Street bridge over the White River were left unsevered although the poles were carried away when the bridge was demolished. This handsome arch bridge, which was of massive stone construction, was built recently. Telephone and telegraph cables which were run through conduits in this bridge were totally destroyed.

Re-establishment of telephonic communication across the river was accomplished by a rather novel method as the swift current and width of the river at this point would not permit crossing in a boat. A line was carried across the river by means of a kite and the messenger for supporting the cable pulled across in turn and anchored on each bank. Fig. 5 shows one of the Central Union Telephone Company's employees hooking the cable to the messenger. As the location of the temporary cable will interfere with the reconstruction of the bridge, it will be moved about 25 yd. to one side and supported from each bank by a frame. A permanent cable will not be installed until the bridge is reconstructed, as it will have to be inclosed in conduit in the bridge proper.

Mr. T. A. Wynne, vice-president and treasurer of the Indianapolis Light & Heat Company, said that the losses sustained by the company due to the flood would probably not exceed \$1,000, excluding the loss of revenue due to the output dropping to about 50 per cent of normal during the worst part of the flood.

At present the load is about 80 per cent of normal and only awaits the rehabilitation of the flooded district to assume standard conditions. This company supplies electrical energy to factories and suburbs and furnishes considerable lighting. About one-half mile of its 4100-volt transmission line running to the Prest-O-Lite Company was torn down on the West Side of the city. It is asserted that this damage was caused by the traction company's heavy feeder line falling and uprooting poles on a curve. Line drops to houses were removed by the flood in several cases, but these will not be repaired until the houses are ready for occupancy. Except for short periods when permanent grounds occurred and circuit-breakers were blown, electricity was supplied to all who could use it during the flood.

Thomas Cusack & Company said that their electric signs, aggregating 1239 in number, were not extinguished during the entire period of the flood except a small lighted bulletin and a cigarette company's sign which were blown over by the recent cyclone. The cigarette company's sign contained about 3000 lamps and was about 45 ft. sq. Its failure during the cyclone is laid to faulty anchorage.

Among the large electrically driven factories along the banks of the White River which were submerged during the flood and unable to operate were those of the Nordyke & Marmon Company, Willys Overland Company, R. J. Irwin Company, Parry Manufacturing Company, Motor Car Manufacturing Company, the Marion Sales Company and the National Starch Manufacturing Company.

These concerns ranged from 100 hp to 500 hp in motor loads. The first six companies were supplied with electricity from central stations in Indianapolis and the latter had an isolated generating plant. The actual extent of the damage done in each case cannot be ascertained until the water recedes.

Although the Kentucky Avenue bridge across the White

River was demolished, the Merchants' Light & Heat Company's main leads were not affected at this point as they were not supported on the bridge, but were anchored on heavy poles on each bank.

These poles were on high ground and not reached by the flood. For similar reasons the main leads across the river at the north of the city were unharmed.

About eight poles supporting the transmission line which supplied the Marion Sales Company with electricity were washed out on the levee, but another line was run in from the north immediately. Water is still in the engine room of this building. Water breaking through the levee to the north of the city broke several poles on a small transmission line supplying energy to Broad Ripple, a suburb of Indianapolis, causing a short-circuit and burning out the line.

The isolated generating plant at the Claypoole Hotel in Indianapolis was put out of service because it was impossible to get water for boiler feed. The Merchants' Light & Heat Company supplied electricity to this hotel as well as to the traction terminal building during the flood.

Service might have been interrupted at the Merchants' Light & Heat Company had it not been for an electrically driven centrifugal pump which emptied the basement of the



FIG. 3—CABLE AND CONDUIT AFTER FLOOD—ROADWAY BRIDGE, INDIANAPOLIS

generating station of the water which backed up through the sewers. The sewers were later closed up.

Instead of the output of the People's Light & Heat Company decreasing during the flood period it was increased to a slight extent on account of the contract for lighting the Coliseum during the Auto Exhibit March 31-April 5.

The Indianapolis abattoir which was being equipped with about sixty Westinghouse motors aggregating 300 hp for packing purposes, was submerged in 7 ft. of water. About 75 per cent of the work was finished when the flood came.

Four Western Union cables supported from angle-iron braces on buildings at each end of the Kansas bridge across the White River at Indianapolis were cut to prevent the buildings from being pulled down when the bridge went out. These were replaced by temporary cables running across an adjoining bridge which withstood the flood.

A telegraph office at Alexandria, Ind., was burned as a result of a "cross" with a 100,000-volt line. The equipment the water was 5 ft. deep in the office. Counters and furniture floated away. The currents with this wire were fast for three days.

Mr. A. C. Cronkhite, district commercial superintendent of the Western Union Telegraph Company, said that the wild reports which spread around the country concerning conditions at Indianapolis caused a tremendous congestion in telegraph traffic.

A commissary train was sent out of Richmond on March 27, in charge of Mr. S. V. King, of the *Commercial Age*, Indianapolis, to take care of operators in Dayton and vicinity.

Conditions similar to those mentioned above were experienced by the Postal Telegraph Cable Company. Pole lines were down in practically every direction. About 500 poles were down between Columbus and Seymour, Ind. Twelve poles were carried away at Terre Haute by the Wabash River, but in eighteen hours, with the help of two motor boats, the circuit was re-established. It is asserted that 75 per cent of the telegraph service has been restored.

Considering the extent of the damage, the conditions under which repairs have been made and the short time that has elapsed, the progress made toward restoration is to be commended. Construction men employed by the Central Union Telephone Company were scattered all over Indiana, preparing for spring extensions and reconstructions, when the flood overspread the State. Mr. W. R. Hirst, plant superintendent at Indianapolis, concentrated his efforts and succeeded in getting practically all of the men back in forty-eight hours.

On March 26 the exchanges on the North and West Sides of the city were put out of commission, making about 6000 stations idle in Indianapolis. In five days all except 600 of these stations were again in service. Drinking water was pumped from a well located in the Central Union Telephone building by electricity and distributed to employees by automobiles during the flood.

According to reports made by the Central Union Telephone Company of Indiana, the following equipment was lost or destroyed in the State of Indiana because of floods: 500 poles, 15,000 ft. underground cable, 10,000 ft. aerial cable, 8000 ft. underground duct and 100 miles toll circuits. It is estimated that temporary repairs in the State of Indiana for damage done by flood will amount to \$50,000, and an additional \$100,000 will be required to make repairs permanent.

General Manager Moriarty of the Indianapolis Telephone Company should be especially congratulated on the progress made by the independent telephone system in re-establishing service in Indiana.

About 3000 independent stations were out of commission in Indianapolis and two-thirds of these were in service again in three days. Cable had to be shipped in from Chicago and men were recruited from various places, while some came in and offered their services. Mr. William Fortune, president of this company, said that by April 1 80 per cent of toll service would be restored.

Mr. Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company, sent the following letter to the *Electrical World*:

"Newspaper reports were generally very much exaggerated in regard to the flood damages in Indianapolis. The water was 6 ft. higher than ever before recorded, but there have been only five deaths. All the public-service corporations were damaged to some extent. The street-car company and water company were both out of service for four days and are now only partially operating. The Indianapolis Gas Company was out of service for one day. All three of these stations were under from 6 ft. to 10 ft. of water. Both telephone companies were practically out of business. The Indianapolis Light & Heat Company, however, was able to maintain its service intact with the exception of one unimportant line. The water was really about 12 ft. above our station floors at both our generating stations, but owing to strenuous efforts we managed to keep the water out of our stations and they were not particularly damaged.

"The street-car company has had some of its electrical apparatus submerged, but the damage will consist merely in drying and getting ready for service. It also lost all of the cables leading away from its generating station, the

carrying lines having been torn down by the flood, the poles nearly all broken and cable being down along the various rights-of-way. This cable, however, can be reinstalled on new poles.

"The water company's loss will consist largely in cleaning its station and drying out its electric motors, quite a number of which were submerged, and repairing its canal banks and river dikes. Its loss will be perhaps \$100,000. The Indianapolis Light & Heat Company was supplying energy to the motors above specified, which were operating pumps for considerable of the water supply. The station and line loss will be insignificant. Perhaps the greatest loss sustained by any of these companies will be from lack of returns occasioned by the shut-down.

"The Indianapolis Light & Heat Company's output was materially reduced by reason of the fact that a large number of its customers were shut down in the manufacturing district, our output running about 50 per cent of normal during two days of the high water. It is now up to 75 per cent of normal, this being the seventh day from the beginning of the flood. We will probably not reach our normal output for another week."

Marooned in Indianapolis by weather disturbances and floods the executive heads of H. M. Byllesby & Company, of Chicago, were unable for a time to make their whereabouts known, and much anxiety concerning them was felt. A party composed of Messrs. H. M. Byllesby, president of the Chicago company; John J. O'Brien, its first vice-president, and Fred Stearns, the Byllesby general counsel, left for Louisville on the first night of the storm and were compelled to seek refuge in Indianapolis. That city was subsequently cut off from communication with the outside world and for forty-eight hours it was feared that these men had met with some mishap, although subsequently messages regarding their safety in Indianapolis were received.

ELWOOD, IND.—N. M. Argabrite, manager of the Indiana General Service Company, Elwood, an American Gas & Electric property, wrote on March 31 to the *Electrical World* as follows:

"The water backed up on the electric-lighting properties until it was within 4 in. of our fires. It came in on our pump-room floor and also in our substation nearly 2 ft. on the high-tension transformers. It came into our engine room, entirely filling our pump pits and condenser pits, and came faster than we could pump it out.

"In spite of this the Elwood electric-light plant gave continuous service throughout the entire period. It might be interesting to state that the three plants in Indiana belonging to the American Gas & Electric Company, supplying energy to Muncie, Eaton, Hartford City, Dunkirk, Redkey, Jonesboro, Upland, Gas City, Marion, Fairmount, Alexandria and Elwood, were practically the only three plants of any importance in this section of Indiana which continued to give service under the adverse circumstances."

FORT WAYNE, IND.—Owing to the high water the municipal electric-lighting plant at Fort Wayne was shut down on parts of several days. The city water-works were also compelled to discontinue operations, but by building a cofferdam at Station No. 1 and pumping the water out an electric motor-driven pump was enabled to give partial service.

KOKOMO, IND.—While newspaper reports of damage done to the properties of the Indiana Railways & Light Company at Kokomo, Marion and other points were much exaggerated, according to Mr. T. C. McReynolds, secretary-treasurer, interruption to service resulted from the Kokomo power plant being out of commission from noon March 24 to the afternoon of March 29. No great damage was caused, however, except the inconvenience to the company's patrons. Between Marion and Kokomo the inter-urban cars operated during most of the flood week. One small washout occurred on the railway right-of-way.

LOGANSPOUT, IND.—A. C. Parsons, resident agent of the



General Electric Company at Logansport, Ind., reported to the Chicago office of the company on March 25 as follows: "I am marooned here. Wabash and Eel Rivers both over their banks. Business part of town flooded as far back as Fourth Street from First Street the whole width of the city. City Hall, where electric light office is, under water. Pennsylvania, and I think Wabash, depots both under water. No trains in or out. No traction service. Water is rising, with promise of more rain. Don't know when I shall be able to leave Logansport. Wrecks in every direction."

MARION, IND.—Mr. O. M. Dreschel, manager of the Marion Light & Heating Company, wrote on March 29 to the American Gas & Electric Company, New York, as follows:

"On Monday, March 24, we began to have trouble with high waters in this section and we are just beginning to be relieved. One can hardly realize how we managed to keep the Marion plant from going under water.

"Tuesday morning at 1:30 the water was 22 in. high on our turbine-room floor. All of the boiler-room was under water, which rose to an inch of our fire boxes. We had to bank our fires and close down everything with the exception of the spare circuit (supplying the business district), keeping on just enough power to give us light so as to operate the pumps that were removing the water from the pit in the turbine basement.

"Some of the men were on duty sixty to seventy hours. Otherwise we should have gone down and out, and the damage that would have been done cannot be estimated, not only in our own losses but in the loss to the factory people.

"We thought Monday evening that we had the high-water mark and did not believe it possible for the water to get any higher at that time, it being just even with the turbine floor. By operating three of the pumps in the basement we were able to hold our own, but from this time on the water began to rise and, as above stated, reached 22 in. above our main floors. We built cofferdams around the openings leading into the boiler room, but with the three pumps we could not hold our own and lost ground.

"As the last means we broke the 'L' on a No. 4 circulating pump and made a connection for a 4-in. pipe discharge in the handhole of the condenser, and with this outfit in operation we were able to keep the water at a standstill and thereby save the Marion plant.

"About 1:30 Tuesday morning, when the water was at its highest, the south wall of the basement began to leak and water was soon pouring in at the rate of 500 or 600 gal. a minute. Two of the men, with their arms, succeeded in keeping this back until the hole was plugged with rags and clay. About this time the firemen reported that the water was reaching their fires and that the drafts were entirely covered. We thought that within the next fifteen minutes we should be entirely at the mercy of the water. We banked the fires and opened the fire doors, receiving what little draft was possible through them, and by operating only the square circuit with what auxiliaries we had in the plant we were able to run in this condition until about 2:30, when the water reached its maximum.

"At 3 o'clock the water had begun to fall about  $\frac{1}{8}$  in., and we knew if we could hold out much longer the victory was ours.

"By 6 o'clock Wednesday morning we had about 2 in. of draft under our boilers, and we then gained ground. The river began to fall very rapidly, and by Wednesday night only 6 in. of water covered the boiler-room floors.

"To make matters worse about midnight on Tuesday the transmission line in Joliet town went down, the water having excavated the dirt around the poles and left them hanging by the wire. This cut off any chances of receiving aid from Muncie.

"The Marion, Bluffton & Eastern Traction Company's transmission line went out about 2 o'clock Tuesday morn-

ing, several of the houses in Joliet town having washed against the poles, tearing them down."

Managers of the Standard Glass Company and the Standard Chain Company, both of which are large customers of the Marion Light & Heating Company, visited the plant of the lighting company during the flood and wrote to the president of the American Gas & Electric Company warmly commending the loyalty of the Marion employees from the manager down.

MUNCIE, IND.—A letter received by the American Gas & Electric Company, New York, from L. B. Webster, of the Muncie (Ind.) Electric Light Company, told some of the troubles experienced there as follows:

"The White River at Muncie was 3 ft. and the Missinewa at Marion was 4 ft. higher than any previous high-water record. Both the Marion and the Muncie plants were so seriously threatened that at the time of the crest of the flood it appeared impossible to keep the water out of the plants. That the water was kept out and serious damage prevented was due entirely to the perseverance and loyalty of all men in both organizations. At Muncie men worked for hours wet to the skin, and at Marion some of the men worked over forty-eight hours without rest.

"In the whole flooded district in Indiana, including Indianapolis, the Marion and Muncie plants were the only ones operated continuously and had current on the wires at all times.

"At Muncie the water works were shut down, and the



FIG. 1.—STREET-RAILWAY FEEDERS UNDERGUT BY FLOOD

only drinking water in the city was furnished by the hotel wells operated by electric pumps with our service.

"We made every effort possible at Jonesboro to save that plant, men working in water up to their waists trying to raise the motors and transformers to keep them out of water, but it was impossible, and we had to abandon it Tuesday at midnight. However, the water did not get into our high-tension transformers and the light service has been re-established at Jonesboro.

"The plant went under 5 ft. of water, entirely covering the motor-driven pumps and all apparatus with the exception of the high-tension transformers.

"All our transmission lines, with the exception of the one between Marion and Hartford City, are in comparatively bad shape, and I personally believe that we must practically rebuild the line between Jonesboro and Alexandria. The weight of the wireline was one, together with the wires, is entirely too much on this sort of pole, and from the high winds and water's dead ground these lines have in some places gone over 8 ft. to 10 ft. We have temporary guys on them in such places, and I do not believe there is a pole standing straight on the line.

"Before these repairs are undertaken I think that, if possible, this line should be thoroughly investigated and either replaced with steel towers or else shorter spaced poles should be planted. I do not believe our loss will exceed



\$1,500, not including the loss of revenue from the factories being shut down or repairs of the Jonesboro property and the tie lines.

"The flood was due to almost seventy-two hours of very heavy and continuous rainfall which began on Saturday, March 22, and ended Wednesday, March 26, with 6 in. of snow. On Tuesday, the worst day, the water was well over the top of the Muncie forebay, which we protected with a cofferdam of sand bags. At one time the water was 2 ft. deep in the turbine pit at Muncie.

"The switch cells were protected by a cofferdam built around them. The oil-pressure pumps, make-up pumps and hot-well pumps were operated under water.

"The actual damage at these two plants will be small, being merely the cost of material and extra labor needed to fight off the water and to care for minor line and forebay repairs. At Jonesboro the motors driving the water-wheels pumps were soaked and will have to be dried out. When the flood came the motors were disconnected and raised, but not high enough to be entirely above the water."

RICHMOND, IND.—J. B. Wharton, manager of the Richmond (Ind.) Light, Heat & Power Company, wrote to the *Electrical World* March 31, in response to an inquiry as to flood damage:

"The actual damage has probably been somewhat exaggerated, but conditions are extremely bad. Our electric plant was flooded, the dam in the river for intake water was washed away, our smokestack blown out of position and a part of the city was flooded.

"Railroads are at a standstill in every direction on account of the bridges being washed out, and there is grave danger of running out of supplies of all kinds, especially coal, oil, etc. We are in good condition as far as food-stuffs are concerned on account of our agricultural surroundings. The municipal electric-light plant was also flooded and somewhat damaged, but at present is running non-condensing."

TERRE HAUTE, IND.—T. F. Grover, general manager of the Terre Haute, Indianapolis & Eastern Traction Company, in response to a request from the *Electrical World* for information, sent this statement dated March 28:

"The cyclone, which struck Terre Haute at 9:30 p. m. Sunday, March 23, swept a strip about one-fourth of a mile wide in the southern part of the city between Hulman Street and Helen Avenue, leveling all buildings, poles and wires for the entire width of the city east and west. This included our Greenwood transformer station, which steps up the emf from 2300 to 23,000 volts, supplying energy for our Sullivan line. The brick station was wrecked and the cyclone was so strong that it even moved the 500-kw transformers from their foundations.

"In addition to this all our service wires and poles for a section of 2½ miles of the city got in such bad condition that it was necessary for us to cut all wires from the beginning of this section, which was quickly done. Our city service north of this section was put in operating condition on Monday, although we experienced a raging storm during all of this time. The storm caused the Wabash River to go on a rampage, and the floods have done us much damage—to just what extent we are unable as yet to state, as the river is still 31 ft. above low-water mark. We are unable to get out of Terre Haute on our Paris line, or to know the extent of our damage, although we know that we have about 3 miles of high-tension line down.

"The traction line, as well as the Big Four and Vandalia railroads, is entirely flooded out for about 2 miles in this district. On our Clinton line we have about 3 miles of track under water and cannot tell the extent of the damage until the water lowers. We do not know the entire damage on our Sullivan line, as we are unable to get through as yet, but so far as we can ascertain we have about a mile of track washed out.

"Our most serious condition has been at our power

house, where the water has risen 6 ft. beyond any record ever known for the Wabash, and while we now have our power plant in operation, we have saved the day so far by building brick walls and walls with thousands of bags of sand surrounding the power house. Although the water is nearly 3 ft. higher than the doors in our engine room, we are able to keep the water out, and so far no electrical machinery has been damaged. We have accomplished this by shutting down our plant for about fourteen hours and using our circulating pumps for throwing out the immense volume of water that was coming in on us. We feel at this time that we are going to save our power house, but of course cannot be sure until the water falls, as the pressure on our walls is terrific and we have some very bad leaks."

#### AMERICAN GAS & ELECTRIC PROPERTIES HAD MUCH TROUBLE BUT SLIGHT LOSS

Reports of conditions at the Indiana, Ohio and West Virginia plants of the American Gas & Electric Company, sent by the local managers of the public utilities in those States to Mr. George N. Tidd, vice-president and general manager of that company, show that while unprecedented conditions existed at these properties during last week's floods, the perseverance, loyalty and resourcefulness of the operating staffs kept the total property loss down to about \$5,000.

From the local managers and from customers of the companies, warm tributes to the faithfulness of the men have been received by Mr. Tidd, who, when seen this week by a representative of the *Electrical World*, was most enthusiastic over the splendid work done by the men.

Before the floods reached Muncie a heavy windstorm struck that city on the night of March 20, which toward morning gained the proportions of a cyclone. Some of the mast-arms on the Dunkirk line were torn down by the wind, the line between Hartford and Jonesboro was torn down and some of the poles between Muncie and Hartford were also heeled over badly.

Hardly had these difficulties been overcome when the floods broke upon the section.

#### MIDDLE WEST UTILITIES PROPERTIES IN INDIANA

Inquiry at the office of the Middle West Utilities Company in Chicago on March 27 revealed the fact that no word had been received from the subsidiary companies in central and southern Indiana since March 24. The Middle West company serves sixteen communities in Indiana with electrical energy and controls two interurban railways and three street railways in that State. On the date last mentioned the interurbans were practically tied up, but the bridges were standing and no track has been washed out as far as known.

Later news was contained in the following cablegram sent on March 28 by Mr. Samuel Insull, president of the company, in response to inquiries from London, Amsterdam and Geneva: "No Middle West Utilities properties in territory where greatest flood damage occurred. Our interurban road from Indianapolis south only temporarily affected. Now operating about half mileage. Expect to operate remainder within a few days. Delay caused by about 2 miles of track damaged by flood. Only one small girder bridge over culvert damaged. Very nominal damage to any of our power stations and transmission lines. Cannot yet determine exact property loss, but feel from reports received it will be small."

#### Kentucky

LOUISVILLE, Ky.—The flood in the Ohio River at the falls where Louisville, Ky., is located, inundated the entire lower floor of the old generating station of the Louisville Lighting Company at the foot of Tenth Street but caused little damage aside from flooding a quantity of machinery at that level. The station is now using only a 150-kw generating set which is on the second floor and hence

suffered little from the immersion. It is not believed that the rising waters will affect the big station of the Kentucky Electric Company, which is located directly on the river front, as this structure was erected with the view of avoiding all possible floods, even one above the mark of the unprecedented one of 1884.

During the violent windstorms which preceded the torrential rains of March 24, 25 and 26 in the Ohio Valley a large steel stack in the plant of the Campbell Electric Company, which is owned by the Louisville Lighting Company, was blown down, and in repairing the damage the combined crews of the Louisville Lighting Company and the Louisville Home Telephone Company effected one of the quickest pieces of work on record. The stack, in falling, destroyed one of the most important cables of the telephone company, but within two hours after the accident the damage done was completely repaired, the debris of the shattered stack removed and a new cable had been strung through 1500 ft. of alleyway at the point.

#### Missouri

BRANSON, Mo.—Although water poured at a height of 6 ft. over its crest, the dam of the Ozark Water & Power Company, on the White River, near Branson, recently closed, was not affected.

#### New York

In Albany, Schenectady, Troy and many of the other cities in the upper part of New York State electric service was interrupted to some extent owing to high water last week. It was first thought that the new State Barge Canal had been greatly damaged, but it was found later that this had withstood the flood in a satisfactory manner.

State Engineer Bensel said March 31, at Albany: "Along the Mohawk, upper Hudson and other streams which connect with the canals of the State the waters are receding rapidly and conditions are now at a normal point. I have been in close touch with canal officials at Fort Edward, Yosts, Amsterdam, Waterford and other places which have been seriously affected by the floods, and they report that unless something unforeseen occurs there will be no further damage of moment done along the line of the old and new canals.

"Terminal Engineer John A. O'Connor, who has been on the western division of the canals for a week, returned today and reports that while barge canal construction work has been under water, in his opinion no great amount of damage has been done to the permanent work and all the structures are in safe condition."

AUBURN, N. Y.—A telegram to the *Electrical World* from the Empire Gas & Electric Company, Auburn, states that the flood conditions did not interfere with that company's plants.

TROY, N. Y.—In a telegram from the Troy Gas Company, which supplies electric service in that city, it was stated that the service was interrupted from Thursday to Monday. The water reached the line shafting and caused damage estimated at \$15,000, exclusive of the loss in revenue. On April 2 all alternating-current circuits were in operation, while seventy-four direct-current customers were still without service.

ALBANY, N. Y.—Mr. A. Anderson, general manager of the Municipal Gas Company, the electrical department of which furnishes electrical energy to Albany, sent the following statement to the *Electrical World* in response to a request for information:

"The flood did not do any damage to our equipment beyond washing away a couple of poles on our street circuit near the river. Our great difficulty was on account of the water-power stations from which we buy energy being put completely out of commission. The Adirondack Power Corporation furnishes us with all of the power which we use from its station at Spier Falls and another at Mechan-

icsville. The Delaware & Hudson Railway Company has a steam station at Mechanicsville which is supposed to help out the Adirondack company in case of an emergency, but all three of these plants were inundated and completely out of commission so that we had to start our steam reserve and operate from our own station.

"This was a rather difficult problem on account of the steam plant not having been used for about nine years. We had three 500-hp boilers under steam at the time in case of an emergency. These picked up some of the load within a few minutes after interruption of the power company's service. Our men immediately proceeded to fire up the other boilers which had the manhole covers off and had not been used for nine years. In four or five hours these boilers were in commission and that night everything was running in Albany as usual. The company carries a few firemen and engineers as a nucleus of a force for the engine room so that in a case of this kind they can instruct the green men. The scheme worked to perfection and we had no trouble in taking care of our business.

"On Saturday afternoon the Adirondack Power Corporation furnished some energy to us from another source and, with our own steam equipment and what we got from them, we are operating satisfactorily now. Our underground system, which had just been put in commission in the flooded district, was completely submerged and the only



FIG. 5.—LINE MAN INSTALLING TELEPHONE CABLE ACROSS WHITE RIVER AT INDIANAPOLIS

damage that we had was the loss of a few meters. All the underground equipment worked satisfactorily; transformers, junction boxes, fuse boxes and cables which were completely submerged for three days never gave us the least bit of trouble.

"In spite of the flood coming on us so suddenly, the newspapers were all able to get out their editions on time, which was about two hours after the shut down occurred. Some of the Troy newspapers were printed in Albany, as the Troy people were in greater difficulties than we were. The first thing we did was to see that the newspapers had proper facilities for printing their papers so that we could keep the public informed on what was best for them to do."

The electric light service in Troy was normal on the evening of March 31, and many features resumed operations on that day.

NEW YORK, N. Y.—Representatives of Henry J. Deland & Company said this week that the total loss to their properties from flood damage will not exceed \$100,000. This does not include loss of revenue from interruption of service.

Representatives of the Henry J. Deland Company expressed confidence that prospective owners of franchises to public utility properties will be found to have been greatly exaggerated when all of the facts become known.

SCHENECTADY, N. Y.—Mr. Hiram W. Cook, general manager of the Schenectady (N. Y.) Illuminating Company,



sent the following to the *Electrical World* in answer to a request for information regarding the extent of damage to that company's property:

"The flood in Schenectady reached practically the same height as the October flood of 1903, in some places measuring half an inch lower and other places slightly higher. The Schenectady Illuminating Company receives its energy from water-power stations at Schaghticoke and Johnsonville. Neither of these plants was in any way interfered with by the water; in fact, on Saturday connection was made from these plants to the line of the Adirondack Electric Power Company, and surplus energy was supplied to Albany and Troy.

"The steam station reserve in Schenectady, which is surrounded by a dike, was unaffected by the high water. The basement of the substation supplying the commercial circuits about Schenectady was 5 ft. above the high water. The offices of the operating department escaped by an inch, but the storeroom floor was covered with 10 in. of muddy water, backed up through the old bed of Cowhorn Creek, which has been transformed into a drainage sewer.

"The gas works of this company very narrowly avoided a shut-down. Dams made of bags of concrete across the doorways of the boiler, engine and governor houses kept these important rooms dry against 12 in. of water outside. The water-gas generator room and almost the entire yard were submerged, but aside from decreasing the candle-power and losing the tar, no great damage was done. The total expense incurred will not exceed \$100."

ROCHESTER, N. Y.—The Genesee River reached its maximum height at Rochester, N. Y., on March 28, the water covering the business section of the city for about a mile to a depth of from 3 ft. to 4 ft. above the streets. That section of Rochester is served entirely by the three-wire direct-current system of the Rochester Railway & Light Company, and it is a remarkable fact that although the underground conduits, services, service boxes and meters were entirely submerged for a period varying from twelve to thirty-six hours, there were only two interruptions to services out of approximately 250 customers that the company has in that section. The services and meters, of course, were not water-tight and were actually alive, energy flowing through them for this length of time.

The company kept the mains alive, however, as investigation did not show any appreciable loss. In fact, the output from the stations on the Edison system during those two days dropped off quite considerably. In one case—a large hotel which receives its energy from the central station and which has an electric switch of 3000-amp rating—the hostelry continued to receive energy for its lamps and motors, although the service was entirely under water, without any visible difference in the quality of the light.

After the flood subsided, inspection of services and meters in the flooded district showed that severe electrolytic action had taken place and that the wires, plugs, etc., were in many cases just on the verge of being eaten away by the action. Undoubtedly had the flood continued several hours longer some of the places in the flooded district would have been without electricity. The street lamps in the business section are also fed from the Edison system, and it was necessary to go in a boat from post to post for two nights in order to switch them into circuit. It was truly an interesting sight to see these street lamps rising from the water and the buildings on either side illuminated, showing the busy workers moving their goods and protecting their property.

Mr. Thomas Yawger, superintendent of the Rochester Railway & Light Company, said that the company did not have a single short-circuit on the entire Edison system during the flood period that was of sufficient magnitude to be perceptible in any of the stations of the company. Two small low-head water-power developments on the Genesee and forming part of the Rochester Railway & Light Company's generating system could not be operated during the

flood-water period, but beyond this the damage to the meters and service boxes and also to gas meters will not exceed \$10,000. When the water had reached the furnaces in the different establishments there was an immediate demand for gas and electric heaters. The company had a very small number of heaters on hand, but such as it had were soon put to work. It is estimated that if the stock had comprised 1000 kw in heaters these could have been installed temporarily during the few days of the flood, and inasmuch as the meters were not registering, would have added to the comfort of the company's customers in more ways than one. The company's garage was in the flooded district.

When the vehicles attempted to return to it on the evening of March 27 they were unable to enter because of the water. The company knew that it would need the wagons the next day and that they would have to be charged, so a temporary line was run over some buildings on to a street which was high and dry and the electric vehicles were backed up to the curb and charged from this temporary connection.

#### H. M. Byllesby's View of Flood Damage

Mr. H. M. Byllesby wired the following to a New York newspaper on April 1:

"The Middle West has marvelous recuperative powers. The flooded districts and cities of Ohio and Indiana may be depended upon to rehabilitate themselves quickly and efficiently. Estimates of damage to property will be found greatly exaggerated. It cannot be denied, however, that serious injury has been experienced and that electric light and power, gas and telephone properties have suffered, together with other forms of privately and corporately owned property.

"The losses that have been incurred by public utilities emphasize one great advantage of syndicate control and management. It is safe to say that every company so held will be rehabilitated without difficulty, delay or embarrassment in securing the necessary funds. A large holding corporation operating properties over a wide area cannot be vitally injured by great disasters in one or two, or even three, states.

"H. M. Byllesby & Company operate no utilities in Ohio or Indiana, and it does not appear that any damage or loss of consequence is imminent at Louisville. The recent floods should concentrate the mind of the nation upon the necessity of broad measures to prevent such calamities.

"The government, the states and the public-utility companies, by co-operative effort, may not only store, conserve and control the supply of streams, but in so doing develop great amounts of hydroelectric power to be used for lighting and power. This work will be of the greatest magnitude and importance, and will call for the best the United States can produce from statesmen, capitalists and engineers."

#### Chicago Contributions to Flood Sufferers

CHICAGO, ILL.—The Chicago Association of Commerce pledged \$100,000, and actually raised a much larger sum for the flood sufferers. Among the contributors to this fund were the Commonwealth Edison Company, which gave \$5,000, and the Chicago Telephone Company, which subscribed \$2,000. The Middle West Utilities Company gave \$500, the Central Electric Company \$500 and Mr. Samuel Insull \$500. A large number of electrical manufacturers, dealers and engineers in Chicago contributed to the relief fund, which by March 29 had reached over \$200,000 and was growing rapidly.

Subscriptions amounting to \$1,000 were raised in two days by the telephone operators of the Chicago Telephone Company for the relief of their sister operators in the flooded district of Ohio. As about 5000 operators will probably contribute to the fund, the total may be swelled to double or triple the amount named. It is the intention to get in communication with Mr. F. W. Whitten, traffic superintendent of the State of Ohio, and ascertain the condition of the girls in that State.



APRIL 5, 1913

## Pennsylvania Electrification Plans

Although no official information has been forthcoming regarding the details of the plans of the Pennsylvania Railroad Company to electrify its main line from Philadelphia to Paoli, the *Electrical World* is unofficially informed that alternating current will be used and that the company will buy energy locally, at least for the next few years. The announcement of March 13 regarding the Philadelphia-Paoli electrification stated that the improvement would involve an expenditure of \$4,000,000 and would be completed in 1914. It was assumed that the company's plans included the erection of its own power house, but this is an ultimate rather than an immediate probability.

The next steps in Pennsylvania electrification cannot be stated with official exactness, but it may be prophesied that electrification of the Baltimore terminal and tunnel will follow the completion of the Philadelphia work, and that with the electrification of the Washington (D. C.) terminal next in order, the linking up of Washington, Baltimore and Philadelphia by electrified line will not be long delayed.

## Expert Aid in Wireless Rescue

Owing to the practical and timely assistance of Mr. Axel H. Geermann, a Danish electrical engineer in the Mexican government service, who was a passenger on the steamship *Texas*, which was disabled in midocean on March 20, a greater disaster was prevented, or at least the passengers on this ship were saved the experience of drifting for an indefinite time in extremely rough weather in a disabled 4000-ton steamer. From the time the steamer left Stavanger, Norway, on the way to Vera Cruz, Mexico, it had to battle with the high sea, and on the eighteenth day the waves knocked off the propeller and disabled the steering mechanism and the wireless apparatus. The two young wireless operators were ignorant of the construction of the apparatus and unable to repair it. Mr. Geermann, who has had much experience in the wireless telegraph field and has built several wireless stations for the Mexican government, among others those at Guaymas, Islas Marias, Vera Cruz and Puyo Obispo, was able to assemble and restore the apparatus so that thirty-eight hours later he could get into communication with the *C. F. Tietgen*, of the Scandinavian-American Line. At that time the steamer was 1900 miles east of Sandy Hook. By noon the following day the *C. F. Tietgen* reached the *Texas* and succeeded in transferring the passengers by small boats in a very rough sea without any accident.

## Electrical Development Society Offers \$200 for "Slogan" and Trade-Mark

The Society for Electrical Development, Inc., has offered \$200 in cash prizes for a "slogan" and trade-mark to be used in its advertising and other literature. The offer is made in two parts, \$100 for the best slogan and \$100 for the best trade-mark. Competition will close May 5, when the award will be made by the executive committee. It is the aim of Mr. J. M. Wakeman, general manager of the society, to interest all persons in the industry in this competition, focusing their attention on the society, its aims and its possibilities. Contestants should mark their contributions, "Slogan Contest," and address them to the Society for Electrical Development, Inc., 29 West Thirty-ninth Street, New York City.

The next meeting of the executive committee of the society is to be held on Tuesday, May 13. Already the organization is accomplishing valuable results in the line of its efforts. Recently a central-station company appealed to the society for aid in starting a new-business campaign. Secretary P. S. Dodd visited the community to study the

situation, and since his return the society has received a letter from the local management declaring that even should the society do nothing more than it has already done in this instance, the company feels that it has received more than the value of the \$700 paid as its share of dues in the society's membership.

## New York Hydroelectric Plans

By ARTHUR W. WATKINS

The New York Conservation Commission is making every effort in favor of the Murtaugh-Patrie bill, and the commission's endeavors have met with success so far, since the bill has already passed the Senate and will shortly be brought up for vote in the Assembly. This legislation as at present drawn up provides for service in the capital district, promising a price varying from \$7.50 to \$10 annually per horse-power. I am told, however, that lying behind this promise there is a "joker," to the effect that the commission intends to render service only part of the day at this price and then double it if the service be made continuous for twenty-four hours.

I should not be surprised at any kind of mental reservation on the part of the commission. The chairman has repeatedly stated in public that there is 12,000 hp available continuously every day in the year. This is a deliberate misstatement. All engineers agree that for practically half of the year the amount is materially reduced. The best information we can get is that 12,000 hp is available only 175 days of a low year, and but little longer in an average year. In this connection the expert, Mr. M. G. Barnes, a very competent authority in my judgment, in his letter to the commission states: "To supplement this hydraulic plant there should be installed a steam plant of 11,000 hp capacity."

The pending bill cuts the total cost of this particular development in two. The object, of course, is to escape a referendum by keeping the amount under \$1,000,000. Should a single bill be introduced, including the water-power development and the steam plant, the total cost would exceed \$1,000,000, and thus a referendum would become necessary. This those behind the scheme clearly desire to avoid.

The Conservation Commission makes no secret regarding its larger plan of ultimately selling energy at cost to every municipality of the State. This is simply an "entering wedge." The commission purposes an expenditure of from \$250,000,000 to \$300,000,000, which will at least be duplicated in distributing systems to be erected by local municipalities. It further purposes entire independence of the Public Service Commissions of the State. Thus, being producers, its members would also make prices as sellers and would stand unregulated in every respect by other than their own authority.

Were the situation not so serious, it might be thought that one feature of the bill was introduced simply as an element of humor. I refer to the provision which permits the commission to exclude practically any amount of the cost of operation and charge it to a capital account during the first four years of operation. The capital account will, of course, be supplied by taxing the entire State. Can anyone conceive a policy more destructive to present investments or a more satisfactory or complete way of ensuring a drain leading through the state treasury to the pockets of the people? It is inconceivable that any public official having this feature of the bill brought to his attention can vote in its favor.

As the bill, however, has passed the Senate and is now pending final action in the Assembly, with the Lieutenant Governor personally in a high and official position of a private newspaper corporation in Albany—doing all he can to push it, the chances are that notwithstanding this

and its other "jokers," it will pass by an overwhelming majority.

As I have said, nothing has ever appeared in our Legislature so destructive to all the interests of the State. I am not referring to the electrical interests alone. Consider what will happen to the manufactures of every municipality which will be thrown into competition with state-produced and state-subsidized power, sold at a price with which even the cheapest service of Niagara cannot compete.

As the enormity of the thing dawns upon the people of the State, I believe they will rise with that form of slow, cumulative and destructive anger which will sweep out of public office every man who had anything to do with legislation of this character.

Unless the people of the State, however, are immediately aroused—and the State's civic associations and the representatives of the electrical industry are the ones to do it—it may be a case of "locking the door after the horse has been stolen." This, it seems to me, is the serious danger of the moment.

### Maine Public Service Commission Appointed

The appointment of the three members of the new Maine Public Service Commission, in accordance with the utility law recently enacted by the State Legislature, was made public by the Governor on April 1. The commission as named will consist of Messrs. L. B. Deasy, of Bar Harbor, chairman; W. B. Skelton, of Lewiston, and Joseph Williamson, Jr., of Augusta. Messrs. Deasy and Skelton are Republicans and Mr. Williamson is a Democrat. All three members of the new board are attorneys and have had much experience in dealing with corporation matters. The selections made by the Governor in naming his appointees have been generally commended in the State, and the opinion is expressed that under their administration the law recently passed by the Legislature will result in good to both the public and the utility corporations.

### A. I. E. E. Pittsburgh Meeting on "Mining"

Under the auspices of its committee on the use of electricity in mines, the American Institute of Electrical Engineers will hold a meeting at Pittsburgh, Pa., Friday and Saturday, April 18 and 19, to be devoted to the discussion of mining subjects. Mr. George R. Wood, consulting engineer for the Berwind-White Coal Mining Company, is chairman of the committee on mines.

Following the opening address by President Ralph D. Merston at 10 a. m. Friday, the following papers are scheduled:

Friday morning—"Purchased Power in Coal Mines," by Mr. H. C. Eddy, American Gas & Electric Company, New York City; "Central-Station Power for Mines," by Mr. J. S. Jenks, assistant general manager West Penn Traction & Water Power Company, Pittsburgh, Pa.; "Safeguarding the Use of Electricity in Mines," by Mr. H. H. Clark, United States Bureau of Mines, Pittsburgh, Pa.

Friday afternoon—"Electricity as Applied to Mining," by Mr. J. W. Hopwood, master mechanic United Coal Company, Pittsburgh, Pa.; "Central-Station Power for Coal Mines," by Mr. C. W. Beers, electrical engineer Lehigh Valley Coal Company, Wilkes-Barre, Pa.; "Alternating-Current Motors for the Economic Operation of Mine Fans," by Mr. F. B. Crosby, General Electric Company, Schenectady, N. Y.

Saturday morning—"Characteristics of Substation Loads at the Anthracite Collieries of the Delaware & Lackawanna Railroad Company," by Messrs. H. M. Warren and A. S. Biesecker, Scranton, Pa.; "Mining Load for Central Stations," by Messrs. Wilfred Sykes and Graham Bright,

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa. Question box.

The question box is intended to afford to those who do not care to participate in person a means of communicating topics for discussion. Anyone desiring to bring up points in connection with the use of electricity in mines is cordially invited to send his communication to the secretary, or place it in the box in person.

On Friday evening at 6 o'clock a Dutch dinner will be held at the Fort Pitt Hotel. There will be several addresses, although it is planned to close these exercises by 8 o'clock, leaving the evening open to the individual plans of the delegates.

### Demonstration of Effects Produced by Radioactive Substances

In order to give his audience a clearer conception of the effects produced by the presence of radioactive substances, Prof. Edward P. Adams, of Princeton University, interpolated a supplementary lecture in place of the third lecture which he was to have delivered before the American Institute of Electrical Engineers in New York on April 2. The object of the change in program was to demonstrate in more tangible form some of the effects which have been spoken of in the previous lectures, reported in the *Electrical World* of March 22 and March 29.

The first experiment showed the effect of a magnetic field upon a stream of cathode particles in a vacuum tube and illustrated how they are deflected from their path by its action. Next, by interposing a radioactive substance between the plates of an air condenser Professor Adams demonstrated that the air in the vicinity of such substances becomes a conductor. Allowing a wire to become coated with radium emanations, it was shown how the period of decay is observed and measured. In closing, Professor Adams presented figures showing the energy extant in one gram of such a radioactive substance as uranium to be 24,000,000 hp-seconds.

President Ralph D. Merston announced that the remaining lectures will be given on April 9 and April 16. Owing to the enthusiasm with which these lectures have been received by the audiences arrangements have been made with Professor Adams to deliver the same series before the Schenectady Section, A. I. E. E., in the near future.

### The Street Lighting and Fixtures of New York City

On March 28 Mr. C. F. Lacombe, chief engineer of light and power of the Department of Water Supply, Gas and Electricity of New York City, lectured before the New York Electrical Society on "The Street Lighting and Fixtures of New York City." Illustrating the subject with a large number of slides, Mr. Lacombe gave a most interesting description of the way in which the street lighting of New York had been developed from crude beginnings to the present condition. The author referred to the diversified problems of the engineer in the lighting of a city like New York. The illumination must be in proportion to the needs of the various streets or sections and to their importance. A system must be capable of great increase without expensive change of equipment; it must be laid out on economical and efficient lines, and judiciously fair prices must be obtained; glaring lighting must be eliminated, and the system must be as artistic as possible.

In order to obtain these conditions the municipal administration, the central-station company, the artist and the engineer can well work together. The administration should provide the necessary funds for steady progress in lighting, both in extension of service and improvement in illuminating units, etc.



Within limitations the artist should not demand extremely artistic design in lighting. It is too costly except in certain instances. In the general lighting of a great city the useful side must have as great weight as the artistic.

The engineer should not cling too closely to the most efficient and economical devices which only obtain the greatest illumination at the lowest cost, for the lighting must be made agreeable to the eye. In street lighting, unless surrounding buildings are to be specially illuminated, the useful rays are those that can be directed toward the ground. To make this agreeable, the light source of an arc lamp, for instance, must be converted into a ball of softened light by diffusing globes or shades, the light so far as is possible being directed toward the ground by either interior or exterior reflectors. This decreases the efficiency to a certain extent, by the absorption of the light, and demands either closer spacing or more powerful sources of illumination at greater heights from the ground. It is, consequently, more expensive.

The naked source of the light produces glare and is not so agreeable, although very useful and less expensive. Considerable success in suburban sections of the city has been attained by abandoning the intense arc unit and using three or four 60-cp or 70-cp tungsten lamps, which produce better distribution, with less glare, at about the same cost.

The efforts of all should be devoted to the extension of diffused lighting in sufficient amount. The administration, the company, the citizen, the artist and the engineer should all work to this end. The progress of the present street-lighting plans depends on the aid the other factors in this work give the engineers in charge.

Referring to the future, the speaker said that in the borough of Manhattan the locations of the posts for street lighting have been determined, and only more powerful illuminating units are needed in order to bring out the full effect of the proposed system. The increased efficiency of the tungsten lamp over the carbon lamp gives more illumination per unit for the same energy consumed, and hence in the suburban districts the illumination can be increased by changing lamp for lamp without any more expense for energy consumption. The 150-watt unit will give excellent results for side streets in Manhattan.

Among the larger units, the flaming-arc lamp of the long-burning type is now nearly perfected. Its large illuminating power per watt makes it very desirable, and it is now being used and will be used to illuminate streets in the center of the city in areas which are congested at night.

In addition to these, magnetite-arc lamps can be used in districts where series arc lighting is in vogue. The flaming-arc lamp and the magnetite lamp are both types which would be used in important sections or streets. By far the greater territory in the city will be covered for a long time to come with the standard inclosed carbon arc lamp and the mantle gas lamp with either upright or inverted mantles. It is believed, said the speaker, that with these illuminating units the lighting of the city can go forward as rapidly as desired, within the physical and financial limitations, and that the city in due time will become the best lighted in the world.

### The Problem of the Second-Hand Automobile

Mr. Ralph Temple, who says that he was the first automobile dealer in Chicago and that the first automobile he had to sell was an electric pleasure car, addressed the Chicago Section of the Electric Vehicle Association on March 18. Mr. Temple, who devotes his attention at the present time exclusively to pleasure automobiles, claimed that the electric is driving the gas car out of the cities to a considerable extent. In relation to pleasure cars the idea of doing away with season models, as the "1913 model," the "1914 model" and the like, is a good one; the idea of attaching dates to models in this manner should not be allowed.

Mr. Temple devoted a considerable portion of his remarks to the number of second-hand cars which are in the possession of dealers, referring, of course, to pleasure cars. He said that an unfortunate situation had arisen by the eagerness of agents in the past to make deals and their willingness to accept old cars, often at an inflated value, in making the trade. In disposing of these cars a few dealers in second-hand machines have no doubt resorted to dishonest practices. One trouble has been that the manufacturers of pleasure cars have not been sufficiently interested in the problems of the agents. Until recently the demand for the automobile has been so great that the manufacturer could afford to look with indifference on the troubles of the agent. The remedy, of course, is for the agents to trust one another and to co-operate, probably by establishing a clearing house for second-hand automobiles which will treat all the contributing agents on precisely equal terms.

In answer to a question the speaker described the free inspection system which he has established in connection with the sale of electric vehicles. Customers' cars are, or may be, inspected every two weeks, either at Mr. Temple's repair shop or, in the cases of suburban owners, at the customers' premises. There was considerable discussion of the general subjects of prices, price-cutting and discounts, and the general opinion of the commercial-vehicle men present seemed to be that their business is in a healthier condition than the pleasure-car business, as represented by the speaker of the day. Mr. Temple said that the men engaged in the commercial-vehicle business should profit by the lessons to be drawn from the mistakes made by the pleasure-vehicle dealers.

### Turners Falls Hydroelectric Developments

Extensive developments are being planned by the Turners Falls Company, Turners Falls, Mass., near its present generating station on the Connecticut River. The present station, which is rated at 7000 hp, receives its water through a canal which is diverted from the river above the town of Turners Falls. This canal is to be extended more than 2 miles to Montague City, where a fall of 60 ft. will be obtained. A new dam which is under construction will provide sufficient storage for the generation of 40,000 hp during eight months of the year.

The power developed at Turners Falls is sold to a number of allied companies which act as distributors. Among these are the Franklin Electric Company, the Greenfield Light & Power Company, the Amherst Power Company, the Amherst Gas Company and the Easthampton Gas Company. The Amherst Gas Company and the Easthampton Gas Company have also generating stations on the Deerfield River. A description of these stations was contained in the *Electrical World* of Sept. 9, 1911.

A high-tension line from the station at Turners Falls is at present being built through Greenfield, Amherst and Chicopee, with a branch to Easthampton. The main line will probably later be extended across the Connecticut River through West Springfield. A substation is being built at Chicopee which will present some interesting features. It will consist of three 1500 kw single phase condenser oil cooled transformers, stepping down the emf from 66,000 volts to 13,200 volts, and another of switches, lightning arresters and disconnected switches in the main and sub. Space will be provided for two auxiliary transformers banks. Within the substation there will be installed in concrete cells double 13,200-volt busbars and oil switches for the distribution of energy. The local distribution in the town of Chicopee and vicinity will be at 13,200 volts. In the same station will also be installed two 500 kw synchronous motor-generator sets with space provided for a third set of the same rating. These sets will be used to supply energy to the Springfield Street Railway Company in Chicopee. The substation is built for an ultimate rating of 15,000 kw. The



company is also building a substation at Amherst, which will be a sectionalizing station in the transmission line and will also contain transformers for local distribution by the Amherst Gas Company.

The power plant at Turners Falls will be relayed by a steam plant of the Greenfield Electric Light Company at Greenfield and one of the Easthampton Gas Company at Mount Tom. A 66,000-volt branch circuit will connect the Amherst substation with the Mount Tom steam station. The transmission line is complete as far as Amherst and will be finished to West Springfield in June. The Chicopee substation will be ready for operation about July 1.

### Industrial Illumination and Safety

For the purpose of discussing industrial lighting and its relation to the illumination of machinery and manufacturing processes so as to insure safety to the workmen in various ways a joint meeting was held at the Engineering Societies Building, New York, on March 13, by the following societies: New York Association for the Blind, Committee on Prevention of Blindness, American Museum of Safety, American Society of Mechanical Engineers and the Illuminating Engineering Society.

Dr. Ellice M. Alger presented a paper on "Illumination and Eye-Strain," in which he called attention to the causes of eye-strain and discussed the subject of proper illumination.

The results of eye-strain, the speaker said, are manifold and affect no two people exactly alike. They include pains in the eyes and many functional defects of vision and quite possibly often result in organic eye disease as well. They cause 80 per cent of the chronic headaches. They result often in functional disturbances of other organs and in conditions of general nervous exhaustion and irritability. While most of the symptoms that result from eye-strain are of the accommodative sort, these are all capable of aggravation by improper lighting and there are many that are caused directly in this way.

It has been shown by experiment that the light which gives the maximum of illumination with the minimum of irritation of the eye is composed of the yellowish rays from the middle of the spectrum. The light from most of the more recently developed lamps, whether gas or electric, contains a much higher proportion of the short violet or actinic rays, and sometimes it contains many of the ultra-violet rays as well. Prolonged exposure to the light of the electric arc lamp sometimes produces an intense conjunctivitis with contraction of the pupils and erosions of the cornea, which fortunately generally yield readily to treatment. Nearly everybody has experienced the discomfort and premature fatigue that come from reading by unshaded incandescent lamps. Even if they do not actually produce inflammatory changes themselves, they certainly render those already present decidedly less tolerable.

It is quite possible, however, that the delayed actinic effects of light, whether natural or artificial, are much more serious. The ultra-violet rays are arrested by ordinary glass, and in the eye by the tissues of the cornea and lens, so that the deeper structures of the eye escape harm, but there is strong reason to suspect that their constant absorption by the lens may be one of the causes of cataract. But even if the ultra-violet rays do not reach the deeper structures of the eye one must not forget that the shorter waves of the visible spectrum have decided actinic properties.

The speaker suspected that less intense and longer continued light irritation may be a factor in degenerative changes in the retina and choroid, and advised the use of amber glasses and shades of such composition as to soften the light and exclude the actinic end of the spectrum.

In comparing natural and artificial light the speaker said that in order to obtain illumination like the "north light," which is soft and even and well diffused, the artificial illumination must be much more concentrated and intense. This causes retinal exhaustion, and the retina is capable of reacting only to powerful stimulation. In other words, the retina becomes practically blind when subjected to sudden changes. This and other factors such as deep shadows due to poor artificial lighting are potent in causing industrial accidents.

With bad lighting the output of each individual is manifestly less than it should be, there is a larger percentage of mistakes and material spoiled, and the number of accidents, large and small, is vastly increased. It goes without saying, said the speaker, that any system of scientific management worthy of the name implies good lighting as one of the first requisites.

In a paper on "Industrial Lighting," Mr. Ward Harrison discussed the advantages of good illumination and the economical benefit to the plant owner. The speaker emphasized three points: plenty of light on the working plane, even light distribution on surroundings, and avoidance of glare. The observance of these principles is likely to result in longer service of employees, reduced number of accidents, and greater output with consequent greater financial return. Methods for obtaining such results were discussed and illustrated by lantern slides showing interior views and distribution diagrams. In discussing the relative merits of glass and steel reflectors the former were recommended because in using this kind of reflector some light is distributed in the upper hemisphere, thereby improving the general illumination and giving a less gloomy appearance to the factory. The spacing of lighting units and the effect of various arrangements upon general illumination and the illumination of vertical surfaces, the percentage of light absorbed by walls, columns and other vertical surfaces, first cost, cost of operation and ratio of cost of light to cost of labor were further subjects discussed by the speaker.

The subject of illumination from the mechanical engineer's standpoint was discussed by Mr. A. C. Jackson, of Philadelphia, who emphasized the importance of proper illumination in order to obtain the desired efficiency of plants such as machine shops. Building constructions most suitable for various purposes, arrangements for natural and artificial light, interior finish, placing of machinery, cost of adequate lighting and other subjects of interest were discussed by this speaker.

### Turbo-Alternator Plant for the World's Largest Office Building

In an address before the St. Louis League of Electrical Interests, Jovian Chapter, March 25, Mr. Henry H. Humphrey, consulting engineer, St. Louis, Mo., described the equipment of the new Railway Exchange Building in St. Louis. This twenty-five-story structure has a content of 15,500,000 cu. ft., making it the largest office building in the world. The lower seven floors and basement will be occupied by a department store, the floors from the eight to the sixteenth by railroad companies, and the five remaining stories by standard offices, 105 to the floor. Steel skeleton construction has been employed, with wall facings of cream-colored terra cotta.

The steam-heating and electric plant for the building, as well as the shipping department of the store, will be located in a ten-story 66-ft. by 148-ft. warehouse building on St. Charles Street, a block distant from the Exchange, with which it will be connected by a basement-level tunnel 18 ft. wide and 10 ft. high. Besides the service cables and pipes, this tunnel will contain twenty-three package conveyors connecting with carriers traversing the warehouse floors.

## POWER-PLANT APPARATUS

The steam-power equipment consists of four 500-hp Heine water-tube boilers designed to operate at 225 lb. steam pressure, equipped with Green chain grates and Foster superheaters. The electrical generating machinery comprises three 750-kw, three-phase, 60-cycle delta-connected General Electric turbo-alternators designed to operate non-condensing with steam at 50 deg. superheat and 225 lb. pressure. There are also three 300-kw rotaries for transforming three-phase, 60-cycle energy into direct current for the elevators and large fan motors. Two of the boiler-feed pumps are electrically operated, the third being a steam-turbine-driven centrifugal pump. The plant stack is 9 ft. in diameter and 270 ft. in height.

The power plant will be installed and operated by The Light & Development Company of St. Louis, which will furnish the heating and mechanical service of the building. This company has contracted, however, for a summer connection with the central station of the LaCade Gas Light Company, so that by co-operation between the isolated plant and the central station, the former will be operated only during the heating season and central-station service will be used during the summer.

## HEATING AND REFRIGERATION

The heating and ventilation of the building is divided at the second story, the first floor and basement being handled by the hot-blast system. Above the second story only direct radiation is furnished. The total amount of this direct radiation is 133,000 sq. ft. of heating surface, making about forty carloads of radiators.

Refrigerating machinery in the power plant consists of two 50-ton refrigerating machines chain-driven by 75-hp motors. One is an alternating-current motor, the other being a direct-current machine. Ammonia piping is carried through the tunnel to the Exchange sub-basement, where a brine cooler, brine storage tank, two brine circulating pumps, two ice-water coolers and two ice-water circulating pumps are placed.

The vacuum cleaning system in the building will consist of four six-sweeper units, two for the use of the store portion and two for the office portion of the building. All these machines will be in the sub-basement, having remote-control switches so that they can be started or stopped from any floor. The vacuum system was especially selected to handle water used for scrubbing or in case of the emergency operation of the sprinkling system.

## ELECTRIC DISTRIBUTION SYSTEMS

The electrical service for the building is of three kinds, part being a direct-current, two-wire, 230-volt system for the elevators and fan motors and part an alternating-current three-phase, three-wire, 230-volt system for the pumps and smaller store motors, while all the lighting will be by three-wire, 115-230-volt, single-phase circuits fed at the switchboard from a three-phase delta-connected 230-volt system. This has led to some complication in the work, particularly in view of the fact that the type of motors has been changed as contracts were let, requiring changes in wiring from one system to the other.

The lighting on the store floors consists, as a rule, of five outlets per bay, four of these being for lighting and one at the center of the bay for a fan. On the typical railroad floors, from the eighth to seventeenth inclusive, there are, as a rule, six 100-watt outlets per bay with 150-watt outlets at the base of each column for connecting desk fixtures. On the typical office floors, from the seventeenth to twenty-first inclusive, six 100-watt outlets are provided in the ceiling of all offices, while base outlets are arranged, four to an office, for connecting desk lamps, desk fans, etc.

The total connected load for lighting in the building is approximately 1600 kw. The switching of all outlets throughout the store will be controlled from cabinets.

## ELEVATOR AND MOTOR EQUIPMENT

The twentieth-story elevators are of the two-to-one traction type, having direct-connected motors operating at 125 r.p.m. There are also eighteen office-building elevators running from the first to the twenty-first story. Each has a capacity of 2500 lb. at a speed of 550 ft. to 600 ft. per minute. They are all of the one-to-one traction type, with 40-hp direct-connected motors operating at 62 r.p.m.

The number of motors used in the building aggregates 126, a total rating of 2073 hp. The elevator, escalator and large fan motors, as well as the package-conveyor and pneumatic-tube motors, are all supplied with direct current, making a total of 1587 hp. The pumps, vacuum-cleaning machinery, etc., are driven by alternating-current motors, making a total of 486 hp.

The capital invested in this enterprise is approximately \$15,000,000, of which \$10,000,000 covers the erection of the 228-ft. by 271-ft. ground plot. This includes the mechanical and electrical equipment and also the plumbing and spinning sections, the amount of which is approximately \$1,000,000. This is 20 per cent of the entire building investment and is exclusive of the boilers, turbines and other strictly generating-plant equipment.

The architects who designed this building are Mauran, Russell & Crowell, and the Westlake Construction Company is the general contractor.

The contractors for the electrical work are L. K. Comstock & Company.

## Keokuk Water-Power Plant Ready in June

In June of this year, the Mississippi River Power Company anticipates, the great water power plant now in progress completion in the Mississippi River at Keokuk will be turned over to the operating department. Already the water has been raised 12 ft. behind the dam, while the power-house building itself is practically completed. Three units are now in place, and one of the exciters is ready for operation. The 9000 kw transformers stepping from 11,000 to 22,000 volts are being erected, and the various switching equipment, including switchboards, oil-switches, etc., is almost complete. For high-tension buses 2-in. iron pipe suspended on seven-disk insulators has been used.

For the 144-mile 110,000-volt transmission to St. Louis the six 300,000-circ. mil copper cables are suspended from 79-ft. steel towers by special seven-unit 10-in. disk insulators. The towers are spaced at 800-ft. intervals and are connected by a 0.5-in. steel ground wire.

Altogether in the erection of the plant 10,000 cubic ft. of material have been received and distributed, the total labor being equivalent to the effort of one man working ten hours a day for 5000 years. For directing the construction 2000 drawings have been required.

## Big Meadows Dam Altered to Gravity Section

After nearly reaching completion according to the original plans for an Eastwood multiple-arch structure, the Big Meadows Dam of the Great Western Power Company on the Feather River in California is now to be altered to make it of the gravity section type. The project company voluntarily proposed the change in the face of the dam, and the altered plans have been accepted by the Railroad Commission of California, which passed on all modifications.

In its decision the commission declares that the greater stability of the dam is of the utmost importance for the public safety, in view of the enormous amount of water which the structure will impound. The commission has granted the Great Western Power Company authority to issue \$4,411,000 worth of additional securities, of which \$1,607,035 is to be expended for the completion of the Big



Meadows Dam, including its alteration from multiple-arch design to gravity section.

The storage basin to be created by the Big Meadows Dam will impound 45 sq. miles, or 1,660,000 acre-ft., making it the largest artificial reservoir in the world. The 660-ft. length of the dam was originally composed of twenty-two 30-ft. inclined cylindrical arches. Its crest will be 180 ft. above the base, although the dam will make available a total operating head of from 4000 ft. to 4400 ft. Utilizing 2500 cu. ft. of water per second, about 550,000 hp will be obtainable from the flow of the Feather River.

### Hydraulic Storage for Peak-Load Service at Salt Lake

The Utah Light & Railway Company, Salt Lake City, is rearranging its hydroelectric installation in order to take care of peak loads more effectively, and for this purpose is now constructing equalizing reservoirs. The water used at its hydroelectric plants is employed farther down the stream by the farmers for irrigation purposes. For this reason it is impracticable to impound water for peak-load hours in the usual way because such a plan would interfere with the continuity of flow below the station. But by the installation of reservoirs at both the intake and tailrace the difficulty is avoided, and this plan the company is following at its Ogden and Cottonwood Canyon plants. By this means it will be enabled to carry 50 per cent more load during the rush hours. The new equipment purchased for the Ogden Canyon station includes two 3750-hp Morgan-Smith waterwheels, each directly connected to a 2500-kva Westinghouse generator, a bank of three 875-kva Westinghouse transformers for stepping up the emf to 45,000 volts, switchboard, appliances, etc. At the Ogden Canyon station the company is installing a new 1000-kva Morgan-Smith waterwheel and four Westinghouse generators, with corresponding transformers, switchboard, etc.

### Electricity Thieves Punished in Los Angeles

Like other cities, Los Angeles has a small proportion of electricity users who scheme to defraud the electric-service company. In two instances recently offenders of this sort were detected and punished by representatives of the Los Angeles Gas & Electric Corporation. One case was that of a resident on Denker Avenue. A woman neighbor complained that, although she used only about one-third as much light as the householder under suspicion, her bills were considerably higher. Upon investigation it was found that the man living in the suspected house was an electrician. A detective meter was set in the usual manner by running an extra pair of wires and placing the meter on a pole some distance away from the house. After getting several readings, which showed to a certainty that the suspect was making a regular practice of stealing electricity, the inspector called at the house and found a jumper wire connected around the meter. This wire was taken as evidence, and the offender was notified to call at the office of the company. This he did and after some questioning he made a confession. After a conference it was decided that the man should be arrested. This was done, and, in the Police Court, the culprit received a suspended sentence of six months, with the understanding that he was to make satisfactory settlement with the company for the electricity which he had consumed by his fraudulent practice.

In the other case it was noted by one of the inspectors of the company that a customer on Echo Park Avenue was operating an electric heater during the middle of the day, although the bills sent to this residence called for the payment for only about 5 kw-hr. or 6 kw-hr. per month. To

avoid arousing suspicion an inspector was sent to examine all the meters in the block. When the meter at the house in question was reached the inspector found that the pressure wire was loose in it. A few days later a new circuit was put up running past the house, and this was connected to the secondaries supplying energy to this particular residence. A detective meter was set a considerable distance away. In this case also the suspected person was an electrical man, and he discovered the detective meter after it had been installed about three weeks. In order to increase the registration on his house meter he climbed the pole in front of his house and reconnected the secondaries back to the old wires; he then turned on every lamp in his house and also the 500-watt heater. However, he defeated his own purpose, because the connections were made poorly at the pole and the comparatively heavy load caused the wires to become red hot, setting the pole on fire. The emergency crew dispatched to investigate the cause of the fire interviewed the too-ingenuous lineman and got a confession from him, and it was through this evidence that a conviction was obtained in the Police Court. The man was fined \$25, with the understanding that he should also settle in full with the company for all electricity which the company estimated had been used and that he pay also for the expense to which the company had been put in stringing the extra wires and setting the detective meter.

### Pneumatic-Tube Systems for Mail Delivery

Representing a committee of Congress, Commander A. B. Fry, of New York, is making an investigation into the extent, character and physical condition of all the pneumatic-tube systems utilized by the government in various cities of the United States in connection with the transportation of mail matter. The examination is being made with the idea that the government may purchase all of these pneumatic-tube systems at a possible cost of several million dollars. The Chicago Postal Pneumatic Tube Company, which has offices in the Federal Building, is the private company which conducts this service in Chicago. It has three air-compressing plants, two electrically driven and one steam-driven, the last named being installed in the basement of the Federal Building. Mr. William A. Richardson, assistant chief engineer of the United States Post Office and Court House, Chicago, has made an investigation of this system. Elaborate tests have been made as to the condition of the power plants, air leakage in the pipe lines, possible dangers from electrolytic corrosion of buried tubes and the condition of the engines, compressors, motors, etc., in the power plants.

### Electricity from Lumber-Mill Refuse at Vancouver, B. C.

The Vancouver (B. C.) civic committee on abatement of the smoke and sawdust nuisance has, after several months spent in considering ways and means to obviate those two evils, recommended to the Council acceptance of the Public Service Corporation's proposal to supply for lighting, heating and motors electricity generated from the lumber mills' waste. It is the company's intention to develop electricity and steam heat from the refuse at the various mills in Vancouver, thus at the same time doing away with a great deal of smoke and sawdust. The franchise asked is for thirty years, but the company is to have no exclusive right to such a franchise. The city is to have an option on purchasing the company as a going concern after twenty years and at the end of each succeeding five-year period. Disputes as to price are to be settled by arbitration.

The service charges to consumers are to be: For electric



light, 8 cents per kw-hr., to be subsequently reduced to 7 and 6 cents; for steam heat, \$1 per 1000 lb. of condensation. Discounts of 10 per cent will be allowed on bills paid within ten days. In consideration of the franchise the company agrees to pay the city 1 per cent on the first ten years' gross earnings, 2 per cent on the gross earnings for the ensuing five years, and 2.5 per cent for the rest of the term. The company must start operation within eighteen months and expend \$50,000 within this period, otherwise the agreement will lapse.

### Court Awards \$7,500 of \$25,000 Flowage Claim

With the impounding of water behind the great Keokuk dam of the Mississippi River Power Company, now under construction, an island in the river opposite Fort Madison, owned by H. D. Everingham, will be submerged. At the instance of the power company the United States government condemned the island and assessed its value at \$2,000 to \$3,000. The owner, however, made claims to damages amounting to \$25,000 resulting from the loss of his property, and recently brought suit. After visiting the site, the petit jury in the federal court at Quincy, Ill., brought in a verdict on March 27 assessing \$7,500 damages for the owner of the island.

### Electric Utilities Consolidated in Connecticut

The consolidation has been announced of the Connecticut Power Company, the Middletown Electric Light Company, the New London Gas & Electric Company and the Eastern Connecticut Electric Power Company, under the first-named corporate title. The combined properties will be under the administration of the Stone & Webster Management Association, of Boston, Mass. The Connecticut company also owns the Berkshire Power Company at Canaan, Conn., the Norfolk (Conn.) Electric Light Company, and the Sharon (Conn.) Electric Light Company.

It is proposed to develop at once a hydroelectric plant at Falls Village, on the Housatonic River, utilizing an effective head of 90 ft., with an ultimate capacity of 16,000 hp. About 12,000 hp will be developed this year. A steel-tower transmission line will be built from Falls Village through Torrington to Thomaston and thence to Bristol, with a possible extension to Middletown. Securities issued on the completion of the Falls Village plant will be: Preferred stock, \$1,250,000; common stock, \$1,000,000; bonds, \$2,445,000. Practically all the new issues of securities represent the cash cost of the companies and the cost of construction of the new plant. The Connecticut Power Company has modern steam plants of 2700-hp capacity each, at Middletown and New London, and a small hydroelectric and steam relay plant at Canaan.

### New York Progressives Urge Twenty-Five-Year Franchise Limits

A bill introduced in the New York Legislature by Senator A. J. Palmer, of Ulster, and Assemblyman S. Sufrin, of New York City, Progressives, limits the grant of fixed-period public-utility franchises to twenty-five years and of indeterminate permits to a maximum of fifty years. It also provides for the repeal of abandoned franchises and recovery of control of unlimited or perpetual franchises heretofore granted.

The bill declares that in all proceedings involving the rights of corporations now claiming franchises in perpetuity or franchises for a longer period than twenty-five years the burden of proof as to the validity of such franchises shall be upon the corporation claiming them. The public-service commissions are required to make an exhaustive

inquiry into outstanding franchise rights for the purpose of ascertaining whether or not the terms and conditions of these franchises have been complied with. The corporations are required to file with the commission copies of all their outstanding franchises, and failure to file such copies is to be prima facie evidence that the franchises do not exist. The proposed act also provides that municipalities may own and operate public utilities.

Mr. Frederick M. Davenport, chairman of the legislative committee of the national Progressive party, is quoted as asserting that the present bill is the most thoroughgoing and advanced measure of franchise legislation that has been introduced in any state legislature.

### Exhibition of Accounting Forms at Chicago Convention

Between 8000 and 10,000 forms used in the accounting departments of nearly 125 central stations will make up an interesting exhibit now being prepared for the coming N. E. L. A. convention at Chicago. The forms are to be arranged by companies, a grouping which will facilitate study of the scheme used, for instance, by a given utility operating in a community of a certain size. The first such collection of these forms, made three years ago and exhibited at the St. Louis convention, was grouped according to subjects and attracted much interest, although the present arrangement by companies will, it is believed, prove more useful to those who desire to consult the collection. Of the forms now being handled twenty-six represent plants in cities of 5000 population, twenty-five in cities of 10,000, thirteen in cities of 50,000, eight in cities of 100,000, five in cities of 200,000, and six in still larger cities. The sheets on which these various forms have been mounted will be assembled into volumes for the Chicago exhibit.

### Louisville Merger Ordinance Passed

An ordinance providing for the merger of the Kentucky Electric Company, of Louisville, Ky., with the Louisville Gas and Louisville Lighting companies of that city, under the ownership of H. M. Bylesby & Company, Chicago, and also giving the Bylesby interests the right to acquire the Kentucky Heating Company and thus control all public utilities in the Gateway City, has been passed by the General Council of Louisville and signed by the Mayor. This measure has been a vital topic of discussion everywhere in Louisville for months, for the proposed merger is of widespread importance, involving the consolidation of utilities whose combined capitalization is \$22,000,000.

The General Council of Louisville, in the terms of the ordinance, is empowered to regulate rates for electricity, natural gas and artificial gas. The present terms of the ordinance fix the schedules for the next twenty years at rates which are acceptable to the parties concerned and to the public. Mr. C. A. Fridge, utility expert at Indianapolis, Ind., was employed by the Louisville Commercial Club to investigate the proposition and he recommended several minor amendments to the measure which were accepted as being fair to both sides.

### Commission Legislation Pending in Colorado

A public-utility bill is now pending such action in both the House and Senate of the Colorado State Legislature. Originated in the Senate, the bill, which was offered as one of the Democratic party leaders was before the upper body on more than a week and finally went through with few amendments to the House. Extended

debate there, however, resulted in many amendments, among them the elimination of the requirement of permits for railroads before beginning new construction. The proposed schedule of salaries was also reduced to \$3,600 from the Senate figure of \$5,000. A clause was added placing municipal utilities under the state commission. Eight sections providing for indeterminate franchises, methods of acquiring ownership by municipalities, etc., were also introduced from the Wisconsin law.

The amended bill was then passed by the House and returned to the Senate, but the latter so far has steadfastly refused its assent to the amendments, and a conference committee has now been appointed. The Senate, it is believed, may be brought to concur in the Wisconsin-law amendments and the House in the larger salary, both of which, it is declared, would tend to give Colorado a utility law inviting capital, protecting against exploitation and securing the continued existence of fair rates and a fair basis for private competition.

## Public Service Commission News

### NEW YORK COMMISSIONS

The New York Commission for the Second District has authorized the Inter-Village Electric Corporation to distribute electric service in Hamburg, Erie County, and to issue capital stock for \$5,000 and first-mortgage bonds for \$12,500. The company proposes to purchase the property of the Howard A. Pierce Electric Light Company of Hamburg.

The commission has also authorized the Elmira Water, Light & Railroad Company to sell \$339,000 of its first consolidated mortgage 5 per cent fifty-year gold bonds to refund a like amount of bonds of the Elmira Water Works Company.

The commission for the Second District has authorized the Niagara Light, Heat & Power Company, of Tonawanda, N. Y., to issue \$60,000 of consolidated and refunding bonds, to be sold at not less than 80 and the proceeds used for discharging current liabilities. The commission has also authorized the Public Service Corporation of Long Island to issue \$19,300 of first-mortgage bonds to be sold at not less than 85. The proceeds are to be used to reimburse expenditures for organization and issuing funded debt.

The New York & Ontario Power Company, which has a plant at Waddington, has filed an application with the commission for the Second District praying for a modification of former orders of the commission. The company alleges that it will be better able to finance the further development of its plant and dispose of its securities if its authorized bond issue is reduced from \$2,000,000 to \$750,000 and the stock issue increased from \$750,000 to \$2,000,000. At the present time the company has authorized stock amounting to \$750,000. It was incorporated with capital stock of \$2,000,000. It has outstanding bonds amounting to \$2,000,000.

The Second District commission has authorized the village of Hamilton to extend its electrical distribution system beyond its corporate limits into Lebanon to furnish electric service to Randallville.

The First District commission will increase its engineering staff at once to get out plans for the new subway and elevated lines. About 250 additional engineers and draftsmen will be needed. The commission's engineering staff already numbers 764 engineers, draftsmen, architects, clerks and other assistants, so that the increase will bring its membership up to approximately 1000. Most of the new men will be draftsmen. The increased cost will amount to from \$250,000 to \$300,000 a year. The civil-service lists from which draftsmen may be appointed have been exhausted, so that new appointments will have to be made provisionally pending examinations. The increase in the engineering

force will not necessitate any material addition to the commissions's budget allowance for this year, \$1,673,000, since the increase was anticipated. The allowance to the commission for 1912 was about \$1,300,000.

### OHIO COMMISSION

Judge Marcus G. Evans has issued a temporary restraining order to prevent the Public Service Commission of Ohio from enforcing its ruling authorizing the Farmers' Telephone Company to construct lines and operate in Sidney, Anna and the rural districts of Shelby County. The action was taken at the instigation of the Sidney Telephone Company, whose officials claim it is in position to care for all the business given to it and to furnish service to those who desire it. The application of the Farmers' Telephone Company for authority to invade territory occupied by another company is the first of its kind to be granted by the commission. The step was violently opposed by the Sidney Telephone Company at the hearings. It is stated that the company had its licenses and franchise prior to the enactment of the law under which the order was given, but this was not taken into consideration.

### CALIFORNIA COMMISSION

The United Light, Fuel & Power Company of San Diego has filed an amended application with the California Railroad Commission for authority to issue \$100,000 of stock.

The commission has granted authority to the San Diego Consolidated Gas & Electric Company to issue \$106,000 of 6 per cent debentures. The original application was for \$500,000. The proceeds will be used to discharge indebtedness.

The Livermore Water & Power Company and W. A. Bissell have applied for authority to sell their plant to the Pacific Gas & Electric Company for \$142,000. The latter company asked for authority to issue 1400 shares of its common stock at 65, in part payment.

The Tulare County Power Company has asked authority to issue \$50,000 of stock and use the proceeds in extending its line.

The Petaluma Power & Water Company has filed its answer to the complaint of the city of Petaluma, asking for specifications and particulars of cases in which it failed to provide adequate service.

A decision has been rendered granting the application of the Great Western Power Company for authority to issue \$4,411,000 of bonds. The proceeds will be devoted to general improvement, extension and development of the company's facilities. The Big Meadows Dam and Reservoir will be completed at a cost of approximately \$1,607,635.

A decision recently rendered grants authority to the Southern Sierras Power Company to purchase the Elsinore Electric Light & Power Company, of Elsinore, for \$7,500.

The Northern Electric Railway Company has applied for an order authorizing the sale of a high-tension transmission line between Nicolaus, Sutter County, and Riego, Placer County, to the Pacific Gas & Electric Company for \$11,691.37, plus \$185.09 interest.

The Los Angeles Gas & Electric Corporation recently applied for authority to issue \$900,000 of bonds. The proceeds will be used to purchase the Valley Gas & Fuel Company and new equipment and extensions. The Valley Gas & Fuel Company and the California Coke & Gas Company applied for authority to sell their systems to the Los Angeles corporation.

The California commission has rendered a decision on the complaint of Mr. James P. Glass, of Del Mar, who asked that the Del Mar Water, Light & Power Company be compelled to furnish service to him. The water company contended that a large outlay of money would be required to supply water to Mr. Glass, whose holdings were upon an elevation. The commission decided that the company should supply water to Mr. Glass, that the company and Mr. Glass should divide the expense of the pipe re-



quired for the extension, that the cost of making the connection from this pipe with the property of Mr. Glass should be borne by the plaintiff, and that the maintenance of the extension should be borne by the company.

#### MASSACHUSETTS COMMISSION

The Gas and Electric Light Commission has authorized the Harvard Gas & Electric Company to issue 120 shares of stock at \$100 par to meet the cost of establishing its distributing system. The company is owned by the interests in control of the Ayer and Clinton central-station organizations and purchases energy from the Clinton system. The Harvard company has built a transformer station and small distributing system and has erected a high-tension line across the town to connect the stations of the Clinton, Leominster and Ayer companies. It expects to develop a considerable business in supplying large summer residences and to act as the distributor for a wide area of rural and semi-rural territory.

#### MARYLAND COMMISSION

Mr. Edward W. Bemis, of Cleveland, has arrived in Baltimore to assist in preparing the brief to be filed by the Protective Telephone Association for reopening the telephone rate case before the Maryland Public Service Commission. Mr. Bemis has been retained to advise on technical matters, with Messrs. Marbury & French, counsel for the Telephone Protective Association. Statistics will be presented to show that business telephone rates in Baltimore are higher than the rates charged for similar service in other cities of the same class. Mr. Osborne I. Yellott, assistant general counsel to the Public Service Commission, will conduct the case. The association, of which Dr. A. R. L. Dohme is president and Mr. Herbert Sheridan secretary-treasurer, has issued an appeal to business men to join its membership and aid in prosecuting the fight before the Public Service Commission.

Stockholders and directors of the Farmers & Merchants' Telephone Company and the Peninsular Light & Power Company, whose plant furnishes service to Denton, Greensboro and Ridgely, have formed a new corporation to take over both the others. Of the new corporation, the Farmers & Merchants' Telephone & Electric Company, Mr. Harry M. Thompson, of Hillsboro, is president and the Rev. George S. Rairigh is vice-president. Among the directors chosen is Mr. T. Piny Fisher, former president of the electric-light corporation. The capital of the new company is \$175,000. The Maryland Public Service Commission recently gave its consent to the combination of the two corporations.

The Annapolis Public Utilities Company, which recently bought the Annapolis Gas & Electric Company, has filed a petition with the commission for the approval of a proposed deed of trust in connection with a mortgage. At the same time the Washington, Baltimore & Annapolis Railway Company, which controls the Utilities company, asked for approval of its purchase of the stock of the Utilities company to the amount \$110,317.

#### NEW JERSEY COMMISSION

The New Jersey Board of Public Utility Commissioners has approved the application of the Public Service Electric Company for a one-year lease of the property and franchise of the Cinnaminson (N. J.) Electric Light, Heat & Power Company. The board recommends a study of the situation with the view of simplifying the corporate relations between the Public Service and Cinnaminson companies by merging the latter with one of the Public Service operating companies.

The New Jersey Supreme Court has sustained the decision of the Board of Public Utility Commissioners in denying the application of the Interstate Telephone & Telegraph Company for permission to issue 5 per cent refunding-mortgage gold bonds for \$1,525,000. The board had taken

the ground that it did not appear to its satisfaction that there was reasonable warrant that the company would be able to pay from its earnings the annual interest the issue would require. The company contended that no reason existed for the refusal inasmuch as the issue was not designed for public sale. The court in its decision says that the act of 1911 creating the commission vests the board with final power to pass and approve the legality of a proposed bond issue payable more than one year after the date thereof. The legal right of the board to make such an order being clear and the question of the jurisdiction of the board to make the order also being clear, the court refuses a writ of mandamus to compel the board to reverse its action and also dismisses the writ of certiorari obtained by the company to set the order aside.

## Current News Notes

**SOUTH AFRICAN ELECTRICAL ENGINEERS.** Mr. J. W. Kirkland, of the South African General Electric Company, was recently elected president of the South African Institute of Electrical Engineers. The headquarters of the organization, which has a membership of 350, are at Johannesburg.

\* \* \*

**"UTILITY REGULATION" THE ORDER OF THE DAY.**—A bill now before the Kansas Legislature would "regulate" the movements of trains at railroad crossings. "When two trains approach a crossing," orders the proposed statute, "both shall stop, and neither shall go ahead until the other has passed by."

\* \* \*

**LINEMEN AT A PREMIUM.**—The recent severe wind and sleet storms and floods throughout the Middle West brought about a great demand for linemen to do repair work on overhead lines of telephone, telegraph and electric-service companies. Every available lineman that could be secured was pressed into service, and the men were worked at top speed for long hours, in some cases sixteen hours a day. The bill for extra wages paid by electric utility companies on this account will be enormous.

\* \* \*

**DINNER TO NEW ENGLAND CENTRAL-STATION MEN.**—An elaborate banquet was given to the central-station representatives of New England by the General Electric Company at the Copley-Plaza Hotel, Boston, on the evening of March 31. This is an annual event that has steadily grown in proportions from year to year. There were 457 people present at the banquet. Mr. Charles B. Davis, of the General Electric Company, was toastmaster, and the speaker of the evening was Mr. Frederick P. Fish, whose subject was "The Law and the Progress." Among the long roster of guests were Mr. Charles L. Edgar, Prof. Elihu Thomson, Prof. Ira N. Hollis, Prof. William L. Hooper and Prof. D. C. Jackson.

\* \* \*

**INTERURBAN RAILROAD TRANSIT COMPANY AID FOR VICTIMS.**—Two per cent of the gross receipts from the sale of tickets on New York's subway and elevated lines on Monday, March 31, was contributed toward the relief of the flood sufferers. The statement was made by the company that Monday had been chosen because it is normally the day of heaviest traffic. As the intention of the company had been made public, many of the regular passengers of the subway and the elevated lines took the tip and bought enough tickets on Monday to last a month. The total contribution amounted to \$10,773. This indicates that about 125,000 tickets were kept some length of time, having been previously twenty-four-hour tickets in the whole history of the company.



**ARKANSAS CONVENTION CHANGED TO MAY 5-6.**—The date of the meeting of the Arkansas Association of Public Utility Operators has been changed from May 13, 14 and 15 as formerly announced to May 5, 6 and 7, bringing the sessions one week earlier than at first scheduled. The meeting will be held at Little Rock.

\* \* \*

**SUCCESSFUL USE OF GYROSCOPIC COMPASS.**—A gyroscopic compass was installed on the torpedo-boat destroyer *Worden* recently and has since been examined in actual service by a committee of naval officers. This committee reports that the device was found to be remarkably free from oscillation caused by the rolling and pitching of the vessel. Experiments which have been made with the same compass aboard a submarine indicate that with its aid the pilot can direct a more accurate course when the vessel is submerged than with other forms of the mariner's magnetic needle.

\* \* \*

**LARGE JUDGMENT IN PERSONAL-INJURY SUIT.**—Not long ago the Board of Trustees of the Sanitary District of Chicago ordered the payment of \$20,169.35 to Frank H. Perkins in satisfaction of a judgment in a personal-injury case. The plaintiff sustained severe injuries by coming in contact with an electric-lamp post and wires carrying electricity. He was an employee of the Sanitary District and sued for \$50,000 damages. He secured a verdict for \$18,000, and this judgment was affirmed on appeal. Interest and costs brought this amount up to the sum first mentioned. The accident occurred in June, 1908.

\* \* \*

**WHAT CONSTITUTES BREAK-DOWN SERVICE, ANYWAY?**—While undergoing an examination on the subject of break-down charges at the hands of a commission recently, an Eastern central-station man took pains to point out to his inquirers that despite its franchise monopoly his company was not altogether free from competition, which it has in the shape of gas, oil and other artificial illuminants, and even daylight itself. "Very well, then," commented the chairman with a genial twinkle, "if we are to regard daylight as a competitor of central-station lighting, it would seem to me that every kind of lighting service you give should come under the heading of your break-down service schedule!"

\* \* \*

**X-RAY OPERATOR LOSES HIS HAND.**—Dr. J. N. Scott, of Kansas City, has, according to a press dispatch, suffered the loss of his right hand as a result of his early experiments with X-rays. Dr. Scott was one of the pioneers in the application of Roentgen's discovery for medical use and, like a number of other scientific and professional men, suffered burns before it was discovered that it was necessary for operators to handle the X-ray with care. After various minor operations it has been found necessary to amputate the hand. Dr. Scott is reported to have said: "Certainly, I shall continue to operate X-rays, or at least to direct their use. Since we have learned how to use them, the rays have not the danger they used to have."

\* \* \*

**ELEVATOR SAFETY LOCKS NEEDED.**—No less than 322 persons have been killed in New York City passenger elevators owing to improper handling of doors and starting of the cars while passengers were entering or leaving. Of this number eighty-three were killed in 1912 and sixty in 1911. This increasing toll of accidents, culminating in the recent death of a prominent jurist, has drawn public attention to the need for an ordinance requiring the use of automatic devices which will prevent the car from starting while the door is open. A number of such safety devices are available and several states have laws requiring their use. A bill now before the Legislature at Albany would impose a fine of \$5 a day for operating any elevator without such safety precautions.

## SOCIETY MEETINGS

**PITTSBURGH SECTION, I. E. S.**—At the March meeting of the Pittsburgh Section, Illuminating Engineering Society, Mr. M. Luckiesh, Cleveland, Ohio, presented an illustrated address on the subject of "Light and Art," pointing out the importance of the proper lighting of statuary, paintings, etc., in conveying the effect intended by the artist. Messrs. C. J. Mundo and S. B. Hibben took part in the discussion.

\* \* \*

**ST. LOUIS COMPANY SECTION, N. E. L. A.**—At the monthly meeting of the Union Electric Light & Power Company Section, N. E. L. A., St. Louis, March 28, Mr. Stanley Stokes, of the Mississippi River Power Distributing Company, delivered an interesting address, illustrated with lantern slides, describing the new transformer station on Page Avenue, St. Louis, where the Keokuk energy will be received. Mr. A. C. Einstein followed with a brief talk on the relation of the Keokuk water-power to St. Louis, and Mr. K. H. Hansen made a few impromptu remarks on the connection between the systems.

\* \* \*

**PHILADELPHIA N. E. L. A. ACTIVITIES.**—At the meeting of the commercial department branch of the Philadelphia Electric Company N. E. L. A. Section on March 27 Mr. G. Ross Green spoke on the subject of "Education and Training." Mr. H. S. Evans addressed the accounting department branch March 11 on "Time and Efficiency." Mr. Frank P. Cox talked on meter history at the meter section meeting on March 7. At the first regular session of the newly organized engineering-department branch Mr. W. C. L. Egin, second vice-president of the company, made a brief address. This was followed with papers on substation equipment by Messrs. H. Broadbent and H. C. Albrecht. "The A-B-C of Telephony" was the paper of the evening before the regular Philadelphia Electric Company Section meeting of March 17, presented by Mr. S. P. Grace.

\* \* \*

**NEW ORLEANS ELECTRIC CLUB.**—Sixty electrical men make up the membership of the newly organized New Orleans Electric Club, which elected officers as follows at a meeting held in the St. Charles Hotel, New Orleans: President, Mr. Benjamin Willard; vice-presidents, Mr. Chauncey Franch and Mr. C. S. Barnes; secretary, Mr. T. S. McLoughlin, and treasurer, Mr. W. E. Conery. The board of governors named comprises Messrs. F. W. Stevens, I. G. Marks, T. B. Rhodes and W. E. Clement. H. F. Cameron has been appointed chairman of the membership committee. It is planned to erect a comfortable club building and to take other steps to foster a closer relationship between the branches of the electrical industry in the Louisiana city. Three grades of membership have been determined upon—active, associate and non-resident.

\* \* \*

**MEETING OF THE TRI-STATE ASSOCIATION.**—The Tri-State Water & Light Association of the Carolinas and Georgia has arranged a meeting of special interest to water-works and lighting men on April 15 and 16, at Charlotte, N. C. Mr. M. F. Corin, of Philadelphia, will present a paper on "Preventable Economic Loss in the Operation of a Boiler Plant and Its Remedies." Mr. A. M. Schoen will speak on "Fire Prevention and Fire Protection"; Mr. J. L. Ludlow, of Winston-Salem, N. C., will have for his subject "Conservation of Purity of Public Water Supplies," and Mr. G. H. White, of Columbia, S. C., will discuss "The Effect Purification of the Water Supply Has Upon the General Health of a Community." Exhibits will be made by manufacturers of water-works and lighting supplies. The secretary-treasurer of the association is Mr. J. W. Neave, Salisbury, N. C.

# United States Navy Wireless Station

**Service trials and operating features of the high-powered radio station at Arlington, Va. By S. M. Kintner, E. D. Forbes, F. H. Kroger and J. L. Hogan, Jr.**

THE public has become so familiar with reports of wireless (or radio, as it is now officially called) transmissions of thousands of miles that a daily press reporter experiences difficulty in presenting the results of the range test of the United States Navy station at Arlington so as to attract even passing attention. The fact that such is the case should not, however, be taken as an indication of failure upon the part of the equipment to give a satisfactory and really remarkable performance. The test of the Arlington station equipment described below shows results which establish a record of reliable and continuous long-distance transmission between a ship and a shore station. This test has been made primarily with the object of allowing the National Electric Signaling Company to demonstrate, under service conditions, the effectiveness of the apparatus it has supplied to the Navy Department.

The sending part of the radio apparatus was designed under the direction of Prof. R. A. Fessenden in 1908. It was constructed and had a preliminary test about three years ago, but was not placed in its present location until last winter owing to unexpected delays experienced by the Navy Department in securing a suitable site. The receiving apparatus has been redesigned in order that certain improvements in mounting the several rather delicate parts could be employed. The whole fundamental part of the design, however, does not depart from that originally proposed by Professor Fessenden.

A somewhat detailed description of this station having already appeared in these columns on Jan. 18, 1913, it will suffice for the purposes of the present article to give a very brief outline.

## ARLINGTON STATION EQUIPMENT

The Arlington radio station is located on the brow of the

hill at the extreme southern corner of the Fort Myer Reservation, overlooking the city of Washington. The towers supporting the antenna were designed by the engineers of the Bureau of Yards and Docks and were erected by the Baltimore bridge division of the Carnegie Steel Company. Use is made of three towers located at the angles

of an isosceles triangle, one side of which runs nearly north and south and has at each of its extremes a 450-ft. tower, while at the other angle a 600-ft. tower is located. The distance between the two 450-ft. towers is 350 ft., while that between the centers of the 450-ft. towers and the 600-ft. tower is 400 ft. These towers are carried on concrete columns and are provided with an insulating plate of marble, the weight of the tower being distributed over this plate by means of a steel casting. Each tower has four legs and four supporting columns. An excellent idea of the arrangement of these towers, together with the support, can be secured from Figs. 1 and 2.

The antenna carried by these towers consists of three horizontal antennas between the three towers, of a type and supported in a manner similar to that employed on the steamship installations, except that the spread of the wires and the number of wires are considerably greater. These three

antennas are supplemented by an additional spread of wires which is secured by means of a cable supported between the two smaller towers and to which is attached, at intervals of 10 ft., the antenna wires, which are carried up to a spreader supported by the 600-ft. tower. All of these antennas are roped together and form an effort one enormous fan-shaped antenna, the upper corner of which is approximately 100 ft. above ground while the lower side is slightly less than 450 ft. above ground. These antennas are all insulated by means of porcelain disks, such as are ordinarily employed in the construction of high-tension



FIG. 1.—AERIAL TOWERS AT ARLINGTON STATION

energy-transmission lines, arranged in series, as many as ten being employed to provide the necessary insulation. The connection from this antenna to the station is made at the middle of the antenna between the two smaller towers by means of a grid of wire which leads directly down to a pole on which is mounted a switch by means of which the antenna can be connected to either the sending or the re-

ceived. Use is made of an elaborate switchboard, on which are mounted the necessary instruments for indicating the condition of each of the several circuits.

The character of radiation sent out by this equipment is very pure in its wave form, being practically seven times as good as that fixed as the legal limit by legislation which became effective last summer. This purity of radiation is due in a large measure to the low resistance of the antenna, but in order that best advantage may be taken of this condition very accurate tuning of the oscillation circuits in the sending apparatus is required. The low resistance of this antenna is in a large measure due to the large amount of copper employed in the antenna proper, together with the fact that an enormous wave-chute, consisting of a great network of buried copper wires covering several acres, is employed as a means of making the ground connection.

It is worthy of note in passing that the transmitting apparatus of this station employs a high spark frequency—that is, 1000 sparks per second—and, further, that this equipment was the first one contracted for by the government in which it was proposed to employ such high spark frequency. High spark frequency has now become standard practice. In its ability to transmit successfully through atmospheric disturbances it gives vastly superior results over those achieved by the old low spark frequency, which suffered such serious interruptions in the transmission of messages during certain periods of the year.<sup>1</sup>

The constants of the antenna taken after adjustment for the test were as follows: Capacity, 0.01 microfarad; inductance, 0.123 millihenry, and an equivalent resistance of 2 ohms. The power input was about 72 kw and a wavelength of 3800 m was used, experiments having shown this to be the best for sending to the ship. The oscillations are particularly persistent, the logarithmic decrement per complete period being only 0.031.

That the insulation of the antenna, switches, etc., is ample is evidenced by the absence of any corona during operation at the maximum voltages employed.



FIG. 2—GROUNDING SWITCH ON INSULATED TOWER LEG

ceiving rooms or can be connected directly to ground in order to protect it from lightning discharges.

The operating house, which is also illustrated in Fig. 1, is a two-story brick building divided into two separate and distinct parts in order that the noise and vibration produced by the heavy sending machinery can be eliminated from the receiving room, where quiet is necessary in order to secure the best receiving conditions. All the sending apparatus is mounted in the large room provided for this purpose, the rest of this part of the building being occupied by a machine shop, a laboratory and offices of the officers in charge of the navy radio service. All of the receiving apparatus is mounted in a sound-proof room in the other part of the building, in which are also the living quarters of the employees of the station, together with a laboratory for carrying on certain investigations of such a character as not to interfere with the receiving operations of the station.

The energy for the operation of the sending equipment is secured from the Potomac Light & Power Company and is delivered to the station in three-phase, 25-cycle alternating-current form. This energy is used to run a 200-hp Westinghouse synchronous motor, which drives, in addition to a direct-current generator for exciting purposes, a 100-kw, 500-cycle General Electric single-phase alternator. The emf from this alternator is stepped up by means of a General Electric transformer to approximately 25,000 volts, the energy being used to charge Fessenden compressed-air condensers which are in turn discharged by means of a synchronous rotary spark gap, through a high-frequency oscillating circuit. The latter by means of an oscillation transformer feeds the energy directly into the antenna circuit. The control of the current in sending is effected by means of a remote-control switch which interrupts the circuit between the generator and the transformer in the process of making dashes and dots for the Morse code. This control switch is operated by means of an ordinary telegraph key

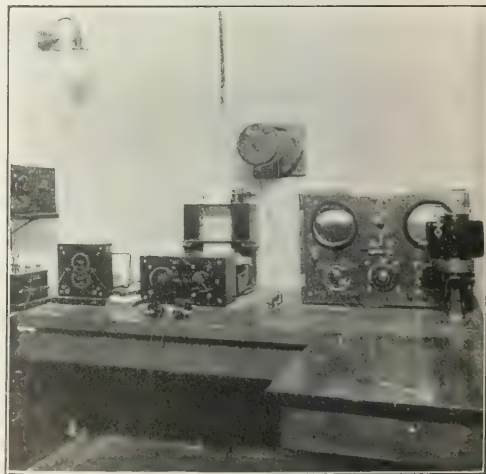


FIG. 3—HETERODYNE AND RECEIVING EQUIPMENT

One feature that attracts the attention of every one familiar with high-power radio installations is the compact arrangement of the sending set. This has been brought about largely by the employment of compressed-air condensers, supplemented by an assembling of parts to the

<sup>1</sup>U. S. patent 918,306; applied for July 1, 1907; issued April 3, 1909.



best advantage. The arrangement of the apparatus and the connections are clearly shown in Fig. 4. The use of compressed-air condensers not only economizes in floor space but also increases the operating efficiency very materially. A total capacity of 0.126 microfarad in compressed-air condensers is used. The dielectric losses of glass and oil when subjected to the high frequencies employed in this service are very serious and, aside from the actual energy loss, cause considerable trouble from heating with its resultant difficulties. The compressed-air condenser is notably free from such losses.<sup>2</sup>

The receiving equipment consists of condensers and inductances together with a suitable oscillation transformer, all being provided with means of adjustment which permit the accurate tuning of each of these several elements so as to secure the best possible results. The detectors employed are the Fessenden liquid barretter<sup>3</sup> and the Nescon crystal

a synchronous rotary gap, through oscillation devices for energizing the antenna. All of these devices were of the same type as that employed at Arlington, previously described. This equipment has been in service in the navy since 1909 and was supplied by the National Electric Signaling Company as part of the same contract on which the apparatus installed at Arlington was supplied. The receiving apparatus on the cruiser *Salem* is a duplicate of that employed at the Arlington station.

#### THE TEST

The actual operation of the radio equipment during the test was in charge of the engineers of the contractor, the operators being supplied by the contractor also. The messages transmitted were, however, supplied by the navy officer in charge of the station and by the captain in the case of the ship. These messages were in most part news

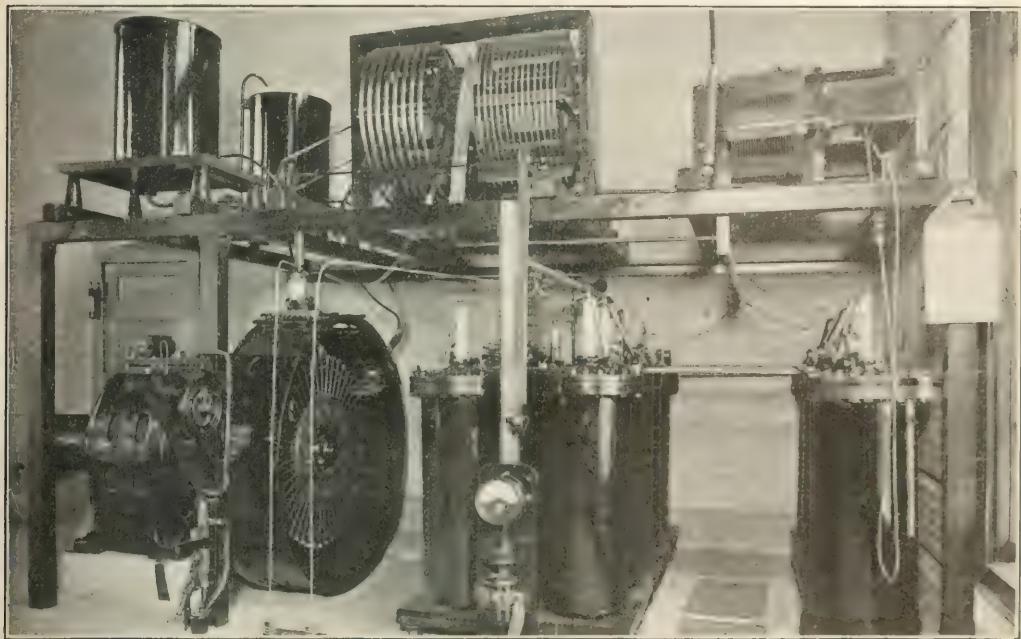


FIG. 4 TRANSMITTING APPARATUS—SYNCHRONOUS ROTARY GAP AND COMPRESSED-AIR CONDENSERS

detector.<sup>4</sup> The arrangement of these instruments is shown in Fig. 3.

In addition to the receiving apparatus described above the heterodyne receiver<sup>5</sup> was employed at times when the signals were exceedingly faint, or when interference from other stations was apt to prevent accuracy.

#### "SALEM" EQUIPMENT

The equipment on the cruiser *Salem* consisted of the usual type of antenna supported on spreaders carried from insulators attached to the tops of the masts. This antenna was 160 ft. long and 40 ft. in spread. The sending equipment consisted of a 10-kw General Electric motor-generator set delivering 500-cycle, single-phase current to a transformer which raised the emf to 12,500 volts to charge compressed-air condensers which were discharged, by means of

items, the ones from Arlington being taken mostly from the daily press and consisting largely of reports on the wars in Turkey and Mexico, while those from the ship were reports regarding progress of the ship, weather reports, reports of derelicts, and finally, when nearing the 1000-mile point, poetry. The fact that Mexican and Turkish rumors were successfully transmitted in a large number of these dispatches from Arlington should be taken as proof of the accuracy of the transmission and of the security of the test.

The cruiser *Salem* left the League Island Navy Yard on Feb. 15 bound for California for the sole purpose of conducting radio telegraphic tests, and generally for the test of the apparatus described above.

The test arrangements provided for the following schedule: Arlington to call the *Salem* and send test D's and M's for fifteen minutes, starting at 7 o'clock; then, without waiting for reply from the ship, to send four messages supplied by the officers in charge of the station and averaging about thirty words each, these messages to be repeated not more than three times. Then the *Salem* at 8 o'clock started send-

<sup>2</sup>U. S. patent 793,727; applied for March 30, 1908; issued July 4, 1905.  
<sup>3</sup>U. S. patent reissue 12,115; original application filed April 9, 1903; reissued May 26, 1904.

<sup>4</sup>U. S. patent 950,781; March 1, 1910.

<sup>5</sup>U. S. patent 1,050,728; issued Jan. 14, 1913, on application filed July 27, 1905.

ing D's and dashes for fifteen minutes, at the end of which she sent four messages supplied by the ship's captain. This program was carried out twice a day, being repeated in the afternoon between 1:30 and 3:30. An additional schedule was run in the evening for the convenience of the engineers in immediate charge of the test, but this had no effect on the official test. The official distance of transmission was taken as the greatest distance at which a successful transmission of all four messages was accomplished without the failure of any intervening schedule. A condition of the test designed to provide for possible emergencies allowed it to continue without prejudice in the event of failure to receive one schedule, provided the next three schedules were received at the same distance.

An idea of the currents received can be gained from microammeter readings taken in the early part of the test. When the *Salem* was approximately 240 miles away in the Arlington receiving apparatus there was 7 micro-amp in the receiving telephone circuit, while in the *Salem's* there was approximately 35 micro-amp. The signal received at Arlington at this point was about 1200 times as strong as one at the limit of audibility.

Arlington succeeded in receiving all messages sent from the *Salem* until 1000 miles was exceeded. Subsequently, after the lapse of one schedule only, all messages were received from 1300 miles. In view of the 1000-mile transmission fully meeting the guaranteed range, no effort was made to establish the higher limit of 1300 miles. It is quite probable that that distance could have been worked successfully as the limit of reliable communication if the attempt had been made. The signal received from the *Salem* at the 1000-mile point of the test was approximately twenty times as strong as required for mere audibility, and by employing the heterodyne it was easily read by two operators simultaneously, each with a separate pair of telephones. The signal received by the *Salem* at this point was 500 times as strong as the minimum audibility signal. The *Salem* succeeded in receiving all messages sent from the Arlington station until 2375 miles had been passed; after which such communication as was had was too feeble and unreliable to meet the full requirement of continuous communication ability.

The transmission distances by night were considerably in excess of those secured during the daylight hours. The *Salem* was able to copy messages until she was very nearly across. In fact, she was able to hear, but not copy, Arlington when lying in the harbor at Gibraltar. The night messages sent from the *Salem* were read without difficulty up to approximately 1600 miles and parts of messages were read at distances up to approximately 2200 miles.

When account is taken of the test conditions under which were determined the daylight limits of reliable communication, of 1000 and 2375 miles for the *Salem* and Arlington stations respectively, one realizes that something out of the ordinary has been accomplished in radio-telegraphic working. This test eliminated the freak transmissions, such as are quite frequently reported in the daily press, and the limits set do not by any means indicate what may be accomplished under particularly favorable conditions. An indication of what may be looked for along these lines is given by the recently reported performance of a set at Key West, of the same make but of only about one-quarter the rating, which was heard one night recently at Cairo, Egypt, some 7000 miles away.

It is difficult to estimate the value of such a station to the government. It has many uses, such as sending out at regular times warnings of storms, derelicts, icebergs, etc., and time signals for the ships at sea. In addition to these, the Navy Department has enormously increased its control of the war vessels, as it can issue orders that can be dispatched immediately to every point within a range of 2400 miles and at night to a distance considerably greater than this.

## Application of Motors in Mining and Mill Installations in Colorado

By W. J. CANADA

In an article on "Electricity in Metal Mining in Colorado," which appeared in the Dec. 7, 1912, number of the *Electrical World*, the wide application of electricity for driving

TABLE 1.—THE COLBURN MINING & MILLING COMPANY, VICTOR, COL.

shaft hoists, cascade mill and auxiliary buildings, producing and reducing gold-ore at below values as \$2.50 per ton, capacity mill, 300 tons ore in twenty-four hours, four mine motors, rated at 57 hp, eleven mill motors, rated at 25 hp, energy 440 volt, 3-cycle, alternating current, three phase.

Department	Machines Operated	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours Operation	Monthly Average, Kw. hr.	Five-Minute Peak, Hp. Installed, Per Cent.	Connected Load, Per Cent.	Hrs. Operated, Per Cent.	5-Min. Pk., Per Cent.
Crushing	1 Symons No. 5 crusher								
Grinding	1 Symons disk crusher								
Elevating	2 sets rolls								
	2 large trommels, 12-in. mesh	1-100	80	6-8	12530	78.3	15.8	46.1	59.1
	Elevators and conveyors	2-5	6	6-8					
Shaft house (Mine)	40 kw. 125-volt, d.c. generator								
	2 mine locomos.								
	2 5-hp motors, each								
	5 hp in black-smith								
	10 hp on chain conveyor								
	10 hp on aerial tram	1-40	40	7-9					
	Assay office, crusher	1-2	1	8-9	2650	98	6.5	19.5	19.8
	Machine shop	1-5	5	8-9					
	Mine pump (emergency)	1-10	10						
Tube mills	3 5 ft x15 ft tube mills			(2)-24					
	12 r.p.m., 60 ton capacity	3-50	155	(1)-12	60560	103.3	\$6.1	67.2	65.0
Pumps Agitators	1 agitator compressor								
	1 centrifugal circ. pump								
	3 triplex solution pumps	1-35	50	24	37010	136.5	121.0	121.0	88.8
Reduction	1 tailings hoist	1-74	8						
	1 assay crusher, grinder zinc								
	1 teeler	1-2	2						
	1 blower tilting furnace	1-1	1						
Electrolysis	1 10-volt double G.E. generator, 1500 amp (Twenty days' operation per month of period averaged)	1-20	20	24 (3)	7974	100	55.3	83.0	83.0
Lighting mine				10-16	2318				
Lighting mill				10-16	1775				
Total load†	Mine and mill	14-383	371 Av. 3 mo	Various	125817	96.9	61.1		63.0

\*Omitting 2 small.

†Twenty-four-hour basis

hoists, pumps, drills, fans, railways and in various processes directly connected with the recovery of precious metal from ore was described at length. In the present article are incorporated data on a number of actual installations in Colorado, the motor equipment of the various departments being given in tabular form with other information.

### ADVANTAGES OF ELECTRIC DRIVE.

From the mine and mill standpoints, which are usually combined in successful ventures by erecting the mill near



the mine plant, the advantages of electric drive apply to many of the most important features. A saving is generally effected in first cost by the possibility of power division, making it feasible to avoid costly installation, operation and maintenance of line shafting and belting, and a ready increase in economy has been effected in several cases by changing to motor drive, assuring constant speed for mills,

TABLE II.—THE PORTLAND GOLD MINING COMPANY, VICTOR, COL.

Cyanide mill and auxiliary buildings, handling profitably ores as low as \$2 50 per ton, capacity, 700 tons ore in twenty-four hours, 24 mill motors, rated at 1050 hp, energy, 440-volt, 51-cycle, alternating current, three-phase.

Department.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours' Operation.	Monthly Average, Kw-hr.	Five-minute Peak, Hp Installed, Per Cent.	Connected Load, Per Cent.	Hours Operated, Per Cent.	Hours Operated, Per Cent.
Crushing.	Crushers, rolls, trommels, . . .	1-150	110	16		73.3			
Conveying.	2 conveyors, . . .	1-20 1-10	11.5 2.7	16		47.2			
Sampling.	Sampling crusher and grinder, . . .	1-15	6.2	16		41.3			
Milling.	4 Akron Chilian mills, . . .	1-300	300.0	24		100.0			
Concentrating.	Carl and Wilfley tables, . . .	1-15 1-30	7.2 18.8	24		57.7			
Classifying.	Classifiers, . . .	1-15 1-20	17.0 18.0	24		100.0			
Tube mills.	2 5-ft x 16-ft. mills, . . .	1-60 1-60	45.0 45.0	24		37.5			
Lime pump.	1 pump, . . .	1-15	5.4	2		36.1			
Agitating.	Air agitators, compressors, . . .	1-20 1-20 1-15	23.0 25.0 8.6	5 5 24		115.0 125.0 57.3			
Filtering.	Pumps and press, . . .	1-10	3.8	24		38.0			
Precipitation.		1-15	2.1	24		14.0			
Solution pumping.	Pumps, . . .	1-20 1-15 1-15	15.0 11.8 9.7	24 24 24		75.0 78.5 64.6			
Filter vacuum.	Vacuum pump, . . .	1-40	23.0	24		57.4			
Air compressor.	Solution pump, . . .	1-15	11.5	24		76.5			
		1-50	25.0	24		50.0			
Tramways.	75-kw, 125-volt d.c. generator, 52-motor locomotive, crane, 10-hp Third-rail on ties between tracks. Ore mine to mill to dump, . . .	1-100	28*	24	20200	28.0	28.0		
Lighting.	Mill and auxiliary grounds, . . .	10kw.	10-16						
Total load.	Mill and auxiliary buildings, . . .	24-1050	550 kw.	Var. hours	120000	70.3	57.8		80.8

\*Average for day.

pumps, tables and feeds. The unified plant provides the further advantages of convenience and possibility of ready repair of motors, enabling all of the attention of the miners and mill hands to be given to the real work of getting out the ore and treating it to recover the metals in paying quantities. In addition to these operating advantages, the considerable decrease in the fire-insurance premiums of the

well-wired electrically driven mine compared with those of the steam-driven mine may be cited as a saving not to be overlooked.

The sole disadvantage pointed out against the electrically driven mine has been that it is more liable to sudden breakdown due to failure of some part of the system than is one run from a private steam-driven plant. This is still used as an argument against electrical operation in sinking shafts.

#### MINING AND MILL INSTALLATIONS.

As samples of highly desirable load conditions in metal reduction mills the condensed notation contained in Table I may be of interest. The mill referred to in this table has been operated under rather adverse conditions since its recent installation. A sample day in April, 1912, under more

TABLE III.—THE PRIMOS MINING & MILLING COMPANY, LAKEWOOD, COL.

Tungsten wet concentration mill handling ores carrying from \$10 to \$300 per ton in tungsten and capacity, 40 tons per hour, eight mill motors, rated at 120 hp, energy, 440-volt, 2-cycle, three-phase.

Department.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours' Operation.	Monthly Average, Kw-hr.	Five-minute Peak, Hp Installed, Per Cent.	Connected Load, Per Cent.	Hours Operated, Per Cent.
Cust. Sam.	1 7-in. x 10-in. 30-ton crusher, belted, 280 r.p.m., . . .	1-10	8	1-8		80.0		
Crushing.	1 9-in. x 15-in. 75-ton crusher, 240 r.p.m. 1 samp. crush., grind, . . .	1-15	12	5 Av		80.0		
		1-5	2	1-5		40.0		
Stamps.	2 batteries, 5-hp each, rated 50 tons, 90 r.p.m., . . .	1-35	25	24		71.3		
Concentrations.	2 Wilfleys, 1 Premier, 240 r.p.m., . . .	1-5	4	24		80.0		
Vanners.	3 6-ft. 8 4-ft. vanners, 210 r.p.m., . . .	1-10	10	24		100.0		
Tube mill.	1 Krupp 6-ft. x 8-ft. tube mill 40 r.p.m., . . .	1-35	22	24		62.5		
	1 Premier sand pumps, . . .							
Circulating pump.	1 300 g.p.m. No. 70 centrifugal, 1000 ft. distant on creek, . . .	1-15						
Lighting.	100 lamps, 10-cp., . . .		8	10-12				
Total load.	Mill and auxiliary buildings, . . .	8-130	64	24	11000	48.2	44.4	80.2

\*Not metered separately for different departments.

favorable operating conditions, shows a five-minute peak of 225 kw, a minimum of 100 kw and an average of 200 kw for twenty-four hours. The readings were taken with recording instruments. The energy is supplied by the Arkansas Valley Railway, Light & Power Company to three 100-kw, 24,000 440-volt transformers, which are placed in the reinforced-concrete substation of the Columbia Company. Graphic meters are installed which record the total load and the load of each department, and the daily readings of these meters are tabulated by the plant electrician.

In July, 1912, the mill of the Portland Gold Mining Company at Victor, Col., referred to in Table II, in treating 15,003 tons of ore consumed 325,400 kw-hr. and showed as its greatest five-minute peak 545 kw, indicating a load factor of 83 per cent. Energy is supplied to the steel substation of this company by the power company mentioned

Twenty-four hours average. Five minute peak.



above, and it is taken directly through the six 100-kw transformers which are protected by electrolytic lightning arresters to recording instruments arranged in the same fashion as those just described. The power-factor at this plant averages 87 per cent.

The mill of the Primos Mining & Milling Company at Lakewood, Col., treated approximately 1100 tons of tungsten ore in July, 1912, with a maximum demand of 55 kw, a minimum of 37 kw and an average of 43 kw. The chief cause for the variation was the 8-kw crusher load, but this never occurs during the 6-kw lighting peak. The Central Colorado Power Company furnishes energy at 13,000 volts and 25 cycles to the substation of the Primos company, where it is stepped down to 440 volts for motor circuits and

TABLE IV.—THE WOLF TONGUE MINING & MILLING COMPANY, NEDEVLAND, COL.

Tungsten wet concentration mill handling \$10 to \$500 ores; capacity, 10 to 12 tons per ten-hour day usually run; largely custom mill; three mill motors, rated at 130 hp; energy, 440-volts, 25-cycle, three-phase.

De- part- ment.	Machines Operated.	Motor, Hp.	Metered Five-Minute Peak, Hp.	Hours Operation	Monthly Average Kw.*	Five-Minute Peak, Hp. Installed, Peak, Hp.	Connected Load, Per Cent.	Hours Operated Per Cent.	LOAD FACTOR.
Crush- ing	1 7-in.x10-in., 1 6-in.x8-in. crusher 1 set 14-in.x27- in. rolls, 120 r.p.m.	1-50	30	3-8	60.0				
Grind- ing	Conveyor, ele- vator, sampl- er, crusher and grinding.								
Trom- mels	1 6 ft.x3-ft. trommel 4-in. mesh 1 6-ft.x3-ft. trommel 12-mesh	1-15	15	8-11	100.				
Jigs	2 2 ft.x3 ft jigs and feeders								
Stamps	4 5-stamp bat- teries, 90 r.p.m. in 2 Fremier, sand pumps. 2 Monnell class- ifiers	1-35	30	8-11	86.0				
Tables	1 centrifugal pump 1 earl conc. tab. 260 r.p.m. 1 Willey conc. tab, 245 r.p.m. 1 Monnell Sli- mers 260 r.p.m.								
Dryer	1 12-ft.x6-ft. brick dryer....	20							
Total load	Mill building .	3-100	65	0-11 25 days per mo	10,200	65.0	18		84.0

Average load factor: Five minute peak, ten hours, twenty five days.

\*Not metered separately for different departments.

110 volts for lighting purposes. Data from this mill are given in Table III.

Another mill handling tungsten ore and obtaining its power from the same source as the Primos company is the Wolf Tongue Mining & Milling Company, of Nederland, Col., which is referred to in Table IV. This mill has in connection with the electrical drive a private steam plant for use during the winter months and as a producer of emergency power. This emergency plant is installed in a concrete building and consists of one 80-hp return-tubular boiler, one 150-hp Chuse high-speed engine, one 150-hp Leffel waterwheel, one 125-kw, three-phase generator and one three-panel switchboard fitted with necessary accessories. The generator may be connected to either the engine or the waterwheel by an interlocking clutch, the connection to the waterwheel being direct and that to the

engine through a belt. The supply to the waterwheel is under a 70-ft. head but is unavailable during two months of the year owing to extreme cold weather. Data gathered from the operation of this mill are given in Table IV.

#### DEVELOPMENT OF THE CRIPPLE CREEK DISTRICT.

The foregoing data establish the fact that a mining and milling load is a highly desirable addition to the business of a central station. In the Cripple Creek mining district, which comprises about 18 sq. miles and is devoid of water-power, this industry has been developed as it has in no other place in the country. When this district was discovered in

TABLE V.—CRIPPLE CREEK DISTRICT ELECTRIC INSTALLATIONS.

Location.	TRANSFORMERS.			No. Mo- tors.	Hp. Rat- ing Motor	Applications.
	No.	Kw.	Volts.			
Ark. Val., Vic- tor substation	3	300	24000= 6600= 2300= 24000			6600 volts to small mines near Victor, 2300 volts to lighting Victor and Goldfield. 6600 volts to small mines near Bull Hill.
Ark. Val., Bull Hill substation, 100% P.F. Syn- cond.	3	200	24000 6600			6600 volts to small mines near Cripple Creek.
Ark. Val., Bad- ger substation	3	200	24000 6600 24000			6600 volts to small mines near Cripple Creek.
	3	150	2400 24000			2400 volts to lighting Cripple Creek.
Colburn mine and mill, sub- station.	3	100	440 24000	15	383	Mine and mill, motor service and lighting.
Independence mill, substation.	3	200	440 24000	22	1070	Mill and mine, motor service and lighting.
Portland mill, substation.	6	100	24000	24	1050	Mill only, motor ser- vice and lighting (mine on 6600-volts).
Cameron Ry. substation	3	150	440 24000		600	Operate Cripple Creek high and low line electric railway.
Anaconda mine. Blue Flag mine and mill. Copeland sam- pler.			370 4 4			
Crescent mine . Drainage tunnel. El Paso mine and mill.			5 4 5		160	15 hp mach., 15 hp bl. sm., 30 hp washer, 25 hp fan, 75 hp—.
Elkton mine and mill.			2			
Eagle sampler. Findley mine and mill.			3 6		224	175 hp compres. 40 hp hoist, 2 hp assay, 5 hp washer, 10 mach.
Golden Cycle mill.			4		110	85 hp mills, 15 hp trans. gen., 5 hp convey, 5 hp convey.
Vindicator.			8		214	10 mach., 175 hp com- pres., 5 hp assay, 1 hp bl. sm., 10 hp convey., 10 hp wash- er.
Miscellaneous.				90		
Total installa- tion, July, 1912	27	4500	24000= 6600= 2300= 440 370	201 +	7800 hp 820 kw.	Town lighting omitted. All railway, motor, and mine and mill lighting included. Kw- hr. metered: April, 1,397,440; May, 1- 383,150; June, 1- 171,114; Monthly average, 1,317,234. Daily, 1830.

Average hp demand per installed transformer hp.	0.407
Average hp demand per installed motor hp.	0.515
Maximum five-minute peak at 9-10 a.m. (no lighting load), kw.	2900-3000
Maximum five-minute peak at 7-8 p.m. (no mine load), kw.	1900-2200
Load-factor, twenty-four-hour, on basis five-minute peak.	0.62
Motor hp installed per substation hp.	1.29
Motor hp installed per inhabitant district.	0.65
Motor hp installed per square mile served.	433
Yearly kw-hr. demand (motor service) per inhabitant district.	113.17

1891 the population jumped to 50,000 inhabitants, but this has recently decreased owing to the application of intensive operation of the mines as opposed to the old and wasteful methods. The total value of production remains nearly constant at \$1,200,000 a month, but the grade of ore now handled is very different from that of former times, the value running less than \$3.50 per ton now, when formerly \$300 per ton was obtained from some of the mines. The amount of ore now mined monthly in the district averages 80,000 tons, and the average value is \$15 per ton. Approxi-

mately one-third of this is now hoisted electrically, and about the same amount is treated in the electrically driven mills of the district, which are operated twenty-four hours a day and vary not over 20 per cent from the average load. The load factors of the stations of this district are now increasing owing to the increasing load from the mills and the decrease in the lighting load of the towns, due to decrease in population.

The decrease in the lighting load is not at all alarming inasmuch as the increase in the use of electricity in the past five years has amounted to 100 per cent and during the year of 1911 an increase of 20 per cent was made in the district. Formerly this load was carried by the Colorado Light & Power Company of Canon City and the Suburban Traction & Lighting Company of Pueblo, with a steam plant at Pueblo and a hydroelectric plant at Skaguay. But during the past year these two companies have been taken over by the Arkansas Valley Railway, Light & Power Company, and all of the power stations are now interconnected with 24,000-volt transmission lines.

These lines enter the main substation of the Arkansas Valley company at Victor at 24,000 volts, and there the tension is stepped down to 6600 volts for local distribution to the substations of the various mining companies. At the various company substations a second transformation takes place and the energy goes to the motors at 440 volts. The primary lighting circuit which serves the city of Victor is operated at 2300 volts and the secondaries carry a potential of 110 volts.

Metal mining, especially gold mining, is an industry which is marked in the public mind because of its instability. But the recent installations of permanent mills where large though low-grade ore bodies are available tend to offset this general opinion. A glance at Table V, which is a tabulation of the electrical installations in the Cripple Creek district, will show what an important factor electricity is in this development.

### Battery-Driven Tractor for Switching Freight Cars in City Streets

What has been aptly designated as "the most powerful electric automobile ever built" is now in the service of the Pennsylvania Railroad at its Jersey City yards for moving



BATTERY-DRIVEN TRACTOR OF PENNSYLVANIA RAILROAD

freight cars through city streets where locomotives are not available or desirable. This 14-ton tractor is arranged to run on the ground, the 7-ft. tread of its rubber-tired wheels easily spanning the standard track. The car can thus be maneuvered around an ordinary train, since its movement is not confined to the rails. A normal drawbar pull of 8000 lb. is developed, which can be increased to a maximum

of 21,500 lb if required. Running light, the tractor maintains a speed of about 6 miles per hour.

Energy for the two 20-hp General Electric motors is supplied by eighty cells of Edison A-12-H storage battery, weighing 4350 lb. Herringbone gears connect the motors to the countershafts, a total reduction of 1 to 40 being obtained at the wheelshafts. The tractor utilizes all four wheels for driving, steering and braking. With this arrangement the car can be turned in a circle of 20-ft. radius. By means of duplicate equipment in the cab the tractor can also be operated in either direction from either position. Compressed air actuates the internal expanding brakes in the four wheels. An arrangement of interlocks prevents the controller being operated to turn on power while the brakes are set. Through standard hose connections compressed air is also supplied for braking the freight cars.

In over-all length, including the M. C. B. couplers with which the tractor is equipped, it measures 23 ft., 19.5 ft. of which is the chassis. The wheelbase distance between the 5-ft. rubber-block-tired wheels is 12 ft., the gage being 7 ft. The over-all width of the machine is 8 ft. 4 in. and the height 11 ft. 3 in. The tractor, which weighs 28,850 lb., was built in the Altoona (Pa.) shops of the Pennsylvania Railroad. While being tested at Altoona it successfully bucked one of the largest steam locomotives in the Pennsylvania's service, moving three freight cars against the traction of the locomotive with wide-open throttle.

### Electromechanics Research Laboratory at Columbia University

By J. H. MORECROFT

Through the generosity of an anonymous donor the department of electromechanics of Columbia University received recently the sum of \$20,000 for much-needed equipment to carry on research work along various lines in the field jointly occupied by physics and electrical engineering. Below is given a brief description of the new apparatus installed in the laboratory together with an outline of the research work for which the laboratory is suited.

The laboratory, which is under the directorship of Prof. M. I. Pupin, occupies the complete basement of the Philosophy Building. All the rooms are well lighted and finished and form pleasant workshops for the research students. In addition to the office of the director there are two very large research rooms and two smaller rooms for the same purpose, a well-equipped machine shop, a lecture room in which are models, demonstration apparatus, etc., and a photographic dark-room. The machine shop is equipped with modern motor-driven tools for working metal and wood and is used exclusively for construction of such special apparatus as cannot be bought. Anyone familiar with research work can appreciate the value of this shop to the research student. He frequently needs some piece of equipment which is of a special kind and not on the market but which can generally be quickly built with proper tools and equipment by a skilled mechanic.

Each research room is equipped with a switchboard panel from which 110-volt or 220-volt energy is available, either direct current or 60-cycle alternating current. In addition to this source of energy many small motor-generator sets are available. These can be transported from one room to another, so that the motor-drive facilities are excellent. Constant speed is obtained either by synchronous motors or by direct-current motors driven from a storage battery with tuning-fork regulator. By this means the speed of a motor may be held constant within less than 0.02 per cent.

For alternating-current work it is necessary to have available a wide range of frequency. From various alternators in the laboratory it is possible to obtain currents of any frequency from a few cycles per second up to 200,000 cycles per second. With the upper frequencies experiments

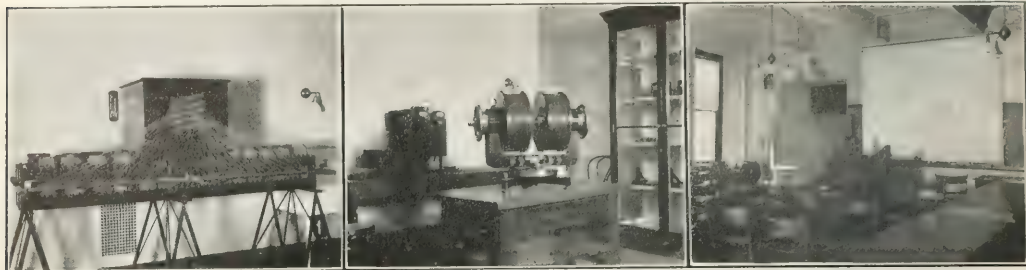


on so-called wireless telephony and telegraphy may be readily carried out and such things as skin effect, hysteresis at high frequencies, etc., may be investigated.

As much of the work carried out in the past in the laboratory has had to do with wave transmission, it is natural to find here proper facilities for the examination of wave phenomena. Telephone cables, real and artificial, loaded

use on a 750-volt line there is a 400-mf condenser, and for continuous use on 2000-volt lines a 40-mf unit. This latter condenser, made of mica, has sufficient capacity to load a 60-kva, 60-cycle alternator to its full rating.

The high-frequency General Electric generator is shown in Fig. 4. It was designed to have a full load of 1 kva at 200,000 cycles per second. It operates at a speed of 20,000



FIGS. 1, 2 AND 3—LOADED TELEPHONE CABLE, POWERFUL WEISS ELECTROMAGNET AND A PROJECTING OSCILLOGRAPH

and unloaded, artificial ocean cables and energy-transmission cables are at hand, and the student interested in this line of work can carry out nearly any conceivable test in the field. A section of loaded telephone cable is shown in Fig. 1; the loading coils may be inserted or removed at pleasure and the resistance of the line can easily be varied to illustrate the comparative effects of loading.

A General Electric oscillograph, with three vibrators mounted on a movable table, can be taken from one room to another. This is, of course, the instrument relied upon for the experimental study of most transient phenomena. The laboratory is also equipped with a Siemens & Halske projecting oscillograph, which is used for lecture demonstration. A view of the lecture room showing this oscillograph and some wave-forms thrown on the screen is given in Fig. 3, the wave-form on the screen is plainly visible over the whole lecture room.

For investigating the effect of a magnetic field on light waves a very powerful Weiss electromagnet has been obtained. This magnet, shown in Fig. 2, produces a flux density in the air-gap up to 100,000 lines per sq. in. The very heavy currents necessary to give this flux density gen-

r.p.m. and its rotating member has a peripheral speed of about 12 miles per minute. The high-speed bearings are equipped with forced-feed oiling as may be seen in Fig. 4. Many very surprising effects are noticeable at once when working with currents of this frequency; for example, an ordinary alternating-current voltmeter reads only 20 volts when connected to a 100-volt, 200,000-cycle line. The inductance of the meter, negligible for ordinary frequencies, becomes so great at these high frequencies that its reading is only about one-fifth of what it should be. This error is different at different parts of the scale so that ordinary alternating-current meters are not at all suitable for these frequencies; hot-wire or static instruments must be used.

In addition to the special pieces of apparatus noted in the preceding paragraphs, there are numerous variable inductors, resistors, galvanometers, etc., for ordinary measurements. Vibrating galvanometers for frequencies from 15 cycles to 2000 cycles per second, frequency meters, direct-current galvanometers with extreme sensibility, alternating-current ammeters with ranges from 6 milliamperes up and other apparatus of similar nature make the experimental

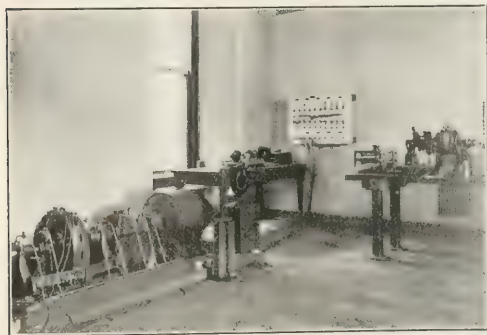


FIG. 4—HIGH-FREQUENCY GENERATOR

erate so much heat in the field coils that it is necessary to have them water-cooled. A calibrated bismuth spiral is used to measure the flux density.

The laboratory is well equipped with condensers which are required in many experiments in electromechanics. For constant use on a 100-volt alternating-current line there is available a condenser of 500 mf capacity; for continuous

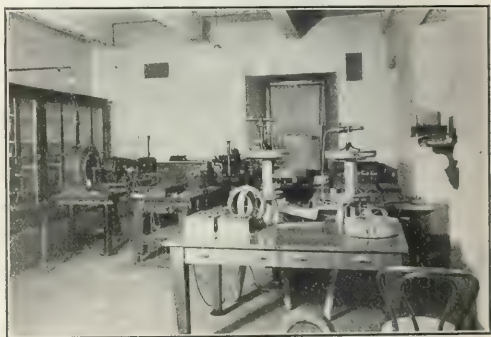


FIG. 5—APPARATUS FOR TESTING AN INDUCTION GENERATOR

equipment very complete. One of the research rooms is shown in Fig. 5. In the work at present being carried out one experiment may require apparatus occupying practically a whole room. Such is the experiment for which Fig. 5 shows the arrangement of apparatus; the running characteristics of an induction generator are being determined by Wheatstone-bridge measurement.



# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Ice Manufacture a Good Revenue Getter

After having operated a 3-ton ice plant in connection with its electrical generating station, an Illinois combination company serving a town of 2500 is now installing an additional 12-ton freezing outfit, bringing its total ice-making capacity up to 15 tons per day.

"We consider the ice proposition a good revenue getter," declares the manager, "and would advise all central stations located in small towns to go into it, provided they can find a market for the product."

## Central-Station Office at Newport News, Va.

The accompanying illustration shows a night view of the 39-ft. sign in front of the Newport News office of the Newport News & Old Point Railway & Electric Company,



A 39-FT. CENTRAL-STATION SIGN

Hampton, Va. The sign contains 842 4-cp, 5-watt tungsten lamps operated by a flasher. The outer row of lamps is colored red and represents a belt which passes around a pulley at the bottom and a motor shaft at the top. Surrounding the whole is a representation of a large incandescent lamp from which rays of light flash at intervals. The words "Light & Power" remain lighted continuously.

The sign and the office in front of which it is placed make the most brilliantly lighted spot on the main street of Newport News, and advantage is taken of the publicity thus secured to display within the office all kinds of electric household devices as well as gas appliances. The window displays are changed twice a week, but the showcases inside and the set pieces of apparatus are not disturbed. Large plate-glass windows on the two streets make every-

thing within the office visible by day or by night. Mr. F. B. Lawton is head of the gas and electric department of the company.

## Ice Plant Was "a Financial Life-Saver"

"We have found our ice plant to be a financial life-saver," declares an Arkansas central-station operator who has been running his ice machine twelve years with a total expense for repairs of only \$50. Last season he made 400 tons of ice with his 6-ton outfit. His 50-lb. renewal of anhydrous ammonia cost \$16.11, and barring a leaky joint or accident, enough is left to make the entire 1913 season's run.

The ice machine is operated only during the night, as the electric plant at present furnishes no day service. During the present season it is planned to inaugurate twenty-four-hour operation of both the ice and electric plants. Arrangements for ice storage will be made, and the company will enter to the out-of-town trade. Until the present it has contented itself with the local business, which during the four-month operating season demands about 400 tons of ice. The cost of manufacture is estimated at \$1.50 per ton. During the year the ice business brings in gross returns of about \$3,000.

## Courtesy from Employees and Public

The wise utility company of to-day overlooks no effort to establish a better feeling between the public, its employees and itself. One of the ways of bringing about this desirable co-operation is the use of placard announcements setting forth in earnest language the company's policies.

Following is the text matter appearing on a number of "courtesy cards" that have been distributed among the properties operated by the Federal Light & Traction Company of New York, the local company's corporate name in each case appearing at the bottom of the placard:

### THE PUBLIC IS ENTITLED TO COURTEOUS TREATMENT AND TO THE BEST POSSIBLE SERVICE

Courtesy is the most valuable asset that an employee of this company can possess. The best efforts of the company to please its patrons are sometimes offset by the thoughtlessness of an employee who may fail to remember that he is not at his work simply as a feeding ticket upon the company, but as a man with fellow employees.

#### TO OUR EMPLOYEES

Courtesy is the outward expression of breeding and character. Don't forget that you are in the service of the public as well as of the company. Never attempt to make a mistake of a patron. The company wants no revenue if it does not come. There is not a "handless person" and the conduct of each individual employee should be judged on that basis.

#### TO THE PUBLIC

Please do us the courtesy of sending any complaint to the proper place to register complaints.

We are ready and anxious to investigate any complaint.

No complaint is too small to be taken into consideration.

We are ready and anxious to make any necessary improvement.

### "COURTESY CARD" OF A NEW YORK COMPANY

Copies of these cards are being placed over the cashier windows of local offices, in the employees' club rooms, in the general offices and demonstration rooms, in show windows, and in the street cars operated by the subsidiary companies.

## Ten per Cent Ice-Making Returns in Poor Season

A Tennessee city of 5000 uses 20 tons of ice per twenty-four hours in the heated season, and during the seven-month period of 1912 consumed 3000 tons of the frozen product. The ice plant is operated as an adjunct of the local central station, whose twenty-thousand-dollar ice-making investment is divided as follows:

Ice machine, freezing tank, etc.....	\$15,000
Addition to building.....	3,000
Delivery wagons.....	2,000
Total.....	\$20,000

A useful auxiliary to this station is the 200-ton ice-storage room, which at an additional investment of \$1,000 permits the plant to be kept at full-rated output during slack periods, manufacturing ice for the heavy demands of the summer days.

Following is the company's balance-sheet account for 1912, "a poor year, owing to low summer temperatures":

Yearly gross income from ice making.....	\$15,000
Yearly expense (interest, depreciation, etc.).....	13,000
Net returns.....	\$2,000

Despite the showing above made, which the company considers as exceptionally low, owing to the poor year, the management feels well satisfied with its ice-making venture.

## Profits of a Wholesale Ice Business

In a Western town of 8000, not far from Omaha, the 21-ton ice equipment in the local combination central-station plant is run profitably seven months in the year, producing 2700 tons of ice. For the convenience of the community during the remaining five months it has been the practice to operate the ice machine at reduced output, although at a slight loss.

The total ice-plant investment in this station reaches about \$25,000. During one of the average ice-making months of last summer the costs for operation were: Fuel, \$524; labor, including office help, \$165; supplies, etc., \$50.

To produce a ton of ice costs an average of about \$2, and this product is sold wholesale to a local dealer at the rate of \$3 per ton. The latter retails and delivers it at 40 cents per 100 lb. This sales arrangement is found to be particularly satisfactory, as the plant is assured of a good profit on all its product while being spared the annoyance of conducting a retail business.

Herewith is given the summary of results of last year's operation:

Gross income from ice business.....	\$8,200
Expenses, including interest, etc.....	5,200
Net income from ice business.....	\$3,000

On an investment of \$25,000 the central station thus earns returns of about 12 per cent, which is added to its other income without particular effort, the work of the ice plant being handled by the regular force of the station.

## Electric Incubation at 1 Cent per Chick

Demonstrating that the proverbial "high cost of living" may certainly be reduced through electrical means by the breeding of chickens at 1 cent per chick, the Kentucky Electric Company of Louisville, Ky., recently brought to a close a window demonstration of electric incubators. Just prior to Easter, and twenty-one days after they had been deposited in the warming chamber of a Cyphers incubator, seventy-five of ninety-eight eggs brought forth their downy occupants, the gradual birth of the big brood being accomplished in plain sight of those passing the Electric Building at Fourth Avenue and Chestnut Street. Fourteen kilowatt-hours of electricity and considerable trouble in turning the

eggs and cooling them properly were required to produce the brood, and the energy consumed, quoted in "Ky-El-Co" terms, made each chick cost a penny exclusive of the price of the eggs themselves. After the successful hatch had been accomplished by the "electric hen," the Louisville company proceeded to prove that young chickens may be "mothered" successfully in an electric brooder.

## Railroad Company a Good Ice Customer

In a Western town with fewer than 3000 inhabitants, situated on one of the transcontinental railroads, a combination ice-electric company has a yearly contract with the railroad company to supply ice for replenishing its refrigerator cars en route. By the terms of this contract the railroad takes all of the surplus ice which the plant can furnish during the summer season. The following data show how great a factor the patronage of the railroad company has been in allowing the plant to operate to its full rated output:

### PERCENTAGE OF SALES TO DIFFERENT CLASSES OF CUSTOMERS

Railroad company.....	62
Wagon and ice book sales.....	28
Butcher shops.....	5
Lobby sales.....	3
Out-of-town customers.....	2
Total.....	100

Since retail and wholesale prices for delivered ice are different, it is natural that the gross income was not in proportion to the percentage of ice sold to the various classes of customers. However, considering the smaller cost of wholesale handling and the increased satisfaction which generally results from dealing with one large customer rather than many smaller ones, the following figures show the wholesale trade to be a very profitable one:

### PERCENTAGE GROSS INCOME FROM DIFFERENT CLASSES OF CUSTOMERS

Railroad company.....	36
Wagons and ice book sales.....	48
Butcher shops.....	7
Lobby sales.....	6
Out-of-town customers.....	3
Total.....	100

The maximum rated output of this busy plant is 10 tons of ice per day. During its season of eight and a half months 1967 tons of ice were made. Adopting a sliding scale of prices, ice was sold in wholesale lots at a figure varying from \$3 to \$4 a ton, and the retailed product was delivered at a cost to the consumers of from \$8 to \$10 a ton.

Details of the expense of producing a ton of ice and delivering it when operating under these conditions, as estimated by the manager of the company, are given below:

### COST OF PRODUCING AND DELIVERING 1 TON OF ICE

Fuel.....	\$1.270
Labor, including clerical work.....	0.860
Water.....	0.080
Oil.....	0.050
Ammonia.....	0.060
Light.....	0.150
Supplies.....	0.190
Insurance on plant.....	0.025
Interest on investment.....	0.320
Depreciation.....	0.400
Delivery.....	0.525
Total.....	\$3.930

The total investment carried by this plant at present amounts to \$11,000, and during the season of 1912 a net earning of \$1238, or a little over 11 per cent, was shown. Depreciation for the entire station and equipment is calculated each year according to the rate prescribed by the public utilities law in the state where it is located.

### Teaching the Customer the Cost

At Manchester, N. H., the central-station display windows recently contained a number of electrical appliances arranged to rotate about a Donkin cent-hour meter with which the devices were successively connected. A dummy figure winked its eye and indicated each appliance as it was being measured by the meter, which showed directly the cost in cents per hour to operate the given device.

Many customers were observed to stop in front of the window and note down on memorandum pads the cost of running the various devices. Some would watch the whole operation through twice, checking the second reading to see if it corresponded with the first. The local company has also made successful use of moving-picture displays in its windows.

### Electric-Vehicle Cost Data

At a meeting of the Electric Vehicle Association of America recently held in New York President Arthur Williams announced that the New York Edison Company has under way comprehensive plans for the establishment and maintenance on a co-operative basis of an electric-vehicle garage in New York City. A complete road map showing the charging stations now extant is being prepared by the New York Edison Company and will be available within a few weeks. This map covers all territory within a radius of 100 miles of New York.

Before introducing the speaker of the evening, Mr. L. T. Gerson, garage manager for the John Wanamaker store, was called upon to outline the electric-vehicle campaign which that store is about to launch. He stated that it is the intention to sell cars upon three different plans, namely, to sell the cars outright, to sell the cars and include in the purchase price one year's complete garage service at any garage designated by the purchaser, or to sell the cars and include one year's private garage service. It is thought that these plans will overcome the greatest obstacle now encountered by the salesmen of electric vehicles, that is, the hesitancy of the prospective customer caused by the lack of garage facilities.

The paper of the evening, presented by Mr. H. F. Thompson, of the Massachusetts Institute of Technology, reviewed the work of the electrical engineering department of that institution in the collection and preparation of comparative cost data on the operation of horse, gasoline and electric vehicles. Articles descriptive of the methods used and results obtained from time to time appeared in the *Electrical World* on April 6, 1912; May 18, 1912, and Dec. 14, 1912.

In addition to results from tape records from numerous vehicles, several very interesting estimates on delivery costs in five classes of business were given, based upon previous data. A summary of these estimates is shown in the accompanying tables.

From these comparisons it will be noted that for the light cars the superiority over horse wagons in suburban service is very evident. This is work in which hauls of considerable length exist between the points of loading and the beginning of distribution. In a limited territory, such as within a 4-mile radius of a loading point, the superiority of the motor cars over horse wagons increases to a marked extent with the size of the load.

The above conclusions are not applicable to all classes of work but only to those cases where the characteristics are similar to the assumptions upon which the estimates are based. The specific services selected are particularly suited for electric trucks. Other services in which the distances traveled per day are in excess of 45 miles would in many cases show a decided advantage in favor of the gasoline truck, while for very small daily distances, 15 miles or less, the horse wagon would undoubtedly prove the cheaper. It must, however, be borne in mind that service requirements

are as important a factor in determining costs as in the type of the vehicle selected.

The discussion following the presentation of the above paper was participated in by Messrs. F. S. Gasaway, W. P. Kennedy, E. W. Curtis, Jr., R. M. Lloyd, J. C. Bartlet, S.

ESTIMATE FOR SUBURBAN PARCEL DELIVERY

	1 car 1/2 1 horse	1 car 1/2 2 horses	One-Horse Wagon (3 Extra Horses)
Total annual expense.....	\$2,400.00	\$2,810.00	\$1,854.00
Cost per day.....	8.60	10.40	6.50
Cost per mile.....	0.23	0.27	0.23
Cost per delivery.....	0.067	0.075	0.085

ESTIMATE FOR CITY PARCEL DELIVERY

	1 car 1/2 1 horse	1 car 1/2 2 horses	One-Horse Wagon (3 Extra Horses)
Total annual expense.....	\$2,365.00	\$2,735.00	\$1,812.00
Cost per day.....	8.30	10.10	6.40
Cost per mile.....	0.25	0.30	0.27
Cost per delivery.....	0.12	0.14	0.045

ESTIMATE FOR FURNITURE DELIVERY

	1 car 1/2 1 horse	4 car 1/2 4 horses	1 car 1/2 Wagon (1 Extra Horse)
Total annual expense.....	\$2,740.00	\$4,180.00	\$2,457.00
Cost per day.....	9.38	12.50	8.60
Cost per mile.....	0.31	0.38	0.35
Cost per call.....	0.31	0.38	0.35

ESTIMATE FOR BEER DELIVERY, 3.5-TON RATING

	1 car 1/2 1 horse	2 car 1/2 2 horses	1 car 1/2 Wagon (2 Extra Horses)
Total annual expense.....	\$3,252.00	\$3,845.00	\$2,866.00
Cost per day.....	11.40	14.15	10.00
Cost per mile.....	0.37	0.44	0.40
Cost per call.....	0.52	0.62	0.48

ESTIMATE FOR COAL DELIVERY, 5-TON RATING

	1 car 1/2 1 horse	2 car 1/2 2 horses	1 car 1/2 Wagon (2 Extra Horses)
Total annual expense.....	\$3,810.00	\$4,380.00	\$3,110.00
Cost per day.....	12.90	16.20	11.00
Cost per mile.....	0.48	0.61	0.48
Cost per ton delivered.....	0.54	0.62	0.48

G. Thompson, E. C. Roberts, H. M. Martin and W. E. Holland. In closing the meeting President Williams announced that the next meeting would probably be addressed by a representative of the teamsters' union.



# Illumination and Wiring

## Lighting of Foyer of Museum of Natural History

In a large museum one naturally expects the lighting to be in keeping with the dignity of the place and to harmonize in effect and appearance with architecture and interior decorations. The foyer of the Museum of Natural History, New York City, presents an excellent example of a lighting installation which conforms with the general re-



SEMI-INDIRECT LIGHTING IN MUSEUM OF NATURAL HISTORY

quirements of dignity and harmony and at the same time employs a fixture which is simple, attractive and effective.

The hall is 110 ft. long by 60 ft. wide with a height of 17 ft. The ceiling, which is divided into twenty-four bays, is tinted a soft cream color, while the walls are of buff color. The side columns and tabulatures are of white marble, as are also the busts in the niches, the latter being of the same color as the walls. At the center of each bay is suspended a fixture containing three 100-watt tungsten lamps arranged horizontally within the frosted-glass bowl. The lamps are so arranged that the filaments are close together at the center, thereby eliminating bright spots on the glass

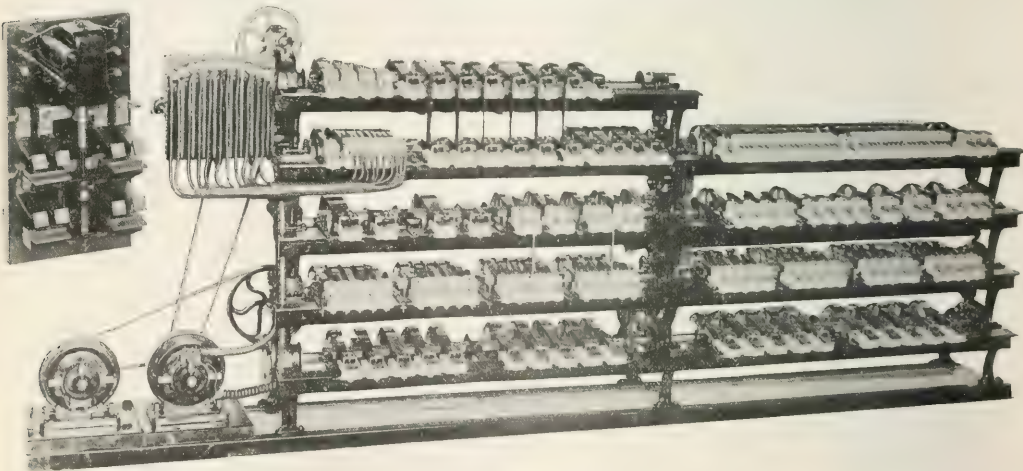


FIG. 2—SOLENOID SWITCH AND MOTOR-DRIVEN FLASHER

bowl and also practically preventing any shadow from the chains being cast on the ceiling. The illumination obtained is approximately 4 ft.-candles at the floor. It is remarkably uniform and without noticeable glare.

The fixtures were manufactured by the Falkenbach Manufacturing Company, Inc., New York, and the installation was made by Chief Engineer Langham of the museum.

## Two-Motor Flasher Control of a Large Sign

The novel sign illustrated herewith is installed at Indianapolis, Ind., and presents the spectacle of a locomotive starting from standstill. At first the wheels revolve slowly and great puffs of smoke appear from the stack, but as the train gets under headway the wheels and side-rods



FIG. 1—REALISTIC FLASHING SIGN IN INDIANAPOLIS

accelerate and the smoke is emitted more and more rapidly until finally full speed is reached.

Two thousand 10-watt lamps are used in this display, which measures 57 ft. long and 35 ft. high. The locomotive itself measures 18 ft., and the letter "M" in the word "Mail" is 15 ft. high. As the smoke drifts back, it forms in succession the letters of the punning word "Choo-choo," which contributes to the popular interest in the clever arrangement. Finally the words "Mail Pouch" appear, followed by the phrase at the bottom, "The chew to choose."

More than 12 tons of structural steel were used in erecting the framework, roof trusses, etc. Nine reflectors illu-

minate the painted portions of the display, which includes an excellent representation of the locomotive. The Thomas Cusack Company of Indianapolis erected the sign, which was designed by Mr. F. E. Faver.

Control of the display and acceleration of the smoke and moving-part effects is accomplished by means of the Betts & Betts flasher shown in Fig. 2. The small motor at

the extreme left runs continuously, driving the main flasher parts. Geared to the flasher-shaft movement, however, is the rheostat arm controlling the speed of the second motor which operates the contactors for the smoke and side-rod lamps. At the proper instant in the sign's cycle the second motor is thus started up, driving its separate contact cams and, as it accelerates, producing the effect of the locomotive getting under speed. The first motor thus runs continuously, but the second is started and stopped during each cycle of the sign's operation.

At the left is seen the solenoid switch which breaks the main circuit just before the various cam contactors are ready to open, thus insuring that all the sign circuits will be extinguished simultaneously. This switch automatically closes again a second or two before the first contactor makes connection. Where there are a large number of contact arms in a flasher of this size "ragged" effects are sometimes caused by difficulty in adjusting the numerous fingers to break at the same time, but the magnet-switch device shown insures that all circuits will be extinguished at the same instant.

### Electric Service in the Home

A number of practical suggestions for amplifying the convenience of electrical service in the home were offered by Mr. F. B. Adam, of the Frank Adam Electric Company, St. Louis, Mo., in a recent address before the St. Louis League of Electrical Interests, Jovian Chapter. Of the total attendance of 102 at the meeting, twenty-five were architects who responded to the general invitation issued by the league.

The electrical equipment of the average home, said Mr. Adam, amounts to only 1.5 per cent of the cost of the structures, not including the cost of the ground or the furnishings for the building. If "economy" is insisted on, the architect can even get the cost down as low as 1.25 per cent, always of course at the sacrifice of comfort and convenience to the owner and of a profitable and satisfactory customer to the electrical industry.

When the architect calls a practical electrical man into consultation concerning the requirements, the cost of the electric work goes up; and whenever the architect is liberal enough to call in the contractor to consult with the owner, and shows him the advantages of equipping his home for "everything electrical" while in course of construction, the percentage of cost is further increased by 3 and even 4 per cent—an average increase of more than 100 per cent over what, under ordinary conditions, should be considered a good job.

In advising the installation of an ample number of plug outlets, Mr. Adam referred to an instance where he recommended at least one receptacle for each room and hall on the first and second floors. The owner then found that the outlet locations did not suit the arrangement of his furniture, and an additional plug outlet was put in each room. After moving in, however, the householder declared he had only one "kick" coming on the job, and that was he regretted that a plug connection had not been installed in each of the four corners of each room and hall.

During the past two years the speaker has advocated for the average-sized home one separate circuit of No. 12 wire, or if possible No. 10 wire, to take care of heating, cooking and power connections. He has also recommended for the past five years the fusing of lighting circuits of 660-watt capacities and less, with 10-amp fuses, to take care of not only the lamps on the circuit but also the connections for curling irons, milk warmers, small stoves, percolators, toasters and the like. But since the advent of the vacuum and suction cleaner there has been much trouble from the blowing of circuits protected with 6-amp and 10-amp fuses, and it has been found necessary for nearly all makes of vacuum and suction cleaners to use 15-amp fuses. As such a cur-

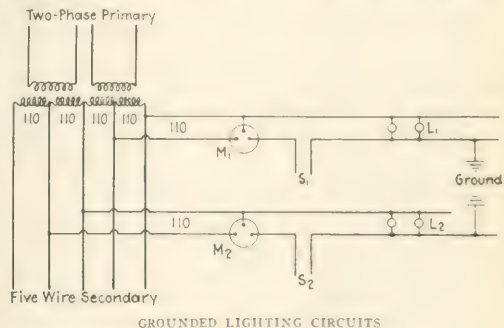
rent is too large for the small wiring of the ordinary lighting fixtures, the speaker argues in favor of the separate circuit of No. 12 or No. 10 wire.

"We have never in our advocacy of this method had an owner refuse the expense of a separate No. 12 or No. 10 circuit," said Mr. Adam, "after he has been told of the benefits of such a circuit. Of course, it must also be understood that the larger the house the larger the number of these circuits that should be installed."

### Lamp Operation Due to Accidental Grounds

Among the troubles recently reported to an Eastern general-station company was the complaint of one customer that he could not turn out part of his lamps. When his snap switch was turned "off" the lamp candle-power was simply reduced, the filament continuing to glow dimly. While this case was being investigated another customer came in with a similar complaint concerning his own installation, which was about 150 ft. distant from the first.

Inspection showed that although both customers' snap switches might be open, the lamps would burn at low voltage. Furthermore, it was found that this energy com-



sumption was not being recorded on either meter. With one switch closed, its own lamps would burn at normal voltage and candle-power; meanwhile the second set of lamps received about 50 volts and could not be turned off by means of their own switch.

After a search the accidental ground of the first installation was located in a fixture which had been hung without an insulating joint. In the second case the ground was caused by abraded insulation where a wire passed through an iron post. As shown by the sketch these two grounds completed the circuit between the pair of main lines, so that while both single-throw switches were open the pairs of lamps were burning in series-multiple through the ground resistance. It so happened, too, that the grounded side in each case passed through the center coils of the meter, so that no registration was made of the current continuously in the fugitive circuit.

### Recent Telephone Patents

#### IMPROVED AUTOMATIC SYSTEM

Automatic telephone systems of many different styles have been designed in which the selective automatic operation is responsive to a series of impulses corresponding in some way to the desired number called. In the system patented by Mr. J. J. S. Schaefer, Germany, the required differentiation is achieved by using two impulses for each selector and by using the two line lines in different combination. There are three of these combinations.



Each may be used for the first impulse, associated with itself or another for the second. There are thus nine combinations, and to meet this condition all numbers containing ciphers have been abandoned.

The mechanical features of the selection may be likened to those of a Yale lock. Four notched disks are arranged upon a common axis. Each receives a slight angular displacement by an impulse received over the controlling line limb. One pair of disks acts upon the first impulse and the second pair upon the second impulse. There are as many sets of notches as there are units in a digit, and in front of each set is arranged a bar which controls the contacts for that unit. When a set of impulses arrives one set of notches of the shifting disks will be so aligned that a bar may fall in and establish the proper contact.

#### SWITCHBOARD CIRCUIT SYSTEMS

The common-battery switchboard circuit seems capable of an almost unlimited number of rearrangements and combinations. One of these, recently patented by Mr. W. W. Dean and assigned to the Dean Electric Company, is of the two-wire type very much like the Dunbar system. A cut-off relay with a double winding is used. One winding is of low resistance and the other of high resistance. When the cut-off relay is not energized the former winding is connected between the jack sleeve and ground and the high-resistance winding is short-circuited. When a plug is inserted the current during the first instant is heavy and a very positive action of the cut-off relay results. This action transfers the short-circuit from the high-resistance winding to the other winding and the usual high impedance conditions are thereby established.

## Letter to the Editors

### Heterochromatic Photometry

To the Editors of the *Electrical World*:

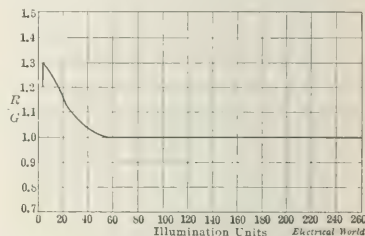
SIRS:—My own work on heterochromatic photometry having been referred to several times in your editorial comment on the article by Mr. M. Luckiesh in your issue dated March 22, I feel warranted in calling attention to certain statements that produce an incorrect impression concerning ideas and conclusions attributed to me.

Mr. Luckiesh's work shows a reversed Purkinje effect with the flicker photometer for the special case of a red light against a green light. This effect was discovered, studied and described at considerable length by me some time since.\* From your editorial it is to be gathered that Mr. Luckiesh has found an effect far greater than my work indicated, and that "there is much to be investigated here." For the magnitude of the effect found by me and also for its partial explanation, let me refer you to my "Studies in the Photometry of Lights of Different Colors," *Philosophical Magazine*, July, September, November and December, 1912. In the tables of the first paper of that series will be found data which when plotted give the kind of curve shown by Mr. Luckiesh. As a matter of fact, a plot of these data was made in this form for that paper, but was later omitted as unnecessary in view of the more significant manner in which the phenomenon is shown in the luminosity curves, because of the full description and the complete numerical data. However, in the second paper, on page 361, the course of this reversed Purkinje effect and its magnitude are arranged in a logarithmic plot, which shows also the reversal of this effect at very low intensities and the result of decreasing the size of the photometric field. For the benefit of those who have not the leisure to plot these data or to transform the logarithmic plot (which, for reasons given in the original paper, is the more logical one) to ordinary units, there is reproduced

herewith, from the figure referred to, the relative readings for red and green light ( $0.653\mu$  and  $0.535\mu$ ) at various illuminations, plotted, however, in ordinary instead of logarithmic units. This curve is, I think, sufficient to show the impression that Mr. Luckiesh's results are new and disconcerting to be an erroneous one.

It would have been better for the popularization of my work had it been presented in even greater detail, with more extended comment and with the data plotted in several more relationships and on more kinds of scales than they are. One expects, however, that those who engage in a line of research or undertake to write authoritatively thereon will acquaint themselves rather thoroughly with previous work. Is it too much to expect them to plot the old and the supposedly new data on the same scale before making comparisons and drawing conclusions?

The statement by Mr. Luckiesh that the flicker and equality-of-brightness photometers "do not measure the same thing" is, I think, fully covered by the third of my series of papers, in which the opposite conclusion is reached. It is there shown that with the equality-of-brightness method different values may be found for the relative brightness of two colors, depending on the color of the comparison light, and also because of the variation of one's criterion from time to time. But it was also shown under what conditions the two methods give similar results and why the flicker value may be identified with the true mean value around which the equality-of-brightness measurements vary. For the full discussion of this point the original



REVERSED PURKINJE EFFECT WITH FLICKER PHOTOMETER

paper should be consulted. I see no reason to alter the conclusion there drawn.

There are, of course, in any problem many points demanding further investigation, and heterochromatic photometry is no exception. But I do not think such points are the ones upon which emphasis was laid in the editorial. I fail to see in this paper by Mr. Luckiesh anything but a confirmation of various points described and more completely investigated by me. I except, however, his assertion that the inverse square law does not hold for red light, being unable to understand just what this means.

Philadelphia, Pa.

HERBERT E. IVES.

[We very much regret that Dr. Ives should in any way feel that his valuable work is unappreciated by us. Such is far from the case, the chief cause for our comment being the considerable troublesome variations brought to our attention after believing Dr. Ives' work had put the flicker photometer in an unquestioned position. We are quite willing to accept Dr. Ives' statement as to priority, but, in view of the facts graphically set forth in Mr. Luckiesh's paper and by reason of the extraordinary results reached by M. Broca and his colleagues, it is pertinent to say that the question of heterochromatic photometry is reopened until these discrepancies are investigated and explained by someone. We know of no one more competent than Dr. Ives to do this, and hope that he will undertake the work. —Eds.]

\*Trans. I. E. S., November, 1910.



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Protecting Exposed Metal Work in Battery Rooms

It is very essential that no metal work in the battery room, especially over the cells, be exposed to the action of the acid fumes and gases. The structural ironwork of the building can be very well protected by incasing it with expanded metal work upon which a coating of cement plaster is placed. This, if kept well painted with a good lead paint, will prove a very satisfactory way of protecting all structural metal work. Pipes and small portions of metal work can be protected by sheet lead, or if they are not in too close proximity to the cells can be protected sufficiently by frequently cleaning and painting with acid-resisting paint. This paint is very thick and heavy and forms a strong, heavy protective coating. It does not contain coal tar to corrode the metal. Paint of this kind is claimed to be acid-proof, gas-proof and sulphur-fume-proof. The battery rooms in all new electric substations of the New York Central Railroad are painted with preservative paint of this character.

One great danger of exposed ironwork in a battery room, if it extends over the battery, is that the sulphate of iron formed by the action of the fumes may fall into the cells and impair the purity of the electrolyte, thereby seriously damaging the plates.

## Testing Lamps by a Motor-Driven Machine

The accompanying photograph illustrates a home-made lamp-testing machine in use in the installation department of the Edison Electric Illuminating Company of Boston, Mass. Special advantages of the device are the increased speed with which lamps can be tested, as compared with former hand methods, and the use of an automatic counter which insures accurate enumeration of all lamps passed through the apparatus.

The device consists of an endless belt carrying about two dozen sockets spaced at 6-in. distances, three driving pulleys



LAMP-TESTING MACHINE OF BOSTON EDISON COMPANY

and a small 110-volt motor. Two brass contact strips  $\frac{1}{2}$  in. wide are provided for a distance of about 2 ft. below the upper belt at the left-hand end of the machine. Lamps returned from customers' installations are placed in the sockets, and as the machine operates they pass rapidly from right to left, each base actuating the counter and being made

alive as the upper portion of the belt passes over the brass contact strips. The belt is 3 in. in width and runs over the contact strips just long enough to enable an operator at the left of the machine to see whether each lamp burns properly or not.

Lamps which burn properly on this test are culled from the rest and, after being photometered into two grades, are installed in various company buildings, in portions of its power plants and substations, or sent to contractors for the rough usage of field work. The usual capacity of the machine is about 3000 lamps per day, with one man working at each end; but it will feed seventy lamps per minute, and in one stretch of four hours a record of 9000 lamps was obtained.

## Experience with Oil Engines in Minnesota

Mr. E. A. Aspnes, of Montevideo, Minn., read a short paper at the recent St. Paul convention of the Minnesota Electrical Association giving a report of a test on a 170-hp Diesel engine. The engine under test is a three-cylinder vertical machine, operating on the four-stroke Diesel principle and turning at 200 r.p.m., with a guaranteed overload range of 25 per cent. It was installed in October, 1911, for the city of Granite Falls, Minn., as a reserve to the municipal water-power plant.

Fuel oil is supplied by gravity through a 1-in. pipe from an outside tank to a 25-gal. tank in the engine room. From this tank a 0.75-in. pipe conducts the oil through a strainer to the engine. The gage glass on the supply tank was carefully marked to read in gallons.

Compressed air needed in the operation of the engine is furnished by a three-stage compressor, belt-driven from a pulley on the shaft of the oil engine. Cooling water for the engine and compressor is taken from the city mains and discharged to the sewer. The engine drives through a belt a three-phase, 60-cycle, 2300-volt, 150-kva generator made by the Electric Machinery Company and running at 900 r.p.m.

### ARRANGEMENT FOR THE TEST.

In addition to the regular switchboard instruments for the test three ammeters, one voltmeter and a calibrated three-phase wattmeter were connected in the leads between the generator and the switchboard instruments. A test load was obtained by connecting three No. 8 wires to three 1-in. pipes, each about 3 ft. long, suspended as electrodes in the tailrace of the water-power plant. These electrodes were arranged in a triangle so as to balance the load on the three phases.

During the fall and winter of 1911 and 1912 the engine was operated about 1800 hours. Last fall it was inspected and readjusted by an expert from the factory. No adjustments have been made since that time by the operating engineer except in taking up wear in the crank and main bearings. During the winter of 1912-1913 the engine has been run about 400 hours. As it is in daily operation, little time was available for making the test.

### FUEL OIL CONSUMPTION OF KILOWATT HOURS

Two readings were taken during the testing at March 1, while the engine was in normal service. During this run 0.1 kw-hr. and 8.25 kw-hr. were generated per gallon of

fuel oil. Three runs of rather short duration were made on March 2. The kilowatt-hours per gallon of oil in these tests were 9.5, 9.25 and 7. In the case of the 9.5 result, which was the highest efficiency obtained, the load was approximately 71 kw. The figures of all five tests are given in the accompanying table. The author of the paper remarks that the exhaust was very dark, filling the engine room with smoke in a short time. His conclusion is that, as the generator is of good design and the belt in good condition, the tests do not show that the engine maintained its rated output and efficiency.

Mr. Aspnes described the lubrication of the engine, which is done by the splash system. The amount of oil used in daily operation for lubrication is 1 pint per hour, mixed with about 3 gal. of water. No difficulty seems to be encountered in starting the engine with compressed air. Quite often, however, it happens that the pressure in the cylinders exceeds the predetermined pressure before the engine reaches full speed, causing the relief valves, which are set

SUMMARY OF TESTS OF A THREE-CYLINDER 14-IN. BY 21-IN. DIESEL ENGINE

	NUMBER OF TEST				
	1	2	3	4	5
Load in kw at switchboard.			71.22	85.385	105
Speed, r.p.m.	198	200	202	196	190
Injection air pressure, in atmospheres.	60	60	73	73	75
Gallons oil per kw-hr.	0.11	0.12	0.152	0.1081	0.143
Kw-hr per gallon oil	9.1	8.25	9.5	9.25	7

at 800 lb., to discharge. This makes a good deal of noise. The summary of the tests, as given by Mr. Aspnes, is shown by the accompanying table.

#### TEN GALLONS OIL PER 100 KW-HR. AT THIEF RIVER FALLS

Mr. Leonard Peterson, superintendent of the municipal electric-light plant at Thief River Falls, Minn., opened the discussion. He said that his city installed two 225-hp Diesel crude-oil engines about a year ago. These engines are directly connected to 150-kw Sprague direct-current generators running at 164 r.p.m. The plant was installed as an auxiliary to water-power, but on account of the low water in Red Lake River it has been in almost constant use since November of last year.

In actual operation Mr. Peterson finds that the engines are using considerably less fuel oil than the guarantee of the maker, the Busch-Sulzer Brothers-Diesel Engine Company, which is also the maker of the engine referred to in Mr. Aspnes' report. At no time has more than 10 gal. of oil per 100 kw-hr. been required at the Thief River Falls plant, whereas the guarantee of the builders was 12.5 gal. per 100 kw-hr. at from one-half to full load. The oil costs 7.6 cents per gallon laid down in the storage tank. Figuring an average consumption of oil of 10 gal. per 100 kw-hr., the cost of fuel oil per kilowatt-hour at the switchboard is 0.76 cents. Adding the cost of lubricating oil, water and engine-room labor makes a total operating cost of about 0.8 cent per kilowatt-hour at the switchboard.

#### DESIRABLE OPERATING CHARACTERISTICS

As a standby for water-power plant Mr. Peterson said that the Diesel engine is superior to any other prime mover of which he has knowledge. There is no expense when the engines are shut down, and they can be started up in five minutes. The regulation is good; at different times full-load and overload conditions have been thrown on from no-load, with a change in voltage of only 5 volts in 220 volts. The engines have operated over a year without any

interruption of service, although the men in charge of them had never seen a Diesel oil engine before the installation was made.

The cost of repairs for the two units during the year has not exceeded \$10. In relation to Mr. Aspnes' complaint that during one test the engine did not come up to speed and emitted black smoke from the exhaust, Mr. Peterson said that this would indicate that the valves were in poor condition or else that the exhaust-valve springs were broken. There has been no trouble from this source at the Thief River Falls plant. It is very important to have all valves tight and the fuel-needle valve set properly to insure that there shall be economical operation and that the engine shall run properly.

#### COST OF OIL-ENGINE INSTALLATION AND USE

Mr. Ludwig Kemper, of Albert Lea, does not favor the Diesel engine. With fuel oil at 3 cents a gallon his experience has been that the cost of repairs and maintenance amount to as much as the cost of the fuel. The first cost is also a serious item. He has figured that in his own city an oil-engine plant with complete equipment would cost \$130 per kw installed, whereas a modern steam-turbine plant, complete with condensers, would cost only \$90 per kw. The increasing price of fuel oil is also to be taken into consideration. At present prices oil for fuel costs more per kilowatt-hour than does coal at \$3 per ton, if the steam plant used in the comparison is a modern turbine installation.

Mr. Holmes Ives, of Redwood Falls, as a result of his experience, spoke favorably of the Diesel engine.

Mr. H. B. Rutledge, of Glencoe and Howard Lake, expressed his belief that the Diesel engine will take its place as an auxiliary in water-power stations and small non-condensing steam plants. He doubts if it can compete with steam turbines in units of 300 kw or more. The oil engine is going through a stage of development, just as the steam turbine did, and no doubt for its own particular field it will be brought to a satisfactory state of excellence.

#### Grounding Secondaries to Water Pipes

Our local water company has raised objections to our making any ground connections to its pipes or mains, declaring that such connections may cause electrolysis and damage the pipes. Is it not true that in several large cities secondary systems are now in operation grounded to the water pipes with the entire sanction and approval of the water company?

P. K. F.

Although some water companies have objected to water-main grounds, this difficulty has not proved important except in localities where the extreme dryness of the soil makes other means of grounding either too expensive for use or to fail of their purpose altogether. Oddly enough, however, the objection to grounding has been persisted in by certain individual water-works managements, in the face of the action of the largest water companies and the recommendations of the best hydraulic engineers. The flow of alternating current in appreciable amount over such grounds is an abnormal condition and one soon detected. If the grounds are adequate, such condition will be soon relieved by the blowing of the next fuses back of the trouble. But even with considerable alternating-current flow no electrolytic injury is to be expected according to the best authorities. And with grounding to the water pipe the tendency of alternating current to leave the pipe except at another ground would be almost wholly lacking, as a better path would be impossible. When it is considered that the flow of an appreciable alternating current is abnormal, that such current does not cause electrolytic damage, and that for the current to leave the pipe for damp ground would be an extremely rare happening, the remoteness of possible damage is quite evident.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Mercury-Vapor Rectifier.**—HARTMANN-KEMPF.—A paper read before the Berlin Electrical Society on mercury-vapor rectifiers of high capacity, according to the system of Schaefer, using steel containers (see *Digest*, Nov. 30, 1912, page 1157). A 100-kw rectifier is shown in Fig. 1. In a foundry in Frankfurt one of these rectifiers is in successful operation, transforming 45-cycle single-phase current into direct current at 220 volts for driving a number of shunt and series motors with a considerably fluctuating load. A 20-kw rectifier of the same type is used in Strasburg for charging storage batteries. Both have proved very satisfactory in practice. A third installation of 300-kw, consisting of four 75-kw rectifiers, is soon to be installed in Mannheim. An account of the extended discussion which followed the paper is also given. The difficulty of removing quickly the last traces of gas from the containers is pointed out and acknowledged; artificial heat must be applied for this purpose. The efficiency averages about 80 per cent, and under favorable conditions it may be 88 or 90 per cent. The expense of the experimental rectifiers in the past has been very high, the cost per kw being about \$250, but it is expected that when the rectifiers are built commercially on a large scale the cost will be brought down to that of the rotary converter or less. On account of the simplicity



FIG. 1.—100-KW  
MERCURY-VAPOR  
RECTIFIER

of construction the cost of the rectifier itself will be much lower, but the necessity of using transformers and rectifiers will increase the total somewhat. Reference was made to the extended use of mercury-vapor rectifiers in the United States in series arc-lamp systems and in telephone exchanges. According to an investigation of Tschudy, the variation of the efficiency with the frequency is small. *Elek. Zeit.*, Feb. 27, 1913.

**Mercury-Vapor Rectifier.**—F. DE LONGREVAL. The author reviews recent progress of the mercury-vapor rectifier. He first gives an abstract of a paper presented by Maurice Leblanc, Jr., before the International Society of Electricians in Paris, reviewing, first, the construction and electrical connections of single-phase and polyphase rectifiers, giving a brief mathematical theory of their operation and sketching their various applications in practice. The author then refers to recent attempts to construct mercury-vapor rectifiers of large capacity. For the solution of this problem it is necessary to replace the glass globe by a metallic receptacle. *La Lumière Elec.*, March 1, 1913.

**Transformers.**—J. REYVAL. The conclusion of his illustrated article on the construction of transformers. In the present instalment the author discusses three phase transformers and outlines the various methods that are used in making connections of transformers. *La Lumière Elec.*, Feb. 8, 1913.

### Lamps and Lighting

**Periodic Fluctuation of the Candle-Power of Alternating-Current Metallic Filament Lamps.**—ALFRED LARSEN. An account of an experimental investigation of the fluctuations of the candle-power of alternating-current metallic-filament lamps during one period. A stroboscopic method was used. A round disk with four slots was placed between the lamp and the photometer and rotated by a four-pole synchronous motor. The photometer thus received light only four times during each revolution through the slots; that is, twice for each period of the alternating current. The voltage curve of the generator was approximately sinusoidal, the frequency 50 cycles per second. It was possible to adjust the position of the disk relatively to the axle of the motor in a series of regular angular intervals. When one experiment had been made the small synchronous motor was stopped, the position of the disk was changed by a certain angle, the motor was started again and a new measurement was made. In this way it was possible to determine the candle-power of the lamp at different instants during one period. Of course during one period of the alternating current there are two periods of light fluctuation. The results are given in Fig. 2 for five different lamps. The abscissas represent time, the period of the light fluctuation being 0.01 second. The ordinates give the relative amount of the candle-power at the different instants. Curve I refers to an osram lamp of 220 volts and 10 cp, curve II to an osram lamp of 220 volts and 16 cp, curve III to an osram lamp of 220 volts and

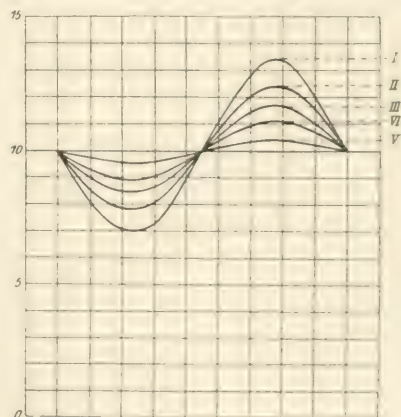


FIG. 2.—FLUCTUATION OF CANDLE-POWER DURING ONE-HALF PERIOD

25 cp, curve VI to an osram lamp of 220 volts and 30 cp, and curve V to a "reflector lamp" of 14 volts and 10 cp. The candle-power fluctuation is greatest for the 10-cp lamp, the candle-power fluctuating between 7 cp and 13.4 cp, so that the variation each way from the mean value is about 30 per cent. The diameter of the wire of the 10-cp lamp is 0.01 mm. With increasing thickness of the wire the relative fluctuation of the light decreases. For the



"reductor lamp" with a filament diameter of 0.08 mm the variation of the candle-power from the mean amounts to 1.4 per cent. For comparison a test was made with a 220-volt, 10-cp carbon-filament lamp. Its curve is practically identical with curve VI. The candle-power curves are not sinusoidal. On account of their light fluctuation 220-volt, 10-cp osram lamps can conveniently be used for determining the slip of an induction motor by a stroboscopic method. For the same effective voltage the candle-power with alternating current differs from that with direct current. If the candle-power with direct current is taken as unity, the results shown in the accompanying table are obtained with a 10-cp, 220-volt osram lamp. For the same voltage the

CANDLE-POWER OF ALTERNATING-CURRENT LAMP AS COMPARED WITH DIRECT CURRENT

Periods	Volts	Candle-Power
50	220	1.016
50	250	1.020
50	268	1.022
30	220	1.037

measured candle-power is, therefore, greater with alternating current and the difference between alternating current and direct current candle-power increases with increasing voltage and especially with decreasing frequency. This is to be taken into consideration in photometric tests.—*Elek. Zeit.*, Feb. 27, 1913.

#### Generation, Transmission and Distribution

*Steam Turbines.*—H. D. HERR.—A very long and profusely illustrated paper on recent developments in steam turbines. The paper gives the early history of the steam turbine and its elementary principles and then describes the more recent developments of the De Laval turbine, the Curtis turbine, the Rateau turbine, the Parsons turbine and the Westinghouse turbine. Then follows a comparison of steam turbines concerning their reliability, maximum output and economy. Notes are added on non-condensing turbines, low-pressure turbines, bleeder turbines and mixed-pressure turbines. After some remarks on the application of the turbine in the field of centrifugal pumps and for auxiliary apparatus in power stations, the author takes up in greater detail the application to marine service and describes the Westinghouse-Melville-Macalpine reduction gear.—*Journal Franklin Inst.*, February and March, 1913.

*Dangerous Rises of Voltage.*—W. PETERSEN.—The conclusion of his long and highly mathematical paper on dangerous rises of voltage and methods of protection of the network against the same. In the concluding instalment some details of protection are discussed and some rules are given for calculating the phenomena of traveling waves.—*Elek. Zeit.*, March 6, 1913.

#### Installations, Systems and Appliances

*Switches.*—The proposed rules of the German Association of Electrical Engineers for the construction and methods of testing of switches and automatic circuit-breakers for pressures up to 750 volts.—*Elek. Zeit.*, March 6, 1913.

#### Wires, Wiring and Conduits

*Notation of Polarity of Conductors.*—A committee of the German Association of Electrical Engineers has worked out proposed rules for the notation of the polarity of conductors on switchboards. For direct current they are as follows: The positive pole should be painted red, the negative pole painted blue, and earth connections and the earthed neutral conductors painted black with white rings. Earthed conductors of other polarity should have the color of their polarity together with black rings. Unearthed neutral con-

ductors should be painted black with red rings. For three-phase currents the proposals are as follows: The three conductors should be painted yellow, green and violet and designated with the letters R. S. T. where the series of the colors and of the letters R. S. T. indicate the series in succession of the phases in time. The fourth wire is painted black with white rings if it is earthed and is painted black with red rings if it is unearthed. For single-phase current the proposals are as follows: The two conductors are painted yellow and violet. If there is a neutral conductor it is painted black with white rings if it is earthed and painted black with red rings if it is unearthed. If a single-phase line is part of a three-phase system, the colors as used with the three-phase system are retained. On every switchboard an explanation of the colors and signs must be found.—*Elek. Zeit.*, March 13, 1913.

*Iron Pipe Used for Electric Conduit.*—OLIVER W. STOREY.—An article describing the methods of manufacture of black enamel or "black pipe" and "galvanized" or "white pipe" and discussing critically the advantages and disadvantages of the different processes and the case of "black pipe" versus "white pipe."—*Mettall. and Chem. Eng'ing*, April, 1913.

#### Electrophysics and Magnetism

*Fluorescent Roentgen Radiation.*—J. C. CHAPMAN.—A paper dealing with Professor Bragg's theory that the fluorescent X-radiation is produced indirectly by the action of the expelled beta rays, and not by the direction of the primary beam. His criticisms of a previous paper of the present author, in which an experiment was described to test this theory, are discussed. Another experiment has been performed, in which the theoretical objections he raised have been obviated. The results obtained agree precisely with those given previously and indicate that Bragg's bombardment theory does not represent even to a small extent the process of production of the fluorescent Roentgen radiation.—*Phil. Mag.*, March, 1913.

*Photo-Electricity.*—H. STANLEY ALLEN.—An abstract of a paper presented before the Royal Society in London on the photo-electric behavior of iron in the active and passive state. The statement that chemical activity and photo-electric activity vary together appears to be justified. If this view be correct, it will be seen that there are degrees of activity and also of passivity.—*London Electrician*, Feb. 28, 1913.

*Composition of Electromotive Forces of Induction.*—A. GUILLET.—A paper in which the author shows how the polygon rule of vibrations of Fresnel can be applied to the composition of electromotive forces of induction.—*La Lumière Elec.*, Feb. 15, 1913.

#### Electrochemistry and Batteries

*Metallic Chromium for Electric Resistance Furnaces.*—O. DANY-HANAULT.—A paper on the use of granular metallic chromium as a resistor for an electric resistance furnace. Chromium can be heated up to temperatures near 2000 deg. But the absence of malleability and ductility has restricted its applications. It must, therefore, be used in granular form.—*Comptes Rendus*, Jan. 6, 1913; abstracted in *La Lumière Elec.*, Feb. 8, 1913.

*Electric Resistor.*—K. PERLEWITZ.—An illustrated article on the properties and uses of "silit," which is a new electric resistance material made by a process of Egly. Metallic silicon is added to silicon carbide and the carefully prepared mixture is brought into the desired form and subjected to heat in an electric furnace, whereby it bakes together into a homogeneous body. This material is especially suitable for electric heating resistors.—*Elek. Zeit.*, March 6, 1913.

*Electrolytic Production of Iron Sheets and Tubes.*—W. PALMAER AND J. A. BRINELL.—The authors were instructed by the Swedish Association of Ironmasters to investigate the Cowper-Coles electrolytic method for producing iron sheets

and tubes. This article is a translation of the report made by them. It describes the principles of the method, the construction of the electrolytic cell and the tests made of the composition and properties of the deposited sheet iron. Some factors are finally discussed which influence the economic result of the process.—*Metall. and Chem. Eng'g*, April, 1913.

**Synthetic Ammonia.**—F. HABER AND K. LE ROSSIGNOL.—Their report made to the Badische company three years ago on the Haber process of producing ammonia from the elements. The essential technical features of the process are the use of a high atmospheric pressure and the circulation of the high-pressure nitrogen and hydrogen gas mixture from a furnace (where at a temperature of between 500 deg. and 700 deg. C. the ammonia is formed) to a refrigerator (where the ammonia is liquefied and withdrawn) and the return of the remaining gases together with a mixture of nitrogen and hydrogen to the furnace. An account is given of the investigations as to the best catalytic agents. These are uranium and osmium. The first large scale factory is now being erected in Germany.—*Zeit. f. Elektrochemie*, Jan. 15, 1913; translated in abstract with illustrations in *Metall. and Chem. Eng'g*, April, 1913.

#### Units, Measurements and Instruments

**Resistance Measurements.**—In a continuation of the serial on shop testing of electrical apparatus the various methods for measuring resistances are reviewed. *Elec. Journal*, February, 1913.

**Testing Ebonite for Electrical Purposes.**—C. C. PATERSON, E. H. RAYNER AND A. KINNES.—An abstract of a paper from the *Journal* of the (British) Institution of Electrical Engineers. Methods of testing ebonite are discussed, and the results of tests made on known qualities of rubber, with and without various adulterants, are given. As the results of these tests a specification is suggested for tests on sheet ebonite, purporting to be made from best Para rubber without adulteration: Specific gravity, to be not more than 1.21. Yield test: A cantilever of the ebonite, 25 mm (1 in.) wide and 10 mm ( $\frac{3}{8}$  in.) thick, supporting a 1-lb. weight 152 mm (6 in.) from the support, shall be placed in an oven maintained at a temperature of 70 deg. C. The ebonite shall not yield so that the point of support of the weight drops through a greater distance than 15 mm (approximately  $\frac{5}{8}$  in.) during two hours at this temperature. The distance dropped shall be measured before and after the test with the weight removed. Electric strength: The sheet ebonite shall be tested for electric strength by embedding metal spheres, 51 mm (2 in.) diameter, into opposite sides of the material, so that the thickness of ebonite between them is about 0.5 mm. An alternating emf with an approximately sine-wave distribution shall then be put across the spheres and the voltage gradually raised over a period of about one minute until breakdown occurs. The test specimens and spheres may be placed under oil during this test, in which case a specimen 100 mm (4 in.) in diameter will suffice to prevent sparking around the edges. The spherical recesses in the test specimens must be machined out with a keen cutting tool, which must be re-ground before the last cut is taken, and the spheres must be a good fit in the recesses. Before the rejection of any material takes place on the ground of insufficient electric strength at least two specimens shall have been tested for breakdown, and if either of them shows the requisite strength rejection shall not take place on the ground of this test. Under these conditions of test the ebonite shall show an electric strength of not less than 125,000 mean effective volts per millimeter.—*London Electrician*, March 7, 1913.

#### Telegraphy, Telephony and Instruments

**Telegraphy and Telephony.**—A committee of the German Association of Electrical Engineers, jointly with the committee of the German Association of Wiring Contractors,

has worked out a set of rules for the equipment of telegraph, telephone and signal installations relating to the apparatus, sources of energy and wiring.—*Elek. Zeit.*, March 6, 1913.

**Telegraphs and Telephony.**—EDMUND W. CHATHAM.—A review of recent progress in telegraphy and telephony. After some notes on automatic telegraphing the author deals with the interference in telephony from single-phase traction systems and then discusses various problems of submarine telephone cables. He deals especially with the problem of telephonic reflections.—*La Lumière Elec.*, Feb. 1, 8 and 15, 1913.

**Telephone Cable.**—An article on the new telephone line between Vienna and Dalmatia, which includes a line across the sea over a series of cables. One kind of overhead bronze wire is used, for crossing the sea a submarine cable. This is a continuously loaded cable of the Krapup system. The copper conductor had a cross-section of 5.5 sq. mm. Around it are wound three layers of soft iron wire of 0.2 mm diameter, and around this a special form of gutta-percha is pressed. This special gutta-percha mixture was so chosen as to reduce the leakage. The speaking tests between the two ends of the combined overhead and submarine lines are said to have given a "brilliant result." The line has later on been extended and speaking tests between Vienna and Sarajevo (at a distance of 1400 km, or 840 miles) have still given good results, although the overhead line in Bosnia consists partly of bronze wires not more than 4 mm in diameter. *Elek. Zeit.*, March 13, 1913.

**New Wireless Detectors.**—The Telefunken company now uses Schloemilch electrolytic detectors in which its former two chief objections were overcome, namely, the deterioration of the platinum electrodes and the leakage of acid through crevices when the detector is inverted, as often occurs in transit. The new detector illustrated in Fig. 3 comprises three Schloemilch cells radiating from the cross-

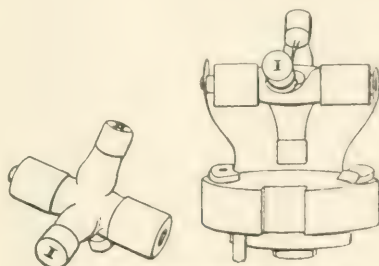


FIG. 3.—ELECTROLYTIC DETECTOR

tube, as shown. The whole glass system is hermetically sealed, and connections are made to the terminal end caps by fused-in platinum wires. Sufficient acid is contained to fill one, and only one, of the cells. The latter are inclined at 120 deg. to each other, so that when one is vertical (as in use) the other two are completely drained of acid. If one cell fails or becomes insensitive, it is necessary only to rotate the system through 120 deg. to substitute another cell in circuit without appreciable interruption of working. In order that the cells may be distinguished for experimental and maintenance record purposes, the numerals I, II and III are marked on the end caps.—*London Electrician*, March 14, 1913.

#### Miscellaneous

**Theory of Commutation.**—KARL FIEDEMAYER.—The author introduces a more general expression for a certain coefficient in the formula for calculating the commutation pressure, which he calls the commutation constant. The main factor in the commutation constant is the self and mutual inductance of the commutating coil. The commu-



tation constant must be determined for every type of machine, and its application in his formula assumes the absence of pulsating pressures.—London *Electrician*, Feb. 28, 1913.

## Book Reviews

**ELECTRICAL MACHINE DESIGN: THE DESIGN AND SPECIFICATION OF DIRECT AND ALTERNATING-CURRENT MACHINERY.** By Alexander Gray. New York: McGraw-Hill Book Company. 528 pages. Price, \$4.

Mr. Gray's book is a work of high order. Through it runs a philosophic conception of the principles and methods used in electrical machine design. In fact, the title of the book is too narrow for its scope, as it treats most successfully of the principles of electrical engineering. A soundness of judgment and a sane and simple treatment are characteristic of the author's methods and, while the book is primarily written for students, it is really a compendium of experience enlightened by scientific method. The book deals with direct-current machinery, alternators and synchronous motors, polyphase induction motors, and transformers. From this enumeration it is not to be assumed that the treatment of each of these subjects has been exhaustive, though it has been most thorough, defining everywhere the principles and fundamental ideas rather than the empirical side. Mr. Gray's experience for many years as an electrical designer and engineer has served him in good stead and has enabled him successfully to avoid too much of the academic side so often in evidence in works of this character. The treatment is everywhere up to the latest standard of our knowledge. In the regulation of alternators the method of zero power-factor is consistently used; in the chapters on heating Mr. Gray's own investigations have been embodied; in the chapters on design very useful design sheets have been inclosed; the interpole has been treated simply and alternator windings have been discussed so far as their practical applications are concerned; the wave-form of alternating-current generators has been simply discussed; the chapter on insulation is sane and to the point; the short-circuit characteristics and the effect of saturation are discussed in a modern manner; the paralleling of alternators and the problem of resonance receive a brief consideration; the circle diagram for induction motors is derived and explained; the leakage of induction motors and the noise as well as dead points at starting are entered into. The closing part of the work deals with transformers, and this portion of the book is not quite so satisfactory as the preceding chapters. At the close the practical mechanical design is discussed and the formulas for the unbalanced magnetic pull are derived as developed by Mr. B. A. Behrend, to the training in whose engineering office Mr. Gray gracefully acknowledges his indebtedness in the preface to the book. Mr. Gray's book bears the stamp of original treatment and is one of the best contributions to electrical engineering literature of late years.

**EXPERIMENTAL WIRELESS STATIONS. Their Theory, Design, Construction and Operation.** By Philip E. Edelman. Published by the author at 2432 Lyndale Avenue South, Minneapolis, Minn. 224 pages. Price, \$2.

A simple and very practical exposition of the constructive details in experimental wireless-telegraph stations, intended for the use of amateur radio-telegraphists. The fundamental principles are briefly outlined in some of the descriptions, although the book is not intended primarily for those who seek explanations of the phenomena presented in wireless telegraphy. There are nineteen chapters relating to the following subjects: Nature of wireless transmission, aërials, grounds, resonance, planning the transmitter, transformers, auxiliary apparatus, condensers, construction of helix, spark-gaps, radiation indicators, continuous waves,

the receiving station, detectors, telephone receivers, tuning, receiving condensers, tuning inductances, conclusion. The book will be useful to many amateurs who seek means of constructing wireless-telegraph installations inexpensively.

**HANDBUCH DER ELEKTRICITÄTS UND DES MAGNETISMUS.** In five parts. Edited by Prof. Dr. L. Graetz. Part II. First edition. Leipzig, Germany: Johann Ambrosius Barth. 336 pages, 252 illus. Paper. Price, 13 marks for the complete set.

A textbook on electricity and magnetism intended for advanced students of physics or of applied electricity. It is divided into three sections. The first deals with the mathematical laws of stationary currents, the second with the measurements of stationary currents, and the third with units and absolute measurements. The treatment is thorough and systematic. The chapters on the measurements of standard resistances are particularly good. The book, as one volume of the series, will recommend itself to students of electrical measurements in connection with continuous-current phenomena.

**ENGINEERING AND METALLURGICAL BOOKS, 1907-1911.** A full title catalog, arranged under subject headings, of all British and American books on engineering, metallurgy and allied topics published during the five years 1907-1911, with their English and American prices and publishers' names. By R. A. Peddie. New York: D. Van Nostrand Company. 206 pages. Price, \$1.50.

A useful book of reference in searching for the titles authors, publishers, or principal subjects of engineering books. More than 1500 books on engineering and metallurgical topics are included in the list. It is greatly to be desired that similar publications should be made of such books in France, Germany and Italy. It is sometimes very difficult to find a book when only one of the four above-mentioned particulars is forthcoming. We hope the author will see that this good work is not allowed to cease in future.

**PRIMARY BATTERY IGNITION.** A simple, practical pocket guide on the construction, operation, maintenance and testing of primary batteries for automobile, motorboat and stationary-engine ignition service. By C. Wadsworth, Jr. New York: D. Van Nostrand Company. 78 pages, illus. Price, 50 cents net.

A practical guide to the automobile driver as to the electrical connections used on the ordinary battery ignition car and as to the nature of the troubles which are likely to be experienced with the apparatus. A table of common ignition troubles and remedies appears on the last page and will be of help to an inexperienced driver. The book outlines the principles of induction-coil ignition and the methods of installing, testing and replacing batteries. It will appeal to a large number of men who operate either their own or other persons' cars.

**THE "MECHANICAL WORLD" ELECTRICAL POCKET BOOK FOR 1913.** A collection of electrical engineering notes, rules, tables and data. Manchester: Emmott & Company, Ltd. 310 pages, illus., cloth. Price, 6d.

A very handy little green pocket book suited for the daily reference of mechanical or electrical engineers in regard to electrical units, measurements, apparatus, machines, connections, systems, conductors, stations and general data. Added to these are a number of tables, such as gage tables and tables of conversion factors. A memorandum diary of sixty pages is appended. The book is surprisingly good for the price at which it is offered and will be useful to many persons coming into contact with the electrical-engineering world, especially if they are interested in British practice. For the illustration of American practice the book is, of course, not directly designed.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Telephone Aid to Edison Talking Pictures

Time and time again moving-picture plays have made use of the telephone as an actor which plays a more or less important part in the working out of the dramas portrayed. In fact, the telephone has come to be such a factor in everyday life that there are very few plays of



INTER PHONE INSTRUMENT SET

any sort which do not utilize the telephone to make the action more realistic.

The telephone has now taken another part in the moving-picture industry. It is used to help the moving pictures talk. Mr. Thomas A. Edison's latest invention, the "kinetophone," probably more popularly known as the "talking moving pictures," is a combination of film and phonograph, both of which, in great measure, have come to be known as Edison's own. In producing these talking pictures it is, of course, essential that the film reel and phonographic record should be absolutely synchronized. That is to say, when the actor's lips form a word that word must be reproduced by the phonograph at that instant, otherwise the effectiveness of the combination is entirely destroyed. This would naturally not be a very difficult matter if the reel and phonograph could be placed next to each other on the stage; but as the moving picture is invariably placed back of the audience in what is known as the "reel house," this is not possible. Furthermore, the reel house is usually entirely enclosed, with only a few openings for ventilation and others through which the pictures are projected upon the screen, and it is manifestly impossible for the operator to hear the phonograph clearly, if at all. On the other hand, the phonograph must be placed on the stage so that the sound will be directed toward the audience.

These facts have made it necessary to introduce a means of synchronizing the pictures and records. After a number of methods were tried out it was found that by making use of an intercommunicating telephone system the best results were obtained. At all moving picture and vaudeville houses where the talking pictures are shown the two attendants—the one operating the reels and the one operating the phonograph—have telephonic communication by means of a special three-wire private-line circuit. At each end of the line a Western Electric "Inter-Phone" hand set affords a means of constant and instant communication between the two men and in this way enables the operator of the picture machine to synchronize the pictures with the phonographic record. This type of hand set was chosen inasmuch as it is especially adapted for this class of service on account of being practically indestructible. In addition to the hand sets, a push button and a buzzer are installed at each station for signaling.

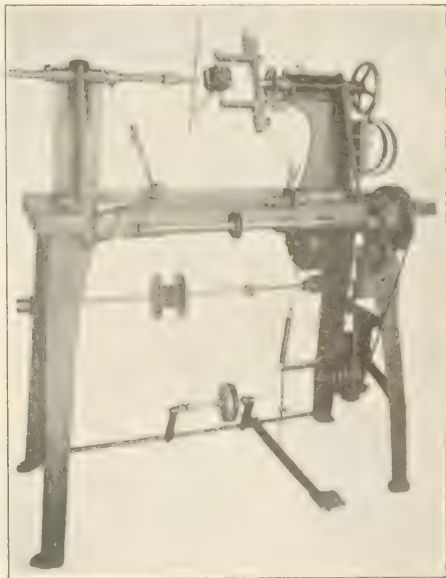
As a further aid to the moving picture operators the Edison company is furnishing them with Western Electric double-head receivers, which act as an auxiliary for the hand set. This makes it possible for the machine man to

attend to his work and still be in constant communication with the phonograph man and able to hear what he has to say at all times.

The kinetophone, which made its first appearance early in March, has already come to be looked upon as the logical successor to the wordless film drama. As a result of its invention, the world's greatest actors and the leading players of the world can be handed down from generation to generation and thus provide instructive and pleasing entertainment for years to come.

### Armature-Winding Machine

The mechanical armature winder illustrated herewith is manufactured by the International Electric Light & Electric Company, 512 Consolidated Realty Building, Los Angeles, Cal. The device, it is explained, will wind armature ordinarily wound by hand, from a vibrator or fan motor to a 15-hp machine, doing the same in a fraction of the time required by the old-fashioned method. The coil-former attachment is adjustable to any size coil or wire, from 1-hp to 50-hp size, thus eliminating the use of wooden forms. The coil taper is a very simple arrangement, which

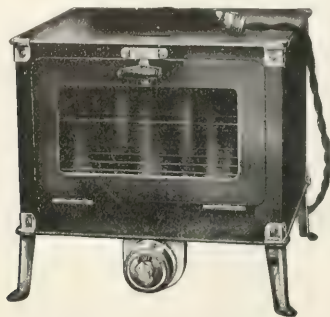


MACHINE FOR WINDING ARMATURES

may be made ready for use in a fraction of time. With this the coils accurately and to any thickness. The armature device can also be readily attached. For winding fields, solenoids, secondary coils, etc., of various design, the wire girder can be used with great accuracy. The coil speed control of the machine is regulated by a tension band and foot lever, including all six speeds and the brake.

### Electric Baking Oven

An electric oven built upon the fireless-cooker principle has recently been placed on the market by the Rochester Stamping Company, Rochester, N. Y. It is built of planished steel and is well insulated by 1-in. insulating walls. In the front door there is a panel of glass so that one can watch the process of baking or cooking without opening



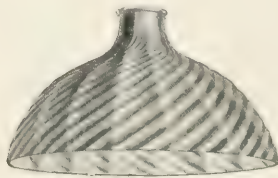
ELECTRIC BAKING OVEN WITH GLASS DOOR

the door. The heating element is guaranteed for five years. All grates and also the heating element can easily be removed so that the oven can be kept clean. It has three heating circuits for high, medium and low temperatures respectively, which are controlled by a three-circuit snap switch. It can be connected to and operated on an ordinary lighting circuit. It is said to be of proper size for doing all the baking and roasting for an average-size family.

### Reflectors for Concentrated Direct Lighting

The so-called "Visor" reflector is an opaque mirror reflector designed solely for store-window lighting. It prevents light being wasted by passing over the background into the store, and it hides the lamp from the ordinary range of vision and covers it in such a way that its reflection cannot be seen in the glass or polished background of the window. It is designed for use with 60-watt or 100-watt tungsten lamps and uses a 2 1/4-in. holder. The dimensions are as follows: depth, front to back, 10 3/8 in.; width, 9 1/2 in.; height, 8 9/16 in.

The line of direct-lighting reflectors for use in warehouses, factories, shops, over special machinery, etc., has been augmented by the addition of a new type of reflector



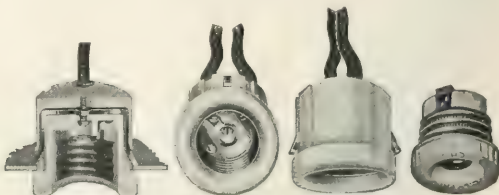
SHOW-WINDOW AND CEILING REFLECTORS FOR CONCENTRATED DIRECT LIGHTING

illustrated herewith. What is true of the show-window reflectors, as to hiding the lamps from view, is also true of the latter reflector. It is a concentrating type of reflector and is used with 60-watt and 100-watt lamps. Its dimensions are: diameter, 11 1/2 in.; height, 6 3/4 in.; holder, 2 1/4 in.

These reflectors are made by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago.

### Lamp Socket for Signs

A lamp socket which is notable on account of the easy method of installing it has been brought out by the Federal Sign System (Electric), Chicago. The socket is held by a U-shaped brass spring with projecting ends which snap out from the sides of the socket after it has been pushed in and are brought firmly up against the back of the metal



SIGN SOCKETS AND PLUG

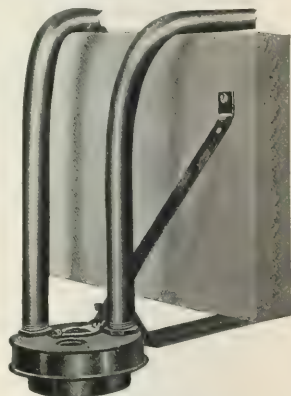
plate of a sign by a screw in the base of the socket. The grooves in the porcelain are intended to fit the small lugs usually left projecting in holes punched for the socket and thus to prevent its turning.

### Metal Holders for Outlet Boxes

A device for supporting outlet boxes has been placed on the market by the McKinley Outlet Box Holder Company, 411 Commerce Building, Kansas City, Mo.

The illustration shows the holder used with a standard outlet box having a depth of 3/4 in. and using an open cover for lath and plaster work. This same holder can also be used with outlet boxes having a depth of 1 5/8 in. where the open cover is not used. Similar holders are made for use with all standard outlet boxes having a depth of 1 5/8 in. and using an open cover for lath-and-plaster work, and for outlet boxes having a depth of 2 1/4 in. without the open cover.

The device consists of two pieces, the holder and a brace. The holder is made of No. 14 gage iron, 2 in. in width and of sufficient length to permit the outlet box being installed



METAL OUTLET BOX HOLDER

at any point between the joists. The base has two slots running the entire length through which it is nailed to the bottom of a joist, thereby permitting ready adjustment, and is fastened to the body by the same bolts which hold the fixture stem.

The brace is made of strap iron 1/16 in. thick and 3/4 in. wide. One end of this brace is made to fit the locking

arrangement where it attaches to the holder, and the other end is perforated in order that it may be nailed to the side of the joist.

The cost of these holders to the contractor is said to be from 25 per cent to 50 per cent less than the expense of nailing in boards.

### Long-Life Flame-Arc Lamp

The new type of flame-arc lamp which is illustrated herewith contains several features of construction and operation worthy of mention. The clutch does not act directly on the electrodes in the usual way but works on the inner machined surface of the roller bearing over which the chain which connects the upper electrode holder and the lower electrode holder rod runs, thus making the clutch independent of the

which raises the current to 10 amp at the arc. The lamps operate at the usual lighting frequencies. A 25-cycle arc lamp has also been designed. All types of this lamp are similar in external appearance and most of the parts are interchangeable.

The lamp described above is manufactured by the General Electric Company, Schenectady, N. Y.

### Vertical Turbines

The Terry Steam Turbine Company, Hartford, Conn., has recently developed a complete line of vertical turbines rated at from 5 hp to 600 hp, operating at from 3600 r.p.m. to 500 r.p.m.

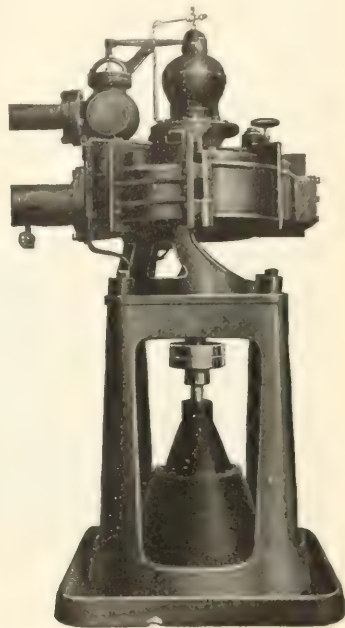
Except in the smaller sizes, where all the parts are so



FLAME-ARC LAMP



TURBINE-DRIVEN BOILER-FEED SET AND DEEP-WELL PUMPING SET



size of the electrode. The lamps are of the focusing design, which keeps the arc always in the same position and gives a more uniform illumination. The focusing rod, which carries the lower electrode holder, is suspended so as to eliminate all friction. Above the arc is provided a condensing chamber into which the gases rise. Coming in contact with the cold metal sides of the condenser, a powder is deposited from the fumes there. Slabs of absorbent material are placed in the condensing chamber to prevent etching of the globes by the fumes. The economizer is so designed that a maximum amount of heat is radiated and a magnetic blow ring is placed around the economizer so as to make the electrode burn squarely.

The inner globe is of clear glass with a light alabaster outer globe. The electrodes burn from 100 to 120 hours. The trimming operation is very simple. The multiple flame-arc lamp is made for use on alternating-current and direct-current circuits of nominally 110 volts, and also for circuits of 220 volts and above, these being operated in multiple series. The direct-current lamps operate at 6.5 amp, while the alternating-current lamps take 7.5 amp at the terminals but are equipped with an auto-transformer

light that they can be comfortably lifted by one man, the casing is divided on the vertical axial plane and the cover or half casing is hinged. All the bearings are easily accessible and are supplied with forced lubrication from a single oil pump on the main shaft. The thrust is taken by a ball bearing which has been submitted to tests at six times normal load, with speeds which are 50 per cent above service speeds.

To safeguard the operation of the thrust bearing, the balls are immersed in oil when starting from rest. A constant circulation of oil through the bearing while running is provided in order to keep all the balls and races cool and free from grit.

This vertical turbine has been found well adapted for deep-well pumping and on shipboard for operating forced-draft and ventilating fans.

These turbine sets are compact, of light weight, and run without vibration. They are reported to have made records of long continuous runs without showing the slightest wear or requiring adjustment. Particular attention has been paid by the manufacturer to absolute reliability in operation without requiring attention.



The turbine is of the single-stage type, with shaft extension to receive the fan or the centrifugal pump. All of these vertical machines can be dismantled without disturbing the steam connections.

### Electric-Arc Welder

The welding machine shown herewith is a self contained machine, thus eliminating the losses in a machine used in connection with a motor-generator set, which is said to be the only other type of arc welder on the market. There is no resistance used with it in any way, which very greatly increases the efficiency, and the manufacturers claim that in careful tests over long periods of time the actual efficiency has exceeded that of other arc welders by from 40 to 60 per cent. The intensity of the arc is controlled through connections in the series field circuits, which increase or decrease the number of turns and thereby change the amount of current in the arc. The machine can be entirely short-circuited without in any way harming it and without consuming an excessive amount of power. There are no automatic connecting devices on the switchboard. As soon as the short-circuit is put on the voltage of the arc circuit immediately drops to zero by the inherent regulation of the machine, the power taken at that time being about one-fourth of full load. This is directly opposite to the action of other arc-welding apparatus in which the current in-



SELF-CONTAINED WELDING MACHINE

creases to maximum at the time of short-circuit—that is, at the time of striking the arc—and decreases with the length of the arc.

This machine can be made for any voltage, or any current and can be used for welding imperfect steel castings, cutting off risers, mis-runs, shrinkage heads, rails, I-beams or work of a similar nature. It is also useful for the welding of sheet metal, calking of boilers and work of that kind.

The fundamental principle of the machine is that the voltage of the motor between the main brushes varies as the amount of flux and position of the flux which enters the armature from the main poles. As is well known, if an auxiliary brush is put half way between the two main brushes, the voltage generated between this auxiliary brush and either of the other brushes will be equal at no-load, but as the load increases the armature reaction will so distort the field that the voltage on one side of the auxiliary brush will be very much greater than on the other side. This action is amplified by the use of an interpole with a winding which bucks the main flux. By varying the number of turns on this interpole the amount of bucking action can be controlled and therefore the amount of current in the arc can be controlled.

The machine is manufactured by the Lincoln Electric Company, Cleveland, Ohio.

### Mine Locomotive

The accompanying illustrations show a type of mine locomotive which is now manufactured by the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. The notable features are the open, cast-steel bar frame and the specially designed commutating-pole motor.

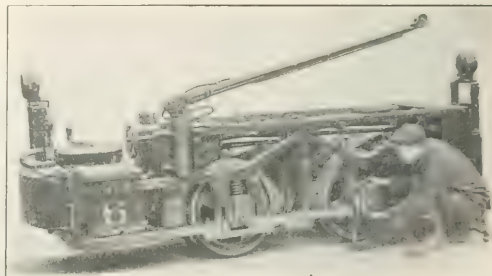


FIG. 1—ELECTRIC MINE LOCOMOTIVE

It is claimed that this locomotive will operate satisfactorily under the worst conditions with minimum attention and maintenance expense. The frame is designed to allow ready access to all parts so that the locomotive can be inspected or overhauled, when necessary, in the least possible time.

The open frame also gives better ventilation to the motors and resistors than that obtained by armor-plate frame construction. The upper parts of the motors and armature bearing housings can be removed without disturbing the suspension, so that each part of the motor is exposed for inspection. To remove the grid resistors it is necessary only to take off the locomotive covers and loosen the bolts and terminals that hold the resistor frames in place.

In mine service it is essential to provide for ease in adjustment and repair. In order to remove a journal box it is necessary merely to drop the binder and take the weight off the journal box. The journal box may then be slipped out from the side. On locomotives with inside frames the journal box cellars are arranged to be easily dropped out for re-packing. If it is desired to take out a set of wheels and axle, this may be done without disturbing the motor suspension or connections by simply blocking the motors in place and removing the binders. The wheels may then be dropped. The frames of the motors are split diagonally.

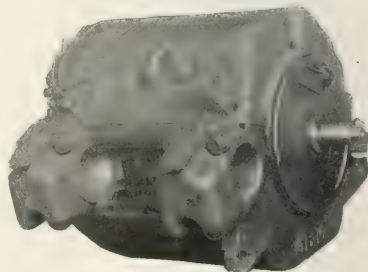


FIG. 2—DRIVING MOTOR FOR LOCOMOTIVE

The axle bearings and suspension nose are on the lower half of the frame, so that the upper half, the armature and bearing housings can be removed without disturbing the suspension or axle brackets. The armature core is mounted on a spider to which it is keyed, making it possible to remove the shaft without disturbing the windings, and also reinforcing the shaft against bending.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Efficient Emergency Work by Western Electric Company.**—The first unusual demands for special service as a result of the Western tornado and last week's floods came to the Western Electric Company from Omaha, where the telegraph and telephone lines were seriously interfered with. The company was notified that 81,000 poles, 25,000 cross-arms, 100,000 pins and 32,000 ft. of telephone cables ranging in size from 25 pair to 400 pair, were immediately needed. The sudden demand found the organization prepared to make a quick response, and on the day the order was placed twenty carloads of poles, 100,000 lb. of copper wire and all of the cable went forward. The company's stock of 25,000 cross-arms at Minnesota Transfer was drawn upon. The poles went forward from the yards in Michigan and the rest of the equipment from the Chicago stock. The next call was for cable for the Chicago district, for the Western Union Company. This emergency cable, to the extent of 235,000 lb., went forward at once by express from New York, almost every through passenger train leaving the East for Chicago up to the time traffic was suspended being pressed into service to carry its quota of this cable. In the meantime the floods began to make themselves felt in Indiana and Ohio, where within a few days not only telegraph and telephone service but electric light, street railway and railroad service was completely demoralized. Again came the call for emergency line material. First of all, the company's stocks of cable, cross-arms, wire and line construction material of every description in its distributing houses at Cleveland, Pittsburgh, Indianapolis and Cincinnati were drawn upon, and then the outlying houses were notified to be ready with their assistance when it was needed. Complete stocks were available at Boston, New York, Philadelphia, Richmond, Kansas City, St. Louis, Minneapolis and Dallas—these houses constituting a chain of reserve depots surrounding the stricken district, while further west were the other distributing centers of the company which might also be called upon to help. Meanwhile, it was seen at the company's executive headquarters in New York that with depletion of all these reserve stocks they must be immediately replenished. Accordingly telegraphic orders were issued to send east from Washington 50,000 cross-arms, and requisitions were placed upon the company's sources of supply to increase the stock of copper wire available for shipment to upward of 500,000 lb., for the drawing of many hundred thousand pounds of copper wire and furnishing of from 5,000,000 ft. to 10,000,000 ft. of rubber-covered wire and outside distributing wire. Following the subsiding of the waters it was expected that there would be like demands upon the company for reserve telephone exchange equipment. At this writing the first of these calls had only just begun to come, but the company was ready with men and apparatus to meet this phase of the emergency. The first call on the New York office was on the morning of March 31, when word came to move a force of telephone installers and switchboard material with the greatest possible speed to Marietta, Ohio, where the lower floors of the Bell telephone exchange building had been flooded to the ceiling, the terminal and power equipment completely submerged and telephone service entirely suspended. Before the day was over tools and material were in transit on taxicabs to the afternoon Baltimore & Ohio express for Wheeling. With this material went a number of men with the superintendent of installation. Their numbers were augmented by others from Philadelphia, Pittsburgh and other Pennsylvania points, and at noon of April 1 the entire party in motor boats, which had been chartered for the occasion, started down the Ohio River for Marietta, this being the only means of approaching the stricken dis-

trict. The dispatch with which this particular case was handled by the Western Electric Company in performing its part in the restoration of the telegraphic and telephone service of the country merits high tribute, not only to the company, but also to American business methods.

**Great Demand for Linemen and Electricians in Devastated Districts.**—Appeals have been sent out from the flood-stricken districts for all available linemen and electricians to aid in the work of making electrical repairs. There was a great deal of repair work to be done in electrical structures in a large area west of Chicago, owing to recent windstorms, and there is still more to be done in a still larger territory, generally east of Chicago, owing to the floods. As far as Duluth, Minn., the word was sent that "every man who can climb a telegraph pole and twist a wire is wanted at Duluth and other flooded cities in Ohio and Indiana." It is said that more than seventy-five men responded from Duluth alone. This widespread demand for linemen indicates in a way the extent of the damage done to telephone, telegraph and transmission lines in the flooded districts, because the States of Ohio and Indiana themselves furnish a large percentage of the linemen employed in the United States. Remarkable progress has been made toward restoring temporary communication in districts which have been entirely cut off from the outside world. The great task to be undertaken now is the replacing of temporary circuits with permanent lines. New poles have to be transported to the various districts to replace old ones which have been broken; poles have to be reset or righted, and hundreds of miles of wire have to be re-strung. With the ground in its water-soaked condition, a considerable impediment will be offered to post-hole digging and the transportation of new poles to the scenes of erection in wagons. It is said that about 2500 outside linemen were sent by the Western Union and Postal companies to the devastated districts between Pittsburgh and Omaha. Where railroad transportation was interrupted, men and construction supplies were conveyed to the various districts by means of teams and automobiles.

**Large Order for Electric Trucks.**—The New York Railways Company has placed a hundred-thousand-dollar order with the General Vehicle Company for electric commercial vehicles as follows: One 1000-lb. wagon with express-type body, two 1000-lb. wagons with panel bodies, and 2000-lb. panel money wagon, fourteen 3000-lb. trucks with steel dumping bodies and hand-operated dumping devices, four 312-ton trucks with platform and stake bodies, one 5-ton truck with platform and stake body, and one 3-ton special truck. This order, in view of its magnitude, and coming from one company, may be regarded as a high indorsement of the electric truck particularly when the wide range of duties which the trucks ordered will perform is taken into consideration. The 1000-lb. wagons will be used for special parcel delivery, while the money wagon ordered is a type already in use by express companies and banks. The fourteen 3000-lb. dumping trucks are to be furnished with the most modern equipment and will be the highest type of truck for the purposes for which they are designed. The 3-ton trucks will be used for mail work and the 312-ton trucks will be used for general hauling.

**Flood Causes Demand for Construction Tools.**—As a result of the damage to overhead electrical lines during the recent storm was a very great demand for construction tools. Urgent appeals were made in those districts in stocks of this description by Chicago and elsewhere. The demand was especially great for digging tools, pole poles and the general line of construction tools. All kinds of overhead material were also in active demand.



**Public Service Corporation of New Jersey Made Good Showing Last Year.**—The annual report of the Public Service Corporation of New Jersey for the year ended Dec. 31, 1912, issued last week, shows that the corporation's subsidiary operating companies obtained an approximate gross increase from operating during the year of \$2,200,000, which represents an increase of 7.31 per cent over the revenues from that source in 1911. The percentage of increase of the Public Service Railway Company was 4.35. This percentage, the report states, is below normal and is due to two reasons—the severe climatic conditions prevailing during the early winter months of 1912 and the direct loss suffered by the opening of the Summit Street, Jersey City, station of the Hudson & Manhattan Railroad Company, together with the joint operation by that company and the Pennsylvania Railroad Company of its high-speed electric line to Newark, N. J. The percentage of increased receipts of the Public Service Electric Company was 12.19, which is regarded as a most satisfactory showing, while the receipts of the Public Service Gas Company increased 8.50 per cent over those in 1911. President Thomas N. McCarter states, as he did in the 1911 report, that the most notable feature in relation to the development of the Electric company's business during the year was the vast increase in the amount of motor-service business obtained, and that merely the surface of the possibilities in this direction has been touched apparently thus far. During the year 1912 a large amount of new underground work was completed by the Electric company. Approximately \$500,000 will be spent in the current year for additional underground work, in accordance with the policy of the company to place its wires underground in populous centers as rapidly as conditions will permit. Four new substations were finished during the year, and the rebuilding and enlargement of four other substations were completed. A very large and valuable piece of real estate has been secured during the year, fronting on the Passaic River in the meadow section of Newark, as the site for a new power station, which the rapidly growing business of the Electric company in this locality presages as a necessity in the early future.

**Proposed Merger in Louisville.**—The lower branch of the Louisville City Council has approved the proposed plan for merging the various heating and lighting properties in that city. The deal includes the consolidation of the two gas companies and four electric companies now operating independently. Interests headed by H. M. Byllesby, of Chicago, control two of the two larger companies, the Louisville Gas Company and the Louisville Electric Company, and also the two smaller electric companies, the George G. Fetter Lighting & Heating Company and the Campbell company. Options are also held on the other two concerns, the Louisville Heating Company, a natural-gas enterprise, and the Kentucky Electric Company. If the city gives its final approval, all these companies will be brought together under one organization, the Louisville Gas & Electric Company, incorporated a short time ago by Byllesby interests with an authorized capital of \$18,000,000. The new franchises under which it is proposed to effect the merger call for a reduction in both electric and gas schedules. The proposition which has been made by the city provides for a sliding scale ranging from 7.6 cents to 4.75 cents per kw-hr. net for electricity, depending on the amount used. For gas \$1.20 is to be the charge for the first 2000 cu. ft., with a minimum of 35 cents per 1000 cu. ft. for all gas above 2000 ft. and a minimum charge of 36 cents a month.

**Changes Coming in Middle West Utilities Company.**—Important changes affecting the Union Gas & Electric Company in both New Albany and Jeffersonville, Ind., as well as four electric railways operating in southern Indiana and a number of other Indiana central stations, are to be made when the Middle West Utilities Company, of Chicago, owning these properties, is reorganized. The proposed reorganization of the well-known Chicago company controlled by the Insull interests has been brought about by the recent enactment of a state law compelling all public-service corporations operating in Indiana to establish their headquarters in that State. It is expected that Chester P. Wilson, first vice-president of the Middle West Utilities

Company and a resident of Indianapolis, will be elected president of the Chicago company. Its main offices will then be moved to the Indiana capital. Through the United Gas & Electric Company the Middle West interests will probably purchase the electric light and power plant in Corydon, Ind., in the near future, enabling them to serve Lanesville, Georgetown, Edwardsville and other points between Corydon and New Albany.

**Receivers for Ohio Company.**—Judge Day of the federal court for the Northern District of Ohio recently made Rees G. Richards and W. R. W. Griffin receivers for the Tri-State Railway & Electric Company. This receivership covers the Tri-State Railway & Electric Company and the operation of its leased properties, which are the East Liverpool Traction & Light Company and the Steubenville & East Liverpool Railway & Light Company. The receivership does not include or in any way interfere with the operations of the following properties: Beaver County Light Company, Midland Electric Light & Power Company of Pennsylvania, Steubenville, Wellsburg & Weirton Railway Company, Wellsburg Electric Light, Heat & Power Company and Hancock County Electric Company of West Virginia. The receivers are authorized by the court to carry on all current operation and pay all expenses of such operation from the revenues received.

**Canadian Westinghouse Company's Year.**—From the year's profits of the Canadian Westinghouse Company regular quarterly dividends at the rate of 7 per cent per annum and a bonus dividend of 2 per cent, making a total for the year of 9 per cent, have been paid, amounting to \$399,762. Fifty thousand dollars have been added to the reserve for insurance fund purposes, which reserve now totals \$100,000. The sum of \$348,505 has been written off property and plant against items included in that account, consisting of factory equipment and manufacturing appliances of a more or less depreciating nature, and also against items not immediately productive from a manufacturing standpoint. The balance, amounting to \$251,754, has been carried forward to the credit of the profit and loss account, which shows as of Dec. 31, 1912, a total unapportioned surplus of \$1,302,599.37. The directors were all re-elected at the annual meeting.

**Electrical Supply Dealers Open Offices in Canada.**—The Perkins Electric Company, Ltd., which was recently organized to carry on business as dealer in and importer of electrical equipment, has opened offices at 322 Craig Street West, Montreal, Canada. The new company will act as wholesale dealer in and importer of flaming-arc, tungsten, carbon and sign lamps, miniature and automobile lamps, tumbler switches and switch plates, flexible conduit, flaming-arc, inclosed-arc and projection electrodes. Other lines will be added from time to time. George F. Perkins is president and managing director of the new company. F. G. Parsons is vice-president, P. F. Ferguson is secretary, and H. N. Howlett is accountant and assistant manager.

**Connecticut Power Company to Build Plant.**—The Connecticut Power Company, the Middletown Electric Light Company, the New London Gas & Electric Company and the Eastern Connecticut Power Company have been merged under the name of the Connecticut Power Company. It is understood that the new company will be managed by the Stone & Webster interests. A hydroelectric plant will be built at Falls Village, on the Housatonic River, and after its completion the company will issue \$1,250,000 preferred stock, \$1,000,000 common stock and \$2,445,000 of bonds.

**American Light & Traction Company Increases Capital Stock.**—A certificate giving notice of an increase in its capital stock from \$40,000,000 to \$65,000,000 was filed with the Secretary of State, New Jersey, on March 31, by the American Light & Traction Company. The new issue is to be divided into \$25,000,000 preferred and \$40,000,000 common stock.

**Change in Control of Lafayette (Ind.) Company.**—Controlling interest in the Merchants' Electric Light Association, which does an electric lighting and steam heating business in Lafayette, Ind., has been acquired by Samuel T. Murdock, general manager of the Indiana Lighting Company, of Lafayette.



**Texas Telephone Changes.**—At a recent meeting of the Houston Home Telephone Company a number of changes in the personnel of the company were effected. J. B. Earle, of Walpole, who is president of the Brazos Valley Telegraph & Telephone Company, the South Texas Telephone Company, the Fort Worth Telephone Company, the United Telephone Company, the Ellis County Independent Company and the San Antonio Telephone Company, was elected president of the Houston company. As a result of the reorganization the Houston company will be brought into touch with the foregoing companies and a number of improvements in the service will be made. B. C. Hyde, of Waco, was elected vice-president of the company and E. C. Blomeyer, also of Waco, was made secretary and treasurer.

**Electrical Manufacturers Open New York Office.**—Messrs. Hickey & Schneider, manufacturers of electrical supplies, Elizabethport, N. J., concerning whose formation a note appeared recently in these columns, have opened a New York office at 227 Fulton Street, where M. D. Maxwell will be sales manager.

**New Factory for National Quality Lamp Company.**—According to advices from Cleveland, negotiations have been completed by the National Quality Lamp Division of the General Electric Company for the erection of a new factory in Cleveland, where 600 persons will be employed.

**Will Represent Electric-Fixture Manufacturers.**—The David Killoch Company, 57 Murray Street, New York, dealer in electric supplies, has been appointed Eastern agent for the S. W. Wakefield Brass Company, of Vermilion, Ohio, manufacturer of electric fixtures.

**Triumph Electric Company Busy.**—Owing to the pressure of orders at the works of the Triumph Electric Company, Cincinnati, Ohio, manufacturer of electric-light equipment, a night shift is working as well as the regular day force.

## Electric Securities

Security	Capital Stock Listed	Dividend	Quotation
		Per Cent	Period
			Mch. 26 April 2
Adirondack Electric Power, c.	\$9,500,000		114 1/2
Adirondack Elec. Power, pf.	2,500,000		114 1/2
Amer. Gas & Electric, S.	2,000,000	2	90 1/2
Amer. Gas & Electric (\$50), pf.	1,537,500	2	90 1/2
Amer. Light & Traction, c.	14,240,000	2	100 1/2
Amer. Light & Traction, pf.	14,240,000	2	100 1/2
Amer. Power & Light, c.	5,631,400	1	100 1/2
Amer. Pwr. & Lt., 6% notes, '21	2,411,000	1	100 1/2
Amer. Pwr. & Lt., 6% notes, '21	2,199,100	1	100 1/2
Appalachian Power, c.	2,100,000	1	100 1/2
Appalachian Power, pf.	2,100,000	1	100 1/2
Arizona Power, c.	3,000,000		12 1/2
Arizona Power, pf.	850,000		12 1/2
Asheville L. & P., 1st s.f. 5s, '42	1,100,000		100 1/2
Auriferous Aiken R. & E., s.f. 5s, '35	2,588,000		100 1/2
Auriferous Aiken R. & E., 1st s.f. 5s, '35	2,588,000		100 1/2
Auriferous Aiken R. & E., 2nd s.f. 5s, '35	2,588,000		100 1/2
Auriferous R. & E., 1st s.f. 5s, '35	2,588,000		100 1/2
Central Maine Power, 1st, 5s.	2,502,000		100 1/2
Cities Service, c.	5,499,410	5-12	100 1/2
Cities Service, pf.	10,195,360		100 1/2
Colt's R. & E., 1st s.f. 5s, '35	2,411,000		100 1/2
Columbus Ry., G. & Elec., c.	2,000,000		100 1/2
Columbus Ry., G. & Elec., pf.	2,000,000		100 1/2
Commonwealth Edison, c.	11,140,000		100 1/2
Con. Gas, El. & Pr. (Balt.), 4 1/2s	11,564,000		100 1/2
Consum. Pwr. (Mich.), 5s, '36.	10,088,000		100 1/2
Consum. Pr. (Minn.), 1st 5s, '29	9,528,000		100 1/2
Dallas Elec. Corp., 5s, '22.	3,659,000		100 1/2
Denver Gas & El. L.	2,000,000		120 1/2
Denver Gas & El. L., 1st s.f. 5s, '35	2,000,000		120 1/2
Edi. El. Ill., Boston, cap. stock.	15,603,700		28 1/2
Federal Light & Traction, c.	2,500,000		100 1/2
Federal Light & Traction, pf.	2,500,000		100 1/2
Fort Worth Pwr. & Lt., 1st s.f. 5s, '35	1,000,000		100 1/2
Harwood Electric, 5s, '39.	1,000,000		100 1/2
Kansas City R. & L., 1st s.f. 5s, '35	9,411,000		100 1/2
Kansas City R. & L., 2nd s.f. 5s, '35	9,411,000		100 1/2
Kans. City R. & L., 1st ref. 5s, '35	10,200,000		100 1/2
Kans. City R. & L., 2nd ref. 5s, '35	10,200,000		100 1/2
Lincoln Gas & Electric, c.	2,100,000		100 1/2
Lincoln Gas & Electric, 5s, '41	796,000		100 1/2
Northern States Power	2,100,000		100 1/2
Northern States Power, pf.	2,100,000		100 1/2
Pacific Gas & Electric, c.	10,000,000		100 1/2
Pacific Gas & Electric, pf.	10,000,000		100 1/2
Philadelphia Electric (\$2)	24,000,000		100 1/2
Portland General Electric, 5s.	8,000,000		100 1/2
Republic Railway & Light	7,000,000		100 1/2
Republic Railway & Light, pf.	6,300,000		100 1/2
St. Joseph's R., L., H. & P., 5s.	2,411,000		100 1/2
Seattle Electric Co., 5s, '29.	7,417,000		100 1/2
Southern Calif. Edison, 5s, '39.	10,043,000		100 1/2
Southern Power, c.	1,000,000		100 1/2
Standard G. & E., 1st s.f. 5s, '35	343,150		100 1/2
Standard G. & E., 2nd s.f. 5s, '35	343,150		100 1/2
Tennessee R. & L., 1st s.f. 5s, '35	2,411,000		100 1/2
Tennessee R. & L., 2nd s.f. 5s, '35	2,411,000		100 1/2
Tri City R. & L., 1st s.f. 5s, '35	2,411,000		100 1/2
Tri City R. & L., 2nd s.f. 5s, '35	2,411,000		100 1/2
Virginia Railway & Power	10,000,000		100 1/2
Western Electric	10,000,000		100 1/2
Western Electric, pf.	10,000,000		100 1/2
Western States Power	10,000,000		100 1/2
Western States Power, pf.	10,000,000		100 1/2
W. States R. & L., 1st s.f. 5s, '35	2,411,000		100 1/2

## Industrial Securities

Security	Capital Stock Listed	Dividend	Quotation
		Per Cent	Period
			Mch. 26 April 2
Allis-Chalmers, t.r., 3d pd.	\$15,501,800		21 1/2
Allis-Chalmers, t.r., 3d pd.	14,115,500		21 1/2
Amalgamated Copper	15,887,000	1 1/2	7 1/2
American Tel. & Tel.	344,139,200	2	103 1/2
Electric Storage Battery, c.	16,074,425	1	50 1/2
General Electric, c.	101,274,800	1 1/2	103 1/2
General Electric, pf.	41,350,100	1 1/2	103 1/2
Mackay Cos., pf.	50,000,000	1	67 1/2
Western Union Tel.	99,216,900	1	67 1/2
Westinghouse E. & M., c.	33,870,000	1 1/2	103 1/2
Westinghouse E. & M., pf.	3,998,700	1 1/2	103 1/2

\*Last price quoted.

## NEW YORK METAL MARKET PRICES.

	March 25	April 1
	Bid. Asked	Bid. Asked
Copper:		
Standard, spot	14.00 to 14.75	14.75 to 15.25
London, standard, spot	64 to 67	67 to 70
Prime Lake	14.85 to 14.95	15.10 to 15.25
Electrolytic	14.85 to 14.95	15.10 to 15.20
Casting	14.65 to 14.75	15.00 to 15.10
Copper wire, base	16.00 to 16.25	16.25 to 16.50
Lead	4.35 to 4.50	4.35 to 4.50
Nickel	40.00 to 45.00	40.00 to 45.00
Sheet zinc, f.o.b. smelter	8.25 to 8.50	8.00 to 8.25
Spelter, spot	6.10 to 6.20	6.00 to 6.10
Tin, spot	46.50 to 47.00	48.00 to 48.50
Aluminum:		
Prompt delivery	26.87 1/2 to 27.12 1/2	26.75 to 27.50
Future	26.62 1/2 to 26.87 1/2	26.75 to 27.50

## OLD METALS.

	14.00	14.25
Heavy copper and wire	9.00	9.37 1/2
Brass, heavy	7.75	8.25
Brass, light	5.25	5.75
Lead, heavy	4.25	4.75
Zinc, scrap	5.25	5.12 1/2

## COPPER EXPORTS IN MARCH.

Total tons	41,702
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## Personal

**Mr. H. D. Beaumont** has been appointed superintendent of the Hearne (Tex.) municipal plant.

**Mr. J. M. Bramlette** is the successor to Mr. J. H. Humpe as manager of the Lincoln Traction Company, Lincoln, Neb.

**Mr. G. M. Ronanan** is the successor to Mr. C. F. Appleton as treasurer and manager of the Dublin (N. H.) Electric Company.

**Mr. Adolf Wagner** has succeeded Mr. H. D. Hayden as manager of the Red Wing (Minn.) Gas, Light & Power Company.

**Mr. F. C. Kimball** has been appointed to fill the office of manager of the Commonwealth Water & Light Company, Summit, N. J.

**Mr. Orlando McClure** has resigned as superintendent of the Idelwild Electric Light, Heat & Power Company of Federalsburg, Md.

**Mr. W. G. Ghiselin** has been appointed manager of the St. Charles (Mo.) Electric Light & Power Company, succeeding Mr. W. S. Merkle.

**Mr. William Gorenflo** is the new president of the Columbia Ice & Power Company, Columbia, Miss., having succeeded Mr. C. W. Grayson.

**Mr. Colin K. Lee**, formerly of Kansas City, Mo., has become manager of the Pike County Electric Light & Power Company of Bowling Green, Mo.

**Mr. A. M. Little**, manager of the Mohawk Electrical Supply Company of Syracuse, N. Y., has been elected a vice-president and director of the company.

**Mr. George F. Morrison**, general manager of the General Electric Company's works at Harrison, N. J., has returned from an extended trip to Japan.

**Mr. E. G. Taylor** combines the duties of president and manager of the Loup City (Neb.) Mill & Light Company, which has recently entered the lighting field.

**Mr. Judson E. Strong**, of Chicago, Ill., has been appointed manager for the Central Illinois Public Service Company at Pittsfield, Ill., succeeding Mr. Frank R. Harder, resigned.

**Mr. Harry E. Dauner** is now new-business manager for the Fremont Gas, Electric Light & Power Company of Fremont, Neb. Mr. Dauner was formerly stationed at Pueblo, Col.

**Mr. A. J. Mueller** has been appointed manager and superintendent of the National Light, Heat & Power Company, Brainerd, Minn., which took over the municipal electric-lighting plant at that place.

**Mr. J. T. Shannon** has been appointed commercial agent for the United Electric Light & Water Company of New Britain, Conn. Mr. Shannon was formerly stationed at Waterbury, Conn., Harrison, N. J., and Nashville, Tenn.

**Mr. Mason D. Pratt** has joined the staff of the United Railways & Electric Company of Baltimore, Md., as engineer under Mr. J. M. Hood, consulting engineer. Mr. Pratt formerly had a consulting engineering practice at Harrisburg, Pa.

**Mr. A. L. Thorn**, formerly superintendent of electric works at Tacoma, Wash., has been transferred to the commercial department which the city recently established, and will devote his time to the sale of energy for motors, heating and lighting.

**Mr. Albert L. Pearson**, electrical engineer for Lockwood, Greene & Company, Boston, Mass., addressed the meeting of the American Society of Mechanical Engineers at the Boston Engineers' Club, March 25, on the subject of industrial illuminating engineering.

**Mr. William L. Wilson**, president of the Wilson-Maltman Electric Company, of Baltimore, was the speaker at the weekly luncheon of the Jovian Order of Baltimore, held at the Hotel Emerson March 27. His subject was "Co-operation from a Contractor's Standpoint."

**Mr. O. B. Nelson** has become manager of the Colonial Power Company, with offices at Claremont, N. H., succeeding to the control of the Claremont Railway & Lighting

Company and the Claremont Power Company, of which Mr. L. N. Wheelock was formerly manager.

**Mr. J. M. Wakeman**, general manager of the Society for Electrical Development, addressed the Jovian luncheon held at Philadelphia, March 27, outlining the aims and objects of the society and suggesting directions in which the Jovian Order and the society can work together for mutual aid to the industry.

**Mr. H. L. Lincoln**, formerly in the contract department of the Commonwealth Edison Company, Chicago, has been appointed instructor-in-charge of the new Chicago Central Station Institute, recently established at 1120 Merchants' Loan & Trust Building, Chicago, for the training of central-station commercial men.

**Mr. Louis A. Alexander**, superintendent of the F. Bissell Company, Toledo, Ohio, addressed the members of the Toledo Section of the American Institute of Electrical Engineers at a recent meeting, taking for his theme the technical features of high-speed motors in the operation of vacuum cleaners and pumps.

**Mr. J. G. Pomeroy**, who for seventeen years was manager of the Chicago office of the Adams-Bagnall Company, and later in charge of the Cleveland headquarters, has joined the forces of the Illinois Electric Company, with offices at Los Angeles. Mr. Pomeroy has been in Southern California on a vacation since the early fall of 1912.

**Mr. B. W. Collins**, who has been appointed superintendent of the Tacoma (Wash.) electric works, was formerly manager of the Northwestern Supply Company and the Pacific Lamp & Supply Company of Tacoma. Previous to his Tacoma connections, Mr. Collins was general superintendent of the Monterey County Gas & Electric Company, of Monterey, Cal.

**Mr. Nils Sundblad**, who is in charge of hydraulic construction work at the Trollhättan power station, Sweden, and also of the extensive reconstruction of the ancient Göta Canal at Trollhättan, is at present visiting this country to study recent developments in the hydraulic features of power-plant design. Mr. Sundblad expects to remain in this country about three months.

**Mr. H. C. Eddy**, recently appointed engineer of the public utilities commission for the District of Columbia, received his technical training at Lehigh and Columbia universities, and after experience in power-plant operation for several New Jersey electric railways, joined the staff of J. G. White & Company as electrical engineer and assistant superintendent. In this connection he installed an extensive street-railway system at Auckland, New Zealand. Later he became superintendent of underground construction for the Potomac Electric Power Company of Washington, resigning to fill the appointment of assistant electrical engineer for the District of Columbia. From 1908 until the creation of the public utilities commission by Congress, March 4, 1913, Mr. Eddy served as executive officer for the Interstate Commerce Commission which had jurisdiction over the Washington utilities.

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## Obituary

**Charles E. Wilson**, general manager of the Keystone Telephone Company of Philadelphia, died at his home in that city March 29. Mr. Wilson was forty-five years of age and had been ill for several months.

**John Cashman**, president of the Quincy Electric Light & Power Company, of Quincy, Mass., died at his home in West Quincy March 29. Mr. Cashman was a citizen of much public spirit and built the monument to the Pilgrims at Provincetown.

**C. Edgar Titzel**, manager of the Lancaster Edison Electric Company and the Lancaster County Railway & Light Company, of Lancaster, Pa., and the Columbia Light, Heat & Power Company of Columbia, Pa., died at Lancaster, Pa., March 30 of paralysis caused by a hemorrhage of the brain. Mr. Titzel was thirty-nine years of age at the time of his death and had been in the employ of the local electric companies twenty-four years.





**SENECA, N. Y.**—The West Seneca Town Board, has decided to create a lighting district including Ebenezer, Gardenville, Winchester and the section of the township extending from the city line out on Seneca and Clinton Streets to the southerly limits of the villages of Ebenezer and Gardenville. The proposed lighting system provides for about 350 electric lamps. The board will ask for bids for furnishing, installing and maintaining the system, which will be opened in about 30 days.

**SYRACUSE, N. Y.**—The Syracuse Ltg. Co. has applied to the Public Service Commission for permission to issue \$239,000 in bonds, the proceeds to be used for extensions to its system in Syracuse.

**TROY, N. Y.**—The city of Troy contemplates the installation of an ornamental street-lighting system, to cost \$67,000, during 1913. The plans provide for the installation of 310 standards, each carrying five Mazda lamp clusters. The installation of a fire-alarm, telegraph and police-signal system, at a cost of \$98,000, is also contemplated. Paul Schultze is city engineer.

**ALLENTOWN, PA.**—Terms have been agreed upon by which the Lehigh Valley Transit Co., of Allentown, will purchase power from the Lehigh Navigation El. Co., instead of adding to its own power plant as first contemplated. The contract will start with 5300 kw and increase in four years to 9000 kw. With the initial installation of 30,000 kw the Hauto power plant of the Lehigh Navigation El. Co. is expected to be ready to go into operation in June.

**PITTSBURGH, PA.**—The West Penn Ry. Co. is planning to extend its service through the Ligonier Valley and supply an electric railway service and electricity for lamps, heaters and motors. The company is also planning to serve various coal and sand developments in that district.

**PITTSBURGH, PA.**—Notice has been filed that applications will be made on March 31 to Governor Tener for charters for 43 electric-light companies for the purpose of distributing electricity in cities, townships and boroughs throughout the city of Pittsburgh and its environs in the Monongahela and Allegheny valleys as follows: Pittsburgh, McKeesport, Glassport, North Braddock, Pitcairn, Wilson, Etna, Wilmerding, Swissvale, Trafford, Braddock, Rankin, Hays, Spangsburg, Millvale, East Pittsburgh, Wilkinsburg, Edgewood, Verona, East McKeesport, Munhall, West Homestead, Homestead, Port Vue, Clairton, Duquesne, Turtle Creek and Wall, and the following townships: Mifflin, Penn, Shaler, Braddock, Wilkins, Patton, Indiana, Spring Garden, Reserve, Whitaker, North Versailles, Versailles and South Versailles. The incorporators are A. C. Christiansen, R. E. Anderson and M. G. Deeley. Thomson & Thomson, Bakewell Building, Pittsburgh, are attorneys for the petitioners.

**READING, PA.**—The Metropolitan El. Co., of Reading, has started work on placing all of its wires underground. The cost of the work is estimated at \$700,000.

**SHARON, PA.**—The contract for street lighting with the Shenango Valley El. Lt. Co. for a period of five years has been signed. Under the terms of the contract the company is to furnish arc lamps at \$48 per lamp per year, and is to replace the present arc lamps with flaming-arc lamps by May 1.

**CLEMENTON, N. J.**—The Public Service Co. is contemplating extending its electric traction system across Clementon Lake.

**JERSEY CITY, N. J.**—The Public Service El. Co. has been granted permission by the building department to build an addition to its Marion power station on Duffield Avenue, to cost about \$80,000.

**MONTCLAIR, N. J.**—Bids will be received until April 14 by Harry Tripp, town clerk, Room 3, Crane Building, Montclair, for fire-alarm system, cable and connections to be laid in conduits already provided on Bloomfield Avenue and other streets in the town of Montclair in accordance with plans and specifications on file in the office of Edgar S. Closson, town engineer, Room 5, Crane Building, Montclair. The cost of the work is estimated at \$5,000.

**NEWARK, N. J.**—The Public Service Corporation has purchased a large site on the Passaic River in the meadow section of Newark as a site for a new power station, which, it is said, will take the place of the electric light and power stations on River Street and at the city dock and also supplement the station at Marion. The proposed plant will supply electricity in Essex County and part of Union County. An addition is being built to the Marion plant.

**SUMMIT, N. J.**—The capital stock of the Commonwealth Wtr. & Lt. Co., of Summit, has been increased from \$1,000,000 to \$3,000,000, to provide for extensions to its business. The company has acquired the property of the Point Pleasant El. Lt. & Pwr. Co., which serves Point Pleasant, Bay Head, Spring Lake and vicinity.

**WILMINGTON, DEL.**—The People's Ht., Lt. & Pwr. Co., recently incorporated, has applied to the directors of the Street and Sewer Department for a franchise to erect transmission lines and to lay conduits in the streets of the city for the distribution of electricity for lamps and motors.

**BALTIMORE, MD.**—Two additions will be made to the plant of the Consolidated Gas, El. Lt. & Pwr. Co., at the corner of Carey and Wicomico Streets, to cost \$25,000.

**WHEELING, W. VA.**—The Eastern Pwr. & Lt. Corp., recently organized with a capital stock of \$20,000,000, has acquired the public utilities in Wheeling, including the Suburban Lt. & Wtr. Co. and the City and Suburban Gas Co. The company will be operated by W. S. Barstow & Co., 50 Pine Street, New York, N. Y.

**COVINGTON, VA.**—The Town Council has adopted an ordinance providing for the granting of a franchise for the installation of an electric-light plant and distributing system for a period of 30 years, bids for which will be received until May 5, 1913. W. C. Wright is clerk of Council.

## North Central

**ALBION, MICH.**—The City Council is considering the installation of a municipal electric-light plant.

**ANN ARBOR, MICH.**—Gardner S. Williams, Cornwell Building, Ann Arbor, will receive bids in the near future for the construction of a power plant and dam at the Argo plant, near Ann Arbor, for the Eastern Michigan Edison Co.

**BAY CITY, MICH.**—The City Council has approved the report of the committee recommending the purchase of two 400-hp Wickes boilers and a 750-kw Allis-Chalmers turbo-generator set for the municipal electric-light plant. The People's Savings Bank and the Fisher Land Co. have applied to the Council for permission to erect ornamental street lamps similar to those in use in Wenonah Park in front of their buildings.

**BELDING, MICH.**—The Richardson Silk Co. has completed the installation of a 320-kw electric generator to furnish electricity for lighting its mill and boarding house. The company proposes to extend its wires to connect with other silk mills to furnish energy for lamps and motors. Fred A. Washburn is superintendent.

**BELLEVILLE, MICH.**—Gardner S. Williams, engineer, Cornwell Building, Ann Arbor, is preparing plans and will receive bids in the near future for the construction of a power plant and dam at Belleville for the Eastern Edison Michigan Co., of Detroit.

**CARSONVILLE, MICH.**—The taxpayers have voted in favor of installing a municipal electric-light plant.

**ECORSE, MICH.**—The Eastern Michigan Edison Co. is planning to install an electric-lighting system in Ecorse. The village is now served by a gas plant.

**GRAND RAPIDS, MICH.**—The cost of installing an ornamental street-lighting system on Ionia Avenue from Oakes Street to Lyon Street is estimated at \$8,520. The plans provide for 71 lamp standards at \$120 each.

**HOUGHTON, MICH.**—J. K. Gronhold, of St. Louis, Mo., engineer, for Viclem, Blackwood & Buck, of New York, N. Y., promoters of the Sturgeon River Land & Devel. Co., which proposes to erect a hydro-electric power plant on the Sturgeon River, is preparing to make surveys for the proposed transmission lines to distribute electricity throughout the copper country, covering about 43 miles.

**CINCINNATI, OHIO.**—Preparations are being made for the erection of a large power building by the Scarborough estate at the corner of Seventh Street and Broadway, Cincinnati. A large electric plant will be installed in connection with the proposed building. J. V. B. Scarborough is agent for the estate.

**CLEVELAND, OHIO.**—Steps will soon be taken toward connecting the patrons of the three small municipal lighting plants with the \$2,000,000 plant at the foot of East Fifty-third Street. Ducts will be laid for two miles in Lakeside Avenue Northeast for the cable from the East Fifty-third Street station on Lakeside Avenue east of Ninth Street. F. W. Ballard is constructing engineer of the city lighting department.

**CLEVELAND, OHIO.**—Sealed proposals will be received at the office of the secretary to the director of public service, Room 104, City Hall, Cleveland, Ohio, until April 10, for furnishing steam engine and generator for the Collinwood station of the municipal electric-light plant, specifications for which may be obtained at the office of the engineer of construction, Room 319, City Hall. W. J. Springborn is director of public service and W. H. Kirby is secretary to the director.

**ELYRIA, OHIO.**—The large dam at East Falls owned by the Elyria Milling & Pwr. Co. has been carried away by the flood.

**LINDSEY, OHIO.**—The Sandusky County Commissioners have granted the village of Lindsey permission to erect transmission lines on the road leading from the Lake Shore El. Ry. Co.'s right-of-way on the pike to the village, a distance of 2 miles. Work will begin at once on the construction of the Lindsey plant.

**PUT-IN BAY, OHIO.**—The Put-In Bay Improvement Co., of Put-In Bay, has decided to install a new electric light and power plant, bids for which have already been received. The proposed plant will cost about \$16,000 and will have sufficient output to maintain 22,000 lamps.

**SHAWNEE, OHIO.**—The American Gas & El. Co., of New York, N. Y., has acquired a controlling interest in the People's El. Lt. & Pwr. Co., of Shawnee, the Perry El. Co., of Crooksville, and the New Lexington El. Lt. & Pwr. Co., of New Lexington. The company now controls in addition to the above the electric light and power companies of Mount Vernon, Coshocton, Newark, Lancaster and Logan. A power plant is now being erected in Newark to supply electricity for lamps and motors to all these cities and intermediate points.

**LOUISVILLE, KY.**—Designs for the electric-lamp standards to be placed at intervals along Eastern, Western and Third Street Parkways and in Central Park, as submitted by the Louisville Ltg. Co., have been

accepted by the Board of Park Commissioners. The standards for the parkways are to be 26 ft. in height, each with concrete base and metal extensions, surmounted by a 200-cp lamp. Those selected for Central Park are of the goose-neck type. Bids have already been asked for electricity to maintain the lamps.

**SOMERSET, KY.**—The Kentucky Utilities Co., of Lexington, which recently purchased the local electric-light plant, water-works and street-railway systems, is installing new machinery at the power plant to provide power for the new filtration plant which is being installed and also to furnish electricity in the town of Burnside, 7 miles distant.

**WHITESBURG, KY.**—Plans are being considered for the installation of an electric-light plant here. Wesley Wright, of Wright & Cause, of Jenkins, is interested.

**WILLIAMSTOWN, KY.**—The Williamstown Mill & Lt. Co. is installing a 35-kw alternating-current generator and electric distributing system for the purpose of furnishing electricity for street and commercial lighting. Power to operate the plant will be furnished by a 50-hp gas engine which operates the mill. The contract for the entire work has been awarded to Ellis G. King, of Williamstown and Fair mouth. J. W. Shields is president and manager of the company.

**RUSHMORE, IND.**—The installation of an electric-lighting system in Rushmore is under consideration.

**ABINGTON, ILL.**—The plant and holdings of the Abington Lt. & Pwr. Co. have been purchased by the Galusha Ry. & Lt. Co. of Galusha. A transmission line will be erected to connect the two properties, and the Abington plant will be converted into a substation for distributing electricity in this locality.

**ALEDO, ILL.**—The Tri-County El. Lt. Co., with offices in Aledo, has entered into contracts to furnish electricity in Aledo, Alexis, Viola, New Boston, Joy, Keithsburg, Seaton, New Windsor, Alpha and Rio.

**ALTON, ILL.**—Surveys are being made for the proposed high-tension transmission line to furnish electricity for the Alton Gas & El. Co. from the plant of the Mississippi River Pwr. Co. at Keokuk, Ia. The line will follow the route of the Alton, Jacksonville & Peoria Railway. The Mississippi River Pwr. Co. will supply energy to the Alton, Jacksonville & Peoria Ry. Co. and also to the Pea Lt. & Pwr. Co., Alton.

**CENTRALIA, ILL.**—The City Council contemplates the installation of ornamental lamps on seven blocks. Lee S. Tramm is city engineer.

**CHARLESTON, ILL.**—The Central Illinois Pub. Ser. Co., of Mt. Zion, proposes to erect 20 ornamental street lamps around the public square.

**CHICAGO, ILL.**—The Northwestern El. Co., of Chicago, has increased its capital stock from \$25,000 to \$100,000.

**CHICAGO, ILL.**—Plans have been submitted to Mayor Harrison by City Electrician Ray Palmer for extensions to the street-lighting system which provide for the installation of 48,000 flaming-arc lamps within the next five years. Mr. Palmer advises a new contract with the Sanitary District of Chicago for the installation of 10,000 additional arc lamps immediately at a cost of \$2,000,000, and the furnishing of all its available electric energy which can be used for public lighting and other purposes; also a contract with the Commonwealth Edison Co. for emergency throw-over service and for additional energy necessary for municipal purposes which cannot be supplied by the Sanitary District plant. The present contract for 10,000 lamps has practically been fulfilled.

**DECATUR, ILL.**—The property owners on West Mason Street have started a movement for the installation of an ornamental street-lighting system.

**MATTOON, ILL.**—The electric-light plant of the Central Illinois Pub. Ser. Co., of Mattoon, in Kincaid, now in course of construction, was damaged by a windstorm March 23, causing a loss of about \$6,000.

**MOUNT PULASKI, ILL.**—The City Council has granted West & Veall, owners of the local electric-light plant, a 35-year franchise. It is proposed to enlarge the plant and extend the service to neighboring towns.

**MONMOUTH, ILL.**—The City Council has appointed a committee, consisting of Aldermen Giltner, Strand and Castello, to confer with M. A. Walsh, vice-president of the Rock Island Southern Ry. Co., regarding a plan to transmit electricity from the company's power house on its northern line to Monmouth.

**ONARGA, ILL.**—The Village Board has passed an ordinance revoking the franchise of the Northern Indiana Utilities Co., which was granted recently for the purpose of operating an electric-light plant in Onarga.

**RIVERSIDE, ILL.**—Bids will be received by the town of Riverside, Town Hall, Riverside, until April 14, for furnishing material and constructing a water-works system as follows: For three 7.00-gal. per minute, motor-driven centrifugal pumping units, cast-iron piping, switch-board, wiring appurtenances and machinery necessary, 150,000 gal. steel water tank with gallery and appurtenances, pumping-station building and masonry tower for water tank. Contracts to be let separately or together. Plans and specifications may be obtained at the office of D. H. Maury, consulting engineer, 1137 Monadnock Building, Chicago, or from C. D. Sherman, city clerk.

**SPRINGFIELD, ILL.**—The cost of installing the ornamental street-lighting system on Fourth Street is estimated at \$14,200. The property owners along the street are to pay for the installations of the lamps and the city will furnish electricity to maintain them.

**VIRDEN, ILL.**—The Virden El. Lt. Co. is erecting a transmission line to Grand, where it will connect with the Grand and Quincy.

**BRainerd, MINN.**—A proposition to build a transmission line owned by M. D. Stoner, president of the Cuyuna Range Pwr. Co., of Deerwood, offering to furnish electricity to the city of Brainerd from its dam on the Gray River, the present plant to be removed and reconstructed.

**WINDOM, MINN.**—The town of Windom is planning to install a new municipal electric-light plant and extending a line across.

**WINONA, MINN.**—The property of the Winona Ry. & Lt. Co., including electric-lighting plant and street-railway system, has recently been taken over by the Wisconsin Ry. Lt. & Pwr. Co.

**CEDAR RAPIDS, IA.**—It is common belief generally the proposition to grant the Cedar Rapids & Iowa City Ry. & Lt. Co. a new 25-year franchise was rejected. The proposed extension of the main power transmission and middle trunk to Iowa City was not. The cost of the work is estimated at about \$250,000.

**CLINTON, IA.**—Plans will be prepared at once by the Clinton Gas & El. Co. for the reconstruction of its electric-light plant and distributing system in the business district and extension of a line from Second Street. Improvements will also be made to the gas plant.

**DES MOINES, IA.**—The Board of Supervisors is contemplating the purchase of bronze electroliers (at a cost of \$700 each) to be placed at the entrances of the various buildings. Exact specifications will be required, making the total cost \$5,600.

**ELKHIDGE, IA.**—The citizens of Elkhridge have petitioned the Town Council to take steps to supply the necessities of an efficient system here.

**HAMPTON, IA.**—The local electric-light plant, owned by J. J. Roe, has been purchased by H. H. Coughlan, of Waterloo, and M. A. Harrison, of Nevada. The new contract will have power to run at the plant at once and propose to rebuild the plant and extend the company.

**JESUP, IA.**—A special election held recently for the proposition to grant a franchise to H. C. Young and Charles Tipton to construct and operate an electric-light plant in Jesup was carried.

**LE MARS, IA.**—An electric-light plant, owned by the Le Mars & Peoria Gas & El. Co., is being planned by the Le Mars City Wtr. & Lt. Co. for the city.

**LE MARS, IA.**—Sealed proposals will be received at the office of the engineering engineer, Westcott, Deane, and Ward for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Le Mars. Drawings and specifications may be obtained at the above office at 1111 Broadway, St. Paul, or at Le Mars. O. Westcott is supervising architect.

**MARBLE ROCK, IA.**—Savanna Gas & El. Co. has been awarded the contract by the People's Gas & El. Co., of Minneapolis, Minn., in Marble Rock, for the proposed dam and power house.

**MOUNT VERNON, IA.**—The Wayne Pwr. & Lt. Co. of Mount Vernon is extending its 33,000-volt transmission line from Stanwood to Tipton, a distance of about 7 miles. The transmission line passes through Lisbon, Mechanicsville and Stanwood and supplies electricity in these towns.

**SABULA, IA.**—The installation of an electric-lighting system in Sabula is under consideration. The proposed plant will be owned by the People's Gas & El. Co., of Savanna, Ill. The town of Sabula will have to bear the cost of erecting the transmission line from Savanna and the cable across the Mississippi River, the cost of which is estimated at about \$8,000.

**STOCKTON, IA.**—The Davenport & Muscatine Interurban Ry. Co. contemplates furnishing electricity to Stockton, Ia., for street lighting.

**JOPLIN, MO.**—A proposition to build a transmission line to the town of Joplin to issue \$60,000 in bonds for improvements to the municipal electric-light plant and extension to the street-lighting system in Joplin.

**MARSHALL, MO.**—The City Council has passed a resolution for the purchase of a new electric-light plant and extension to the street-lighting system in Marshall, Mo., to provide for the installation of a new plant of sufficient output to meet the demands of the city.

**RIDGEWAY, MO.**—Plans will be prepared by the Ridge & Wagon, Millard Building, Kansas City, Mo., for the reconstruction of the Ridgeway. The cost of the proposed plant is estimated at \$15,000.

**ST. CHARLES, MO.**—A proposition to build a transmission line to the town of St. Charles to issue \$60,000 in bonds for improvements to the municipal electric-light plant and extension to the street-lighting system in St. Charles.

**EDGEMONT, S. D.**—The town of Edgemon, S. D., has been granted a franchise by the city of Edgemon, S. D., for the installation of a new electric-light plant and extension to the street-lighting system in Edgemon, S. D.

**INTERIOR, S. D.**—The town of Interior, S. D., has been granted a franchise by the city of Interior, S. D., for the installation of a new electric-light plant and extension to the street-lighting system in Interior, S. D.

**QUADAMA, S. D.**—The town of Quadama, S. D., has been granted a franchise by the city of Quadama, S. D., for the installation of a new electric-light plant and extension to the street-lighting system in Quadama, S. D.

**ROCKHAM, S. D.**—The town of Rockham, S. D., has been granted a franchise by the city of Rockham, S. D., for the installation of a new electric-light plant and extension to the street-lighting system in Rockham, S. D.



**WHITE, S. D.**—The special committee appointed by the Commercial Club to make investigations as to the cost of installing an electric-light plant and water-works system has presented its report to the club.

**GRESHAM, NEB.**—At the spring election to be held in April, the proposition of purchasing the local electric-light plant will be submitted to the voters. Dr. W. N. Hylton, owner of the plant, has offered it to the village for \$4,000.

**ARKANSAS CITY, KAN.**—The Arkansas City Gas & El. Co. has submitted a proposition to the Board of City Commissioners offering to furnish and maintain an ornamental street-lighting system for \$5,000 per year, under a ten-year contract. The plans provide for the erection of ornamental standards carrying three-lamp clusters.

**BEATTIE, KAN.**—The local electric-light plant and garage building, owned by Harry D. Hockman, was recently destroyed by fire, causing a loss of about \$5,000.

**MOLINE, KAN.**—At a special election held recently the proposition to issue bonds for a municipal electric-light plant and water-works system was carried. Plans and specifications for this work, it is expected, will be ready by May 1. The Benham Engineering Co., American National Bank Building, Oklahoma City, Okla., is consulting engineer.

**RUSSELL, KAN.**—We are informed that the city of Russell does not contemplate issuing bonds for a municipal electric-light plant as published in the issue of March 22. The city installed a plant over a year ago,

installing box equipment, including an electric generator. The company has recently issued \$35,000 in capital stock.

**SULPHUR SPRINGS, ARK.**—The contract for construction of the new municipal electric-light and water plant has been awarded to R. M. Gilbraith for \$19,161.

**NEW ORLEANS, LA.**—Sealed proposals will be received at the office of the supervising architect, Washington, D. C., until April 22 for conduits and wiring system in the United States Marine Hospital, New Orleans, La., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian, New Orleans. O. Wenderoth is supervising architect.

**BRISTOW, OKLA.**—Bonds to the amount of \$25,000 have been voted for the installation of an electric-light plant in Bristow.

**DALLAS, TEX.**—The Dallas El. Lt. & Pwr. Co. will begin the work at once of placing underground all wires on Main, Elm and Commerce Streets from Pearl Street West to the Houston River. The total cost of the work is estimated at \$1,000,000.

**FOWLER, TEX.**—Preparations are being made for the installation of an electric-light and power plant and an ice factory in Fowler. Work will soon begin on a water-works system.

**NACOGDOCHES, TEX.**—The city of Nacogdoches has purchased the plant of the Nacogdoches Lt. & Pwr. Co. for \$25,000, to be owned and operated by the municipality.

**SAN ANTONIO, TEX.**—Plans have been prepared by the San Antonio Gas & El. Co. and the San Antonio Trac. Co. for extensions and improvements to their systems, involving an expenditure of \$300,000. About \$200,000 will be expended by the Traction company for the purchase of new street cars, double-tracking of its present lines, etc. The remaining \$100,000 will be used for improvements to the electric-lighting system and extensions to gas mains.

## Southern States

**KINSTON, N. C.**—The City Council is contemplating calling an election to vote on the proposition to issue bonds, the proceeds to be used for improvements to the municipal electric-light plant, sewer extensions and street paving.

**CAMDEN, S. C.**—Plans have been completed for the construction of an electric-light plant and water-works system, for which bonds were recently voted. The cost of the electric plant is estimated at \$35,000 and that of the water works at \$80,000. R. W. Mitcham is engineer.

**ORANGEBURG, S. C.**—The proposition to issue \$60,000 in bonds to remove and erect the electric-light, power and water-works plant from the present site to one on municipal property adjacent to the Edisto River will be submitted to the voters on April 29.

**ATLANTA, GA.**—The city of Atlanta is contemplating the installation of a 600-kw electric generating plant in the river pumping station, at a cost of \$9,500, to furnish electricity to operate the pumping station. R. C. Turner is city electrician, and R. M. Clayton is chief of construction department.

**ATHENS, GA.**—The citizens have petitioned the Athens Ry. & El. Co. to extend its street-car line to Barberville, a suburb of the city.

**AUSTELL, GA.**—The City Council has entered into a contract with the J. B. McCrary Co., of Atlanta, Ga., to furnish electricity for lamps and motors.

**GIRARD, GA.**—The City Council is considering the question of establishing a municipal electric-light plant and water-works system. A \$45,000 bond issue is proposed.

**ROYSTON, GA.**—The Franklin Lt. & Pwr. Co. has petitioned the State Railroad Commission for permission to issue \$150,000 in capital stock. The water rights, partially completed plans, contracts and franchises of the J. B. McCrary Co., of Atlanta, Ga., are to be turned over to the Franklin Lt. & Pwr. Co. for 1494 shares of this stock. The contracts and franchises are in Royston, Canton, Hartwell, Lavonia, Bowersville, Carnesville and Bowman.

**JACKSONVILLE, FLA.**—The Jacksonville Trac. Co. is considering making several extensions to its street-railway system.

**ST. PETERSBURG, FLA.**—Surveys are being made by W. W. Barton, of Tarpon Springs, for an electric railway from St. Petersburg to Indian Rocks. Thomas E. Lucas and S. R. Morey, of St. Petersburg, and M. Joel McMullen, of Largo, are interested in the project.

**DRESDEN, TENN.**—At an election to be held April 24 the proposition to issue \$24,000 in bonds, the proceeds to be used for the installation of an electric-light plant, will be submitted to the voters.

**GLEASON, TENN.**—The installation of an electric-light plant in Gleason is under consideration.

**ROGERSVILLE, TENN.**—The Hydro-El. Pwr. Co., recently incorporated, will soon begin work on the development of a water-power 4 miles east of Rogersville. The company expects to purchase machinery and equipment at once.

**BIRMINGHAM, ALA.**—The Birmingham Wtr., Lt. & Pwr. Co. has submitted a proposition to the city commission offering to furnish the city with electrical energy for primary power with 24-hour service at 1 cent per kw hr, and at 6 mills for secondary power during nine months in the year.

**TUSCALOOSA, ALA.**—It is reported that the contract for the construction of the power plant for the Birmingham-Tuscaloosa Ry. & Utilities Co. in Tuscaloosa has been awarded to the General El. Co., to cost \$140,000. The whole project will involve an expenditure of about \$5,000,000. Fred S. Morris, of Morris Brothers, bankers, is at the head of the railway company.

**HARRISON, ARK.**—The Harrison El. Lt. & Ice Co. contemplates

## Pacific States

**ARLINGTON, WASH.**—Plans and estimates have been submitted to the Council by Lewis C. Kelsey, engineer, Selling Building, Portland, Ore., for the installation of a lighting system and improvements to the water-works system here.

**BREMERTON, WASH.**—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 3 for four electric traveling bridge cranes and two electric traveling wall cranes for the general foundry, navy yard, Puget Sound, Wash. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named. The estimated cost of the work is \$17,000. H. R. Stanford is chief of bureau.

**EVERETT, WASH.**—The Everett Ry., Lt. & Wtr. Co. will make improvements to its reservoir, involving an expenditure of about \$20,000.

**KIRKLAND, WASH.**—Application will be made to the Town Council by the Puget Sound Trac., Lt. & Pwr. Co., of Bellingham, for a franchise to furnish electricity for lamps, heat and motors in Kirkland. A transmission line is now being erected between Snoqualmie and Kirkland.

**OLYMPIA, WASH.**—The Olympia Lt. & Pwr. Co. has started condemnation proceedings against A. H. Chambers for the purpose of securing 10 acres of land with a view of enlarging its dam and reservoir at Tumwater.

**SEATTLE, WASH.**—Bonds to the amount of \$425,000 have been voted by the city of Seattle for an auxiliary steam plant for the lighting department.

**WENATCHEE, WASH.**—Work, it is stated, will begin within thirty days by the Great Northern Ry. Co. on the construction of a large power plant in Chelan George, to cost about \$7,000,000. The proposed plant will develop 100,000 hp and will be used to operate the lines of the Great Northern Railway in this territory. Robert Herzog is chief hydraulic and electrical engineer.

**COTTAGE GROVE, ORE.**—A committee has been appointed to make investigations with a view to installing an electric fire-alarm system here.

**GRANT'S PASS, ORE.**—Bonds to the amount of \$200,000 have been sold by the city, the proceeds to be used for the construction of a municipal electric railway from Grant's Pass to Crescent City on the coast via the Illinois Valley. Practically the entire right-of-way has been secured and 26 acres have been purchased in Grant's Pass for a terminal site.

**HOOD RIVER, ORE.**—A number of property owners are contemplating the construction of an electric line from the business section of the city to the residential district. Alva Day, W. L. Smith and A. F. Howes are interested in the project.

**PORTLAND, ORE.**—Improvements are contemplated by the Portland Ry. & Lt. Co. involving an expenditure of about \$4,000,000. About \$1,500,000 will be expended on the lighting plant.

**PORTLAND, ORE.**—Preparations are being made by the Portland Ry., Lt. & Pwr. Co. to erect a one-story reinforced-concrete electrical switching station on East Thirteenth Street, corner of Ochoco Avenue, to cost \$4,000.

**PORTLAND, ORE.**—If an agreement reached recently by Mayor Rushlight and members of the street-lighting committee of the City Council and representatives of the Portland Ry., Lt. & Pwr. Co. meets



the approval of the City Council, provision will be made for the immediate installation of 388 new arc lamps in various parts of the city.

PORTLAND, Oke. The West Coast Engineering Co., Portland, has been awarded the contract by the city of Portland for installing a lighting system on the new Broadway Bridge across the Willamette River, at a cost of about \$21,000. The plans provide for 200 two-lamp cast-iron brackets and 50 five-lamp electrics, on which will be used 100 watt Mazda lamps. A decorative system will also be installed, consisting of approximately 7000 4-in. carbon lamps.

ST. JOHN'S, ORE.—The Washington Wtr. Pwr. Co., of Spokane, has applied to the City Council for a 50-year franchise and a contract for street lighting for a period of ten years. Under the terms of the contract the company agrees to furnish 60 lamp of 100 cp at \$3,000 per year.

**SILVERTON, ORE.**—At an election to be held May 5 the proposition to issue \$50,000 in bonds, the proceeds to be used to establish a municipal electric-light plant, will be submitted to a vote.

BAKERSFIELD, CAL. The San Joaquin L. & Pwr. Co. is planning to extend the local street railway system to the Kern River oil fields and to the new Standard Oil refinery on the north side of the river.

CHICO, CAL.—Application has been made to the City Council by A. C. Agnew, representing the Sierra El. Pwr. Co., for a 50-year franchise, to erect transmission lines to distribute electricity for lamps and motors in Chico. Mr. Agnew stated that the company had a power site near Mantion, Tehama County.

CORONA, CAL.—The Pacific El. Ry. Co., of Los Angeles, has applied to the city trustees for a franchise to construct and operate an electric railway in Corona. George E. Pillsbury is chief engineer of the company.

GRIMES, CAL.—A. Young and A. Butler are securing rights of way for the Oro El Corpn., of San Francisco, for a street car line from its new power project in Plumas County to a new point on San Francisco Bay. A branch line will run from Grimes to Colusa, a distance of 10 miles.

HERMOSA BEACH, CAL.—City Engineer Archie E. Jones, awarded the expenditure of \$5,000 for a fire alarm system and police gear system and \$10,000 for an electric light and power distribution system here.

LAKEPORT, CAL.—A committee, consisting of Trustees F. H. Boggs, W. C. Moore and William K. Lane, has been appointed to investigate the matter of equipping the municipal water works system with electrically driven pumping plant.

LIVERMORE, CAL.—The Livermore Wtr. & Pwr. Co. has applied to the State Railroad Commission for permission to sell its plant to the Pacific Gas & El. Co., of San Francisco. The price given is \$142,000.

LOS ANGELES, CAL.—The Board of Education will receive bids for furnishing boilers and power machinery for ship work. L. J. McGee is purchasing agent.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Corp. expects to purchase a large quantity of line material for both 69,000 volt and 115,000 volt transmission service. W. J. Gracey is purchasing agent.

**LOS ANGELES, CAL.**—The Los Angeles Gas & Ed. Corp. has applied to the State Railroad Commission for authority to issue \$900,000 in bonds, the proceeds to be used as follows: For the purchase of the Valley Gas & Fuel Co., \$175,000; purchase of additional gas generating set and new equipment, \$160,000; extension of the distributing system for new consumers, \$600,000, and extension of the electrical distributing system, \$280,000.

MARYSVILLE, CAL.--The Oro Fl. Co., of Oroville, has applied for a franchise to erect and operate an electric distributing system in Marysville. If granted a franchise, the company agrees to spend \$300,000 on its system here.

PASADENA, CAL.--The City Council has adopted a resolution authorizing the erection of ornamental lamp standards on Los Robles Avenue from the north to the south city boundaries, a distance of 4 miles.

PASADENA, CAL.—The Home Tel. Co. has authorized expenditures to the local exchange involving an expenditure of about \$50,000. Three new sections of switchboard will be added to the exchange and a complete power plant installed.

PLEASANTON, CAL.- The question of issuing \$16,000 in bonds to establish a municipal electric light and power plant is under consideration. S. A. Winnegar is clerk.

POMONA, CAL.—The State Railroad Commission has authorized the Pomona Valley Tel. & Teleg. Union, which serves the cities of Pomona, Chino, Claremont, Lordsburg and San Dimas, to issue \$100,000 in bonds, the proceeds to be used to retire existing bonds and for extension to its system.

REEDLEY, CAL.—The State Railroad Commission has granted the Reedley Tel. Co. permission to purchase the interests of E. W. Crosby and to make extensions, involving an expenditure of \$11,000.

RIVERSIDE, CAL.-The Board of Public Utilities has awarded two contracts for furnishing energy to the city. The Southern Sierras Pwr. Co. was awarded the contract for supplying electricity in the district south of Arlington Avenue, amounting to 1000 hp per year, with the privilege of increasing the amount, at 1 cent per kw-hr., and the Southern California Edison Co. the contract for furnishing energy to the rest

of the city at 87 miles per hour. The Southern Railway Power Co. will erect a substation at Arlington.

SAN FRANCISCO, CAL.—The opening of the Panama-Pacific Exposition is placing the attention of the general community on Mount Tamalpais, to be glad to see the completion of 1915.

SAN FRANCISCO, CAL.—The City El. Co., of San Francisco, has been authorized to extend its service conduits on Market, Larkin and Howard Streets, on condition that the city may take over such conduits at any time upon payment of their value to the company.

plied to the State Railroad Commission for authority to issue \$80,000 in bonds and notes to the amount of \$64,000, to be used for financing the extension of the line from the present terminus to a new station to be known as Two Rocks, a distance of 5¼ miles.

VENICE, CAL.—The city engineer has prepared estimates for the erection of concrete lamp-posts to be located throughout the entire Colegrove district. The posts will carry cluster lamps like those used in Venice.

CALDWELL, ID. HO. The Caldwell area has been closed off and  
way around the south side of the lake is being investigated.

FORT COLLINS, COL.-

ORDWAY, CO.—The Ordway runs 2, 4, 6, 8, 10, 12, and 14 miles from Pueblo, and has been granted a franchise to extend its transportation line from Rocky Ford to Ordway. The railroad is leasing some lands to its farming customers at a low rental price.

## Canada

**CALGARY, ALA.**—The Calgary Pwr. Co., Ltd., is developing another water-power on Bow River at Kananaskis Falls, 2 miles above the Horseshoe Falls. The new plant will have an output of 12,000 hp under a 70-ft. head, and will consist of a single vertical shaft with a 36-in. diameter, a 10-ft. diameter, 100-in. stroke, 5100-kw., 12,000-volt, three-phase, 60-cycle, 164 r.p.m. generators; switchboard, cables and auxiliaries. The Calgary Pwr. Co. supplies energy in bulk to the city and to the plants of the Canada Cement Co., Ltd., at Exshaw and Calgary, B. C.

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**TORONTO, ONT.**—The 4-pointed star has been just given up for two weeks at the corner of Dundas and Dundas streets. The time recently being used with a temporary sign at the corner, pointing to the "Star" office at the west. The sign is located at the east end of the street and Wellesley Street and St. James Street in Ottawa.

**TORONTO, ONT.**—The Ontario Ministry of Education has announced that it will be providing special conditions for students with special needs in the province's public schools. The ministry says that the new set of policies will be the first of its kind in the country. The policies will be based on the Ontario Education Act, which states that every student has the right to a full and appropriate education. The ministry says that the new policies will be based on the following principles:

### Miscellaneous

**PANAMA.**—Proposal will be received at the office of the general purchasing officer, Isthmian Canal Commission, until April 15, for furnishing induction motors, auto starters or compensators, automatic oil switches, copper cable, journal bearings, brake rod connection pins, steel keys for brakeshoes, etc., under Circular No. 769. Proposals will also be received until April 19 for induction and direct-current motors, copper louver panels and rubber valves under Circular No. 770. Blanks and general information relating to the above circulars may be obtained from the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

## New Industrial Companies

**THE ELECTROCHEMICAL PRODUCTS COMPANY**, of Los Angeles, Cal., has been incorporated with a capital stock of \$1,000,000 by J. F. Curran, C. S. Long and R. C. McAvoy.

**THE HAZAREZ ELECTRIC COMPANY**, of New York, N. Y., has been incorporated by Edgar W. Hazarez, Harry H. Bascom and Samuel W. McCarter, 318 West Fifty-seventh Street, New York. The company is capitalized at \$10,000 and proposes to install electric equipment, etc.

**THE INDUSTRIAL LIGHTING EQUIPMENT COMPANY**, of Indianapolis, Ind., has been incorporated by Felix Devere, Flora M. Devere, Claude Shaw and others. The company is capitalized at \$10,000 and proposes to manufacture electrical appliances.

**THE LATROBE ELECTRIC STEEL COMPANY**, of Latrobe, Pa., has been incorporated with a capital stock of \$300,000. The officers of the company are: Marcus Saxman, president; Charles W. Gutzzeit, vice-president; F. B. McFeely, secretary, and Ira C. Shallenberger, treasurer.

## New Incorporations

**DENVER, COL.**—The Western Colorado Pwr. Co. has been incorporated with a capital stock of \$5,000 and will operate in La Plata, San Miguel, San Juan, Ouray, Montrose, Delta, Montezuma, Mesa and Dolores Counties. The company, it is said, will soon begin construction work to develop power for the agriculture districts it will tap. M. A. Lewis, D. E. Wilson and H. B. Teller, of Denver, are among the incorporators.

**SEBREE, KY.**—The Sebree Lt. & Milling Co. has been granted a charter with a capital stock of \$20,000. The incorporators are: John B. Ramsay, J. J. Korb and M. J. Ramsey.

**STERLINGTON, N. Y.**—The Sterlington El. Ltg. Co., Inc., of Rockland County, has been incorporated with a capital stock of \$10,000 by Benjamin Moffat, Jr., George T. Carpenter and Robert B. Potter, of Tuxedo.

## Trade Publications

**DISCOUNT AND PRICE BOOK.**—The Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., has issued a 104-page discount and price book, which will be found a useful adjunct to its 1912 catalog, No. 28.

**SHURLOCK SOCKETS.**—Pass & Seymour, Inc., Solvay, New York, have issued an attractive pamphlet telling of the Shurlock socket, "the socket that locks." Its sub-title fittingly describes its contents: "Facts entertainingly told for the man who wishes to protect himself against the loss of lamps." And these facts are based on real experience in hotels, offices and other large buildings, where lamps are sometimes taken as souvenirs, or in manufacturing plants, where they are sometimes traded off by employees.

**FURNACE ARCHES.**—The Carr ventilated furnace arch is made the subject of a neat little pamphlet issued by the Evens & Howard Fire Brick Company, St. Louis, Mo. This furnace arch has been designed to withstand the high temperatures of furnace practice and is said to aid in smoke prevention as well as lengthening the service of the arch by from 100 to 400 per cent over that of arches constructed in the usual manner. An excellent picture is shown of a Stirling boiler equipped with ventilated arch and another of a water-tube boiler with Dutch-oven setting similarly equipped. A number of railway and light companies as well as electrical manufacturing firms are using the Carr type of furnace arch.

**ICE-MAKING AND REFRIGERATING MACHINERY.**—Current interest in refrigerating and ice-making machinery makes timely the appearance of the catalog of the Carbondale Machine Company, Carbondale, Pa. Comprehensive information as to the methods of operation of the Carbondale exhaust-steam machine is followed by a description of the various types of machines made by the company and a number of its auxiliaries. Central-station managers desirous of reducing the cost of operation of their plant or of increasing their revenue will find this catalog of interest. Many illustrations showing plants installed for various classes of refrigeration and ice-making enhance the attractiveness of this 64-page publication.

## Business Notes

**THE BUCKEYE ENGINE COMPANY**, Salem, Ohio, has appointed the Federal Engineering Company, 1112 House Building, Pittsburgh, Pa., agent for the Pittsburgh district for the sale of steam and gas engines and other products of its manufacture.

**DEARBORN CHEMICAL COMPANY.**—Mr. Paul T. Payne, who has been associated with the Dearborn Chemical Company, Chicago, for many years, and for the past ten years has been engaged in various capacities in the sales department of the company, has lately been appointed district sales manager with headquarters at the Indianapolis office, Hume-Mansur Building. Mr. Payne will direct the sales of the several company branches in that district.

## Directory of Electrical Associations, Societies, Etc.

**ALABAMA LIGHT AND TRACTION ASSOCIATION.** Secretary-treasurer, H. O. Hanson, Mobile, Ala.

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.** Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

**AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION.** Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

**AMERICAN ELECTRIC RAILWAY ASSOCIATION.** Secretary, H. C. Donecker, 29 West 39th St., New York.

**AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.** Secretary, H. C. Donecker, 29 West 39th St., New York.

**AMERICAN ELECTROCHEMICAL SOCIETY.** Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

**AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.** Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

**AMERICAN INSTITUTE OF CONSULTING ENGINEERS.** Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.** Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cooperstown, N. Y., June 23-27.

**AMERICAN PHYSICAL SOCIETY.** Secretary, Ernest Meritt, Cornell University, Ithaca, N. Y.

**AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.** Secretary, W. W. Macon, 29 West 39th St., New York.

**AMERICAN WATER WORKS ASSOCIATION.** Secretary, J. M. Diven, 271 River St., Troy, N. Y.

**ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS.** Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 5, 6 and 7.

**ASSOCIATION OF EDISON ILLUMINATING COMPANIES.** Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

**ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.** Secretary, James Farrington, Steubenville, Ohio.

**ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.** Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

**ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.** Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

**CANADIAN ELECTRICAL ASSOCIATION.** Secretary, C. E. Bowden, Birkbeck Building, Toronto, Ont., Can. Annual convention, Port Arthur, Can., June 23-25.

**COLORADO ELECTRIC CLUB.** Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

**COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.** Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

**ELECTRIC CLUB OF CHICAGO.** Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

**ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE.** Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

**ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI.** Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

**ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN.** Secretary, Albert Petermann, Milwaukee, Wis.

**ELECTRICAL CREDIT ASSOCIATION OF CHICAGO.** Secretary, Frederick P. Vose, Marquette Building, Chicago.



**ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA.** Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

**ELECTRICAL SALESMEN'S ASSOCIATION.** Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

**ELECTRICAL SUPPLY JOBBERS' ASSOCIATION.** Secretary, Franklin Overbach, 411 South Clinton St., Chicago, Ill. Spring meeting, Chicago, May 26-28.

**ELECTRICAL TRADES ASSOCIATION OF CANADA.** Secretary, William R. Staveland, Royal Insurance Building, Montreal, Can.

**ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST.** Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

**ELECTRIC VEHICLE ASSOCIATION OF AMERICA.** Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

**ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION.** Secretary, L. L. Edgar, 39 Boylston St., Boston.

**EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.** Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

**FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION.** Secretary, H. C. Adams, West Palm Beach, Fla.

**GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA.** Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

**ILLINOIS STATE ELECTRICAL ASSOCIATION.** Secretary, H. E. Chubbuck, Peoria, Ill.

**ILLUMINATING ENGINEERING SOCIETY.** General secretary, J. D. Itael, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

**INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK.** Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

**INDIANA ELECTRIC LIGHT ASSOCIATION.** Secretary and treasurer, J. V. C. 100 South Meridian St., Indianapolis, Ind.

**INSTITUTE OF OPERATING ENGINEERS.** Secretary, L. Houmiller, 29 West 39th Street, New York.

**INSTITUTE OF RADIO ENGINEERS.** Secretary, E. J. Simon, 81 New St. New York. Meeting, first Wednesday of each month.

**INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.** Secretary, H. J. F. Porter, 29 West 39th St., New York.

**INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.** Secretary, C. R. George, Houston, Tex.

**INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION.** President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

**INTERNATIONAL ELECTRICAL CONGRESS.** Secretary, J. A. Barr, Exposition Building, San Francisco, Cal. San Francisco, 1915.

**INTERNATIONAL ELECTROTECHNICAL COMMISSION** (international body representing various national electrical engineering societies contributing to its support). General secretary, C. de Maitre, 28 Victoria St., Westminster, London, S. W., England. Next plenary meeting, Berlin, Sept. 2-6.

**IOWA ELECTRIC ASSOCIATION.** Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

**IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.** Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

**JOVIAN ORDER.** Jupiter (president), F. E. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

**KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION.** Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

**LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION.** Secretary, W. H. Power Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

**MAINE ELECTRIC ASSOCIATION.** Secretary, Walter S. Wadman, Waterville, Maine.

**MINNESOTA ELECTRICAL ASSOCIATION.** Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

**MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION.** Secretary-treasurer, F. W. Markham, Brookfield, Mo. Annual convention, Kansas City, April 17, 1913.

**NATIONAL ARM, PIN AND BRACKET ASSOCIATION.** Secretary, J. B. Marks, Madison, Ind.

**NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.** Secretary-president, Wm. L. Smith, Concord, Mass.

**NATIONAL DISTRICT HEATING ASSOCIATION.** Secretary, D. J. Gaskill, Greenwich, Ohio. Annual meeting, Indianapolis, Ind., May 27-28, 1913.

**NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES.** Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual meeting, Chattanooga, Tenn., July 16.

**NATIONAL ELECTRICAL CREDIT ASSOCIATION.** Secretary, Frederick I. Vane, 1343 Marquette Building, Chicago.

**NATIONAL ELECTRIC LIGHT ASSOCIATION.** Executive secretary, T. C. Martin, Engineering Societies Building, 29 West 39th St., New York. Annual meeting, Chicago, June 2-6, 1913.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION.** Secretary, E. L. Callahan, 29 West 39th St., New York.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW YORK SECTION.** Secretary, R. E. Russell, Schenectady, N. Y.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION.** Secretary-treasurer, M. H. Brown, Atlanta, Ga. Annual meeting, Miami Ave. 14-16.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION.** Secretary, Herbert Stearns, 20 Washington Building, Detroit, Mich. Annual meeting, Ottawa Beach, Aug. 14-16.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, MASSACHUSETTS SECTION.** Secretary, A. H. Jones, 400 Commercial, Mass. Annual meeting, New York, April 21-23.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION.** Secretary-treasurer, S. J. Bell, David City, Neb.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION.** Secretary, M. O. A. Bussell, 135 Tremont St., Boston, Mass.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW-YORK SECTION.** Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash. Annual meeting, Seattle, Wash., Sept. 10-12.

**NATIONAL ELECTRIC LIGHT ASSOCIATION, HOFFMANN ENGINEERING TRANSMISSION SECTION.** Secretary, L. H. Conklin, Scranton, Pa.

**NATIONAL FIRE PROTECTION ASSOCIATION.** Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

**NATIONAL INDEPENDENT TELEPHONE ASSOCIATION.** Secretary-treasurer, Richard Valentine, Janesville, Wis.

**NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION.** Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

**NEW ENGLAND ELECTRIC DEVELOPMENT ASSOCIATION.** Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

**NEW ENGLAND STREET RAILWAY CLUB.** Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets first Wednesday of each month.

**NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION.** Secretary, S. J. Stewart, 342 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

**NEW YORK ELECTRICAL CREDIT ASSOCIATION** (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Tuesday of each month.

**NEW YORK ELECTRICAL SOCIETY.** Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

**NEW YORK ELECTRIC RAILWAY ASSOCIATION.** Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

**NORTHWESTERN ENGINEERS' ASSOCIATION.** Secretary, H. H. McKee, Minneapolis, Minn.

**OHIO ELECTRIC LIGHT ASSOCIATION.** Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Copley Park, July 1-3.

**OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.** Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

**OREGON ELECTRICAL CONTRACTORS' ASSOCIATION.** Secretary, J. E. Kilkeny, St. John's, Ore.

**PENNSYLVANIA ELECTRICAL ASSOCIATION.** Secretary, N. B. F. A. Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

**RAILWAY SIGNAL ASSOCIATION.** Secretary, C. G. Russell, Philadelphia, Pa.

**SOCIETY OF ELECTRICAL ENGINEERS, INC.** Secretary-treasurer, Philip S. Davis, 100 West 40th St., New York. Meets first Wednesday of each month, May 13, 1913.

**SOCIETY FOR THE PROMOTION OF ELECTRIFIED TRACTION.** Secretary, Prof. H. P. Norris, Central University, Ithaca, N. Y.

**SOUTHERN GAS AND ELECTRIC ASSOCIATION.** Secretary, H. S. Jones, 405 Shattuck Building, Atlanta, Ga. Meets second 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24.

**TEXAS WATER AND POWER ASSOCIATION.** Secretary, J. H. Gaskill, 1000 Commerce, Dallas, Tex. Annual convention, Dallas, Tex., May 14-16.

**VIRGINIA ELECTRIC ASSOCIATION.** Secretary-treasurer, A. H. Menden, Manchester, Va.

**WESTERN ELECTRIC AND TELEPHONE ASSOCIATION.** Secretary, W. S. Bass, 70 West Monroe St., Chicago, Ill.

**WESTERN RED CROSS ASSOCIATION.** Secretary, R. C. Brown, Seattle, Wash.

**WESTERN SOCIETY OF ELECTRICAL ENGINEERS.** Secretary, J. H. Wadsworth, 1000 Commercial, Portland, Ore. Meets first Tuesday of each month, May 13, 1913.

**WISCONSIN ELECTRIC ASSOCIATION.** Secretary, George A. Scott, Stevens Building, Milwaukee, Wis.

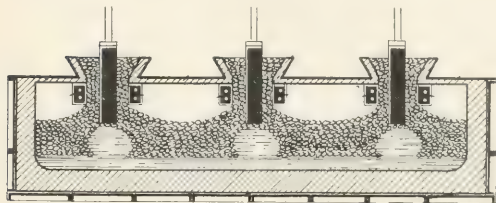


# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 25, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,056,789. APPARATUS FOR PRODUCING OZONE; S. Held, Chicago, Ill. App. filed Aug. 10, 1911. Designed to be connected to the ordinary light circuit and variable in capacity by increasing or diminishing number of electrodes.
- 1,056,830. TREATMENT OF GASES; H. D. Rankin, Joliet, Ill. App. filed July 6, 1909. For producing compounds of nitrogen, carbonic acid.
- 1,056,850. WELDING MACHINE; F. A. Stevens and S. E. Bouchard, Providence, R. I. App. filed Feb. 7, 1912. Special arrangement of the electrodes and clamping of the work.
- 1,056,852. SYSTEM OF CONTROL; N. W. Storer, Pittsburgh, Pa. App. filed June 6, 1911. Control of single-phase railway motors by liquid rheostats.
- 1,056,854. RAIL BOND; C. R. Sturdevant, Worcester, Mass. App. filed May 5, 1911. Tubular terminal with conductor passed there-through; rail is bonded to the splice bar.
- 1,056,862. ELECTRIC FUSE; M. C. Warren, Coffeyville, Kan. App. filed July 31, 1912. Insulating block destroys arc by dropping down between the terminals when the fuse wire is burned out.
- 1,056,866. CIRCUIT-CHANGING MECHANISM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Relay makes one set of connections when energized by momentary impulses and other connections when energized by prolonged or steady currents.
- 1,056,879. SYSTEM OF ELECTRIC-MOTOR CONTROL; G. Baehr, Montclair, N. J. App. filed Dec. 29, 1909. For elevators; current automatically interrupted at predetermined point in travel of car and automatically retarded, dependent upon speed at time of interruption.
- 1,056,894. LOCOMOTIVE DRIVING CONNECTION; K. F. Elers, Pittsburgh, Pa. App. filed May 9, 1911. Flexible connection between an electric motor and a substantially concentric shaft or axle.
- 1,056,900. PROCESS OF DESULPHURIZING ORES AND METALS; A. E. Greene, Chicago, Ill. App. filed Aug. 5, 1910. Pig-iron treated in electric furnace with suitable slag and a reducing agent.
- 1,056,921. SYSTEM OF CONTROL FOR DYNAMO-ELECTRIC MACHINES; J. N. Mahoney, Wilkinsburg, Pa. App. filed May 22, 1911. Continuously circulates the electrolyte in a plurality of liquid rheostats.
- 1,056,933. ELECTRIC COOKER; F. C. Perkins, Buffalo, N. Y. App. filed Oct. 10, 1911. Special heat-insulating means.
- 1,056,946. AUTOMATIC WATER-LEVEL ALARM; S. Q. Saunders, New Bridge, Ore. App. filed Nov. 1, 1911. Scaled casing immersed in the water and containing a circuit actuating float.
- 1,056,951. FIRE ALARM; R. E. Sherer, Luck, Wis. App. filed April 14, 1911. Fusing of conducting member is hastened by surrounding conducting member with inflammable material.



1,057,239.—Electric Furnace.

- 1,056,987. ELECTRIC CURLING IRON; A. C. Gough, Pocatello, Idaho. App. filed July 15, 1912. Heating elements seated in casing and spaced therefrom by wire wrapped end and center bearings.
- 1,056,992. ELECTRIC SEMAPHORE MECHANISM; W. K. Howe, Rochester, N. Y. App. filed Dec. 3, 1909. Motor with detent mechanism to avoid shock and jar when signal is brought to rest.
- 1,056,993. ALTERNATING-CURRENT TRACK-CIRCUIT SIGNALING; W. K. Howe, Rochester, N. Y. App. filed Sept. 30, 1911. Insulated joint breakdown protector.
- 1,056,995. ELECTRICAL TESTING APPARATUS; H. G. Ingram, Juniata, Pa. App. filed March 21, 1912. Receiver having automatic winding spool carrying flexible cord.
- 1,056,998. INSULATOR; B. G. Jamieson and C. A. Keller, Chicago, Ill. App. filed Aug. 4, 1909. Bolt head is incased in insulating medium which rests against the conductor.
- 1,057,016. ELECTRODE; K. Tornberg, Lynn, Mass. App. filed March 27, 1911. Provides an space between an outer shell and an inner metallic shell carrying material yielding a luminous arc springing from a molten pool.
- 1,057,025. LAMP SOCKET; G. Wright, Schenectady, N. Y. App. filed Oct. 9, 1912. Projections on insulating base engage in a pocket or depression in the shell.
- 1,057,035. SELECTIVE SYSTEM; E. R. Carichoff, Schenectady, N. Y. App. filed Aug. 30, 1909. Means carried by the car for automatically reducing the potential when it is on a high-potential section of the line.
- 1,057,038. RAILWAY SIGNALING APPARATUS; W. J. Cook, Den Ver, Cal. App. filed April 22, 1911. Safety light is covered by the semaphore when in the danger position.
- 1,057,041. MERCURY LAMP-STARTING DEVICE; J. T. H. Dempster, Schenectady, N. Y. App. filed Nov. 9, 1905. High voltage is supplied to the lamp and automatically to each of the lamps in series.
- 1,057,045. VARIABLE-SPEED ELECTRIC DRIVE FOR PLANERS; A. D. Du Bois, Chicago, Ill. App. filed Jan. 13, 1906. Resistance automatically cut in and out to vary speed of the working and return stroke of the planer.
- 1,057,046. ELECTRODE; G. W. Elmen, Schenectady, N. Y. App. filed Aug. 30, 1906. Metal tube with filling of iron oxide, rutile and chromite and one-quarter of 1 per cent of sodium fluoride.
- 1,057,049. RAILWAY SIGNAL; H. L. Funkhouser, Beaver Falls, Pa. App. filed Nov. 9, 1912. Semaphore controls track tappets, which in turn control cab signal lights.
- 1,057,054. ARC-LAMP ELECTRODE; C. A. B. Halvorsen, Jr., Lynn, Mass. App. filed March 4, 1911. Fusible luminous arc material surrounded by a plurality of metallic shells in frictional contact with each other.
- 1,057,061. ROTOR WINDINGS FOR ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES; L. J. Hunt, Sandycroft, England. App. filed Aug. 10, 1909. For operating at different speeds.
- 1,057,077. TRANSFORMER; W. S. Moody, Pittsfield, Mass. App. filed March 2, 1910. Transformer with switching means divided into groups and switching means controlling the groups.
- 1,057,082. ELECTRICAL REDUCTION FURNACE; H. H. Noble, San Francisco, Cal. App. filed July 2, 1912. Electrodes entered into the crucible through openings in the arch covers.
- 1,057,088. SHAPING FILAMENTS; R. O. Poag and W. W. Kirk, Cleveland, Ohio. App. filed June 13, 1912. Filament coiled under tension.
- 1,057,126. ELECTRICAL PROTECTIVE APPARATUS; A. F. Dixon, Newark, N. J. App. filed Dec. 24, 1910. For supporting heat coils, spark-gap arresters and other protective devices in a telephone exchange.
- 1,057,147. ELECTRIC SWITCH; H. Hansen, New York, N. Y. App. filed Jan. 19, 1912. Push-button switch with special locking and releasing devices for movable-switch contact.
- 1,057,155. ELECTRIC SWITCH AND CUT-OUT; J. S. Johnson, Utica, N. Y. App. filed Feb. 28, 1910. Fuses mounted in a rotatable tube.
- 1,057,176. ELECTRIC-LAMP SOCKET; F. E. Seeley, Bridgeport, Conn. App. filed Dec. 23, 1909. Key socket having a cam-reflexed contact with opening at bend therein to permit access to the securing screw.
- 1,057,178. CABLE-END BELL; E. C. Sessions, Chicago, Ill. App. filed Oct. 8, 1909. End of underground cable is protected adjacent to the joint with the aerial line by sealing it in insulating material.
- 1,057,179. SLEET CUTTER; C. J. Smith, Altoona, Ia. App. filed Nov. 1, 1911. Flanges of trolley wheel are held together yielding.
- 1,057,184. INSULATING MEANS; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 10, 1912. Plurality of concatenated horizontally disposed longitudinal insulators suspended in column.
- 1,057,208. RAILWAY SWITCH OR THE LIKE; C. O. Anderson, Omaha, Neb. App. filed Feb. 28, 1910. Switch-operated motor has its armature shaft disposed transversely of the stock rails and yielding connected with the throw rod.
- 1,057,213. ELECTRIC FURNACE AND METHOD OF OPERATING SAME; G. H. Benjamin, New York, N. Y. App. filed April 9, 1912. Has heating chamber, reducing chamber and refining chamber; material forms resistant medium.
- 1,057,239. ELECTRIC FURNACE; A. Helfenstein, Vienna, Austria-Hungary. App. filed Jan. 12, 1912. Multiple-hearth type.
- 1,057,258. ELECTRIC SWITCH AND OUTLET BOX; O. Moessner, Philadelphia, Pa. App. filed May 25, 1912. U-shaped box sections held together by detachable clips.
- 1,057,276. ELECTRICAL MEASURING INSTRUMENT; L. T. Robinson and G. Holz, Schenectady, N. Y. App. filed June 9, 1909. Forms factor indicator for alternating-current circuits.
- 1,057,278. ART OF SYNCHRONIZING ALTERNATING-CURRENT GENERATORS; B. P. Romain, Newark, N. J. App. filed Dec. 8, 1909. Indicator moved by movable part of electrodynamicometer and concealed from view when the currents are not in phase.
- 1,057,286. REVOLVING ELECTRICAL FURNACE WITH RESISTANCES ARRANGED DIAMETRICALLY; G. Serpek, Paris, France. App. filed July 23, 1912. Diametrical resistances in sections with beveled edges.
- 1,057,313. ALARM DEVICE FOR MEASURING INSTRUMENTS; S. Worliczek, Zolkiew, Austria-Hungary. App. filed April 30, 1912. For pressure gauges; alarm pointer is adjusted by a worm and worm gear.
- 1,057,320. ELECTRIC SOCKET; F. Barr, New York, N. Y. App. filed Nov. 9, 1912. Recesses in side of the insulating base receive the circuit terminals; circuit terminal provided with strain-relieving finger.
- 1,057,367. ELECTRIC WATER PURIFIER; A. H. Van Pelt, Los Angeles, Cal. App. filed June 29, 1912. Water purified by electrolysis.
- 1,057,370. ELECTRIC FUSE LIGHTER; H. Bargman, Los Angeles, Cal. App. filed Dec. 29, 1910. Has fuse-penetrating points with switch mechanism controlling passage of current through such lighting points.
- 1,057,383. ELECTRICAL APPLIANCE FOR ACTUATING AND CONTROLLING DUMB-WATERS; C. H. Larson, New York, N. Y. App. filed July 18, 1911. Elevating circuit or lowering circuit is automatically cut out when the floor is in actual use.
- 1,057,386. DYNAMO-ELECTRIC MACHINE; E. M. Tingley, Pittsburgh, Pa. App. filed March 17, 1905. Cooling circulation is maintained from end chambers through constricted passages and out through exhaust ports in middle chamber of the structure.
- 1,057,394. ELECTRIC MOTOR; H. C. Ogle, Dexter City, Ohio. App. filed Feb. 20, 1912. Controller for the motor mounted on the armature shaft.

# Electrical World

The consolidation of ELECTRICAL WORLD and ENGINEER and AMERICAN ELECTRICIAN

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Vol. 61

NEW YORK, SATURDAY, APRIL 12, 1913

No. 15

## Electrical Exports for the Year 1912

The returns of electrical exports for the year 1912 are given in the December summary of the United States Department of Commerce and are really quite gratifying. While the total in 1910 was \$17,001,126, it had risen to \$19,355,536 in 1911, but last year it was no less than \$23,212,833. We would like to discuss the figures in some detail, but it is obviously quite difficult to do so when "all other" bulks up to the extent of \$13,810,637, or very nearly two-thirds of the total. He must indeed be a mind reader, or something of that kind, who could "go behind" such vague returns and extract their significance. We can only congratulate the industry on the general showing and hope that it will continue. In this respect we are glad to note that, taking months singly, the upward trend is strongly in evidence. In December the total rose to \$2,186,264, as compared with \$2,079,213 in 1911. But in January, 1913, it rose to \$2,217,625, as compared with \$1,721,269 in 1912. If such a rate of growth can be maintained, it will put the exports of electrical machinery and supplies above \$25,000,000, or not far from 10 per cent of the production. It would be interesting to know how many other industries are doing equally well.

## The Resale of Patented Articles

One of the most important patent cases to come before the Supreme Court is now being argued in Washington. It relates to the right of a patentee to fix the price at which his invention shall be resold. At the hearings nearly a year ago before the House patent committee many representatives of manufacturing corporations pleaded for the retention of this supposed right. No one hitherto has seriously believed, apparently, that this right did not exist under the present statutes, and it has been freely exercised by the manufacturers of such articles as talking machines, watches, clocks, safety razors, carpet sweepers, fountain pens and the like. Many arguments have been advanced to show that the practice is beneficial to the consumer rather than oppressive, but the silence in regard to its benefits to the inventor is conspicuous. It is difficult to see why price-fixing agreements which are illegal in the case of unpatented articles should be immune in the case of patented articles. In this day of business on a large scale, demanding the combined capital of many individuals to carry on a single enterprise, it is important to keep in mind that rights conferred upon inventors under the patent laws will almost inevitably pass into the hands of large business concerns or corporations, and also that what the individual might safely be left to do alone may become a weapon of extortion when

employed by a powerful corporation seeking to establish a trade monopoly.

## Enlisting the Ally's Aid

There are always plenty of willing hands capable and ready to give the central station gratuitous help in selling its service, if the resourceful commercial agent will only point out to them how their own interests may thereby be benefited. A new-business department of lay experts can thus be created far more effective and subtle than any mere professional sales force could ever be. No more important selling lesson than this was expounded during the recent fertile discussion at the meetings of the Society for Electrical Development. This plan of enlisting the aid of allies in a common commercial cause strikes at the most potent of human motives, selfish gain; but its ethics are soundly justified on every essential economic ground. Take, for instance, the subject of better lighting for suburban roads. In parts of the East the autoists are lending a hand in this agitation. They will get the improved illumination; the local central station acquires additional load. And for everybody concerned the world is thereby made a better place to live in.

## Swiss Transmission Systems

Elsewhere in the current issue is given a resume of the present situation of hydroelectric work in Switzerland which shows admirably the enterprise of the people of the mountain republic in utilizing their natural resources. With its snow-covered peaks and abrupt valleys Switzerland is peculiarly rich in available water-powers and anyone who travels there realizes quickly the work that is being done. The upper valley of the Rhone is specially endowed with streams, and as one travels down it he finds constant evidence of activity. There is a glimpse of a three-phase circuit along the railway, generally in slender wooden poles bearing modest porcelain insulators. Follow the telltale three wires along the valley and presently the line loses itself in the rugged wall of the Alps, and if one looks carefully he obtains a fleeting glimpse of sharp steel lines along the mountainside; and so it goes as one travels down the valley to Genève, with its far-reaching view. As a rule the Swiss developments are not of great scale, for they employ extreme voltages. Nevertheless the line for electricity over 200,000 volts and over 100 miles of transmissions above 20,000 volts is not a large one. The presence of a pole in the heavy high-voltage transmission, for transferring reasons is about the only feature of the technical practice which would strike the American engineer as unusual. But in a given sense the Swiss situation

is very interesting. Switzerland is the peak of the European roof and the tendency to develop power there for transmission into neighboring countries was a natural one. A few years ago the Swiss government laid down the rule that no such export of electrical energy should be permitted without the approval of the Federal Council. A little later by an amendment of the national constitution the Federal Council obtained at least nominal control over the utilization of the hydraulic resources of the country, and exportation of energy was prohibited except under special license. The government, however, has not taken over the water-powers in the way of full ownership, and the several districts retain the right of hydraulic regulation as part of their local self-government. Hence, it is the local authorities who make the necessary restrictions and determine what fees are to be paid. The taxes levied for the use of water-power vary considerably but range in the vicinity of \$1 or a little less per hp-year. Switzerland has thus definitely adopted, in the control of its water-powers, both governmental control and the exercise of this control through the local authorities, presumably on the basis that they are better qualified to judge local conditions than would be the whole Federal Council.

At the present time only about 20 per cent of the 2,000,000 hp available on the Swiss streams is utilized for hydroelectric work, so that much yet remains to be done in the granting of concessions, and the government has thus taken the whole matter in hand at an early stage of the proceedings. The general service from the Swiss plants is to be of much the same character, as here, and the prices charged for energy do not differ materially from those found in American practice. It is not uninteresting to the consumer here to realize that his Continental fellows, with municipal electric plants, "kick" as often and as vigorously at service and prices as do the most active and loquacious opponents of private monopoly. On the showing made in the paper before us the Swiss are certainly to be congratulated not only on their splendid resources but on the consistent enterprise with which they have been enabled to meet public needs.

### Waves and Surges on Overhead Transmission Lines

Stationary electricity as presented in the case of a good condenser, first charged and then insulated, and stationary magnetism, as presented between the poles of a permanent horseshoe magnet, seem to be in as steady and quiescent a condition as a belfry bell at midnight; but one has only to allow the electricity or magnetism to be disturbed with reasonable freedom to generate oscillations that resemble those of the belfry bell when vehemently agitated. The quiet, sleepy electric charge becomes active with tremendous friskiness. The late Lord Salisbury defined the universal ether as the entity which gave physical possibility to the verb "to undulate," but electricity and magnetism, when disturbed, may be regarded as prominent nominatives of this verb.

In energy transmission lines the steady state of operation at constant load is a comfortable and quiescent process, whether the line is short or long and whether direct or

alternating currents are used, but if a disturbance occurs anywhere in the system an oscillation is nearly always set up. The magnitude of the oscillation will depend upon the magnitude and suddenness of the disturbance, as well as on various other circumstances. The oscillation may be so slight as to be quite imperceptible, or it may be so powerful as to throw out circuit-breakers, unsynchronize machinery, puncture insulation or lead to other destructive effects. On long lines supplying energy to many machines the little accidental variations of load existing in normal operation set up oscillations that skim to and fro over the line, one coming in before its predecessor dies away, like breeze ripples on a lake surface, so that the becalmed state of equilibrium is never reached, albeit the range of departure from equilibrium may be quite insignificant. Lightning discharges, or a sudden short-circuit and its rupture, can, however, set up an electric tidal wave in the system that may have very unhappy consequences.

In an article in this issue, Mr. Alfred Still draws attention to some of the laws which control waves on overhead-transmission lines, either stationary, in the steady state, or surging to and fro, in disturbances. It is shown that, according to known relations, the reciprocal of the geometric mean of inductance and capacity for such a line approximates to the velocity of light in air. Consequently the sine-wave charging current of the line is definitely related to the sine-wave reactive drop in the line. The experimental and theoretical evidences seem to unite in making the velocity of electric waves always equal to the velocity of "light" in the same dielectric, but the apparent velocity of electric wave transmission over wires is always distinctly, and sometimes enormously, less than this light velocity, owing to absorptions of energy in the conductor, and also in the dielectric, if a solid dielectric is used. The case may be likened to the actual velocity, as contrasted with the effective velocity, of an attacking column storming a redoubt. The column may be advancing at the "double," or say at 9 miles per hour; but, owing to the shooting down or attenuation of the head of the column under rifle fire, the apparent velocity of the column, as judged by the time it takes to reach the redoubt, may be only 6 miles per hour. Here the speed of the soldier corresponds to the light-speed of electric propagation in the dielectric, the destructive attenuation to the loss of energy in the copper and dielectric, while the apparent speed of the column corresponds to the apparent speed of electric transmission.

The article draws attention to the marked superiority of half-wave lines over quarter-wave lines in regard to self-regulation of pressure during the steady state. At the ordinary frequency of 60 cycles per second, the wave-length is about 500 km, or 3000 miles. The quarter-wave length, which self-regulates badly, would be 1250 km, a very great and unlikely length from an engineering standpoint; while the half-wave length, which self-regulates excellently, would be the practically almost impossible length of 2500 km. It seems unfortunate that a half-wave cannot precede instead of being so remotely distant. It would be possible to imitate half-wave action on a tenth-wave line, either by loading the line or by increasing the frequency; but the disadvantages would ordinarily outweigh the advantages.



### The Thury System in Mines

A paper by Mr. Sidney F. Walker, read in England before a section meeting of the Institution of Electrical Engineers, an abstract of which appears in this issue, deals with the application of the Thury high-voltage, constant-current system to mining work. As our readers are well aware, the Thury system for general transmission purposes is very far from being a dead issue. It has proved satisfactory in several large installations and has certain advantages which under favorable circumstances count for much. Its application, however, to so difficult a proposition as mining operations is something of a novelty. In its simplest development the constant-current system calls for motors forming translating devices in series on the main system. When thus used these motors utilize high-tension current, and while their control is a very simple matter they still require unusual precautions in insulation. By using the equivalent of the interpole construction M. Thury has been able to reduce the regulation of his motors to extreme simplicity. The motor is started without the usual complication of resistances, by merely opening a short-circuiting switch, and the speed regulation is customarily obtained by shifting the brushes. In this way the troubles due to starting and regulating resistors are effectively obviated. In mining work, however, the necessities of working under conditions of extreme moisture and sometimes in danger of gaseous mixtures are serious, and we find Mr. Walker advocating some special precautions which certainly do not seem to be unnecessary. Of course, energy transmitted at constant continuous current can be utilized indirectly by motor-generators, as is the case in several of the foreign plants.

Passing to constant-potential continuous current, or if necessary to three-phase current, both entail some difficulty in the matter of speed regulation, and the alternative suggested by Mr. Walker is an interesting one. For much work in general mining operations the ordinary constant-current motors of the Thury system could be used, but for operation underground the required voltages are generally too high. Mr. Walker suggests the use in such cases of a constant-current series motor not operated from the main circuit but from a motor-generator delivering constant current at a moderate tension. In this way the danger from high voltages is practically eliminated while the starting and regulation still remain in a state of extreme simplicity.

The importance of the gain in regulation over constant-potential or three-phase motors, we are inclined to think, is somewhat overestimated by Mr. Walker. In practice both of these systems seem to work pretty well, although it is undeniable that the brush-shifting device gives efficient and close control of the speed. The regulation curve shown for various outputs—that is, speeds—of the Thury motor is certainly admirable. Yet it will be a question to be solved in each individual case whether the requirement of highly efficient speed control is worth the extra cost of the constant-current apparatus. Several mining installations on the Thury system are already in use, generally at 100 amp or 150 amp constant current. The motors employed range from five to several hundred horse-power. Where several mines have to be operated from the same power station

all the motors may be connected in series or separate circuits can be run from the generator station to reduce the voltage necessary on each circuit. This looks somewhat complicated and so in principle it is, the chief gain being in the almost rudimentary simplicity of the generating stations themselves.

In the present state of the art the regulating and switching mechanism for a transmission station is very intricate and expensive. In the constant-current system these elements amount to next to nothing, but this simplification is at the expense, in such work as that before us, of complication in the matter of circuits and the motor-generators to an indefinite but undoubtedly large amount. To tell the truth, Mr. Walker's plea for constant-current operation in mining work, while forceful, does not impress us as very convincing. That the Thury constant-current system has an important and useful field we have many times maintained. It would seem to us that this field lies rather in transmission at high voltage over long distances and with comparatively simple receiving units than in distribution to many motors working under difficult conditions and requiring special transformation of the current to render them safe for the purpose in hand.

### Alternating-Current Lifting Magnets

It is well known that the pull, or dynamical tension, exerted at any point of a magnetic field is equal to  $B^2/8\pi$  dynes per sq. cm, exerted in the direction of the flux density  $B$ . Starting from this fundamental law of Maxwell, the total pull exerted between the poles of an electromagnet can be evaluated, if the distribution of flux density across the polar surfaces can be determined in magnitude and direction at all points. In the alternating-current case the magnetic flux density passes through zero twice in each cycle, so that, with a frequency of 60 cycles per second, there are 120 instants per second when the lifting power of an alternating-current magnet is nil. With a 50-lb weight the armature has time to fall through a distance of perhaps one-tenth of a millimeter before the tension due to the next half-wave can reverse the direction of motion and relift the weight. The result is apt to be a loud vibration and chattering of the opposed magnetic polar surfaces, with a frequency double that of the exciting current.

A remedy for the chattering ailment of alternating-current magnets has been found in polyphase excitation, whereby some polar attraction is always being exerted. In cases where polyphase mains are available, this expedient works very satisfactorily, but in single-phase current supply some split-phase method is necessary for producing the polyphase excitation locally. A working coil was part of the single-phase pole circuit, while a shaded-pole paper presented to the Physical Society at Leeds, March, Prof. F. Wilson gives some experimental results obtained from a shaded-pole single-phase lifting magnet. With the gap closed the phase displacement was found to be one-fifth of a cycle, which is not very far from the theoretical quarter-cycle limit. With an air-gap of 1/8 in. the phase displacement fell to 18 deg. The principle is mirrored in a great variety of alternating-current pulling magnet devices.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### New Tariff Bill

The Democratic tariff bill, which bears the stamp of approval of President Wilson, was introduced in the House of Representatives by Chairman Underwood of the ways and means committee immediately after Congress convened on April 7. The schedule contains a number of articles on which either no reduction in duty has been made or an advance has been provided for. In each case the effort has been to consider not only the character of the article but also the amount of its probable importation and its relation to the revenue-yielding power of the schedule. The prime motive being that of granting to the public as much relief as practicable while at the same time conserving the income of the government to the necessary extent. In order to provide a source of revenue to compensate the government for the losses incurred by the new tariff bill, a tax on all annual incomes which exceed \$4,000 is proposed.

In the dutiable list the following items are of particular interest to the electrical fraternity: Calcium carbide, which is made in electrical furnaces and is employed in manufacturing acetylene, 10 per cent ad valorem; calcined magnesias, which is employed largely as a lining in electric furnaces, 35 cents a pound; mica and manufactures of mica, 30 per cent ad valorem; ground mica, 15 per cent ad valorem; gas retorts, 10 per cent ad valorem; carbons for electric lighting, wholly or partly finished, made entirely from petroleum coke, 15 cents a hundred feet; if composed chiefly of lampblack or retort carbon, 40 cents a hundred feet; porous carbon pots for batteries, 15 per cent ad valorem; iron in pigs, wrought and cast scrap iron, scrap steel, 8 per cent ad valorem; titanium, tantalum, tungsten, 15 per cent ad valorem; boiler or other plate iron or steel and strips of iron and steel, 15 per cent ad valorem; railway fish-plates or splice bars made of iron or steel, 10 per cent ad valorem; round iron or steel wire, telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials, iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin or other metal, 20 per cent ad valorem; aluminum, aluminum scrap and alloys of any kind in which aluminum is the component material of chief value, 25 per cent ad valorem; copper, in rolled plates, sheets, rods, pipes and copper bottoms, sheathing or yellow metal of which copper is the component material of chief value and not composed wholly or in part of iron ungalvanized, 5 per cent ad valorem; quicksilver, 10 per cent ad valorem; steam engines, 15 per cent ad valorem; telephone, trolley, electric light and telegraph poles of cedar or other woods, 10 per cent ad valorem; indurated fiber ware and manufactures of pulp, 25 per cent ad valorem; manufactures of asbestos, 10 per cent ad valorem; manufactures of india rubber or gutta percha, 10 per cent ad valorem; vulcanized india rubber known as "hard rubber," 25 per cent ad valorem.

On the free list are to be found the following: Nitric, hydrochloric and sulphuric acid; unmanufactured asbestos; crude bauxite; beeswax; sulphate of copper; coal; crude gutta-percha; crude india rubber; unmanufactured lava; life-saving apparatus specially imported by societies and institutions; oxide and ore of manganese; models of inventions; philosophical and scientific apparatus not intended for sale, and unmanufactured platinum.

### New York State Hydroelectric Bill

With all calendars crowded and with the Murtaugh-Patrie hydroelectric bill taken out of the hands of the ways and means committee and placed in charge of the all-powerful rules committee of the Assembly, there is an excellent chance that the plan to rush through this proposal to launch New York State in the wholesale electric-service business can be delayed at least until the project is better understood than it is at present. The legislative sponsors of the bill and members of the Conservation Commission with which the bill originated said this week, however, that they knew of no obstacles and fully expected prompt action on the measure. The higher powers in the Legislature are more dubious about it, not so much on account of its merits or demerits as because of the congested condition of the Legislature's calendars as a whole.

In this situation it is curious that the rank and file of the Legislature profess to be ignorant of the fact that there is any opposition to a state-wide development of hydroelectric powers, with the capital district as the first beneficiary of the scheme. This might be expected if the plan were local, but, as Lieutenant-Governor Glynn said, "this bill is the beginning of a system to develop power everywhere and anywhere in this State where water is running to waste." A considerable proportion of the existing electric properties in New York may therefore be menaced by State competition, expressly removed from control of the Public Service Commission, if the hydroelectric bill passes. In view of this fact and the difficulties that would naturally be placed in the way of raising new capital for private enterprises, it seems strange that these interests have not made themselves more emphatically heard and that the general public has not taken more interest in a proposal to enter upon a plan of exploitation which promises to involve the expenditure of hundreds of millions of dollars.

The discovery was made this week that the Murtaugh-Patrie bill as passed in the Senate and introduced in the House is probably unconstitutional in that under the head of "appropriation of property" it provides for virtual confiscation of "any lands, structure or water the appropriation of which shall be necessary." This may require amendment of the bill and thus aid in securing time for fuller consideration if promptly demanded by those most obviously concerned.

### Colorado Utilities Bill Passed by Legislature

The conference committee of the Colorado Legislature has reported back to both the House and the Senate on the subject of the proposed public utilities bill, restoring the terms of the California law practically intact by the elimination of the House amendments from the Wisconsin law, particularly those relating to municipal ownership and indeterminate franchises. Both houses concurred in the action of the conference committee, and the bill is now up for the Governor's signature. The "saving clause" was omitted, and the bill if signed will undoubtedly be referred by petition. The executive signature is expected, since Governor Ammons has been reported to be urging the passage of a stringent utilities measure, as an argument to help his controversy with the federal government toward state rather than federal control of Colorado's resources.



### Pittsburgh Mining Session, A. I. E. E.

Arrangements have been completed for the meeting of the American Institute of Electrical Engineers to be held in Pittsburgh April 18 and 19 under the auspices of the committee on electricity in mines. Indications are that a large number of members and non-members interested in the subject will be present and take part in the discussions. The Pittsburgh Section announces also an interesting entertainment in connection with a Dutch dinner to be held at the Fort Pitt Hotel on Friday evening. A set of moving-picture films furnished through the courtesy of Rogers, Brown & Company will be exhibited, showing the mining, handling and final working of iron ore. These films show the ore being taken from the ground, loaded on ships, transferred along the lakes, unloaded at the docks and transferred to the train, closing with views in the steel mills.

### Municipal Plants Included in Iowa Commission Bill

Representative Francis, of Dickinson, Ia., has introduced an amendment to the public service commission bill now before the Iowa State Legislature, placing municipal electric-lighting plants partly under the control of the proposed commission. The amendment, which has occasioned considerable opposition, provides that "the powers delegated to the public utilities commission shall not apply to municipally owned utilities, except in so far as such powers have to do with the regulation of annual reports, the prescribing of a system of uniform accounting, the requiring that there be set aside a depreciation and maintenance fund and the hearing and determination of complaints as specified by the bill." The measure also prescribes that complaints may be taken before the commission by 10 per cent of the people affected.

### \$30,000 to Promote Electric Vehicles in New York City

Following an address by Mr. W. C. Anderson, president of the Anderson Electric Car Company, to a meeting of the New York Edison Company's managers, a special appropriation of \$30,000 was voted for establishing an exclusive electric-car garage in New York City. Mr. Anderson also suggested a vigorous educational campaign to acquaint central-station customers with the unusual and desirable capabilities of the electric car for town and suburban use. The \$30,000 appropriation will be expended at the rate of \$10,000 per year toward the rental and promotion of an electric garage. In order that no partiality may be shown any particular make the expenditure will be under the jurisdiction of the New York office of the Electric Vehicle Association of America. The New York Edison Company will also advertise through newspapers and by personally addressed letters.

### Electric Vehicle Convention for Boston

At a regular meeting of the Electric Motor Car Club of Boston at the Hotel Thorndike, April 2, it was announced that a convention will be held at Boston during the late spring for the purpose of insuring a larger degree of co-operation between the central stations of New England, the sales managers and local representatives of electric-vehicle manufacturers, the advertising interests and the large users of pleasure cars and electric trucks. The convention will be planned to exhibit the opportunities in New England to manufacturers and others from outside its borders and will enable those in attendance to see at first hand what has been accomplished during the last two years in the electric-vehicle campaign in eastern Massachusetts.

It was also voted to hold the electric-vehicle parade in Boston on Memorial Day this year.

A feature of the gathering was a talk by Mr. L. D. Gibbs, superintendent of advertising for the Boston Edison company, upon relations with the daily press. A six weeks campaign in the Boston dailies will shortly be inaugurated by the club. Mr. Gibbs advanced the suggestion that, forming a sort of electric-vehicle "flying squadron," much good might be accomplished by visits of such a group of enthusiasts to other central stations in New England. Upon arrival in a distant city a series of conferences would be held with central-station directors, officers and "live" prospects for business, with practical talks at a central location in the evening. The plan of co-operating in local electric-vehicle advertising was also commended.

### Heavy Sleet in Montreal

In view of the attention attracted by the recent snow-breaking sleet deposits in northeastern New York state and in and about Chicago, described in the *Electrical World* Feb. 22 and March 22, 1913, the accompanying photograph is of timely interest. The illustration shows the extraordinary



HEAVY ACCUMULATION OF ICE ON TELEPHONE WIRES

heavy accumulation of more than a foot of soft snow and copper telephone wires on the Montreal & Southern Ontario Railway. This particular sample was found along the track at the west end of the Victoria station bridge, near Montreal after the heavy snow storm which swept in from St. Lawrence Valley on March 10 and 11, 1913.

The photograph has reached us through the kindness of Mr. A. F. Hunt, electrical engineer on the Montreal & Southern Ontario Railway Company.

### Single-Phase Railway Electrification in Europe

Single-phase electrification of railways has made rapid advances in Germany and Switzerland during the last few years. Among the new systems to be thus electrified is the Wittenthal line, which now connects the Basel-Alf and the Schaffhausen-Sargheim, have a total length of 302 miles on single track. The gradients reach



1 in 100, and there are numerous curves with a minimum radius of 890 ft. Power is transmitted from the Rheinkraftwerke, Augst-Wyhlen, at 6800 volts by a pair of underground cables. A substation near Basel contains two converting sets to supply single-phase current at 2000 volts and 15 cycles to a step-up transformer with a secondary voltage of 15,000, which is connected directly with the high-pressure overhead-contact lines. For cases of emergency a three-phase Brown-Boveri turbo-generating set is installed in the substation. The contact line from Basel to Schopfheim has been constructed on the multiple suspension system, and the lines from Schopfheim to Zell and from Schopfheim to Säckingen on the catenary suspension system.

The rolling stock consists of twelve locomotives. Ten of these were furnished by the Siemens-Schuckert company and the others by Brown, Boveri & Company. The former are provided with single-phase series-wound motors with an average terminal voltage of 300, controlled by an induction regulator, and the latter are worked with Déri repulsion motors.

### The Japanese as Electrical Manufacturers for the Orient

It is the ambition of Japanese engineers to make their country the workshop from which a great part of Asia will draw its requirements in respect of electrical and other machinery, declares the London *Times*, and it does not appear to be realized by European manufacturers that already the diligent imitative talent and the energetic enterprise of the Japanese have established important works of this character. There is no sign as yet that Japan will contribute anything toward the progress of engineering science and invention, and the protective policy aims rather at providing the means whereby the new ideas of European and American engineers may be readily adopted as soon as their value is proved. For repetition work the low cost of Asiatic labor may or may not become a powerful competitive influence, but as there appears to be no reason why nearly all the generating and distributing electrical plant and apparatus needed for the Japanese home market should not be manufactured locally, the attention of outsiders may preferably be directed in the near future to the prospects on the mainland. China has already made a start with engineering works in connection with the railways, and it will perhaps be necessary before long for Western enterprise to come to a decision as to whether financial and commercial control should be acquired of the infant electrical factories that will come into being.

### Electrical Construction Here and Abroad

At the meeting of the Boston Section, American Institute of Electrical Engineers, April 4, Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, gave an illustrated talk upon "Comparisons Between European and American Electrical Construction," as observed during a recent trip to England and the Continent. Examples of construction in the electric railway, telephone, telegraph and central-station fields were shown. Professor Jackson pointed out incidentally that the street-railway fares in London and other European cities where the zone system prevails were from 1 cent to 1.25 cents per mile on the longer hauls, closely corresponding to those in effect in the United States for similar distances. The general problem of railway electrification deals with lighter service and a less varied traffic density, and even the Bavarian State Railways, which the speaker approached with special interest from the standpoint of American electrification engineering, furnished no suitable comparison with trunk-

line service in this country. In the telephone and telegraph field Professor Jackson commented on the marked superiority of the poles used abroad, where creosoting is general. A useful life of twenty years results, with a salvage value at the end of 8 to 10 per cent. Wooden cross-arms are used but little abroad, and in small sizes. As yet the steel-tower line has not been used to any extent in heavy power work and transmissions have been short. The artistic character of the street-lighting poles and fixtures in Germany, notably at Munich, surpasses American practice. Professor Jackson recognized that the use of metal poles for street lighting abroad is made possible by the operation of low-voltage street lamps with arrangements for cutting the lamps entirely from the lines in trimming. He contended that the use of more ornamental poles in America is "up to" the municipalities and urged the education of public sentiment along these lines. Incandescent street lighting is better developed in America than abroad and the mechanical construction of overhead lines is better here.

Mr. J. W. Cowles, of the Boston Edison company, also spoke, citing the difficulties and restrictions imposed in street-lighting pole design by the use of high-voltage systems.

### Mass and Velocity of Electron

Prof. E. P. Adams, of Princeton University, in his third lecture on radioactivity, delivered before the American Institute of Electrical Engineers in New York on April 9, spoke of the dependence of the mass of an electron upon its velocity, the electron theory of matter, electrons in optical theory (Zeeman effect) and the emission and absorption of light.

As yet no success has attended the attempts to explain all physical phenomena in terms of matter. The much-sought-for explanation of gravitation and electricity cannot be evolved in these terms. However, with the aid of the electron theory it is possible to conceive of the mass of an electrical corpuscle in terms of its electrical properties. In order to help his audience to conceive of the mass of a corpuscle in the ether increasing in mass as its velocity increases, the analogy of an elastic sphere in a fluid was presented by the speaker. As the sphere gains velocity its tendency is to flatten and to present to the fluid an increased surface so that a greater amount of fluid must be set in motion. As the mass of one-half of the fluid in motion must be added to the mass of the sphere, it is seen that as this action continues the effective mass of the sphere will increase.

In speaking of the action of a powerful magnetic field upon the spectrum, known as the Zeeman effect, Professor Adams expressed himself as being of the opinion that each line of the spectrum is caused by the gyrations of a separate corpuscle. The splitting of these lines under the action of a magnetic field he attributed to the change in the direction of motion of the corpuscles. Each atom contains a number of corpuscles proportional to its atomic weight. An atom of hydrogen has about 2000 corpuscles. He characterized the discovery of the Zeeman effect as one of the most brilliant achievements of the age in the field of physical research.

From experiments which have been made to determine the mass of the positive corpuscle it is thought to be greater than the mass of the negatively charged particle. It was thought for some time that the alpha particles were positively charged corpuscles. If this is the case, an atom of helium which has lost two negative charges becomes an alpha particle.

At the close of the meeting President Ralph D. Merzhon announced that the next and last of the series of lectures to be delivered by Professor Adams will be given on April 16.

### Daylight Absorption of Wireless Signals

At a meeting of the New England Wireless Society held in Pierce Hall, Harvard University, Boston, Mass., April 7, Dr. A. E. Kennelly, professor of electrical engineering at Harvard, spoke on the subjects of daylight absorption phenomena and the relation of the waves used in wireless telegraphy to those electric waves sent over an ordinary telegraph wire. Daylight absorption of wireless impulses was explained by Dr. Kennelly on the basis of ionization of the atmosphere by the ultra-violet waves in the sun's rays, changing the air's absorption quality for electromagnetic waves. For example, just before sunrise at a given European station the sun's rays would be passing through the upper air at a very oblique angle. The resulting ionization of this upper air would act as a reflector for the waves being propagated, increasing the strength of the signals at the American receiving station. Later this reflecting surface would come between the two stations, where its action as a barrier would be noticed in the weakened signals. Shortly after sunrise at the western station the reflector would be behind the station, again augmenting the strength of the signals. A similar set of phenomena takes place at sunset. Upon this theory the occurrence of the "notches" in the transmission curve are plausibly explained.

### Light and Art

At the meeting of the New York Section of the Illuminating Engineering Society on April 9 Mr. M. Luckiesh gave a most interesting discussion and demonstration of the direction, quality and quantitative distribution of light for esthetic illumination. The direction and quantitative distribution can be varied by changing the position of the light source or by altering the shape of the reflector. The quality of an illuminant is inherent in the light source itself and can be altered by the use of colored glass and reflecting media and by employing fluorescent materials.

Referring to quality or color value, the speaker explained the composition of light and the sensation produced by the various color values. Daylight, for instance, though varying greatly, has an abundance of all rays and is considered as the ideal illuminant by many. To the speaker, however, there appeared no other reason for its popularity than possibly its cheapness and its usefulness for accurate color matching. Daylight is cold and rather cheerless, while there is a warm, cheerful effect from most artificial light sources. Sunlight is more cheerful than light from the open sky, and carbon-filament lamps have the same advantage over tungsten lamps owing to the former's preponderance of yellow rays.

A given light source, even daylight itself, may be augmented by other special lighting to produce desirable decorative effects, to bring out the true color values of a painting, or for obtaining the proper direction of the light on a piece of sculpture. In this connection the speaker referred to the excellent lighting effect obtained in the Allegheny County Memorial Building at Pittsburgh.

The speaker considered each class of art work from the basis of the function it is to fill. In three-dimensional sculpture light and shadow are of great importance, making the direction of the lighting essential. In architecture the direction of the incident light is of less importance than in purely sculptural art, yet great changes can be effected by varying the direction of the light. In illuminating colored objects the quality of light is of greatest importance. In purely conventional painting the effect of yellow artificial light is to shift the colors toward the red or warmer end of the spectrum.

Discussing the effect of the quality of light and its influence on paintings, the speaker said that practically every painting has its own particular quality and quantitative

distribution of light best fitted to its needs. By varying these factors most interesting effects are often introduced. After having discussed certain physiological and psychological phenomena of vision and their importance in viewing paintings, the speaker gave an interesting demonstration of the effects of direction, quality and quantitative distribution of light. In booths arranged for the purpose art objects were exhibited under various lighting conditions.

At the same meeting Mr. John B. Taylor, Schenectady, N. Y., gave an illustrated lecture on color photography, presenting a study of various makes of screen plates by means of microscope and spectroscope.

### Atlantic City Meeting of the American Electrochemical Society

The twenty-third general meeting of the American Electrochemical Society was held in Atlantic City from April 3 to April 5. The registry list contained over 150 names.

On Friday a very enjoyable excursion was made to Philadelphia. In the morning a visit was made to the works of the Crucible Steel Casting Company, at Lansdowne, Pa., where a 2-ton Roehling-Rodenhauser induction steel furnace (the only one of this type in the United States) was shown in operation. The party then went to the University of Pennsylvania, where the society was entertained at luncheon. The provost of the university, Dr. Edgar F. Smith, in a felicitous speech, welcomed the society to the university. The president elect, Dr. F. F. Rocher, replied for the society.

In the afternoon two different parties were formed. One visited the works of the Harrison Brothers Company, on Grays Ferry Road, where lead paints, lithophone and contact sulphuric acid are manufactured, while the other party was taken by automobiles to the United Gas Improvement Company's works at Point Breeze. Afterward all met again at Broad Street station and returned to Atlantic City to listen in the evening to an interesting lecture by Prof. Frank B. Kenrick, of Toronto, on the subject of hyperbasis. The various phenomena discussed in the lecture were illustrated by projecting them on a screen.

The two sessions of Saturday, in the morning and afternoon, were devoted to Dr. W. Lash Miller's presidential address and to a symposium of papers on electroplating, which was greatly enjoyed owing to the interchange of ideas between scientific electrochemists on the one side and practical electroplaters on the other side.

Papers by Dr. Irving Langmuir, of the General Electric Company, Schenectady, N. Y., gave a concise and complete summary of the extended investigation which the author has been carrying on for several years on the subject of the conduction and radiation of heat and the design of furnaces.

The emissivity of various metallic surfaces was found to be as follows: Thermodynamical black body, 100 percent; oxidized, 72; copper, oxidized, 66; silver, 43; zinc, 38; bright, 22; cast iron, oxidized, 62; aluminum paint, 40; enamel, 37; monel metal, 41.50; 43; monel metal, oxidized, 43.

### EXPERIMENTS WITH FURNACE ELECTRODES

A paper on furnace electrodes was presented by Mr. F. A. J. FitzGerald, of the FitzGerald & Bennie Laboratories, Niagara Falls, N. Y., and Mr. A. T. Henckley, of the National Carbon Company, Cleveland, Ohio.

It related to a very extended series of experiments for the purpose of finding the best methods of making large electrodes so as to be thoroughly trustworthy and not fail under the severest usage and at the same time give the smallest wear under the ordinary conditions of use. This study also involved the problem of joining electrodes together so as to avoid the loss in "butts." The object of



this paper was to describe the methods used in testing the experimental electrodes and some of the results recently obtained.

As to electrode consumption the authors pointed out that, however useful from a purely commercial point of view the method of estimating electrode consumption in pounds per ton of steel may be, the important consideration when comparing electrodes is to determine how many kilowatt-hours are generated in the furnace per unit weight of electrode.

Several tests were described in detail showing the behavior of an electrode joint in the furnace. The resistance of the joint is higher when cold and decreases as the electrode becomes hotter, even a short period of heating producing a great improvement.

The paper was discussed quite extensively by Messrs. Petinot, Hering, Hansen, Richards, Lidbury, Acheson Smith and Miller.

#### ALUMINUM NITRIDE

A paper by Dr. J. W. Richards, of Lehigh University, reviewed and discussed the Serpek process for the production of aluminum nitride. The great point of the process is that when aluminum nitride is treated by water or caustic soda solution, the nitrogen is liberated as ammonia and an alkaline aluminate solution is produced from which pure alumina can be obtained.

#### EDISON STORAGE BATTERY

A paper on some tests of the Edison storage battery was presented by Dr. C. W. Bennett and Mr. H. N. Gilbert, of Cornell University. The authors reported tests made on nickel-iron storage cells, undertaken to determine efficiencies at different rates of discharge and effects of charging at various rates, to check ratings and to study operation at low temperatures. Some 300,000 150-amp-hr. Edison-cell equivalents are in use to-day. The battery tested was made up of four type A-8 300-amp-hr. cells (normal charge and discharge rates 60 amp) connected in series.

From their experiments the authors conclude that:

1. The energy efficiency, at the normal rate of operation, is about 55 per cent, the ampere-hour efficiency being about 85 per cent.

2. The cell can operate continuously at high rates.

3. At the forty-minute discharge rate, with charge at the normal rate, the energy efficiency is about 32 per cent, the ampere-hour output being about 60 per cent of the rated output.

4. The cell can be charged at high rates, the efficiency being about normal when a "booster" charge at three and one-half times the normal rate, for one hour, was given to the cell. There is no reason why the cell should not be charged at five times the normal rate for a few minutes.

5. If the cell is to be charged the day before it is to be used, energy will be conserved if the charge is maintained until the emf reaches about 7 volts, instead of carrying it to completion. In other words, no nickel peroxide should be formed on charging, the loss of energy on standing being due, presumably, to the spontaneous decomposition of this compound.

6. If the charge is stopped before the higher oxidation products of nickel are formed, the efficiency is higher than normal, being about 64 per cent.

7. At 4 deg. C. the battery is capable of delivering more than two-thirds the normal output, when charged at the same temperature. The voltage, of course, is lower than normal, for the internal resistance of the cell is higher at the lower temperatures. The efficiency also is low.

8. The cell may unquestionably be allowed to stand an indefinite length of time without injury.

9. The flexibility is so great that the cell can be used under the most adverse circumstances.

10. The method of charging until the voltage has remained constant for one hour gives satisfactory results but requires watching or the use of a recording voltmeter.

11. The continuous drop in voltage on discharge (about 10 per cent per hour) is a disadvantage for this cell, as compared with the lead cell.

12. When referred to equal amounts of power delivered, the Edison battery weighs about 25 per cent less and costs about 25 per cent more than does the "Iron-clad Exide" battery.

The paper was discussed at some length by Messrs. Clymer, Langmuir, Hering, Smith, Calmus, Schluederberg and Smith.

Mr. H. H. Smith, of the Edison Storage Battery Company, said that the Edison battery

had been placed on the market in a radically changed structure in 1908, and for this reason the literature prior to 1908 could not be relied upon as referring to the present Edison battery. He also stated that the paper was based on isolated tests and claimed that there were some inaccuracies and discrepancies between the drawings and the tables. He criticised especially the voltage figures and said that the established average discharge voltage of the Edison battery at normal rate was 1.20 volt per cell. Dr. Bennett had reached the conclusion that "if the cell is to be charged the day before it is to be used, energy is conserved if the charge is maintained until the voltage reaches about 7 volts, instead of carrying it to completion. In other words, no nickel peroxide should be formed on charging, the loss of energy on standing being due presumably to the spontaneous decomposition of the compound." Mr. Smith thought this statement was not substantiated by evidence in the paper and was merely an assumption. Concerning the conclusion of Dr. Bennett that "the continuous drop in voltage on discharge (about 10 per cent per hour) is a disadvantage against this cell, over the lead cell," Mr. Smith thought this was hardly accurate. According to a curve in the Bennett paper (see reproduction on page 765) the drop in voltage during discharge was not more than 4 per cent per hour, and even this was considerably more than is usually found. He also claimed that the use of recording meters was not reliable.

Dr. Bennett acknowledged some inaccuracies in the drawings which were due to a misunderstanding of the draftsmen, but said that the figures in the tables were correct, though no very high accuracy was claimed for them. This, Dr. Bennett said, he had clearly stated in the paper.

#### CONCENTRATION CELLS

Dr. Reinhard Beutner, of the Rockefeller Institute for Medical Research, presented a paper on concentration cells containing organic liquids immiscible with water. The author had formerly found that the skin of plants behaves



EUGENE F. ROEBBER



like an electrode reversible with respect to various positive ions. More recently he deduced that with a number of water-immiscible organic substances similar effects can be produced to those obtained with the skin of plants. This has led to further investigations into the electromotive properties of water-immiscible organic substances, and the surprising result has been reached that cells may be built up from such organic compounds and aqueous solutions showing an electromotive force which nearly equals in magnitude the emf of galvanic cells with metallic electrodes.

#### CHANGES IN COPPER SULPHATE ELECTROLYSIS

A paper by Dr. C. W. Bennett and Mr. C. O. Brown, of Cornell University, on concentration changes in the electrolysis of copper sulphate solutions, was then presented by Dr. Bennett. The chief results are as follows:

There is a definite measurable increase in potential difference in the electrolysis of acid copper sulphate solution with a rotating cathode, as the speed of rotation of the cathode is increased, from 1000 to 5000 r.p.m., for instance. The increase indicated to maintain zero current is from 0.001 volt to 0.015 volt. This can be accounted for by the increase in the rotating electrode potential, with increased rate of rotation. The increase in the potential of the rotating electrode with increased rotation is due to the tendency to form cuprous ions, the increase being greater when conditions are favorable for the formation of cuprous ions, and vice versa. As the rotation increases, the stirring becomes more efficient, the cuprous ions are removed, and the solubility of the copper is, therefore, increased. This gives rise to a higher voltage.

#### ELECTRODEPOSITION OF METALS

The two sessions on Saturday were devoted to the presidential address of Dr. W. Lash Miller and the symposium of papers on the electrodeposition of metals. The meeting was particularly interesting as the National Electroplaters' Association had been formally invited to attend it and discuss the papers, and some twenty or thirty of its most prominent members were present. The meeting, therefore, gave an opportunity for a very interesting exchange of views and ideas between scientific electrochemists, industrial electro-refiners, and practical electroplaters.

As all these papers are very concise encyclopedias of the work that has been done in the past in electroplating, it is clearly impossible to abstract them. It will, therefore, suffice to give here the titles.

Presidential address of Dr. W. Lash Miller introducing the electrodeposition of metals. He discussed and reviewed in a very clever manner the vast amount of scientific work that has been done on the various phenomena of electrodeposition, and especially on the underlying reasons of polarization. The address was a masterpiece of critical reasoning.

Other papers were on electrodeposition of gold and silver, by Francis C. Frary; electrodeposition of copper, by C. W. Bennett; electrodeposition of brass and bronze, by C. W. Bennett; electrodeposition of cobalt and nickel, by O. P. Watts, and electrodeposition of lead, by F. C. Mathers.

Mr. Proctor, founder of the National Electroplaters Association, and Mr. Hogaboom, secretary of the association, made addresses.

Dr. Wilder D. Bancroft presented the following axioms of electroplating for discussion:

1. Bad deposits are due to excessive admixture of some compound or to excessively large crystals.
2. Excessive admixture of any compound can be eliminated by changing the conditions so that the compound cannot precipitate.
3. Increasing the current density, increasing the potential difference at the cathode or lowering the temperature decreases the size of the crystals.
4. The crystal size is decreased when there are pres-

ent at the cathode surface substances which are adsorbed by the deposited metal.

5. If a given solution will give a good deposit at any current density, it will give a good deposit at any higher current density, provided the conditions at the cathode surface are kept constant.

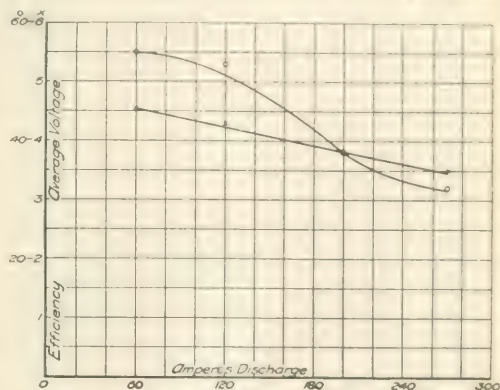
6. Treating is facilitated by a high potential drop through the solution and by conditions favorable to the formation of large crystals.

On the side of the American Electrochemical Society the chief speakers besides Dr. Bancroft were Dr. Miller, Dr. Bennett, Dr. Richards, Dr. Keith, Mr. Cowles, Dr. Kern and Dr. Cushman.

The meeting then adjourned. The next meeting of the American Electrochemical Society will be held in Denver, Col., on Sept. 8, 9 and 10, and a feature of the meeting will be a symposium of papers on the application of electrochemistry in Western metallurgy.

#### BUSINESS MEETING

The annual business meeting of the society was called to order in the morning of Thursday by the president, Dr. W. Lash Miller, of the University of Toronto. From the report of the secretary, Dr. J. W. Richards, it was learned



EFFICIENCY AND RATING FOR VARIOUS DISCHARGE RATES

that the society is in a flourishing condition, the total of the investment funds being more than \$6,000 and the membership on Dec. 31, 1912, being 135.

The result of the latter ballot for election of officers for the next year was then announced. Dr. E. F. Kucher was elected president. Dr. J. W. Richards and Mr. P. G. Salom were re-elected secretary and treasurer respectively; Prof. C. F. Burgess, Prof. S. A. Tucker and Mr. C. F. Townsend become vice-presidents, and Mr. F. A. J. FitzGerald, Dr. J. W. Brown and Dr. C. G. Schlenker became managers.

The new president, Dr. Eugene F. Kucher, formerly of Metallurgical and Chemical Engineering, was born in Lorgau, Germany, in 1857. He was educated at the University of Jena, Halle and Berlin, receiving the degree of Ph. D. from the latter in 1882. Dr. Kucher was one of the founders of the American Electrochemical Society. He served continuously as its manager in various capacities and has contributed a number of valuable papers to the transactions of the society. He contributed to the *Engineering World's* the first theory of the Edison battery with special reference to concentration changes. This theory was later confirmed experimentally by Mr. M. U. Schoop. To him was granted a United States patent, later acquired by the American Telephone & Telegraph Company, on the use of combined storage and starting batteries in automobile circuits in accordance with a theory outlined originally in our columns. For the past few years Dr. Kucher has presented our weekly *Digest of Current Chemical Literature*.

## Flood Damage to Electrical Interests in Ohio

Personal investigation by an editorial representative of the *Electrical World* made a week after the floods in Ohio served to confirm the first reports of the widespread extent of the disaster and the almost appalling destruction left in the wake of the unrestrained waters. Fortunately, in the first excitement, the loss of life was exaggerated; but in other respects the scene of desolation—the loss to many people in homes wrecked or carried away and in household effects ruined and to many manufacturers, utility operators and merchants in loss to business property and goods—can hardly be described in terms too emphatic. Of course, only a comparatively small area of the great State of Ohio was seriously affected, yet this area was large enough for twenty or more communities to be crippled; probably 500 lives were lost and a property damage of upward of \$50,000,000 was sustained. But the people of the afflicted districts are meeting the situation courageously, in the main. Stunned at first, they soon recovered and plunged with energy and determination into the work of rehabilitation amid scenes of ruin that would have unnerved the stoutest heart. Much outside relief has been given, but more will be needed. The State administration of Ohio, assisted by the cities of the State less seriously affected, like Cleveland, Cincinnati and Toledo, has responded nobly to the cry for help, and so have the national government and the nation at large, although their ministrations have been needed also for other states suffering from floods, Indiana particularly.

First-hand information relating to the damage to electrical interests in a few Ohio cities is given below. The interruption to the means of communication and transportation has made it difficult to secure accurate information promptly.

### CINCINNATI

The high water in the Ohio River, reaching perhaps 50 ft. above normal stage, did much damage in Cincinnati. But this city was so busy helping others, and notably the smaller city of Hamilton, 30 miles north, on the Miami River, that it had no time to talk about its own troubles. Moreover, a flood is usually an annual event in Cincinnati, and the business men are prepared. However, railroad communication was crippled and street-railway service was abandoned on some of the lines. It is said that in the suburb of Sedamsville the water at its greatest height was within a few inches of the trolley wires. In Riverside from 6 ft. to 10 ft. of water covered the tracks. Similar trouble was experienced in Newport and Covington, on the Kentucky side of the river. The Union Gas & Electric Company found it necessary to disconnect and remove nearly 20,000 gas meters in the flooded district in Cincinnati. These were replaced as fast as possible as the water receded. A large number of expert metermen were brought from other cities. Some damage was done to electrical structures, but the city is not only taking care of itself but is a great center of relief work, electrical and otherwise.

### COLUMBUS

Columbus, the capital of Ohio, paid a heavy toll in human life and loss of property as the result of the unprecedented floods in the Scioto and Olentangy Rivers. West Columbus presented a pitiful aspect after the calamity. But the principal business section of this busy city was not seriously affected, being on higher land. The Spring Street station of the Columbus Railway & Light Company, the municipal electric-service plant and the plant supplying electricity to State institutions, located in the penitentiary, are all near the junction of the two rivers and all were inundated. The Spring Street station is the principal plant of the central-station company, but fortunately the company was able to fall back on old plants on high ground in the emergency. Its lighting service, restricted to actual needs, and with

electric signs and ornamental lighting cut out, was available on the afternoon of March 25, when the flood came, and by 6 p. m. on that day some street cars were in operation. Industrial service was given a week later. The municipal plant resumed street lighting in the business district on March 31, and a few days later resumed service to its industrial customers, including the Kilbourne & Jacobs factory. The State plant, which supplies the Capitol, was able to supply lighting on April 1. Owing to the flood situation the Capitol was a busy place. The electric-service company was able to light the Governor's office and the Adjutant-General's office in emergency fashion, but the occupants of other rooms had to depend on candles or oil lamps for a week.

### DAYTON

Brief press dispatches from the *Electrical World's* representative who went to Dayton gave in last week's issue some faint idea of the electrical situation in that stricken yet undaunted city. Electrical men are particularly interested in Dayton, because it is one of the most progressive cities in the country from the electric-service point of view and also because Mr. Frank M. Tait, president of the Dayton Power & Light Company, is also president of the National Electric Light Association. Mere words can give but an imperfect idea of the ruin and desolation in the Gem City after the flood and the fire. The situation was radically different from that of Columbus because practically all the business district was inundated. About 150 lives were lost (as in the case of Columbus, Hamilton, Piqua and other cities, the exact number will probably never be known), while the property loss is estimated at from \$10,000,000 to \$20,000,000. All sorts of merchandise—clothing, food, cigars, furniture, coal, automobiles—almost everything—were washed from the stores and warehouses into the streets and covered with mud and slime in indescribable confusion. Asphalt pavements were torn up, poles were broken, wires were down, windows were smashed, doors had disappeared, basements were full of water, and the litter and confusion were almost past belief. At first there was no light at night except that of an occasional lamp or candle, no water to drink or bathe in, no food but that brought in from outside, no sanitary conveniences, practically no heat—in fact, hardly anything but mud, debris and gloom.

Life in Dayton was very primitive for a few days. But the Daytonians are of the breed of enterprising, optimistic Americans, and they refused to be cast down. Mr. John H. Patterson, president of the National Cash Register Company, assumed leadership because he is apparently a man possessing the qualities of a leader. Dayton is a city of progress and made an exceptionally wide use of electricity. The Dayton Power & Light Company has no competition and supplies energy to one street-railway system and about 85 per cent of the available industries. It was necessary to produce electricity at once to operate the telephone systems, the telegraphs, the fire-alarm system, furnish energy to the newspapers, light the streets, pump out the basements and get things going generally. This was Mr. Tait's task, co-operating with Mr. Patterson, Mr. Talbot (who is the engineer in charge of the cleaning up), the military authorities, the director of public safety and others. Dayton is Governor Cox's home town, and the chief executive gave it attention with the rest of the State. An emergency organization was quickly built up.

The flood, beginning on March 25, went down so that inspection could be made on March 28. In this interval Mr. Tait, like all the employees, was floodbound. It was found that there had been 6 ft. of water in the engine room of the Third Street generating station, the principal plant, and 12 ft. in the old Fourth Street plant. The latter is better situated for emergency distribution, and from it, on March 30, electricity was supplied for some arc lamps for street lighting. Gradually energy was given to telegraph



and telephone offices, relief headquarters, military headquarters, newspaper plants and other places where the need was pressing. The Fourth Street plant was in nearly entire operation by April 3. Temporary headquarters were established by the Dayton Power & Light Company in the Home telephone building. By April 7 nearly normal service had been restored outside of the flooded district. That meant that people had light in their homes.

The loss of the Dayton Power & Light Company was heavy. Practically all other electrical concerns in Dayton were severely damaged. Some rough estimates of losses to dealers and contractors are as follows: William Hall Electric Company, \$25,000; Gibbons, fixtures, \$20,000; Erner & Hopkins Company, \$7,500; E. E. Johns, fixtures, \$5,000; Brook-Walter Electric Company, \$3,000; James Atwood, \$3,000; C. Leshner Electric Company, \$2,000; W. L. Cottom Electric Company, \$500. The Dayton Globe Iron Works Company and the Platt Iron Works Company, makers of waterwheels, and the Apple Electric Company, manufacturer of automobile lighting systems and specialties, all suffered loss.

#### GREENVILLE

Service from the Greenville Electric Light & Power Company was interrupted for two days. Water flooded the boilers. It rose to within 3 in. of the engine-room floor, but Mr. D. L. Gaskill, president of the company, reports that the turbo-generators were saved by keeping down the water by means of a big centrifugal pump operated by a traction engine.

#### HAMILTON

In proportion to its size, Hamilton suffered worse than Dayton, both in loss of life and property. To an outsider the outlook was completely disheartening, but with the mottoes "Stick to Hamilton" and "Cheer up and clean up," the plucky people went to work. This city is supplied with gas and electricity by the Hamilton Utilities Company, of which Mr. E. M. Peters is president, and with electricity for street lighting and commercial service by a well-designed municipal plant in charge of Mr. James O'Toole. The private company engaged Mr. J. F. Shoemaker, of Cincinnati, as its electrical engineer of rehabilitation, and at the municipal plant Mr. W. W. Brownell, of the Cincinnati plant of the Allis-Chalmers Company, was called in as expert.

The generating plant of the Utilities Company is at the by-product plant of the Hamilton-Otto Coke Company, 2 miles north of the center of Hamilton. Here there was 7 ft. of water on the engine-room floor. Service from this plant was interrupted on March 25 and was not resumed for two weeks.

On April 2 some temporary street lighting on High Street was afforded by the Ohio Electric Railway, which rigged up bunches of five incandescent lamps in series.

There is practically no underground electrical construction in Hamilton, and poles and wires were down in all directions.

The Hamilton municipal electric and pumping plant is on Third Street, not far from the river. It contains three Ballock three-phase, 60-cycle generators, driven by horizontal piston engines and with a combined rating of about 1000 kw. Here the water stood 15 ft. over the engine-room floor on March 26. Mr. O'Toole and Mr. Brownell hoped to give service by April 9. The greatest delay was occasioned by the rehabilitation of the overhead wires, which were in a sad tangle. The damage to the municipal plant was estimated at \$75,000.

On April 4 it was reported at the municipal plant that there was sufficient coal on hand for a week for operating at no load or very light load for drying out generators and current regulators. Unless the railroads get in shape quickly, shortage of coal will cause the shutting down of a number of public-utility plants in southwestern Ohio.

#### Piqua

Piqua, a small city north of Dayton, on the Miami River, was also hit hard by the flood. The loss of life here was especially high in proportion to the size of the town. The Miami Light, Heat & Power Company of Piqua is owned by the Dayton Power & Light Company. The water rose to the engine-room floor and put the boilers out of service. The station was unable to furnish electricity for thirty hours. Mr. Mason Lytle is the superintendent of the Piqua company. When he managed to find time to get through to Dayton he reported to Mr. Tait that Piqua, electrically and figuratively speaking, was disfigured but still in the ring and that the city stood in no need of outside assistance of an electrical nature.

#### SPRINGFIELD

Springfield was comparatively fortunate, at least so far as its electric-service enterprises are concerned. Mr. Wear Parsons, general manager of the Springfield Light, Heat & Power Company, told the *Electrical World* representative on April 1 that he judged that \$2,000 would cover the flood damage to his company's generating station. Service was interrupted only four hours. But here, as elsewhere in the



FLOOD-WATER DELETED IN DAYTON, OHIO

flooded district, great difficulty is experienced in getting coal, and there is no immediate prospect of relief. The railroads are badly crippled themselves, and there seemed at the date mentioned no prospect of getting coal within two or three weeks. The State has commandeered all available railroad service where it is thought to be desperately needed, and the utilities are for the time being left to do the best they can. This situation may result in the shutting down of some plants not directly damaged by the flood.

#### TRIVION

Earlier reports of the damage to the Sandusky River Power Company's plant at Trivion were exaggerated. The W. H. Schott Company, Chicago, which has charge of the construction of the plant, reports that only a portion of one of the wing walls was carried away by the rush of water and debris caused by two old dams breaking upstream.

Water got into the basement of the generating station, and a short time will be required for the installation of wires laid in the shops and walls to the better disposition of the building is finished. A few construction tools were washed away and shipment of material by railroads were delayed. The power plant, which was to have been finished about April 20, will probably be delayed in its completion about two weeks. None of the electrical machinery was damaged, nor did the building or the dam suffer.



### Boatmen Enjoined from Mooring Craft to Electric-Light Poles

Following proceedings before Judge Quarles, the Louisville (Ky.) Lighting Company, during the recent Ohio River floods, secured a novel injunction against local owners of river boats, enjoining the defendants from mooring any sort of water craft to the company's poles along the river front. Under ordinary conditions at the Ohio falls, these poles are far above the water's edge, but the flood stage induced among the river men the practice of tying their craft to the nearest poles, endangering this equipment when swells in the river caused the captive boats to tug at their moorings.

### Edison Talking-Picture-Machine Demonstration

At a joint meeting of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, held in the Engineering Societies Building, New York, on April 4, the recently improved Edison talking moving pictures were strikingly demonstrated. The speakers of the evening were Mr. John W. Lieb, Jr., who outlined the development work in stroboscopic phenomena especially as exemplified in motion pictures, and Mr. M. R. Hutchinson, chief engineer of the Edison Laboratory, who explained some of the problems involved in making motion-picture films of an educational nature and called attention to the highly satisfactory results now obtained in combining the phonograph with the motion-picture machine.

Although the arrangement of the apparatus installed temporarily in the auditorium differed somewhat from that used in motion-picture theaters, yet excellent synchronizing was secured between the phonographic reproduction and the motion picture. The phonograph was motor-driven at constant speed, while the picture was hand-driven at exactly the same relative speed. The condition of synchronism was determined by the motion-picture machine operator by purely audible means; he was guided in maintaining exact synchronism when once established by means of a speed-setting pulley driven by belt from the shaft of the phonograph. A braking mechanism prevented the speed of the motion-picture machine from exceeding that of the phonograph, while at a lesser speed the operator was conscious of a lack of resisting torque in the manual-driving mechanism.

### Governor Sulzer Urges State Control of Niagara Water-Power

In a special message to the New York State Legislature, Governor Sulzer urges recognition of the State's right to the control of the waters of Niagara, declaring that federal regulation is properly limited to matters affecting only the navigability and commerce of the stream. The Governor's views include those of Attorney-General Carmody, who, in a report to the chief executive, makes the following statements:

"The title to the center of the Niagara River, both in the bed of the stream and in the waters that pass over it, is in the State of New York, subject also to federal control in the interest of commerce and for the purpose of protecting the navigability of the stream. Federal control under the Constitution is limited to these two purposes and the federal government has no power to regulate the diversion of water for power purposes other than that expressly given it in the Constitution.

"The State has during the last two years vigorously opposed the principle of federal control as embodied in the Burton act, which expired on March 4, 1912, since which time there has been no federal control."

Attorney-General Carmody goes at length into the opera-

tions of the two companies and says that they are operating under federal grants and acts of the New York Legislature, but he maintains that whatever rights the companies have to divert water from the Niagara River must be justified by riparian ownership and not by any grant from the Legislature. He holds this same opinion concerning grants made under the Burton act.

But he points out that neither company as a riparian owner has the right to divert the water as is done at present, basing this belief on the fact that neither company pays the State any revenue, as do the Canadian companies across the river. He suggests, in conclusion, however, the advisability of imposing a special franchise tax upon the franchises received, or upon the profits of the companies, until the State adopts a policy of dealing with the surplus waters of navigable streams.

### Invention of Suspension Insulator

The Court of Appeals of the District of Columbia handed down a decision on April 7 on the appeal brought before it in the case of Edward M. Hewlett, appellant, versus Louis Steinberger, appellee, affirming the decision of the Commissioner of Patents and awarding to Steinberger priority of invention of a disk strain insulator comprising suspension members partially enveloped by a mass of insulating material and having a disk portion provided with annular collars or flanges extending in opposite directions therefrom and generally parallel with the suspension members. The decision of the Commissioner of Patents was given quite fully in the *Electrical World*, Dec. 21, 1912, page 1300.

### National Forest Water-Power Rights Sustained Under Early Claim

Judge John A. Marshall of the United States Court at Salt Lake City has sustained the Utah Light & Power Company in its defence in the government's suit against it. The government contended that the company did not have the right to establish and maintain certain pipe lines, flumes, reservoirs, tramways, conduits, telephone or transmission lines upon national forest reserves without complying with the regulations respecting a permit.

The company contended that it had obtained its rights under Section 2339, Revised Statutes of the United States, which was enacted in the 60's for the benefit of mining companies and gave the right to establish various accessories to mining, milling, etc.

Judge Marshall held, in the matter of the complaint against the company's operations in the Cache forest, affecting the plant in Cache County, that the flume and reservoir had been established prior to the proclamation of the government establishing the forest reserve and that the company had a right to maintain them.

### Massachusetts Legislative News

The committee on public lighting gave a hearing at Boston, April 1, upon the proposed codification of laws relating to gas and electric companies. The chief point discussed was the question of giving mandatory and initiative powers to the Gas and Electric Light Commission in respect to rates, a plan recommended by the Boston Chamber of Commerce. Mr. Everett W. Burdett, of Boston, counsel for the Massachusetts Electric Lighting Association, and ex-Attorney-General A. E. Pillsbury, representing the Massachusetts gas-lighting interests, opposed this enlargement of the board's powers on the ground that its present scope of authority enables rate questions to be dealt with adequately. It was pointed out that the establishment of the plan would carry with it a large staff of official investigators.

## The Wisdom of State-Wide Regulation

"I am fully convinced that the only practical regulation of public utilities is by the state," declared Mr. W. L. Huggins, an attorney of Emporia, Kan., in a recent address before a local club, in which he discussed the history of utility regulation and the provisions of the Kansas commission law. Mr. Huggins is a member of the legal staff of the Emanuel syndicate, which leases and operates the Emporia municipal plant.

"Regulation by local communities," continued the speaker, "will cause interminable and constant friction between the public utility and the community which it serves and, will, therefore, fail to be beneficial to either. But state regulation by a utilities commission will be found not only efficient but fair to the public and just to the investors in public-utility securities. If we expect good service at reasonable rates, we must be fair to the investors in public-utility concerns. The building of public utilities and the operation of them thereafter at reasonable rates to the public both demand cheap money. In order to get cheap money you must give adequate security. The almost universal custom is to issue and sell bonds. In order to sell these, the purchaser must be assured that his investment will be protected; otherwise the investments in public utilities would be a mere speculation and no prudent man would invest his money in such an enterprise at a low rate of interest. The public utilities commission law offers this protection in two ways: First, by absolutely prohibiting the issuance of stocks and bonds based upon what has been commonly called 'water'; no issue of stocks and bonds is permitted under the public-utility law unless approved by the commission. Secondly, protection is given to the investor because reasonable rates and just regulations are assured to the public utility by the public utilities commission."

## Public Service Commission News

### CALIFORNIA COMMISSION

The engineering department of the California Railroad Commission is investigating telephone interference by high-tension transmission lines within the State. The power, telephone and telegraph companies are aiding the commission in its study of conditions.

### WISCONSIN COMMISSION

After five years of experience with the standards for gas and electric service in the State of Wisconsin as fixed by the Railroad Commission in its order of July 24, 1908, the commission is satisfied that certain of these standards are now inadequate and in need of adjustment and revision. As the conditions are such as to warrant the co-operation of all gas and electric utilities operating in the State, the commission has ordered that a public hearing in the matter be held at Milwaukee April 22, at which time an attempt will be made to establish reasonable rules, regulations, specifications and standards of gas and electric service. All public utilities concerned have been invited to attend and to take part in the discussion.

### NEW YORK COMMISSIONERS

The Public Service Commission, Second District, on complaint of the Buffalo Gas Company against the city of Buffalo has filed an order fixing the maximum rate for manufactured gas supplied to the city at 90 cents per 1000 cu. ft. The commission was not asked in this case to fix the price to be charged to individuals or corporations other than the municipality. At the present time the rate charged to the public generally for manufactured gas is \$1 per 1000 cu. ft.

The Public Service Commission, Second District, has rendered its decision in the complaint of the city of Buffalo against the Cataract Power & Conduit Company and the Buffalo General Electric Company, ordering in the case of

the first-named company a horizontal percentage from the existing rate of 28 per cent and in the case of the other company an average reduction of 2 per cent upon the basis of the revenues of 1911. The commission did not attempt to interfere with the price paid by the Cataract Power & Conduit Company to the Niagara Falls Power Company for energy nor did it find any reason for disturbing the contract existing between the Cataract Power & Conduit Company and the International Railway Company. The very elaborate opinions prepared in both cases by Chairman Stearns were made by the commission and inasmuch as only a very general summary will be available until the report is printed, the technical questions arising out of "going concern" value, general amortization and like matters cannot be considered at this time. In the case of the Buffalo General Electric Company the commission prescribes a maximum rate based upon a division of the consumers into classes as suggested by the company itself—namely, into residence lighting, general lighting, general motor service, large motor service and lighting customers, and municipal lighting. The average reduction to residence-lighting customers is 33 per cent, to general-lighting customers 28 per cent, to general-motor-service customers 32.7 per cent, to large lighting and motor-service customers 33.2 per cent, for street arc lighting 10 per cent, with no reduction in incandescent lighting and no reduction in special and feature lighting. The maximum rate for all lighting is 7 cents. For residence lighting the rate is as follows: 7 cents per kw-hr. for the first sixty hours' use of maximum demand, 4 cents for the next 120 hours' use and 1.5 cents per kw-hr. for the remainder, the maximum demand to be taken as one-quarter of the connected lighting load, which is to be determined by inspection. For general lighting the rates are as for residence lighting except that the maximum demand is taken as one-half of the connected load. For general motor service the rate is 7 cents per kw-hr. for the first thirty hours' use of maximum demand, 3.5 cents per kw-hr. for the next forty hours' use of maximum demand and 1 cent for the remainder. For street lighting a reduction has been made in arc lamps from \$56 a year to \$50 a year and from \$75 a year to \$69 a year. About one-third of the reduction in the Buffalo General Electric Company's case is due to the fact that the price paid by it to the Cataract Power & Conduit Company for electricity is reduced about 50 per cent.

## Current News Notes

**AUTOMOBILE INTERESTS INVESTIGATING FUEL COSTS.**—Owing to both the increasing price of gasoline as fuel for automobiles and the lowering quality of the distillate now furnished, the National Association of Automobile Manufacturers has authorized the Society of Automobile Engineers to undertake a thorough investigation, including research work, on the general subjects of automobile fuels, the immediate applicability of kerosene and other petroleum products and the possibilities of developing substitutes for even gasoline itself.

**ELECTRIC WATER-WORKS FORTIFICATION.**—It is a resolution offered by Alderman Lipp, is adopted by the City Council of Chicago will set up a public arc lamp station at the comparative merits of electric and steam pumps in water-works stations in Chicago. The resolution, which for some reason was referred to the Finance Committee, calls upon the commissioner of public works to ascertain the cost of operation of electric pumps in the City of Chicago and to compare the same with the cost of operation of steam pumps. The relative efficiency and economy of the two kinds of service are to be ascertained.



**CARNEGIE \$1,000,000 GIFT TO TECHNICAL SCHOOL.**—Mr. Andrew Carnegie has presented \$1,000,000 in cash to the Carnegie Technical Schools of Pittsburgh, Pa., bringing his total endowment to date up to \$8,000,000. The philanthropist's former gifts were in the form of bonds.

\* \* \*

**ELECTRIC VEHICLE ASSOCIATION OF AMERICA.**—The publicity committee on the national co-operative advertising campaign of the Electric Vehicle Association of America has begun active solicitation for contributions to the 1913-14 fund. It is the aim of the committee to raise \$75,000 this year, \$15,000 of which has already been pledged on personal solicitation. Last year the amount raised was \$41,036.52.

\* \* \*

**HIGH-POWERED RADIO SIGNALING.**—Since the appearance in our columns on April 5 of an article on the United States Navy wireless station we have learned that the *Salem* not only heard but easily copied messages from the Arlington station at night while she lay at Gibraltar. In our comment upon this article, on page 698, it is stated that by using waves 6000 m in length transmission might be effected over 500 miles. In view of the fact that the actual transmission distance exceeded 1300 miles the error in the statement is obvious; the distance should have been given as 5000 miles.

\* \* \*

**ELECTRICAL CABLES FOR PANAMA CANAL.**—The work of pulling in the cables for lighting, power and control of the Panama Canal, now under way, is expected to be completed by June of this year. The control and motor-operation systems will necessitate the pulling of 246 miles of lead-covered cable through vitrified clay ducts which have been laid at the Gatun and Pedro Miguel locks and are now being laid at Miraflores. The pulling will be accomplished by means of an electrically driven winch enabling 900 ft. length of No. 0000 B. & S. gage cable (about 2 in. in outside diameter) to be handled at one time, as against 300 ft. lengths by other methods. In addition, about 112 miles of wire will be employed for the lighting systems.

\* \* \*

**VOLTA'S ELECTRICAL INSTRUMENTS.**—Several pieces of electrical apparatus constructed by Volta during his early electrical experiments were discovered recently by Sir Henry Norman, a member of the British Parliament, in a little curiosity shop in an out-of-the-way section of a small Italian town. The uncle of the shopkeeper was Volta's cook and body servant for thirty years. On the death of the scientist he left much of his experimental apparatus with this servant, and it has since passed down from generation to generation. The collection comprises a cupboard full of old apparatus, a number of books, portraits, papers and letters and some personal and domestic articles. Sir Henry Norman suggests that the collection be purchased and presented to the Royal Institution to remain alongside Faraday's original apparatus.

\* \* \*

**"WIRELESS STATION" WITHOUT GROUND CONNECTION.**—The new wireless-telegraph station at Freemantle, Australia, which has just opened communication with Sydney, across 200 miles of the Australian continent, is operated without a ground connection, in the ordinary sense. Freemantle has absolutely no rain during the seven-month summer season, and the ground water is at a great depth below the surface. On account of the resulting extreme dryness of the climate a satisfactory ground connection for the station could not be established readily. Accordingly, an insulated counterpoise is employed instead, constituting the lower element of the electrically vibrating circuit of which the antenna is the upper. The counterpoise consists of about 100 insulated wires radiating out from the antenna tower and joined and supported by three concentric circles of wire.

## SOCIETY MEETINGS

**FACTORY HEATING AND LIGHTING.**—At a local meeting of the American Society of Mechanical Engineers to be held at the Sheffield Scientific School, New Haven, Conn., 3 p. m. April 16, Mr. A. C. Staley of the mechanical engineering department will read a paper on "Factory Heating and Ventilation." Following intermission and dinner, Mr. C. E. Clewell will at 7:30 p. m. present a paper on the subject of "Factory Lighting."

\* \* \*

**PHILADELPHIA SECTION OF ILLUMINATING ENGINEERING SOCIETY.**—At a meeting of the Philadelphia Section of the Illuminating Engineering Society on March 28 in the Pennsylvania Academy of the Fine Arts Mr. M. Luckiesh delivered a lecture on the subject of "Light and Art." The effects of direction, color and quantitative distribution of lights on objects of architecture and sculpture and on paintings were demonstrated by the speaker.

\* \* \*

**INSTITUTE OF RADIO ENGINEERS.**—At a meeting of the Institute of Radio Engineers on April 2, Messrs. A. E. Seelig and F. van der Wonde, of the Atlantic Communication Company, presented a paper on the Sayville (L. I.) high-power radio-telegraph station. The description was of a general rather than purely technical nature and was illustrated by a number of good lantern slides. Much interest was shown in the paper, and the extended discussion was for the most part in the form of questions. In the absence of the president, Mr. G. W. Pickard, the chair was taken by Mr. R. H. Marriott, who commented upon this paper as the first detailed description of a powerful radio plant to be made public by presentation before a general engineering body. A vote of thanks was extended to the authors by the Institute. The next meeting will be held at Fayerweather Hall, Columbia University, on May 7.

\* \* \*

**PARALLEL SESSIONS FOR GALVESTON CONVENTION,** MAY 21-24.—The ninth annual convention of the Southwestern Electrical and Gas Association, at Galveston, Tex., May 21-24, will be a four-day meeting instead of three days as heretofore, since the association has so increased in scope and numbers as to necessitate more time for its proceedings. In addition, it has been found necessary to have "parallel sessions" for electrical, gas and accounting members. One full session will be given up to the supply men, to be followed with a Jovian rejuvenation. A large attendance is anticipated from the East and North. Two special cars have already been reserved from St. Louis to Dallas, where it is expected to "hitch on" enough Texas delegates to make a solid "convention train" through to Galveston. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary of the Southwestern Electrical and Gas Association.

\* \* \*

**SONS OF JOVE AT PITTSBURGH.**—At the luncheon of the Jovian League of Pittsburgh, held at the Fort Pitt Hotel, April 3, Mr. J. C. McQuiston, manager of the Westinghouse department of publicity, read a paper on the subject of "Efficiency in Local Advertising." This paper was originally presented before the Society for Electrical Development at New York City, March 5, and was repeated at the request of the Jovian League. The remarks on the electrical pages in newspapers brought forth considerable discussion. On motion a committee was appointed to consider the matter of electrical advertising for Pittsburgh, Statesman M. F. Knapp naming as members Messrs. F. R. Fortune, chairman; George W. Smith and J. C. McQuiston. Statesman J. Crawford Bartlett, of Philadelphia, was also present at the meeting and gave an interesting account of what is being done in the Quaker City to push the sale of electric vehicles.



## Swiss Hydroelectric Developments

Statistical data on water-power developments, with comparison of steam and gas-electric plants and transmission systems—Notes on some typical plants

THE pioneer hydroelectric plant in Switzerland is that at Heerbrugg, in the district of St. Gall, built in 1887. Hydraulic stations for production of electricity have since sprung into existence in all parts of the country. In 1911 there were 783 plants in operation. Of this number 473 were distributing systems. Of the generating systems 233 were wholly or partly hydroelectric stations and only 77 were steam or gas plants. Comparing the above figures with those of only one year previous, when there were 675 electric plants, 383 of which were distributing systems, 228 hydroelectric generating stations and 64 steam or gas-electric plants, it will be seen that there was an increase of 108 plants in one year.

Though there were only seventy-seven steam or gas plants, all of which are small, many of the hydroelectric works have auxiliary steam or gas engines as stand-by equipments. Some of the most important sources of water-power are rivers supplied by glacial waters which at certain times of the year are very low. The Rhine River, for instance, at the point where the important Laufenburg plant is being constructed, ordinarily discharges from 132,000 gal. to 176,000 gal. of water per second, but the flow is reduced to about 60,000 gal. during nearly two months each year.

In addition to the power plants enumerated above there are many isolated plants which furnish energy to individual factories or small railways.

### LEGISLATIVE PROTECTIVE MEASURES

The federal government has long realized the great importance to Switzerland of proper legislation to protect the waters and prevent foreign firms from securing control over the rivers and streams. In 1906 a resolution was passed to the effect that no concession for the transmission into a foreign country of electricity generated by water-power within Switzerland should be granted without the approval of the Federal Council. Such concessions would be approved only in case the energy was not needed in the Confederation, and grants of twenty-year duration were allowed, but these could be withdrawn at any time that public necessity demanded such action. In the district of Ticino, on the Italian border, concessions had been granted for the sale of energy to Italy, and it was feared that if similar arrangements were made by other boundary districts for granting such rights to German, Austrian and French firms, Switzerland in time would be unable to obtain the power required for its own uses.

As new fields were constantly being developed for elec-



FIG. 1—THE CAMPOLOGNO PLANT OF THE CANTON OF VALAIS

trical enterprises and the proposal to electrify the entire system of federal railways was actively advocated, popular opinion urged that further legislation upon the subject should be adopted. By an amendment to the national constitution in 1908 the Federal Council thus obtained nominal control over the utilization of hydraulic power, and the transmission of water-power, or electric energy derived



FIG. 2—EXTERIOR OF THE CAMPECOLOGNO PLANT

therefrom, into a foreign country was prohibited except when a special license was granted by the council.

The districts retain the right of taxation, fixing concession fees and making such restrictions as may seem best adapted to the general welfare. In practically all cases the district governments themselves make these regulations, but in some districts the community or town officials have this authority. Taxes for the use of water-power vary in the different districts, and range, on an average, from \$0.60 to \$1.16 per hp-year.

These laws in no way give the government a monopoly over the use of rivers and streams for hydroelectric purposes, and when the proposed electrification of the state railways takes place the government will be obliged to purchase either the energy or the water rights for stations from the various districts or individual owners.

Prof. W. Wyssling, of Zurich, one of the foremost author-

TABLE I—RATING OF SWISS GENERATING PLANTS

Rating of Plants, Kw	Number	Total Production, Kw	Rating of Plants, Kw	Number	Total Production, Kw
500 or less	97	9,926	10,001-15,000	2	25,920
501-1,000	18	12,407	15,001-20,000	1	18,800
1,001-2,000	11	14,955	20,001-30,000	2	48,334
2,001-3,000	4	9,770	30,001-40,000	1	39,470
3,001-4,000	9	31,417	40,001-50,000	1	41,300
4,001-5,000	2	9,040			
5,001-6,000	2	11,290			
6,001-10,000	8	62,671	Total	158	335,300

ities on the subject, estimated that Swiss waters are capable of furnishing 2,000,000 hp, and of this amount from 500,000 hp to 700,000 hp is now developed, 390,600 hp being used for the generation of electrical energy.

Some idea of the size and importance of the Swiss plants may be derived from Table I, which includes 158 of the 233 existing generating stations.

#### COST OF INSTALLATION

Data as to the cost of the plants have been obtained from 303 electric stations. Of this number 178 were generating plants and all but twenty were hydroelectric works. The output of these 178 plants is 342,122 kw, the combined cost of their hydraulic installations \$39,677,133, and that of the electrical part of their plants \$32,379,803. From these fig-

ures it is found that the average cost of construction of the Swiss hydroelectric plants is \$210.62 per kw produced. The cost per unit of production is considerably greater in the smaller plants than in the large ones. For example, the kilowatt cost of construction of the plants producing less than 100 kw was \$466.87; of plants producing 100 kw to 100 kw, \$281.01; of plants of 5000 kw to 6000 kw, \$177.17, and of the 20,000-kw to 30,000-kw plants, only \$161.35.

While only 158 of the equipments from which data have been obtained are hydroelectric, 20 being steam plants and the remaining 125 distributing systems, it may be interesting to note the kinds of current used, which will give an idea of general conditions prevailing in the country. Fifty-one plants have only direct current, 210 have alternating current, and 42 have both direct and alternating current. Of the 210 alternating-current plants the great majority use the three-phase or the single-phase and the three-phase systems.

Of the 132 plants in the Confederation employing high-tension transmission, 59 use the three-phase, 29 single-phase and three-phase, and 20 the single-phase system. For lighting and motor service three-phase energy is used by the large majority of plants.

Ordinarily 2000 volts or 4000 volts is employed for transmission. The following high-tension systems are in operation: the Aigle and La Goule systems, each of which transmits energy at 20,000 volts; the Rheinfelden, Lucerne-Engelberg, Wangen, Fordola-Lugano and Neuchatel systems, 25,000 volts; Thusis-Hauterive system, 32,000 volts; Altdorf and Zurich-Albula system, each 40,000 volts; the Beznau-Löntschi and Bernische stations, 45,000 volts, and the Brusio plant 50,000 volts, all of these being alternating-current systems. The Chaux de Fonds and Réseau plants transmit direct current at from 14,000 volts to 15,000 volts and the St. Maurice-Lausanne plant at 25,000 volts.

For lighting purposes the usual emf is 120 volts, although thirteen systems use 240 volts.

#### LENGTH OF TRANSMISSION LINES

There are 181 plants supplying energy to distant localities by overhead transmission lines, the total length of which is 4604 miles. The longest individual line is that of the Kander-Hagnek plant, above the Lake of Thun, 452 miles in length. Besides the above there are 3896 miles of overhead distributing lines supplied by 284 power sta-

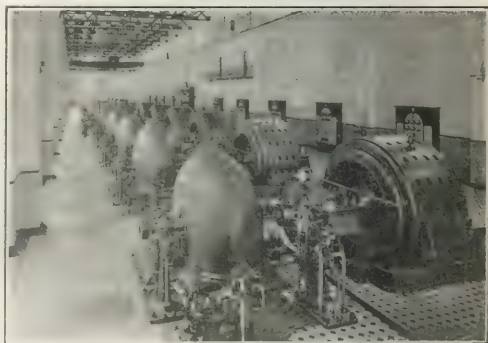


FIG. 3—INTERIOR OF THE CAMPECOLOGNO PLANT

tions. The largest is that of the Hauterive plant, in the district of Neuchatel, measuring 623 miles. Underground systems are rapidly coming into use in Switzerland, especially in the large cities, as is shown in Table II.

Of the fifty-seven plants mentioned in the second column, twenty-four had less than 1 km (0.62 mile) of tube line, this being also true of forty-one of the seventy-nine plants given



in the last column. The longest underground transmission line is in Geneva, 46 miles; the length of cables is greatest in Zurich, 109 miles. Zurich also possesses the longest underground distributing lines, the length of the tubes being 110 miles and that of the cables 590 miles.

The latest census of electrical works in Switzerland was taken in 1910, when it was found that there were 666 water

TABLE II—EXTENT OF UNDERGROUND SYSTEMS IN SWITZERLAND

	Transmission Lines		Distributing Lines	
	1909	1910	1909	1910
Number of stations.....	57	57	77	79
Total length of tube lines, miles	210	254	436	448
Total length of cable, miles..	413	444	1,367	1,465
Total length of core, miles..	999	1,061	1,972	2,184

turbines in operation in the various plants, the total rating of which was 282,900 hp. The supremacy of the hydraulic works over other kinds of power stations is shown by the fact that there were only eighty-six steam engines and seventy-nine gas engines in use. The census returns gave the number of generators in the country as 850, of which 335 were direct-current, 80 single-phase, and 435 polyphase current. Their total generative power was 350,560 kw. There were also ninety-eight storage batteries installed in seventy-five plants, with a combined rating of 22,470 kw-hr. The number of transformer stations was 5194, containing 9055 transformers, with a total rating of 243,722 kw. The largest number of transformers was on the Geneva system, where 1431 were in use. Several small isolated plants have not been included in the above figures. They would increase the amounts given by about 7 per cent.

Statistics for 1910 give the amount of power used for motors as 160,000 kw, that used for lighting as 106,500 kw, and that for heating and cooking as 27,300 kw. The number of 50-watt lamps supplied with energy was 2,130,000, as compared with 1,968,000 lamps in 1909. The number of

tariff for lighting is 12 cents per kw-hr. in the winter and 10 cents in the summer, and for motor service 2 cents to 4 cents per kw-hr. with discounts up to 30 per cent for large contracts.

For motor service the following monthly prices are charged in Basel for alternating current of 50 cycles and 500 volts: Up to 500 kw-hr., 4.82 cents per kw-hr.; from

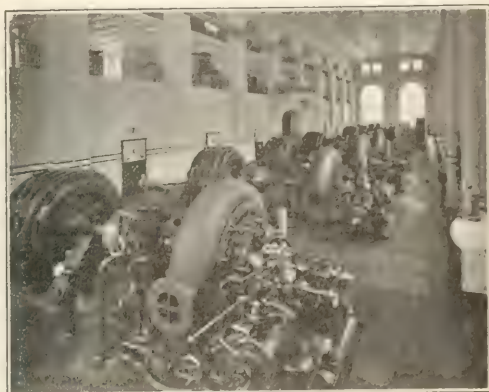


FIG. 5—INTERIOR OF ALBULA PLANT

501 kw-hr. to 1000 kw-hr., 3.86 cents; from 1001 kw-hr. to 2000 kw-hr., 2.89 cents; for 2001 kw-hr. or more, 1.93 cents.

#### LAUFENBURG POWER STATION

When completed in 1914 the Laufenburg plant will be the largest hydroelectric station in Switzerland. It is being built at Laufenburg on the Rhine. About 50,000 hp will be developed by utilizing the fall of a cataract over one-half mile in length. A dam with four sluiceways is being constructed just below the cataract, raising the level by 26 ft. to 35 ft.

At this point the Rhine discharges from 132,000 gal. to 176,000 gal. of water, which during two months of the year is reduced to 60,000 gal.

The power station will contain ten turbines, each directly coupled to a 5200-kw, three-phase generator. The voltage of the generators will be between 6000 and 6600, which will be raised to 47,000 by three-phase transformers. The sluiceways of the dam and the sluice valves of the turbines are to be operated by motors supplied with energy from a storage battery.

#### BRUSIO POWER STATIONS

The Brusio Power Company is the largest hydroelectric firm operating at the present time in Switzerland. It utilizes the mountain streams in the district of Graubunden, between Campegg and the Lake of Poschiavo, and the glacial waters descending into the Val di Pila from the celebrated Bernina Range. The company has three stations, near the Italian frontier, and the energy generated is distributed all over northern Italy by the Lombardo Electric Company of Milan. A part of the energy is used by the Bernina Railway and the remainder for lighting and motor service. In the near future this company is to furnish energy for moving rolling stock on the Rhaetian railway.

The Campegg plant, the largest of the three, at over 40,000 hp, derives its water-power from the Lake of Poschiavo, which forms a natural reservoir of 2,640,000,000 gal. capacity at an altitude of 2000 ft. Water is taken from the lake by means of a siphon carried to the forebay through a tunnel 3.5 miles in length cut through solid rock. From the forebay the water is carried through five steel pipe



FIG. 4—ALBULA PLANT WITH COVERED PENSTOCKS

motors was 31,640. In 1910 there were 183,677 purchasers of electric energy in Switzerland, 141,996 using energy for lighting purposes, 22,232 for heating and cooking and 19,449 for motors.

#### RATES

Prices of energy for lighting and industrial purposes differ greatly in the various districts. In Berne the municipal



lines, descending the mountain side in straight paths to the turbines. The length of each headrace is over one-half mile, with an average diameter of 2.5 ft. The head of water is 1300 ft. The power-house equipment comprises twelve 3200-hp high-pressure Pelton turbines directly coupled to 7000-volt, 50-cycle, three-phase generators. There are also four 250-hp direct-current exciters.

The Robbia station is near the town of Poschiavo and takes in water at Cavaglia, at an altitude of 5100 ft. The water is carried through a tunnel 383 yd. in length and about 30 in. in diameter to the turbines. The total head of water is 1800 ft. The equipment consists of two units of 3000 hp and two exciter units of 150 hp, while a third unit of 3000 hp is now being installed.

The energy supplied to the Bernina Railway is transmitted at 23,000 volts and that for Italy at 50,000 volts. The two power stations are connected by a high-tension line over 9 miles long, operating at 50,000 volts. A short distance from Campocologno, on Italian territory, is a large transformer station, belonging to the Lombardo Electric Company, which is connected with the Campocologno plant by two high-tension lines, one being a 7000-volt underground line and the other a 50,000-volt aerial line. From this point the energy is carried into Italy by two transmission lines each 112 miles long.

Two new dams now nearly completed will increase the capacity of the Lakes of Bernina by storing all the summer water from the mountains to be used in the dry winter season. This storage will create an additional water supply of 2,640,000,000 gal. One of the dams is 33 ft. high and the other 75 ft. high.

#### ALBUA-ZURICH PLANT

The Albuia-Zurich power plant, owned by the municipality of Zurich, uses the water-power of the Albuia River between Sils and Alvaschein. The dam is built near the latter town, about 70 miles from Zurich. From the basins the water runs into a tunnel 4.5 miles long, with a cross-sectional area of 78 sq. ft., which carries the water to the forebay. About 20,500 hp is developed and with the reserve plant 24,600 hp. The plant consists of eight 3000-hp

This plant supplies the city of Zurich with energy for the tramway system, lighting and motor service. According to the terms of the concession, Zurich must deliver energy to some of the towns and communities interested in the water rights, partly gratis and partly at reduced prices. The energy for this purpose is delivered at 6000 volts, the emf being stepped down to 250 volts for distri-

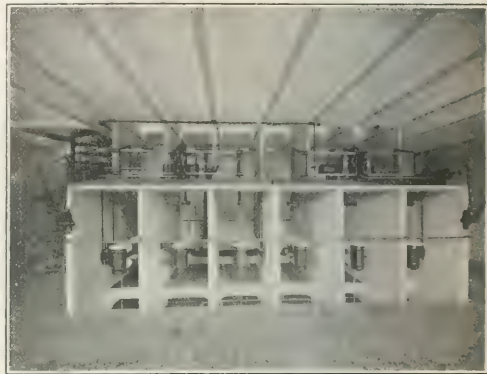


FIG. 7—SWITCH COMPARTMENT IN ALBUIA STATION

bution. At Zurich the emf is stepped down to 6000 volts to provide for feeding the primary side of the distribution network

#### ALTDORF AND AUGST-WHYLEN STATIONS

The Altdorf hydroelectric plant is also important and interesting. The company has the sole right to use the waters of the three streams, Leutschach, Intschialp and Arni. The combined drainage area of these rivers is estimated at 6313 sq. miles. The outlets of a small lake in the neighborhood are stopped by dams, making a storage reservoir of 48,500,000 gal. capacity, which may be increased to 75,000,000 gal. by making the dams higher. There are two other mountain lakes in the vicinity in which 484,000,000 gal. might be stored.

The intake of the Leutschach pipe line is 4592 ft. above sea level. The first 459 ft. of this line consists of cast-iron pipes of 23.5 in. diameter, carrying the water to a collecting shaft, from which it runs through a cement-pipe conduit 1870 ft. long and 31.5 in. in diameter to the storage reservoir. The vertical height between the water surface of the reservoir and the turbine shaft is 2791 ft. At present there are two waterwheels for a head of 2788 ft. to 2854 ft., developing 1300 hp and 3000 hp respectively. The turbines are of the horizontal type with automatically governed needle nozzles as well as water-jet deflectors. Each delivery can be closed by a piston valve of 11.8 in. diameter. The generators are directly coupled to their respective turbines.

Another important plant is the Augst-Whylen water-power station, near Basel, on the Rhine River. Since this river marks the boundary line between Germany and Switzerland, half of the total available power of about 30,000 hp must be taken into Switzerland and half into Baden. The dam has a total length of 700 ft. and contains ten sluices, each 57 ft. in width, and each divided by nine piers 14 ft. wide and 60 ft. long. The piers and dam sills have their foundations in solid chalk rock and consist of concrete faced with granite. The Augst power plant of 15,000-hp rating consists of ten turbines, to which are directly coupled 10,000-volt, three-phase generators. The Whylen power house will also have an equipment of ten turbo-generators, each of which will yield 2200 hp at 107 r.p.m. at a fall of



FIG. 6—47,000-VOLT TRANSMISSION LINE BETWEEN SILS AND ZURICH

turbo-generators generating three-phase current at 7000 volts, which is stepped up to 47,000 volts for transmission to Zurich. The conductors are carried on two separate lines of poles, or masts, the sectional area of the conductor being 0.077 sq. in. per wire. The maximum power transmitted is 13,500 kw at 47,000 volts, corresponding to a tension of 40,000 volts at the Zurich end of the line.

## OTHER IMPORTANT PLANTS

Among other important works may be mentioned the Ackersand electric plant at Gampel, 11,000 hp; Beznau-Löntsche power plant, Beznau and Döttlingen plants, 14,500 hp, and the Netstal plant, 36,000 hp; Gampel Electric Works, two plants, 10,000 hp; Gordola Company, near Lugano, 10,000 hp; Hauterive Works, in the district of Neuchâtel, 9800 hp; Lugano Electric Company, Lugano, 10,000 hp; Lucerne-Engelberg Company, Lucerne, 8600 hp; the Rheinfelden station at Baden, 16,800 hp, and the Wangen electric station at Bannwil, near Wangen, 10,500 hp. For the information contained in this article we are indebted to Mr. Harry A. McBride, United States vice-consul at Zurich.

## Use of the High-Tension Direct-Current Thury System in Mines

At a meeting of the Western Local Section of the Institution of Electrical Engineers (England) on April 14, 1913, Mr. Sidney F. Walker will present a paper on the application of direct current on the Thury system in mines. The author calls attention to the fact that it is not merely a system of high-tension continuous currents that Thury has introduced. It is a system in which high tension is incidental, but in which the principal features are the fact that the circuit is always closed, no matter whether any work is being done or not, and no matter how much or how little work is being done, and that the current passing through the whole of the circuit is constant.

It is also mentioned that while with the Thury system every apparatus supplied directly from the service must form part of the circuit in which the generators are also included, it is perfectly practicable to supply energy under other systems, such as the low or medium constant-pressure service or the three-phase service, by the use of motor-generators. This is shown diagrammatically in Fig. 1, in which a low-pressure generator is shown, driven by a motor in the constant-current circuit. A three-phase generator could be run equally well. It will be seen from this that the system is at least as flexible as the three-phase alternating-current system.

### THE CONSTANT-CURRENT SERIES MOTOR

One of the important features which Thury has developed in connection with his system is the complete supersession of the starting switch and resistance, and of the regulating switch and resistance for his motor. The use of either constant-pressure, continuous-current motors or wound three-phase rotors in mines frequently causes trouble from the starting and regulating resistors employed in both cases and from the switches used in connection with them. For variations of speed both these types require some form of controller which easily gets out of order. The method of varying the number of poles in operation for varying the speed of a three-phase motor is not sufficiently flexible for mine work.

In the constant current series motor all the factors except the speed are constant, and it follows that the work performed by any given constant current series motor may be varied at will by varying the speed. For the greater part of the work about a mine this type of motor, designed with its maximum speed at a little above the normal speed required by each machine to be driven, allowing, of course, for any reducing gear that has to be provided, should fulfil all requirements. A moderate increase of speed is obtained at will and any decrease that may be required down to zero.

### METHOD OF VARYING THE SPEED

In Fig. 2 is shown diagrammatically a ring armature with twenty coils and twenty segments in the commu-

tator, and with one pair of field magnet poles and one pair of brushes.

Assuming for the moment that armature reaction is absent, the collecting points for the brushes will be at opposite ends of a diameter at right angles to the line passing through the center of the field magnet poles, as shown in the figure. This is the point where sparking is least, and where with the most modern machines it has been reduced to a minimum.

As is well known, the armature of a two-pole continuous-current dynamo consists of two halves, each half having exactly the same number of coils. Only thirty coils are shown in the diagram for the sake of simplicity. In the practical dynamo there is a very much larger number. As is also well known, there is normally a current through the armature from the negative brush to the positive brush dividing equally between the two halves of the armature.

If, however, the position of the brushes be altered, instead of each half of the armature producing equal pressures, the balance is upset, and certain coils will furnish pressure in the opposite direction. This is the method which Thury has employed. It will easily be understood

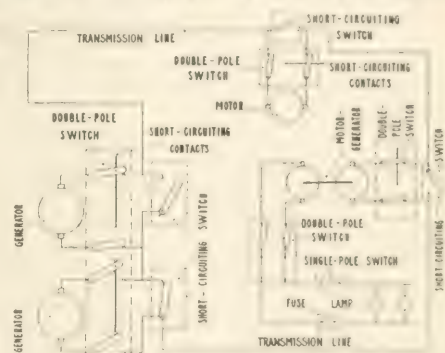


FIG. 1. GENERAL LAYOUT OF DIRECT-CURRENT SYSTEM

that as the brushes are moved forward in the direction of rotation, more and more of the ends of each half of the armature are acting against the main poles, and finally, at a point which is known as commutation, with brushes of this type as the neutral point, the pressure delivered is nil. Fig. 3, which is a development of the commutator section, but with only fourteen instead of twenty coils, shows this more clearly.

Considering the machine as a motor, it will be evident that the same reasoning applies, and the whole of the coils do their best work when the two halves of the armature run in the case of a two-pole machine, follow in an exactly similar manner. Also, as the brushes are pushed backward more and more coils will act against the main body of the coils until the two sets of coils, from backward to forward motion of the armature are thus acting. In every position of the armature, will be equal, and an equal will be furnished.

The method which Thury has adopted for avoiding the difficulty of sparking is a development of the commutating or interpole system. As he expresses it, his ordinary field-magnet poles are really commutating poles, inasmuch as they perform the same function as the interpole poles in series machines; the ordinary field magnets are so arranged, the brushes are pushed forward, and it is proved that the equivalent of the commutating poles or interpole pressure is produced.

There are other methods of varying the speed, but Thury's constant-current motor, under the name of the Thury's constant-current motor, is the only one which runs at a constant speed. The speed is varied by the brushes being moved forward, and by pressing the brushes with the



speed constant, and third, by a combination of the two. With each arrangement commutation is sparkless.

#### APPLICATION TO THE DRIVING OF DIFFERENT MACHINES

For the great majority of machines about a mine the application of the constant-current series motor presents no difficulty at all. No starting or regulating resistors are required, but an insulating coupling between the motor and

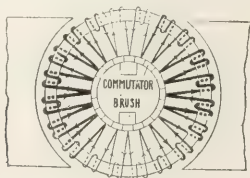


FIG. 2—ARMATURE OF DIRECT-CURRENT SERIES MOTOR

the driven machine has to be provided. In cases where variable speed is needed this is accomplished by rocking the brushes and this can be done either by hand or automatically.

There are two very important machines about any colliery, the winding engine and the coal-cutting machine, which present very difficult problems. For the driving of the coal-cutting machines the author suggests the use of constant-current series motors. They should not, however, be included in the main circuit but be operated by a motor-generator set, the latter being in the main circuit and furnishing energy for the driving motor at, say, 100 volts direct current. A number of motors could be furnished with energy from one motor-generator set. The motor driving the coal-cutting machine would have no starting switch; it would be started by rocking its brushes. The author suggests that this might be accomplished by means of a lever outside the case of a totally inclosed motor, in very much the same way as switches inclosed in gas-tight switch boxes are worked by levers on the outside of the boxes. An arrangement of this kind overcomes all the difficulties attendant upon the possibility of coaldust getting between the brushes and the commutator, and the possibility of sparking at the starting switch of the motor; while the efficiency of the motor would be very much higher than that of the alternating-current squirrel-cage high-resistance-rotor machine. The only switch to be employed in the arrangement would be the gate-end switch, which again would be a short-circuiting switch. There would be a switch for each machine, the whole being in one circuit. Working at the low pressure of 100 volts direct current with a single machine, shocks should be practically eliminated. Even with five coal-cutting machines on one circuit the total pressure would only be 500 volts and might be reduced by constructing the motors for lower pressure.

The difficulty in the winding problem lies in the fact that the load varies constantly throughout the wind and during the latter portion of the wind is reversed or negative. During the first portion of the wind, power is being demanded to lift the cage and the rope, and to overcome the friction of the rope over the pulley, of the pulley upon its axle, and of the drum upon its axle. As the wind proceeds, however, the descending cage gradually acquires momentum, while the work demanded by the ascending cage is being steadily reduced, owing to the decreased length of the winding rope. When the descending cage has acquired a sufficient momentum to overcome all the resistances then existing in the system, no power is required, and as the wind proceeds further, the continually increasing momentum acquired by the descending cage delivers energy to any apparatus that can absorb it.

Fig. 4 shows a curve taken from an actual wind, driven by a Thury electric motor. The quantity of coal to be raised was 1200 tons in eight hours, at  $2\frac{1}{2}$  tons per wind.

the depth of shaft being 1000 ft. It will be seen that during the acceleration period the power absorbed rises steadily to 930 hp, then it descends rapidly to 515 hp, then more slowly to 260 hp, and from this the power falls straight to zero, and the descending cage then commences to deliver energy to the system at an increasing rate till the maximum of 770 hp is reached. Then the curve returns to zero, the rate of delivery of energy to the system steadily decreasing till the cage comes to bank. The total time occupied by the wind is forty-five seconds, of which the acceleration period occupies eleven seconds, and the period during which energy is being returned to the system only four seconds. In the Siemens-Ilgner system, which is a modification of the Ward-Leonard system, and in which the important feature is the use of the flywheel, the flywheel absorbs the energy delivered by the descending cage during the later portion of the wind, and redelivers the energy so absorbed, less a certain charge for its own friction, to the winding motors at the commencement of the next wind. In so doing, it will be remembered, the flywheel and its accessories perform two distinct offices; they lessen the power demanded from the power station, and they also lessen the variations in pressure in the distribution system, and at the busbars of the generating station, that otherwise would be caused if the heavy currents demanded for the wind were taken straight from the busbars. It will be remembered, however, that, beautiful as the system is, in practice it is subject to certain slight drawbacks. The power demanded from the generating station is relatively high as compared with that usefully employed in the wind. Notwithstanding this, the economy obtained over the ordinary steam wind is very considerable. The weak point in the system is that the flywheel will not deliver its stored energy at a sufficiently rapid rate to relieve the distribution service unless special appliances are provided to cause an increased slip of the three-phase motor where that is employed. Practically the economical working of the system, and the protection of the three-phase distribution network, depend upon the successful working of the slip regulator.

With the constant-current series system it is claimed that the automatic regulation of pressure at the generators is so perfect that it is necessary to utilize only one or two of the generators to vary the pressure in response to the variations in the demand for power by the winding engine. It is recommended, however, to insert a constant-current series motor in the circuit, the motor having a flywheel mounted on its axle in the usual way. One such motor is

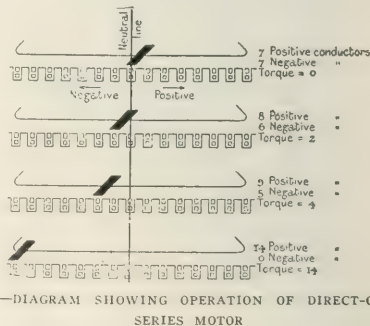


FIG. 3—DIAGRAM SHOWING OPERATION OF DIRECT-CURRENT SERIES MOTOR

said to take care of several winding drums. It will be remembered that the constant-current series machine works equally well as a motor or as a generator; it is only a question of motion and the position of the brushes. Consequently a machine of suitable size placed in the circuit and installed in the generating station will absorb all the energy that is given out by the descending cages of several



winding engines, and will give out the stored energy on the commencement of the next wind. If preferred, the constant-current series motor may be arranged to drive a constant-current series generator, the flywheel being mounted as usual between them through an insulating coupling and the generator furnishing constant current for several winding motors. One advantage of this arrangement is that the winding-motor circuit can be at low pressure and it will have all the advantage of the Thury system without the high pressure.

The winding drums can be arranged in pairs and the system worked so that the acceleration period of one winding drum coincides partly with the period during which the other drum is returning energy to the system so that the electrical service will only have to make up the difference between the two.

The Thury system can also be applied for winding to a three-phase system. A three-phase motor drives a constant-current direct-current generator, a flywheel being mounted between them and the continuous-current generator furnishing energy to constant-current motors driving the winding drums. This arrangement is in operation at the Auchincruive pits of the Wm. Baird & Company's mines in Scotland, the continuous-current generator furnishing energy in the manner described above.

Fig. 5 shows the efficiency curve of a constant-current series motor used for driving a winding drum. The maximum power furnished is 935 hp, the efficiency then being 95 per cent. The efficiency curve is almost flat, there being no decrease when the power delivered is reduced to 561 hp, while at 374 hp it has only fallen to 93 per cent, at 280 hp to 92 per cent and at 160 hp it is 90 per cent, while at 90 hp, or one-tenth of full load, it is still 80 per cent.

As to the fan engine it presents no technical difficulties for any system. It presents an ideal load, always the same from Monday to Saturday. The speed of the fan is changed slightly in order to meet the requirements due to change in barometric pressure and also to occasional change in operating conditions. Owing to these facts the constant-current series motor is said by the author to be very much superior to the three-phase alternating-current motor. The former enables the speed to be varied without the slightest trouble of any kind, without any wasteful resistors or other complications. All that is required is the rocking of the brushes through a small arc of the commutator. It is also mentioned that lowering or increasing the speed of the motor, the fan or any other machinery involves no decrease of efficiency, within very wide limits.

In driving air compressors with constant-current series motors no difficulty whatever is encountered in varying the speed of the motor either by hand or automatically in accordance with the requirements of the air receiver. In both cases the speed regulation is obtained by rocking the brushes, and where the regulation is to be automatic it can be accomplished by a device somewhat similar to that which regulates the pressure of the generator.

#### APPLICATION OF THE SYSTEM TO INDIVIDUAL MINES AND TO GROUPS OF MINES

In considering mine service as a whole it will, perhaps be well to note a few points. Up to the present such service has been worked usually at 100 amp or 150 amp, while 50 amp could be used in special cases and 200 amp is being considered for certain other cases. There are not, however, any lamps of any type, to the author's knowledge, which could be operated on such system. Special arrangements will, therefore, have to be used for lighting of the mines, such as direct-current generators driven by constant-current motors.

It should also be mentioned that there are limits as to the size of motors that can be worked with the constant-current system. The smallest motor at present being rated at 5 hp.

Where the constant-current service is to be applied to a single pair at mines requiring only a moderate quantity of power, the arrangement is very simple. The power station can be placed at any convenient position, not necessarily as close to the mine as it is with the constant-voltage system, as the cost of cable between the power station and the mine will not be so heavy. It can be placed where it is convenient to bring the fuel and to obtain water for condensing, which is not always in the neighborhood of the pit mouth. The motor-generator for the lamps and small motors on the surface would probably be placed in the power house. Below ground, the cables would be led into the different districts, just as they are now, but with the difference that they would form one continuous circuit, in place of circuits being branched as on the three-phase system. Each motor would be protected by an automatic and a hand short-circuiting switch. Each section and the

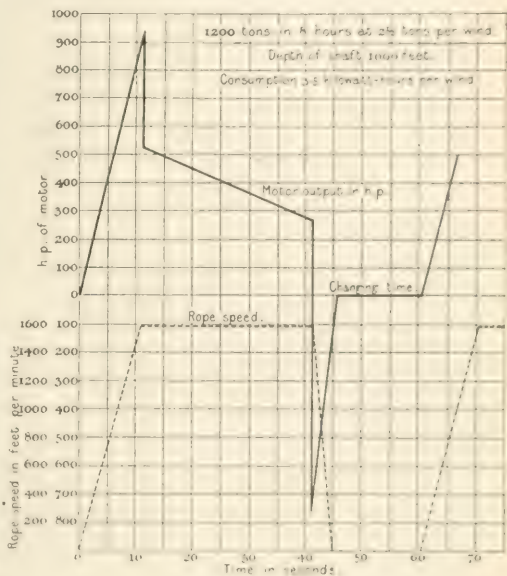


FIG. 4—OPERATING CHARACTERISTICS OF MOTOR DRIVING WINDING DRUM

whole of the mine would be protected in the same way, so that in case of anything happening in any part of the mine that section would be automatically short-circuited; and in case of anything of importance happening to the mine as a whole the automatic short-circuiting device at the pit mouth would cut off the whole of the mine circuit.

For a group of mines two methods are available. The whole of the large motors in all the mines could be arranged in one circuit. The arrangement would be very similar to that for a single pair of mines, but several pairs would be included in the system. Motor-generators would be provided for the lighting and small motors on the surface, and for the lighting and coal-cutting underground. Each mine would be protected by the automatic short-circuiting device mentioned; also each district of each mine, each motor, the surface motors, and the portions of work on the surface.

In the other method a motor-generator would be fixed at each mine for supplying the power required for the mine itself, also a motor-generator for the lighting and small motors on the surface, the larger motors on the surface being either included in the main circuit or supplied from the motor-generator furnishing energy for the mine, or

again from a separate motor-generator. The energy supplied to the mine would be at a lower pressure than that of the main circuit, but the other arrangements would be the same. Two cables would be taken down the shaft, and would be carried into each district, the cables being in series in the same way as described for a single mine. Each district again would be protected by an automatic short-circuiting device, and the constant current motor

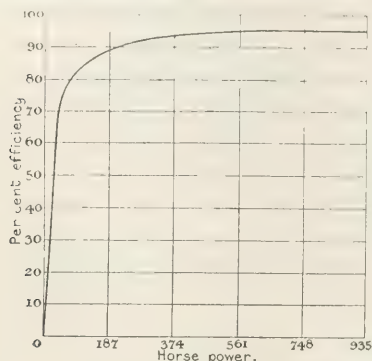


FIG. 5—EFFICIENCY CURVE OF DIRECT-CURRENT SERIES MOTOR DRIVING WINDING DRUM

driving the constant-current generator supplying the mine would be protected in the same way.

#### THE AUTOMATIC SHORT-CIRCUITING DEVICE

The automatic short-circuiting device is equivalent to the ordinary circuit-breaker. It consists of a solenoid energized by a current in parallel with the section of the circuit to be protected. The core of the solenoid forces a contact piece into connection with two contacts joined to the two sides of that section of the circuit. The pull of the solenoid is opposed by a spring that can be adjusted. The apparatus is set to operate if the pressure in the motor or the section it is protecting rises above a certain figure. If there is a partial disconnection in the circuit the automatic device closes the short-circuiting contacts and cuts out the section. It opens automatically when the trouble is off.

#### THE GENERATING STATION

The generating station, as is well known, is different in many respects from the station where three-phase alternating current is produced. The principal difference is the greater simplicity. No paralleling of machines is required; there is no complicated switchboard, no busbars, no adjustable rheostats for exciters, no boosters, no synchronizing appliances. The generators are connected in series and each generator, as arranged by Thury, has its own switch pillar, which carries an ammeter and a voltmeter and the short-circuiting switch. Each generator also carries an apparatus for automatically regulating the position of the brushes. This brush rocker is moved back and forth by levers operated by a small motor similar to those employed with water turbines in which oil pressure is used to move levers. The rocker, which is shown in Fig. 6, is said to operate so satisfactorily that no attendance is required.

The number of generating units to be employed depends upon the size of the station. As an illustration the author takes three cases, making suggestions for generator equipment for each particular case.

1. A small plant designed to supply energy to a single pair of pits, and requiring a total of 500 kw to meet all requirements. With this plant it is supposed that there are 3 miles of cable, above and below ground.

2. A plant suitable for a group of mines, requiring a

total of 3000 kw and having a total length of cable, above and below ground, of 12 miles.

3. A plant suitable for a larger group of mines, spread over a larger area, requiring a total of 10,000 kw and a total length of cable, above and below ground, of 40 miles.

For the first case the author suggests two units, each furnishing 250 kw, or if preferred, three units each of 200 kw, the current to be 50 amp. For the total output of 500 kw the highest pressure would be 10,000 volts. Probably the working pressure employed would be about 6000 volts.

For the second case he suggests four units, each of 1000 kw, each consisting of two machines driven by one steam turbine, each of the machines furnishing 500 kw, the current being 100 amp. The highest pressure required for the full output of three units would be 30,000 volts, and the usual working pressure would probably be in the neighborhood of 20,000 volts.

For the third case he suggests three units each of 4000 kw, each unit consisting of two machines driven by one steam turbine, each machine having two commutators and furnishing 2000 kw. The highest pressure for the full output of the three units would be 60,000 volts, the current being 200 amp. The working pressure would be probably in the neighborhood of 30,000 volts to 40,000 volts.

For the 10,000-kw station it might be better to divide the load into six units, each of 2000 kw, but any arrangement that was convenient could be made.

#### INSULATION

The matter of insulation with the high pressure employed is of great importance. The generators are all insulated by being placed on concrete foundations, below and around which are several inches of asphalt. The concrete is supported on porcelain or glass insulators resting on and partly embedded in asphalt. The mechanical connection between prime movers and generators in the power house and between motors and generators is by flexible insulating coupling.

For switching stations and for apparatus outside the generator and motor houses the author suggests special

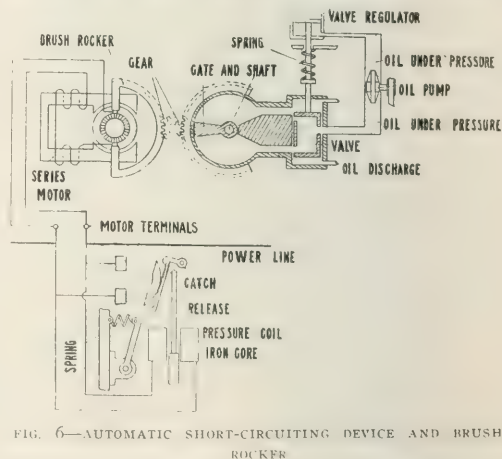


FIG. 6—AUTOMATIC SHORT-CIRCUITING DEVICE AND BRUSH ROCKER

insulation of all parts for the full pressure of the service and efficient earthing of the containing cases.

Haulage and pumping stations can be worked on low-pressure, constant-current circuits similar to that suggested for coal-cutting machines. This method should provide complete safety, while keeping all the solid advantages of the constant-current system and not sacrificing much in the matter of efficiency.

# Surges, Standing and Traveling Waves on Overhead Transmission Lines

By ALFRED STILL

The title of this article is perhaps somewhat misleading. It is not intended to condense within the limits of a few pages an account or analysis of the somewhat complicated phenomena, still unfamiliar to the majority of practical engineers, which Dr. C. P. Steinmetz has so ably treated of in his work on transient phenomena, and which would lead to astonishing revolutions in the transmission of power by alternating currents if the length of line, or the frequency, or both, could be sufficiently increased to make use of some valuable properties peculiar to traveling waves.

The phenomena referred to depend mainly on the relation between the inductance and capacity of the circuit, and it is thought that a brief examination of the relations existing between these quantities on practical overhead transmission lines may be helpful in clearing the ground for further investigations; but for a thorough study of the subject the reader is referred to such authorities as Dr. Steinmetz, Dr. A. E. Kennelly and others.

## THE QUANTITY $\sqrt{LC}$

The diagram herewith shows the arrangement of conductors of an overhead transmission which may be either single-phase or three-phase. If the latter, it must be understood that the vertical dotted line is no longer the neutral plane of a two-wire system, but that  $\frac{D}{\sqrt{3}}$  is now the dis-

tance of any one of the three conductors from the neutral line, and  $C$  is the capacity measured between one conductor and neutral.

The approximate formula for the voltage drop per mile of single conductor due to the inductance of the line when the current is 1 amp, is

$$E_L = 0.004050 \times f \times \log \frac{D}{r} \tag{1}$$

where  $f$  is the frequency in cycles per second.

The coefficient of self-induction, in henries, is

$$L_h = \frac{E_L}{2 \pi f} = 0.000742 \log \frac{D}{r} \tag{2}$$

The approximate formula for capacity per mile of conductor is,

$$C_m = \frac{0.0388}{\log \frac{D}{r}} \tag{3}$$

where  $C_m$  is the capacity in microfarads between one wire and neutral. Obviously, the product of (2) and (3) is constant irrespective of the diameter and spacing of the wires, and

$$C_m \times L_h = \frac{1}{34.7000} \tag{4}$$

This relation becomes more interesting when the capacity and inductance are expressed in the same units.

1 henry =  $10^9$  electromagnetic units, and

1 microfarad =  $10^{-9}$  electromagnetic units, thus

$LC$  = quantity (2)  $\times 10^9 \times$  quantity (3)  $\times 10^{-9}$  and the reciprocal, or

$$\frac{1}{\sqrt{LC}} = 3.47 \times 10^8$$
$$\frac{1}{\sqrt{LC}} = 186,000,$$
$$\sqrt{LC} = C$$

which is the velocity of light in miles per second.

Thus the reciprocal of the quantity  $\sqrt{LC}$ , on an overhead transmission line, is constant and approximately equal to the velocity of light. (The velocity of propagation of elec-

tric waves is practically the same as the velocity of light.)

That the quantity  $\frac{1}{\sqrt{LC}}$  has the dimension of a constant velocity is seen by reference to the fundamental dimensions of  $L$  and  $C$ . In a medium such as air, of which both the permeability and inductive capacity are unity, the product  $L \times C$  is of the dimension

$$\frac{\text{length}}{\text{length}}$$

and the dimension of the partial  $\frac{1}{\sqrt{LC}}$  is therefore

$\frac{1}{\text{time}}$ —which is a constant velocity.

The formulas (2) and (3) are approximate only. The former does not take into account the flux of induction within the conductor itself, so that for a closer approximation for transmission-line calculations it will be better to use

$$\sqrt{LC} = 183,000 \tag{5}$$

—is expressing the constant relation between capacity and inductance.

## RELATION BETWEEN CHARGING CURRENT AND INDUCTIVE DROP

The constant relation between inductance and capacity on a practical transmission line suggests the possibility of simplifications in certain transmission-line calculations. Mr. R. S. Brown, in the A. I. E. E. *Proceedings*, November, 1911, evolved a method of determining the electrical characteristics of a long line, based on the fundamental relation as given in formula (5). He points out that this relation will not be correct in the case of lead sheathed cables or where the capacities between overhead conductors of a transmission line are appreciably influenced by the nearness of the earth or other conductors.

Since there is a definite and constant relation between the inductance and capacity of overhead conductors, there must obviously be a definite relation between charging current and induced volts, whatever may be the diameter or disposition of the wires. It will be interesting to determine this relation.

By inserting for  $L_h$  in formula (4) its equivalent value  $\frac{E_L}{2 \pi f}$  the relation  $C_m = \frac{2 \pi f}{34.7000 E_L}$  is obtained; which, when corrected for the closer approximation to the actual speed of propagation of electric waves, as previously referred to becomes

$$C_m = \frac{2 \pi f}{33.9000 E_L} \tag{6}$$

This is the relation between capacity to neutral, in microfarads, and the induced volts per ampere for a single conductor of any overhead transmission.

On the assumption that the pressure alternates according to the simple harmonic law (see note), the charging current per mile of single conductor is then electrostatic capacity is

$$I_c = 57.7 (E - 0) \times 10^{-9}$$

where  $E$  is the transmission voltage measured between conductor and neutral. By inserting for  $C_m$  its equivalent value by formula (6)

$$I_c = \frac{E \times C}{1.1 \times 34.7} \tag{7}$$

Thus, knowing the self-inductance per mile of single conductor per ampere of current, the charging current per mile of single conductor can easily be obtained. This formula will, on account of the necessary assumption, give a result generally too small. The charging current is measured on a practical transmission line, and is usually 10 to 20 per cent greater.



RELATION  $L/C$  : SURGES

Given an electric circuit in which there is alternating or oscillating electric energy which is not dissipated in the form of heat through the ohmic resistance of the conducting circuit, it is obvious that at the instant when the current wave is at zero value the whole of the energy must be in the electrostatic field, and at the instant when the pressure wave is at zero value the whole of the energy is in the electromagnetic field.

It can readily be shown that the electromagnetic energy stored in a given circuit is  $\frac{L I^2}{2}$  watt-seconds, where  $L$  is the inductance in henries and  $I$  the maximum value of the current wave. Also, the electrostatic energy stored in the dielectric (the air surrounding the conductors) is  $\frac{C E^2}{2}$  watt-seconds, where  $C$  is the capacity in farads and  $E$  the maximum value of the emf wave.

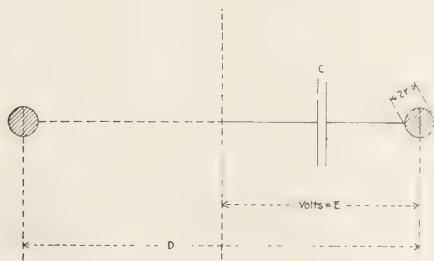
Now, since these quantities must obviously be equal so long as the interchange of energy from one form to the other continues,

$$L I^2 = C E^2$$

or

$$\frac{E}{I} = \sqrt{\frac{L}{C}}$$

The quantity  $\sqrt{\frac{L}{C}}$  is therefore seen to be of the nature of a resistance. This can be checked by referring to the



ARRANGEMENT OF CONDUCTORS

fundamental dimensions of an inductance (or coefficient of self-induction) and of an electrostatic capacity.

The ratio  $\frac{L}{C}$  is length  $\div \frac{(\text{time})^2}{\text{length}}$ , or  $\frac{(\text{length})^2}{(\text{time})^2}$ , the square root of which is  $\frac{\text{length}}{\text{time}}$ , being a velocity and having

the properties of a resistance or reactance which may be expressed in ohms. This quantity  $\sqrt{\frac{L}{C}}$  Dr. Steinmetz has called the "natural impedance" of the circuit.

In the case of an overhead transmission line, the ratio  $\frac{L}{C}$  can be obtained from formulas (2) and (3). Thus

$$\begin{aligned} \frac{\text{henries}}{\text{farads}} &= 0.000742 \log \frac{D}{r} \div \frac{0.6388 \times 10^9}{\log \frac{D}{r}} \\ &= 0.0191 \left( \log \frac{D}{r} \right)^2 \times 10^9 \end{aligned}$$

and

$$\sqrt{\frac{L}{C}} = 138 \log \frac{D}{r} \text{ ohms.} \quad (8)$$

In practical overhead work, the limiting values for the ratio  $\frac{D}{r}$  will probably be 800 and 50, which, when inserted in formula (8), show that the "natural impedance" of an

overhead transmission line must lie between 400 and 230 ohms, or, to be well on the safe side, between (say) 500 and 200 ohms.

A knowledge of this quantity renders it possible to determine the maximum value of any surge pressures that can possibly occur on the line due to the sudden interruption of the current. Thus, if the "natural impedance" is 300 ohms, and the instantaneous value of the current at the crest of the wave is 200, the surge pressure, however suddenly the current is interrupted, cannot possibly exceed  $200 \times 300 = 60,000$  volts; because this is the maximum value of the pressure wave necessary to store in the electric field the whole of the energy stored in the magnetic field at the moment when the current was interrupted. It is safe to say that on a practical transmission line the surge pressure is never likely to exceed 200 times the current in amperes, but with heavy currents this may well be sufficient to break down insulation and cause considerable damage to the power plant. It must not be overlooked that it is often more difficult to handle heavy currents at comparatively low pressures than small currents at the very highest pressures yet attempted. When the current is large the opening of a switch or fuse on full load, or an accident causing a break in the circuit, with or without the formation of an arc across the gap, may lead to insulation troubles on many widely separated parts of the system; but on a high-pressure system, even if the current were as large, the insulation is frequently so good that it will withstand without injury the stress imposed by the highest possible value of the surge pressure.

Of course, these considerations do not take into account the effects of lightning, either by direct stroke or by induction, because in such cases a pressure from an outside source is impressed upon the circuit, and the potential of these atmospheric charges may be tens of times greater than any surge voltage due to a redistribution of the energy stored in the circuit itself.

Whether or not oscillations will be set up in the circuit, due to the interchange of stored energy between the electromagnetic and the electrostatic fields, will depend upon the resistance of the circuit in which the energy can be dissipated. This circuit need not be entirely metallic; it may include an air path through which the current can expend energy in the form of an arc in addition to what is spent in heating the conductors. If a long transmission line of negligible resistance be closed through a resistance equal to the "natural impedance" of the circuit, the discharge will take place without oscillations. Thus, if

$$R > \sqrt{\frac{L}{C}}$$

there will be no oscillations set up on closing the circuit; the suddenly impressed voltage will cause not a surge of energy, but a traveling wave of decreasing amplitude carrying energy along the line without oscillations. But if

$$R < \sqrt{\frac{L}{C}}$$

energy will oscillate between the magnetic and electrostatic fields with decreasing amplitude of pressure and current waves, until the energy is dissipated in the resistance of the circuit. The conditions leading to an oscillatory discharge of a condenser is  $R < 2 \sqrt{\frac{L}{C}}$ , but this assumes

massed capacity, inductance and resistance. The case of a transmission line with distributed capacity and inductance is somewhat different. In an imaginary circuit having appreciable capacity and inductance but no resistance what is known as a standing wave would be produced; that is to say, there would be a stationary oscillation of energy surging between the magnetic and dielectric fields, but no propagation of energy along the line, and this action would continue indefinitely with undiminished amplitude of current and pressure waves, provided the further assumption is

made that no loss could occur over insulators or through "dielectric hysteresis."

A mechanical analogy to this state of things is the action of a pendulum hung from a frictionless pivot and swinging in a frictionless medium, periodically converting its store of kinetic energy into potential energy, and vice versa.

In a practical circuit there can be both traveling waves and stationary oscillations of energy, the frequency of which is entirely independent of the working frequency of the system.

#### NATURAL FREQUENCY OF CIRCUIT

If  $C$  is the capacity of a condenser in farads, and  $E$  the maximum value of the potential difference in volts, the total charge in coulombs at the end of each half period will be  $C \times E$ . But,

quantity = current  $\times$  time,

hence the maximum charge in coulombs is:

$$I_a \times \frac{1}{4f}$$

where  $I_a$  is the average value of the current between zero and its maximum and  $\frac{1}{4f}$  is the time in seconds taken by the current to change from its maximum to its zero value. It follows that

$$\frac{I_a}{4f} = CE$$

If  $I$  is the maximum value of the current wave, this will on the sine-wave assumption, be  $\frac{\pi}{2}$  times the mean value, thus,

$$\frac{I}{2\pi f} = CE$$

or

$$\frac{1}{2\pi f C} = \frac{L}{I}$$

but, as previously shown, when energy is oscillating between the magnetic and electric fields, the ratio  $\frac{E}{I}$  is equal to the

"natural impedance," or to  $\sqrt{\frac{L}{C}}$ ; therefore,

$$\frac{1}{2\pi f C} = \sqrt{\frac{L}{C}}$$

and

$$f = \frac{\sqrt{C}}{\sqrt{L} \times 2\pi C} = \frac{1}{2\pi \sqrt{LC}}$$

This is the rate, in periods per second, at which energy will oscillate in a circuit of negligible resistance. It is sometimes called the "natural frequency" of the circuit.

In transmission lines, if  $L$  and  $C$  are in absolute units per mile length of line,

$$f = \frac{1}{2\pi l \sqrt{LC}}$$

where  $l$  is the length in miles. But the quantity  $\frac{1}{\sqrt{LC}}$  is in this case approximately equal to the velocity of light, as previously shown; and the natural frequency of an overhead transmission line is, therefore, approximately,

$$f = \frac{183,000}{2\pi l} = \frac{29,200}{\text{length in miles}}$$

The length of the complete circuit must be taken at twice the distance of transmission. The length of the traveling waves will be,

$$\text{velocity of propagation of electric waves} = 2\pi l / \text{periodicity}$$

Thus it is seen to be an easy matter to calculate the frequency and wave-lengths of oscillations set up on overhead transmission lines through suddenly applied charges of electric energy, or such impulses are liable to be set up

through sudden changes of emf or current. The problem is, however, greatly complicated when the effect of transformers and other apparatus connected to the line has to be taken into account.

The length of a circuit of overhead conductors along which an electric impulse will travel and return to the starting point in the time of one half-period is obviously,

$$\frac{183,000}{2f}$$

and the distance of a straight transmission will be

$$\frac{183,000}{4f}$$

This is the quarter wave-length transmission, the characteristics of which are quite different from those of the ordinary line.

Without artificial loading of the line to alter the ratio of  $L$  to  $C$ , which is not an easy matter, the distance of transmission equal to one-quarter of a wave-length is very great at ordinary frequencies. Thus, with a periodicity of 60, the distance would be 750 miles, and on a transmission of half this distance, or 380 miles (which might be commercially practicable), the frequency would have to be raised to 120.

The peculiar properties of such a line may be said to be largely due to the fact that the "half-wave action" provides the charging current for the line, so that the generators have only to supply the load and the losses. The inductive pressure drop and the capacity current are, in fact, wiped out by the peculiar overlapping of the traveling waves of energy. The power-factor of such a line would therefore be very nearly 100 per cent on all loads, and the regulation, even if the load were inductive, would be surprisingly good.

#### The Uses of Alundum

Alundum, which is a derivative of aluminum and is commonly known as an abrasive similar to carborundum or corundum, has found in the last few years additional and important applications in physical and chemical laboratories. A very interesting lecture was recently given on the subject at the Massachusetts Institute of Technology by Mr. K. E. Herrick, of the Norton Manufacturing Company, Worcester, Mass. Mr. Norton took as his particular subject the laboratory applications of alundum.

This material is an artificial oxide of aluminum. The latter is produced from a mineral, bauxite, which is a hydrated oxide of aluminum found in the southern portions of this country and also in Europe. Domestic bauxite is shipped to Niagara Falls, N. Y., where it is first calcined and then melted in electric furnaces. The impurities, consisting mostly of metallic oxides, and the pure alumina— $Al_2O_3$ —are removed in immense ingots weighing about 5 tons each. These are broken up and shipped directly to Worcester. There they are ground, mixed with a binder and burned in a kiln. The final product is alundum, which gives great promise of revolutionizing certain processes in the chemical laboratory.

One of the important properties of alundum is its high refractive power, and in this respect it is far superior to ordinary porcelain. It has also a low coefficient of expansion and will endure very rapid heating and cooling. It furthermore possesses very fair thermal conductivity. Chemically it is a very inert substance, and although it cannot be employed as a complete substitute for platinum, in crucibles, it is an excellent supplement to the latter material. Alundum has also been employed as an refractive lining for electric furnaces. What seems to be the most important use for this material is its application to filters, which is a consequence of its porosity. Alundum filters have been on the market only a few months, but are said to be superior to the time-honored asbestos filters.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## "Any 10-Ton Ice Plant Will Make Money"

"Any electric-light plant that will install an auxiliary equipment of ice-making machinery can make money," declares a Missouri manager, "provided that an output as large as 10 tons daily can be sold. The ice business is far more satisfactory than electric lighting. Bad accounts, for instance, it avoids altogether."

He has a 30-ton plant and finds that it consumes about a ton of slack coal for each 3.5 tons of ice manufactured. Labor to operate the plant costs about \$25 per day, including office salaries, and supplies are entered at \$3 per day. To produce a ton of ice costs \$1.15, according to his estimate, although to deliver it to retail customers costs nearly an equal amount. Wholesale the product sells for from \$3.25 to \$4 per ton, and at retail for from 40 cents to 60 cents per 100 lb. Although the population of the community is only 5000, this plant last season manufactured and disposed of 8000 tons of ice, and the management expresses itself as very well pleased with its by-product business.

## Central-Station Service in Spotless Town

To advertise central-station service in the Gateway City, Mr. A. T. Macdonald, sales manager of the Louisville Lighting Company, is preparing to distribute many thousand small cakes of high-grade transparent toilet soap. These bear the advertisement of the company, suitably phrased, pointing to the fact that the high road to cleanliness at home or in business is illumined by electricity, and that along this highway dwell consumers of electric light, heat and power. The legend will remain plain and legible as long as a fragment of the cleanser lasts for use. Several ways of distributing the novelty are being arranged, among them being a plan for supplying many of the public lavatories in the city's hotels, office buildings and other public structures. While such use of soap for general advertising is not new, its application to central-station purposes is decidedly so.

## The Electric Vehicle in Delivery Service

A large dry-goods and department store at Indianapolis recently purchased six light electric delivery wagons and one 1-ton truck, which it placed in service just before the holidays with operators taken off its former horse-drawn delivery wagons. The seven battery-driven vehicles replaced twelve one-horse wagons and two double teams, and the drivers took up their new duties about Dec. 1.

Following is a tabulation of the cost of operation of the new electric service:

Operating expense—charging, washing, garaging and replacement of parts	\$2.00
Fixed charges, including depreciation and interest	1
Driver's wage	2.50
Total daily cost per vehicle	\$5.50

These Indianapolis delivery wagons have made as many as 67 miles in a single day during the severe winter weather although the average mileage has been about 35. The maximum number of packages delivered per day per vehicle was 462, and the average number 241.

## Division of Ice-Making Equipment

In laying out ice-making equipment a Kansas operator who has run a 20-ton plant for several years suggests that the compressor capacity may be best divided between one large steam-driven unit and one smaller motor-driven set, the combined rating of the two outfits to be slightly in excess of the capacity ordinarily required. This arrangement will obviate the necessity of running the large unit during dull seasons, and in case of break-down or interruption to the large set's operation, it affords an opportunity for "holding" the low temperature with the motor-driven outfit. In places of 4000 population or less this operator recommends that careful study be made of the opportunity for selling the output, although in his own community he experiences no trouble in disposing of 3000 tons of ice during the six-month season.

The investment in this 20-ton plant is as follows:

Plant addition to building	\$10,000
Steam compressor outfit, tank, etc.	17,000
Wagons and teams	2,000
Total investment	\$29,000

Operating expenses for the year are divided as follows, omitting, of course, various fixed overhead items, such as interest, taxes, depreciation, etc.:

Fuel	\$2,500
Labor, including office help	1,200
Water	300
Supplies	500
Delivery	1,300
Total	\$5,800

While the cost of manufacture is about \$1.50 per ton, the company receives an average wholesale price of \$3.65 per ton, and at retail 35 cents per 100 lb. Its yearly income from its ice department is \$12,860, against which must be charged \$9,400 for expenses, including interest and depreciation. The remaining net return of \$3,460 therefore affords a desirable income from the \$29,000 invested.

## Relations with the Public

At the recent convention of the Minnesota Electrical Association, Mr. Ludwig Kemper, of Albert Lea, read a short paper on "The Central-Station Manager." This individual, said the speaker, should be a man possessing an unlimited amount of tact. He should recognize his company's limitations as well as its privileges. He should be able to inspire in his employees also the spirit of tactfulness in dealing with the public. Care should be taken in the use of the telephone so that those doing business with the company shall receive a pleasant impression. The manager should foster the civic spirit of his community and should not burden himself with details to such an extent that he is not able to see the big things. Courteous attention to complaints is essential, of course.

Mr. Leonard Peterson, of Thief River Falls, indorsed what Mr. Kemper had said, as did Mr. R. B. Wallace, of St. Paul. Mr. A. H. Dickerson, of Windom, said that the main thing is to gain the confidence of customers. The management should not try to cover up mistakes, as in



meter reading, for instance. Mr. H. J. Gille, of St. Paul, declared that electric service nowadays implies a study of the customers' requirements. If, for instance, a merchant can increase his business 30 per cent by doubling the amount paid for store lighting the company will be of benefit to him by pointing this out. The amount of the bill is not so important as the character of the service rendered.

Mr. Eugene Holcomb, of St. Paul, emphasized the point that repairmen should be gentlemanly and considerate. Mr. Thomas Pitts, of Hutchinson, mentioned the use of a postal-card check on repairmen. After a job has been completed the customer receives a card asking if the workman has handled the task to the entire satisfaction of the consumer. Mr. E. T. Street, of St. Paul, hinted that the heads and officers of companies should set an example to their employees in the matter of courtesy. Mr. R. E. Brown, of Mankato, declared that the manager should take part in all local movements for advancement such as those in relation to good roads, automobile clubs, etc.

Mr. E. A. Aspes, of Montevideo, mentioned his practice of giving a talk once a year to the pupils of the local high school on the uses of electric appliances. Mr. Aspes makes it a point to attend to every complaint, no matter how trivial.

### Club House of New York Edison Employees

The new club house of the Association of Employees of the New York Edison Company is located at 113 East Twelfth Street, New York City. The building was opened with fitting ceremony early last month and officially pre-

large hall suitable for dances or entertainments, while leading off of this is the music room. The furniture in these apartments is of leather and mahogany. The lower floor, all on the lower are of hard maple, highly polished. The third and fourth floors are given over to pool and billiard rooms, equipped with every modern appliance. The fifth floor is the library, furnished in bird's-eye maple. This



FIG. 2. RECEPTION ROOM.

room contains more than 1000 volumes. On one of the tables is the first electric fan modeled by Thomas A. Edison, while a life-sized portrait of Mr. Edison adorns the wall. Adjoining the library are several little nooks suitable for quiet reading.

Mr. William T. Dempsey is the present president of the Association of Edison Employees, which numbers nearly 3000 members.

### "Very Satisfactory Addition to Plant"

Commenting on the advantages of combination ice electric operation, a Central Nebraska operator remarks that his own 12.5-ton ice equipment has proved to be a very satisfactory addition to his plant. With an investment of about \$13,200, this station produced, for the local population of 3200, 1250 tons of ice in 1911 and 772 tons in 1912. The ammonia compressor is motor-driven, and distilled water obtained from the electric generating department is used as ice-making material.

To freeze a ton of ice at this plant 88.5 kw-hr. is required, for which the ice department is charged at the rate of 3.5 cents per kw-hr. Under these conditions the gross cost of producing a ton of ice at this station pattern is about \$2.70. To deliver in local markets, water can be averaged \$1.20 additional per ton. The retail rate received, however, is 25 to 30 cents per 100 lb., or \$2.50 to \$3.00 per ton. For such fees as can be paid locally, at wholesale the price is \$3.10 to \$4.10 per ton.

Following is the company's most common set of ratings:

Rating	Rating	Rating
Very satisfactory	Satisfactory	Unsatisfactory
Excellent	Good	Poor
Very poor	Very poor	Very poor

At this rate a ton of ice is delivered at the \$1.00 per ton. The company has looked out of its house and storage house, and delivery that only is adequate for its best purposes and consequently the presence of ample storage capacity for loading facilities to meet peak demands.

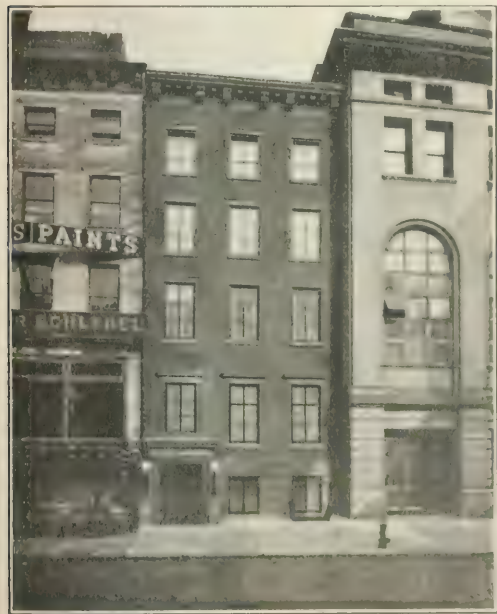


FIG. 1. NEW YORK EDISON EMPLOYEES CLUBHOUSE.

sented by the company to the association of its employees. The club building, a five-story structure, is the property of the company, which will bear all of the running expenses. The entire equipment and furniture were also supplied by the company.

On the ground floor, besides a reception room, are the bowling alleys and shuffleboard. On the second floor is a

# Illumination and Wiring

## Lighting of an Electrical Salesroom

The barefooted condition of shoemakers' children has become proverbial; too often, also, does a similar state prevail in the illumination arrangements of the average electrical supply store. The special lighting requirements



FIG. 1—PORTION OF RETAIL SALESMAN'S ROOM

of such premises are not numerous, although they are definite. Primarily, there should be as high an intensity of illumination on the shelves as on the floor or working plane. The light sources should be either out of the line of vision of customers or else altogether free of glare, for the electrical store, above all others, should provide an example of good lighting. The appearance of the installation should also be pleasing.

Fig. 1 shows the main supply salesroom of the Commonwealth Electric & Supply Company, Pittsburgh, Pa., which measures 65 ft. long, 20 ft. wide and 15 ft. 10 in. high. Along one side is a row of shelves extending out 2 ft. into the room and rising from the floor to the ceiling. The permanent lighting units of this salesroom comprise three 500-watt and two 250-watt tungsten units, inclosed in Alba acorn globes and suspended at a height of 11 ft. 3 in. above the floor. Some diffuse reflection is obtained from walls and ceiling. The ceiling is finished in light-green color, while the walls are tinted to a darker olive.

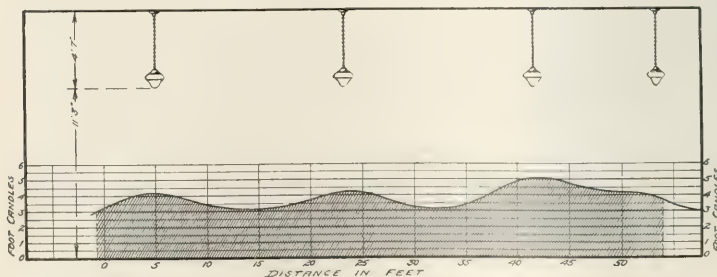


FIG. 2—DISTRIBUTION OF ILLUMINATION

Measurements have been taken on a working plane 30 in. from the floor, approximately the height of the counter, which is 8 ft. 9 in. below the bottoms of the acorn globes. The actual intensities obtained along the center line of the room are shown in Fig. 2, the average illumination at the counter level being 3.82 ft.-candles. From these figures

the intensity on the shelves is computed as having an average value of 3.6 ft.-candles. This, it will seem, agrees quite closely with the former recommendation that the intensity should be as high on the shelves as on the so-called working plane of the store.

For electrical display windows the degree of intensity secured must, on the one hand, be sufficient to show off dark metal goods to advantage, at the same time not being



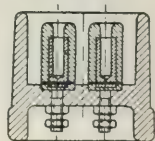
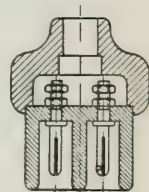
FIG. 3—FIXTURE AND GLASSWARE SALES PARLOR

too bright to interfere with exhibits of luminous radiators lamps, etc. Each window in the present installation is lighted by seven 40-watt lamps in Macbeth-Evans diamond-prism glass reflectors. Two units are installed at the front and five at the sides of the exhibition spaces. For special display purposes 60-watt tungsten lamps may be used.

Throughout the offices a general illumination of 3 ft.-candles is obtained from semi-indirect lighting bowls

## Explosion-Proof Connector Plug

In garages and other places containing explosive gases a great deal of risk accompanies attempts to use ordinary insertion plugs for making temporary connections. A Ger-



EXPLOSION-PROOF PLUG

man concern which owns a number of garages has made a series of experiments in order to obtain a reliable explosion-proof plug. The one shown herewith was designed by one of its engineers and has been submitted to exhaustive tests at the Royal Testing Laboratories at Gross-Lichterfelde, Germany, and is said to have proved very satisfactory.



It will be seen from the illustration that in making the contact the pins are inserted into shells of insulating material surrounding the metal part of the receiver. These shells fit snugly about the contact pins so that when the connection takes place the surrounding air is excluded. As a further precaution there is an outer shell around the contact pins which fits into an outer shell of the receiver. This excludes the air even before the pins reach the inner shells.

### Comprehensive Plan for Future Street Lighting of Chicago

In a communication to Mayor Harrison of recent date Mr. Ray Palmer, the city electrician of Chicago, makes a report on his plan for the future electric street lighting of that city. By a contract dated Oct. 27, 1910, the Sanitary District of Chicago is installing 10,000 10-amp flame-arc lamps, or their equivalent, for city street lighting, in addition to the 12,200 lamps that existed at the time of the execution of the contract. Looking ahead, however, Mr. Palmer thinks that by 1918 the city should have most of its business and residence sections well lighted by electricity, the installation comprising approximately 48,000 flame-arc lamps.

The map which is printed on this page shows the layout of what it is hoped to accomplish within the next five years. At the present time there are nine substations in operation. Under the existing contract three new substations were built, and in addition the necessary substation equipment was added to the Thirty-ninth Street pumping station. (See *Electrical World* of Oct. 12 and 19, 1912, pages 772 and 822.) The distribution of the street-lighting lamps under the existing contract includes 8421 arc lamps and 7056 series-tungsten incandescent lamps. In making the distribution four and a half tungsten lamps are held equal to one arc lamp. This makes the total arc-lamp equivalents 9989. The distribution of lamps from the new substations is as follows: Thirty-ninth Street, 746 arc and 2164 tungsten lamps; Twenty-second Street, 2650 arcs; Wabansia Avenue, 1435 arcs; Byron Street, 1365 arcs and 4748 incandescents.

When the present contract is finished about 2200 old direct-current arc lamps will still remain in service. These, Mr. Palmer thinks, should be supplanted by alternating-current arcs. The direct-current lamps were installed more than ten years ago and were spaced farther apart than present conditions would require. The rules which are used at the present time in placing flame-arc lamps for street lighting in Chicago are as follows:

**Central Business District.**—Two lamps at each street intersection and one lamp at each alley intersection with "such other lamps as are necessary for good lighting." Space between lamps not to exceed 250 ft.

**Other Business Streets and Streets Having Street-Railway Lines.**—One lamp at street and alley intersections and such other lamps as are necessary for good lighting. Space between lamps not to exceed 250 ft.

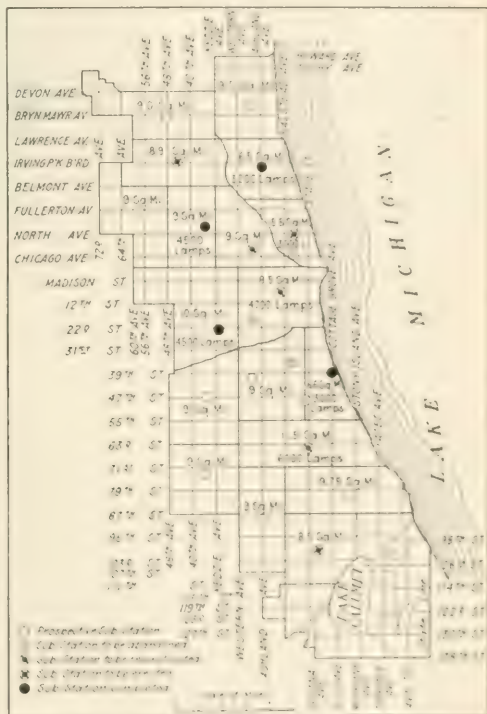
**Residential Streets Thickly Populated.**—One lamp at each street and alley intersection and such other lamps as are necessary for good lighting. Space between lamps not to exceed 350 ft.

**Residential Streets Thinly Populated.**—The circuits are planned so that ultimately there may be one lamp at every street and alley intersection and other lamps not over 350 ft. apart. In service the lamps are placed at street intersections with such other lamps as are needed in the judgment of the engineer. A thinly populated street is understood to be one in which the houses do not exceed one for each 125 ft. of street frontage.

To carry out the plan for future lighting will require a large number of new lamps as there are many districts

comparatively thickly settled in which lamps are now spaced from 400 ft. to 600 ft. apart. Woodlawn and River-view would become direct-current lighting districts, and the change proposed by the city electrician will require about 7000 additional lamps here. In the Lincoln Park district 3000 more lamps should be added, making about 10,000 additional lamps which will be needed within two or three years after the completion of the present contract. Mr. Palmer figures that the approximate estimated cost of the second 10,000 lamps as proposed above would be \$2,040,000. This allows for 8000 lamps on overhead circuits at \$160 each, including station equipment, circuits and lamps, and 2000 lamps on underground circuits at \$380 each. Of course, the carrying out of this plan is dependent on the city's ability to finance it.

Mr. Palmer pointed out that it is evident that unless the Sanitary District is allowed to use a greater flow of water



LOCATION OF SUBSTATIONS UNDER NEW PLAN

from Lake Michigan than at present (400 cu ft. per second) the electrical energy available from this source will not supply more than 27,000 arc lamps, which is only 4000 more than the system as planned under the existing contract. The city's present contract with the Sanitary District for supplying energy for street lighting will terminate on Dec. 1, 1917. It provides for the different maximum supply of electrical energy for approximately 2500 arc lamps, or 11,000 kw at 80 cents per kw. or \$200,000 per kw. year. It is probable that a higher rate will be required if the contract is renewed in 1917. In view of this situation Mr. Palmer continues substantially as follows:

"From the above facts it is evident that additional power beyond the 27,000 kw. (plus 10,000 kw. of the existing contract and 2000 kw. in addition) which the Sanitary District might be able to furnish must be supplied from some other source. If Chicago's existing system is to be in-



creased beyond 27,000 arc lamps. The writer believes that the Commonwealth Edison Company can supply energy to the city on a profitable basis for the street-lighting system at approximately 0.7 cent per kw-hr., which is similar to the rate charged for the energy supplied to the electric-railway companies at the present time. A more reliable and economical service will be obtained should the Commonwealth Edison Company's lines ever be connected direct to the city's lighting system through the Sanitary District's terminal station at Thirty-first Street and Western Avenue, as the auxiliary steam plants which are now being maintained by the Sanitary District can be dispensed with. Undoubtedly, a satisfactory working agreement between the Sanitary District, the Commonwealth Edison Company and the city can be consummated on an advantageous basis for the taxpayers of Chicago, for the supply of electrical energy for the city's use, if the city takes the initiative in proposing such a step."

In conclusion, the city electrician recommends: First, the postponement of certain parts of the present lighting contract with the Sanitary District until the districts lighted by the old direct-current arcs can be rehabilitated properly with flame-arc lamps; second, a new contract with the Sanitary District for the installation of 10,000 additional arc lamps beyond the present contract, this contract to include the furnishing of all the available energy of the District for public lighting and other municipal purposes; third, a contract with the Commonwealth Edison Company for emergency throw-over service and for additional energy necessary for municipal purposes which cannot be supplied by the Sanitary District.

### Grounding Requirements in California

An electrical ordinance to supplement that at present effective in Colorado Springs, Col., is being prepared by Mr. C. L. Reasoner, city electrician, with the aid of the engineer of the Rocky Mountain Fire Underwriters' Association, Mr. W. J. Canada. The act provides that within one year all transformer secondaries be grounded where the voltage will not exceed 250 above ground connection. It further prescribes methods for grounding various types of secondaries, and fixes the character of ground connection to water mains for future electrical service. The ordinance will be prepared in considerable detail and is intended to prevent merely perfunctory grounding. A maximum resistance of 0.25 ohm for any ground is required. The Colorado Springs Electric Light Company will co-operate in securing the best results.

An ordinance has just become effective at Greeley, Col., requiring the grounding in thorough and reliable manner of all alternating-current secondaries within one year. Mr. L. Fitch, manager of the Home Power & Light Company, is proceeding under the advice of the Underwriters on methods.

## Letters to the Editors

### Researches in Magnetic Hysteresis

To the Editors of the *Electrical World*:

SIRS:—In your editorial entitled "Researches in Magnetic Hysteresis" in the Feb. 15 issue of the *Electrical World*, page 331, reference is made to a thesis by Dr. Fritz Holm, which is abstracted in the *Digest* of the same issue on page 363. The attention of your readers should be called to the fact that researches identical in nature were made previously by Mr. G. Vallauri, and published by him in "Atell' Associazione Elettrotecnica Italiana," Vol. 15, February, 1911.

Zwickau, Germany

GUSTAV W. MEYER

### New York Hydroelectric Development

To the Editors of the *Electrical World*:

SIRS:—The so-called "conservation" movement, as applied to the subject of flowing water, has suffered in the past, and continues to be retarded in the present, by lack of proper consideration and understanding as to what constitutes true conservation. The movement in New York has developed into the form of proposals for the operation of power plants by the State, in competition with existing systems of electrical utilities, which policy has been very recently embodied in the Murtaugh-Patrie bill, passed by the Senate in the month of March, 1913.

Public education upon this subject has been largely carried on by mere assertions and semi-political presentations by enthusiasts lacking the technical and statistical information which should be applied to the study of so wide a subject.

So far as the application of "conservation" to water powers is concerned, it will be found on careful inquiry that there are modifying factors which place the subject in a different class from that occupied by other features of the general movement. These factors are ignored by the majority of enthusiastic writers upon this subject and receive but slight consideration even at the hands of such officials as those composing the New York State Conservation Commission, who should give them full consideration.

The original suggestions as to the conservation of waters during recent years have been widely extended into a combined form of governmental ownership, development and operation of such waters as means of power development. This matter, in the State of New York, has become a question not of conservation but of practical economics opposed to politics. It involves also, indirectly, the question of public ownership and operation of a technical utility such as the distribution of electrical energy.

The value of falling water does not always consist in its development as a source of energy, for it is in notable instances of greater economic value in its natural condition. Its development, in whole or in part, for the production of energy may result in less effective value to the community than its maintenance in its natural state. Such is particularly the case in connection with the largest of the waterfalls of the State of New York, that of Niagara, where some of the suggested schemes for the utilization of the water would undoubtedly rob the country of its greatest scenic attraction and would thus deprive the locality, the State and the country of the financial benefits derived from the vast numbers of visitors who bring to the channels of general trade, as reported by the committee of engineers appointed by the United States government, an annual revenue exceeding \$20,000,000, representing a capitalized value of the esthetic features of Niagara amounting to \$4 per head of our entire population. One of these suggestions proposed the artificial control of a supply of water to be turned on at intervals for the delectation of visitors. Fortunately the attitude of the public is averse to any such schemes, whether advanced in the interests of commercial corporations or of State politics.

Much of the erratic and ill-defined action of the conservationists in this direction is due to exaggeration and misstatements of the power available in the form of falling water. Of this class of misinformation the publications of the Conservation Commission form an example.

In the first place, the whole subject of available powers in the State of New York, and of their practical utilization for the production of energy, was carefully studied and its limitations decided by the State Water Commission, which was in existence prior to the present Conservation Commission. That body ascertained that the amount of power thus obtainable was much less than that which is now so glibly assumed by the commission.

In the second place, the value of all these powers in



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Tests of Small Oil-Engine Sets

The municipal lighting plant at Clarks, Neb., is equipped with a 35-hp Alamo oil engine belted to a 22.5-kw Westinghouse generator and a 25-hp Fairbanks-Morse gasoline engine belted to a 12.5-kw Westinghouse unit. With the aid of the Electric Storage Battery Company's E-11 equip-

shown at *F*. The pieces were held in position by several small wooden wedges which were driven between the asbestos board and casing.

When the first attempt at welding was made excessive caution prevented adequate heating of the fractured parts, and only the surface of the break was welded. This weld

TESTS OF INTERNAL-COMBUSTION ENGINES AT CLARKS, NEB.

	Started	Stopped	Length of Test, Minutes	Fuel Consumed, Gal.	Amp	Volts	Kw-hr. Delivered at Switchboard	Cost per Kw-hr. at Switchboard	Oil Consumed per Kw-hr. of Engine, Pints	Hp Delivered by Engine, Allowing for Losses
Alamo 35-hp Engine	9:13	9:27	14	1	180	120	21.6	0.0214	1.28	35.84
	9:27	9:41	14	1	180	120	21.6	0.0214	1.28	35.84
	9:50	10:05	15	1	167	125	20.87	0.0192	1.237	34.62
	10:12	10:37	25	1	83	125	10.37	0.0386	1.5	17.20
	10:45	11:14	29	1	41	125	5.12	0.0404	2.615	8.49
	11:17	11:50	33	1	42	125	5.25	0.0347	2.237	8.71
Fairbanks-Morse, 25-hp	3:18	3:41	23	1	100	120	12.00	0.0313	1.405	19.91

ment of cells installed, local customers can obtain electric service for fans, irons, etc., any hour out of the twenty-four, although the plant itself need be operated only during the evening hours of heaviest load, the battery being meanwhile charged with the marginal capacity of the sets.

During some tests conducted recently on these oil-engine sets at Clarks, by Mr. W. E. Donner, the accompanying results were obtained. The effort in each case was to determine the output for a consumption of 1 gal. of fuel at various engine and generator loadings. For the Alamo engine 39 deg. distillate was the fuel used, costing 10 cents per gal., and for the Fairbanks-Morse set commercial gasoline was supplied. While the oil engine carried an overload of 220 amp at 120 volts for an hour, the gasoline unit, according to the report of the test, refused to carry any overload. In making the calculations 5 per cent was allowed for belt loss and 85 per cent for generator efficiency.

was very promptly broken as soon as strain was placed upon the foot again.

The owner of the motor was told that a second attempt would not be made unless the motor foot could be treated exactly as though it were a bare casting with no windings in proximity to it. He assented but stationed one of his men beside the motor to inspect the field winding during the operation.

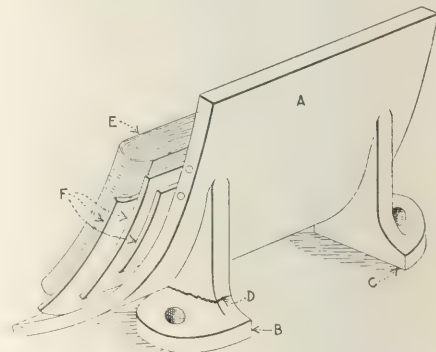
When the motor was in position above the forge, bricks were placed about the broken parts to keep the heat as much as possible from all other portions of shell. Pieces of

## Repairing a Broken Motor Leg

BY JAMES F. HOBART

During shipment the foot of a 30-hp induction motor became broken as shown in the cut. The motor had been sold under a guarantee and it was necessary to repair the break with the least possible delay and at the lowest cost. The foot being an isolated projecting member of considerable section, it was not necessary to provide for the expansion and contraction of other portions of the casting. The sole object of solicitude in this job was to heat the fracture without damaging the coils of the stator winding.

The outside of the motor casing is shown at *A*; *B* and *C* are the feet, and the break to be repaired is visible at *D*. The field winding *E* was protected by placing between the coils and the shell casting several thicknesses of asbestos board which had previously been saturated with water. The several layers of asbestos which were packed into the space between the shell and the field winding are



BREAK IN MOTOR FRAME

asbestos board were freely used. After these precautions had been taken the foot was heated to a red heat. The welding was then completed as speedily as was possible. An excellent job seems to have been secured and the motor is now in constant service. The asbestos apparently did its work well, for the coils were not damaged in the least degree.



## Operating the Terre Haute Station with Water 3 Ft. Above Floor

With the surface of the Wabash River 3 ft. above the level of the engine-room floor, satisfactory operation of the 12,000-kw generating station at Terre Haute owned by the Terre Haute, Indianapolis & Eastern Traction Company was maintained throughout practically the entire flood which recently overspread that section. This station, besides generating energy for the four interurban lines radiating from Terre Haute, furnishes electricity for lighting and motor service in Terre Haute, West Terre Haute, Brazil and several small towns along the interurban lines. Since all these places were dependent on this station for their lighting, considerable credit should be given Mr. T. F. Grover, general manager of the Terre Haute division of the company, and to the men under him for maintaining the service despite such adverse circumstances.

When the Terre Haute station was erected the engine-room floor was constructed about 4 ft. above the highest recorded mark which the Wabash River had ever reached, but the unusually heavy rains of the recent spring swelled the river until at the crisis it was 3 ft. above the generator-room floor.

Had the direct force of the river current struck the north or upstream wall of the building, the latter undoubtedly would have collapsed, as it is of temporary construction to allow for future addition. To meet the oncoming flood about 75 or 100 men were employed to lay a wall of sandbags around the building for the purpose of deflecting the current of the river and keeping out as much water as possible. Fig. 2 is a view of the downstream side of the building taken during the worst of the flood.

Fortunately there was a hominy mill near the generating station, and most of the bags required for the temporary dike were obtained here without much delay. The men were able to lay the bags fast enough to be at all times 8 in. ahead of the rising flood.

Practically all of the foundation walls are constructed of concrete, with the exception of the north wall, which is of brick. The basement floor at its lowest point is probably 20 ft. below the engine-room floor, so that the walls

fourteen hours, with the exception of the exciters which furnished light. After the circulating pumps were again connected to the condensers a pair of reciprocating pumps were used to remove seepage water, and no further interruption to service was experienced.

To prevent the water which leaked through the barricade of sandbags from running into the basement through doors



FIG. 2—WATER AT WINDOW LEVEL ON DOWNSTREAM SIDE OF STATION

and windows a temporary brick wall was built across the building on the interior at each end, as shown in Fig. 1, and the doors were sealed and backed up with sandbags.

One of the concrete piers supporting a leg of the high-tension tower just outside the building (see Fig. 2) was carried away by the flood, although it extended about 15 ft. into the ground originally. A corduroy wall which had been built along the river bank at this point to give a neater appearance and prevent inundation was completely carried away by the water.

The tornado of March 23, which preceded the flood devastation in Terre Haute, tore down practically everything in its path for about 2½ miles in a strip about a quarter of a mile long. A brick high-tension booster station located on the south side of the city was completely demolished and one of the 500-kw. 230,000-volt transformers was turned around on its concrete foundation. In addition to this damage, about 1,000 ft. of high-tension line was demolished, and it was necessary to feed the entire length of the interurban line running south from a specially erected, 26 miles long. The voltage drop over this line was kept as low as possible by running light cars.

## Ground Connections

In what type of ground connection is best and most practical for lightning arresters.

Fully 75 per cent of lightning arrester troubles are directly traceable to inadequate ground connections. Copper sheets with at least a sq. ft. of surface should be used for the ground connections, and should be thick enough to prevent wearing away. The depth to which the plates should be buried depends to a large extent upon the nature of the earth about the station. It can be said that the plate should be buried to a depth of 10 ft. at which the soil is always damp. Further than this so hard and fast rule can be made.



FIG. 1—TEMPORARY BRICK WALL TO KEEP OUT FLOOD

without any lateral bracing were in a precarious condition because of the enormous water pressure from without. Perhaps the coarse fill around the building is all that saved the foundation walls from collapsing.

Centrifugal circulating pumps were used to remove the first large quantity of water which leaked into the basement. During their use the plant was shut down about

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Single-Phase Commutator Motor.**—GABRIEL MARTIN.—An illustrated article on the theory of the Latour compensated shunt motor. The author first gives an approximate physical theory and follows it up by a more exact mathematical theory, developing the diagram of this type of motor. The results of tests of a 7-hp and a 2-hp motor of this type are given.—*La Lumière Elec.*, March 8, 1913.

**Variable-Speed Alternating-Current Motors.**—A note on a recent British patent (No. 9210, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. Two brushes are provided per pole, and the speed is controlled by varying the distance between them. The arrangement is applicable to forms of repulsion as well as of conduction motors.—*London Elec. Eng'g*, March 13, 1913.

**High-Frequency Generator.**—A note on a recent British patent (No. 3555, 1912) of R. Heyland. In this generator the frequency is not determined by the speed and number of poles, but by oscillations of the magnetic field secured by the reaction of a short-circuited polyphase winding unconnected to any source of supply but having its phases connected in parallel so that oscillations of low frequency are damped out by equalizing currents and only a particular higher harmonic determined by the difference in phase of the separate coils is developed. The oscillations may be strengthened by suitably tuned inductances and condensers.—*London Elec. Eng'g*, March 13, 1913.

**Mercury-Vapor Rectifier.**—DANIEL BERTHELOT.—A note on the priority of invention of the mercury-vapor rectifier. The writer states that "the use of the carbon-copper—or, better, the carbon-mercury—arc, as a rectifier of alternating current, was described in 1888 by Jamin and Maneuvrier (*Journal de Physique*, second series, page 437). The apparatus was applied to produce electrolytic decomposition of water by means of a combination of an alternating-current generator with a mercury arc. Jamin and Maneuvrier concluded their paper with a reference to the attempts to use alternating-current generators for electrochemical work by rectifying the current by means of a commutator. "It is seen that this commutator can be replaced automatically by one or several arcs formed between a bath of mercury and a point of carbon."—*La Revue Elec.*, March 7, 1913.

**Mercury Converters of Large Capacity.**—BELA B. SCHAEFER.—An English translation in abstract with illustrations of his German paper, noticed some time ago in the *Digest*, on mercury-vapor converters of large capacity, the containers being of steel.—*London Electrician*, March 21, 1913.

**Magnetic Properties of Sheet Iron for Dynamos.**—DE NOLLY and VEYRET.—An account of an investigation on the best composition and the best treatment of steel in order to obtain the most favorable results with respect to permeability and hysteresis and eddy-current losses.—*Revue de Met.*, Jan. 1, 1913; abstracted in *La Lumière Elec.*, March 1, 1913.

**Rotary Converter for Industrial Railways.**—F. RIEP.—For industrial railways, as far as they are operated with direct current, some means is required to transform the three-phase currents which are generally available into direct current. In Germany for that purpose motor-generators have been almost universally used in the past, but

beginning with 1910 rotary converters have been introduced and are now finding increased favor. Their advantages are pointed out.—*Elek. Zeit.*, March 13, 1913.

### Lamps and Lighting

**Danger of Fire from Electric Hand Lamps.**—BOJE.—As the result of a fire in the theater of the city of Stettin in Germany the question has been raised whether this could have been caused by a transportable electric hand-lamp, and a large number of experiments concerning the safety of hand-lamps have been undertaken. The conclusion reached from these tests is that all transportable hand-lamps now on the market, if equipped with 16-cp, 220-volt carbon lamps, can cause fire if in contact with such an ignitable material as sawdust, while such ignition could not be produced in the tests with 16-cp, 220-volt metallic-filament lamps. In the experiments the lamps were firmly covered with wool, linen or silk materials, or embedded in sawdust, so as to exclude the air as far as possible. Of the four lamps shown in Fig. 1 the one marked No. 4 gave the best

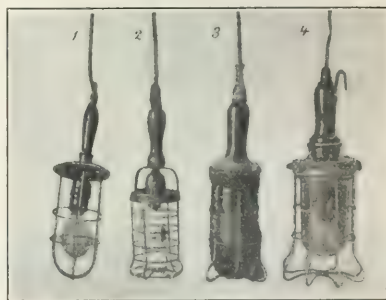


FIG. 1—PORTABLE HAND LAMPS

results. When metallic-filament lamps of 16 cp were employed the highest temperature observed was 149 deg. C. (for No. 1 in Fig. 1) and the lowest temperature 100 deg. C. (for No. 4). With metallic filaments of higher candle-power, such as 25 cp, 32 cp and 50 cp, ignition could be obtained. In the theater in question all the hand-lamps have been exchanged for 16-cp tungsten lamps constructed like No. 4.—*Elek. Zeit.*, March 20, 1913.

### Generation, Transmission and Distribution

**Lignite as Central-Station Fuel.**—The use of lignite for the firing of boilers in generating stations is attracting increased interest in Germany, in the district west of the Rhine. It is claimed that the erection of stations adjoining the deposits of lignite, which is worked from the surface, dried or partly dried in apparatus and pressed into briquets, permits of the production of electric energy at an exceptionally low cost. It was for this reason that the Berggeist supply station was established several years ago near Bruhl, whence a supply of energy is furnished over a considerable area. The station, which in the meantime has been taken over by the Rhenish-Westphalian Electricity Works Company, of Essen, which also possesses bituminous coal plants on the colliery site, delivered 25,800-



600 kw-hr. in 1912. Now the Rhenish-Westphalian Company has started the building of another large station in the vicinity of the Ver. Ville lignite mine belonging to the Roddergrube. Two 15,000-kw steam turbines will be installed at first, the cost, including boilers, being estimated at \$875,000. A lengthy contract has been concluded with the mine owners for the supply of fuel. The station will supply energy to the network of cables which the Rhenish-Westphalian company possesses in the district of Cologne and beyond, and energy for electrochemical purposes is also to be furnished to chemical works to be built on the Rhine. A third instance is that of the Rhenish Lignite District Electricity Works Company, which was constituted in 1910 and has contracts for the delivery of energy to Cologne, Mulheim and other places. The first plant was of 8000 kw; a second generating set of 8000 kw is now being put into service, and a third will be ready on Oct. 1, making a total of 24,000 kw. It is expected that the output will amount to 25,000,000 kw-hr. this year, without taking into consideration the annual supply of 16,000,000 kw-hr. which has been contracted for, for chemical works to be erected in the neighborhood of the generating station, on behalf of the Metal Bank & Metallurgical Company of Frankfurt-on-the-Main. A fourth example related to the decision to establish on the site of the Zukunft lignite mine, near Eschweiler, a station capable of producing 30,000,000 kw-hr. per year, by way of a beginning, and agreements have already been made for the disposal of two-thirds of this quantity at appropriate prices. Apart, however, from these developments, it should be remembered that the generating station which supplies energy for the working of the Dessau-Bitterfeld railway utilizes lignite as boiler fuel, and brown coal is also projected for the power stations in connection with the conversions of the Berlin railways to electric traction.—*London Elec. Review*, March 14, 1913.

**Erection and Operation of a Water-Power Plant by the State.** THEODOR KOELN.—A discussion of the bill which has been introduced in the parliament of the State of Baden (Germany) for the development of the water power of the Murg River and the operation of the power plant by the State. The final equipment is to comprise six 3300-kw and six 3000-kw turbines. The generating emf is 10,000 volts. This water-power plant is to operate in conjunction with the existing steam plants in Mannheim and Karlsruhe, with an aggregate rating of 6700 hp, which are owned by the State. The water supply available in the River Murg is rather irregular, and it is estimated that while the maximum power available will be 45,000 hp, the average power available during the year, including the steam reserve, will be only 15,000 hp. Two reports made by consulting engineers are mentioned which conclude that the plant would be economical, but are rather opposed to its operation by the State. One of the reports proposes the formation of a stock company, the State contributing from 70 to 80 per cent of the total capital. The other recommends that the State should build the power plant and should then rent it to a private company for a longer period of years. There seems still to be some doubt whether this water-power plant can economically compete with a large steam plant of most modern design.—*Elek. Zeit.*, March 20, 1913.

#### Installations, Systems and Appliances

**German Electrical Industries in 1912.**—The first part of a series of reviews of the different fields of the electrical industry in Germany during the past year. G. Klingenberg writes about central stations and transmission systems, K. Pichelmayer about the design of electrical machines, H. Beckmann about primary and secondary batteries, Niethammer about switchboards, switches, circuit breakers, etc. The series is to be continued.—*Elek. Zeit.*, March 20, 1913.

**Spain.**—Statistical tables showing imports of electrical and similar goods into Spain, during 1910 and 1911. In electrical goods Germany is leading all other countries as

an exporter to Spain, while for steam and gas engines and boilers Great Britain is leading.—*London Elec. Review*, March 14, 1913.

**Continuity of Supply.**—R. D. SPURR.—An article discussing the various means for securing reliability and maintaining the continuity of supply in power plants.—*London Elec. Review*, March 14, 1913.

#### Traction

**Berlin-Schoeneberg.**—An illustrated description of the electric subway from Berlin to Schoeneberg. It is owned by the city of Schoeneberg. The energy is bought in bulk from one of the Berlin power stations by means of three-phase current at 6600 volts, two cascade converters being used to produce direct current at 780 volts.—*Elek. Zeit.*, March 6 and 13, 1913.

#### Wires, Wiring and Conduits

**Oxidation of India Rubber.**—An editorial note referring to a paper by S. J. Peachey on the oxidation of india rubber, read before the Society of Chemical Industry. The author showed curves connecting the quantity of oxygen absorbed with time. It was pointed out by W. G. BARKER, of Leipzig, in a written communication to the discussion, that the shape of these curves was characteristic of the so-called autocatalytic processes; that is, reactions during which a catalyst is formed or increased in quantity. These conditions include the phenomenon of auto-oxidation, of which a well-known example is the "drying" of linseed oil, and it is pointed out that the curves for the latter agree very closely with those for rubber. Peachey supported this view, saying that he had found some substance of the nature of a peroxide always produced during the atmospheric oxidation of india rubber. The paper also showed that rubber free from resin was oxidized far more quickly than rubber containing its natural resins. "Cable makers may possibly get a hint from this, though the art of cable making is carried out with such secrecy that the outsider has little chance of learning what is known or unknown, and thus feels that the subject is on a par with catalysis itself."—*London Electrician*, March 21, 1913.

#### Electrophysics and Magnetism

**Alternating Current Magnet.**—J. WILSON.—An abstract of a paper presented before the Physical Society in London. It follows from the well-known law of pull of an electro-magnet that if the magnetic field alternates between positive and negative values the pull is unidirectional and intermittent. Unless means are provided to reduce the consequent chattering and vibration the magnet is rendered useless. In the present experiments a phase-shifting device has been adopted and consists in surrounding a portion of the pole-piece of the magnet with a non-magnetic coil. The portion of the pole-piece so surrounded is sometimes said to be "shaded," and the coil referred to as a "shading coil." The effect of this coil is to alter not only the relative amplitudes but the phase of the magnetic field passing through the shaded and unshaded portions of the pole-piece. The magnet used in the experiments was of the length of its gap when excited, and the difference of the approach upon this phase displacement has been studied. When the phase angle of the shading coil is such that the magnetic induction  $B$  over the whole face is continuous maximum and the gap closed, the phase displacement is 16.5 electrical degrees (360 degrees = 1 period). A gap length of 1 cm. reduces the phase displacement to 18 deg. and consequently the minimum or "holding" pull drops. The minimum or "holding" pull is of course smaller than the average pull and has to be taken into consideration in the design of the magnet. The importance of the shading coil alone as described is very effective in preventing vibration and chattering when the magnet is closed and renders the alternating-



current magnet a practical success. With constant alternating voltage impressed upon the magnetizing coils of the magnet the net pull exerted diminishes rapidly at first as the gap length increases and tends to become more nearly constant. The effective amperes, on the other hand, steadily increase as the pull diminishes, owing to the increase in the gap length. The observed net pull in the case of the magnet experimented upon is less than the calculated average pull, varying from 83 to 59 per cent as the gap length varies from 0 cm to 1 cm.—*London Electrician*, March 14, 1913.

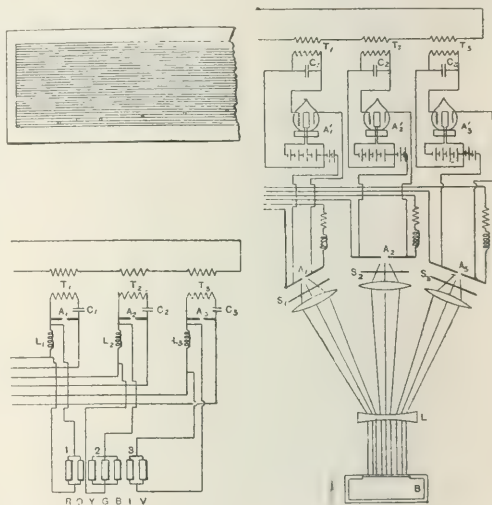
**Structure of the Atom.**—J. J. THOMSON.—The first part of a lecture before the Royal Institution on the structure of the atom. Though the subject is chemical in nature, the treatment was chiefly electrical.—*London Electrician*, March 21, 1913.

#### Units, Measurements and Instruments

**High-Tension Testing Plant.**—An illustrated description of a high-tension testing plant for a new British cable works. Tests up to 16,000 volts can be made. Energy is obtained at 220 volts from a supply system, and the voltage is raised to 2000 volts by a transformer. Single-phase current at 2000 volts passes from the secondary terminals of this transformer to the primary terminals of a Cowan-Still regulating transformer. The output of the regulating transformer at the secondary terminals is obtained at any pressure from zero to 2000 volts. This transformer feeds in turn the primary circuit of the high-tension transformer, which gives out current at any pressure from zero to 60,000 volts in accordance with the position of the hand-wheel of the Cowan-Still regulator.—*London Electrician*, March 14, 1913.

**Electric Transmission of Color Photographs.**—S. M. POWELL.—The use of color-sensitive cells suggests the possibility of transmitting color photographs over an ordinary telegraph line. The solution of the problem is closely related to multiplex telephony, since at least three distinct high-frequency electrical oscillations are transmitted over the same line. Algeri Marino has evolved a system for the electrical transmission of color photographs by the use of three oscillations of high but different frequencies, derived from Poulsen arcs. The intensity of the oscillations at the transmitting station is controlled by analyzing light beams from the picture to be transmitted, and these oscillations are employed to control other arcs at the receiving station, connected in circuits tuned to the frequencies employed. An opaque diaphragm (Fig. 2) having perforations of equal diameter, and equally spaced transversely, moves uniformly in front of an aperture in the dark chamber and quite close to the plate carrying the image to be transmitted. The diameter of the perforations is from 0.7 mm to 1.2 mm, according to the fineness of working, and the holes are equidistant horizontally and are in successively lower bands. As the diaphragm moves uniformly, the first hole traverses the whole image opposite to the first band, and as soon as this hole has passed from one side to the other of the image the next hole traverses the immediately lower strip thereof, and so on. Since the diameter and position of the holes can be determined with high accuracy, very perfect decomposition can be effected and no discontinuities are visible in the reproduced picture. The horizontal distance between perforations may be equal to the breadth of the plate, but it is better to make it somewhat greater so that an interval elapses between the tracing of successive trips. During this interval (which may be regulated by the spacing of the holes) the seven selenium cells remain in darkness and thus an opportunity of losing residual conductivity is afforded them. Returning now to the sending and receiving circuits for color telegraphy, Fig. 3 shows the transmitting connections in which are applied the fundamental principles evolved by Ruhmer. The selenium cells are in three groups, of which the first and third contain two cells in parallel. Each group is shunted in a battery circuit closed by a self-

induction coil  $L$  connected in the supply circuit of a Poulsen arc as shown. The circuit of the battery may be closed on the inductance coil in the oscillating circuit, as in the Campos system of wireless telephony. These are the best two arrangements for the electrical transmission of photographs, inductive coupling being impossible at this point. The three Poulsen arcs emit continuous trains of waves of different frequencies and induce corresponding currents in the line coils and hence superimpose three distinct resonant circuits tuned respectively to the frequencies of the arcs at the sending station. These circuits terminate across three Poulsen arcs placed close together as shown, and in front of the arcs are three colored screens— $S_1$ , a mixture of red and orange;  $S_2$ , a mixture of yellow, green and blue;  $S_3$ , a mixture of indigo and violet. If of equal initial intensity, the beams transmitted through these screens form white light when combined by the lens  $L$ . It should be noted that the detectors used in the receiving circuits must have unilateral conductivity. The De Forest audion valve gives the best results, but crystal detectors can also be employed satisfactorily. At the sending station the beam of light



FIGS. 2, 3 AND 4—APPARATUS AND CIRCUITS FOR TRANSMITTING COLOR PHOTOGRAPHS

which traverses the color photograph (ordinary telephony), or the objective of the photographic chamber in the case of direct telephony, falls on the seven selenium cells and actuates one or more of the groups according to the constituent colors in its composition. The waves emitted by the transmitting arcs, and hence the intensities of the three high-frequency line currents, are correspondingly modulated. At the receiving station the three components of the line current are tuned out and rectified and then modulate the luminous intensity of the arcs behind the three colored screens in sympathy with the variations in the line current components, and hence are ultimately in sympathy with the depth and color of the image transmitted. The resultant combined beam at the receiving station is identical in color variations with the original and may be used to take color photographs in the ordinary manner. In order to obtain the best possible separation of the line current components at the receiving station, the coupling of the transformers  $T_1$ ,  $T_2$ ,  $T_3$  (Fig. 4) should be weak. At the sending station, however, the line transformer coupling must be as strong as possible.—*London Elec. Review*, March 14, 1913.

**Wireless Telegraphy.**—F. J. CHAMBERS.—A long and profusely illustrated article on the Lodge-Chambers system of

wireless telegraphy. Reference is made to the 1897 patent of Sir Oliver Lodge, describing a method of charging the radiator by an "impulsive rush." The 1897 Lodge transmitter is said to have been the first wireless telegraph transmitter including two coupled circuits. Lodge's transmitter was, in fact, a special form of Tesla oscillation generator applied to wireless telegraphy. A description is

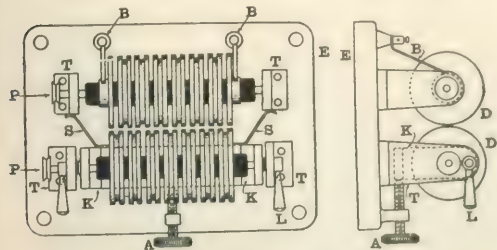


FIG. 5—CHAMBERS ROTARY DISCHARGE

given of the multiple spark-gap of Chambers which is designed to carry out Lodge's system upon the higher powers now in vogue. This consists essentially of a multiple spark-gap in which each individual spark is formed between surfaces very closely adjacent and in relative motion, the electrodes having such dimensions as to possess considerable heat capacity. Two sets of electrolytic copper disks separated by insulating washers are mounted upon insulated shafts. The form of the disks is shown in Fig. 5. One set of disks rotates in ball bearings fitted in the fixed pedestal brackets *T* and *T*. The other set is mounted in a rigid cradle *K*, which swings about the axis shown and is clamped in any position by *L* and *L*. The ends of both the shafts are produced and carry pulleys for belt driving. The swinging cradle is fitted with coach springs, *S* and *S*, and the adjustment of the swinging cradle is made by *A* against these springs in compression. Owing to the fine thread on the adjusting screw *A* and the leverage, the distance between one set of disks and the other can be regulated with great precision. Brushes *BB* make contact with the outer disks on one shaft as shown. The spark passes from one outside disk to the opposite double disk, from that to its neighbor on the other shaft, and so on through all the gaps in series until the brush at the other end is reached. In this form of discharger the two sets of disks can either be driven in the same direction at slightly different speeds, in which case the spark is elongated by the rapid relative

standard forms of the various apparatus used in the Lodge-Chambers system. Reference is made to the "harmonic selector," which it is claimed, is novel. This "harmonic selector" (Fig. 6) consists of a transformer, which may or may not contain iron, the secondary of which is connected through a variable condenser and a pair of telephone receivers. Most modern wireless detectors convert high-frequency currents into weak ones for detection by means of very short unidirectional impulses (see Fig. 7), the frequency of which depends on the spark frequency of the transmitter. Now, if such impulses are brought to bear upon a circuit which has a natural period of its own, the maximum alternating effect in this circuit is obtained when the frequency of the impulses corresponds with the natural frequency of the circuit, or, in a wireless receiver, for instance, where the duration of an individual impulse is very short, the period of the closed circuit may be some multiple of the impulse frequency. Now, as the selectivity of such a closed circuit depends very greatly upon its natural decrement, the inductance should be large and the resistance low. In the harmonic selector, by the adoption of the coupled closed secondary circuit, it is possible to choose suitable inductance and resistance values, and quite remarkable selectivity between transmitting stations with different spark frequencies has been observed. Moreover, with this arrangement, owing to the fact that an alternating current of more or less sinusoidal form operates upon the telephone diaphragm, full advantage can be taken of the extreme

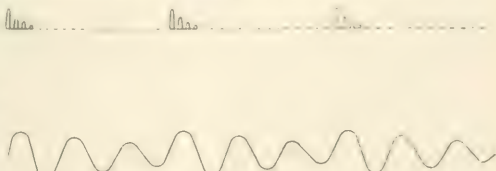


FIG. 7—IMPULSE ACTION IN HARMONIC SELECTOR

sensibility of this to frequencies in its own natural neighborhood, and in practice the secondary circuit is adjusted to a frequency which is some multiple of the spark rate and near that of the telephone diaphragm. *London Observer*, March 14 and 21, 1911.

## Book Review

DIE GRUNDGESAMHEITEN DER WECHSELSTROMTECHNIK. By GUSTAV REINSELKE. Second enlarged edition. Braunschweig, Germany: Friedrich Vieweg & Sohn, 1912. 222 pages, 180 illus. Price, 5.8 marks.

This is the second and enlarged edition of Volume II of a good textbook on elementary alternating currents and their applications. Although vector diagrams are frequently presented in the book, and with the introductory closed derivation of these representations, one is impressed that complex quantities are scarcely referred to. The power and range of the treatment must be greatly improved if complex quantities were treated. It is also to be regretted that the symbols employed to represent Ohm's law are not those internationally adopted by the I. E. C. (in form of 1911). In general, the treatment and conventions are good and correct. The principal weakness of the book relates to the bibliography. The purely alternating current circuit, mutual induction, iron-core transformer, complex vector forms, impedance, admittance, resonance, etc., are treated in a superficial and unsatisfactory manner.

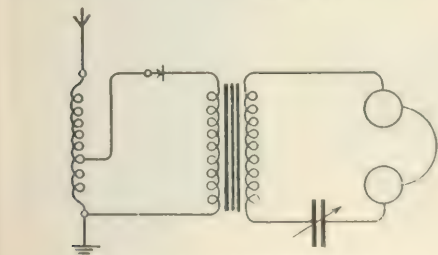


FIG. 6—HARMONIC SELECTOR

motion of the adjacent electrodes, or an alternative method is to drive the two sets of disks in opposite directions at slightly different speeds, in which case the spark is subjected to the air blast produced by surface friction and there is also a magnetic blow-out effect similar to that which is obtained in the well-known horn arrester. The author then describes the designs of the

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Self-Starting Synchronous Motors

A self-starting synchronous motor has recently been designed by the Lancashire Dynamo & Motor Company, Trafford Park, Manchester, England, to overcome the drawback characterizing the synchronous machine in that it requires skilled attention and synchronizing before it can be



FIG. 1—ROTOR OF SELF-STARTING MOTOR

put on the circuit. This type of machine starts up like a wound-rotor induction motor, and when it is up to speed and the exciting current is switched on it pulls itself into step automatically, thus enabling the motor to be used for all sorts of industrial purposes where a synchronous motor of the ordinary type would be inadmissible.

The current is switched on to the stator by the stator switch, and a resistance is put across the slip-rings in parallel with the field winding. The motor then starts up, and as the resistance is cut out the speed rises until it gets close to synchronism. At this point the rotor is put across a buffer resistance, and the switch being moved one step further puts the exciter across the slip-rings, with all the resistance in series with the field.

The motor then comes into synchronism and runs as a synchronous motor, the field excitation being adjusted to suit the power-factor which is required.

This type of motor is well suited for many kinds of industrial works and for driving machines, such as pumps or air compressors, on which the load is fairly constant. The excitation can be adjusted to raise the power-factor of the works to something in the neighborhood of 0.9.



FIG. 2—750-HP COMBINATION UNIT

The motors are of the revolving-field type with cylindrical rotors. The stator windings are form-wound, embedded in partially closed or open slots and insulated in micanite troughs, which project some distance from the core and provide against breakdown at the point where the windings leave the slots. The end connections also are clamped to the end plates when necessary.

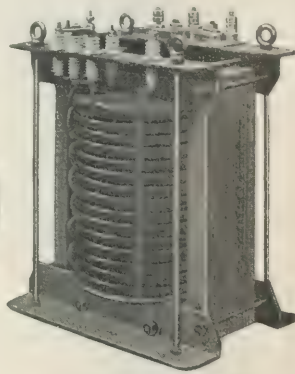
The rotor is constructed with numerous ventilating ducts, and a fan of the full rotor diameter is provided on either side of it, which, in conjunction with the stator end shield, provides an adequate ventilating arrangement.

The rotor coils are wound with flat copper strip and afterward taped. Standard ball bearings are fitted to the journals, and a double-ball thrust bearing is provided to keep the rotor in position, the other bearings being free. These motors have been used for a variety of driving purposes and have also been supplied to run idle and act as rotary condensers.

The cut shows a 750-hp combination, one of two similar sets supplied to the city of Guelph, Canada, each consisting of a 750-hp, 25-cycle self-starting synchronous motor directly coupled to a direct-current railway generator and an alternator with exciter. The latter machine delivers current at 62.5 cycles. The set runs at 750 r.p.m. from 2200-volt, three-phase mains.

### Air-Cooled Transformers

The transformer illustrated herewith is a single-phase, 50-kw, 3300-110-volt, 60-cycle air-cooled unit made by the Foster Engineering Company, Wimbledon, London, England. The low-tension coils are cylindrical and form-wound and placed next to the cores. The high-tension windings are also form-wound in sections and are separately taped and arranged outside the low-tension coils. The porcelain insulators between the sections of the coils allow of ample cooling surface. The insulation between the low-tension and the high-tension coils consists of a mica tube on each limb. As the cores are covered by fiber angle pieces placed on the corners, the low-tension



AIR-COOLED TRANSFORMER

coils are well insulated and breakdown need not be feared on this point.

A special fire-proofing and heat-dissipating treatment is applied to all windings, which is said to make the coils practically indestructible and which allows a very heavy overload to be carried for extended periods without injury to the transformer.



### Motor-Control Pillars

The British Westinghouse Electric & Manufacturing Company, Ltd., manufactures a line of motor-control pillars for direct-current circuits which are particularly well adapted for use in exposed and damp places such as dock-yards, railway yards, mills and chemical works. They are of substantial construction, all parts are inclosed in

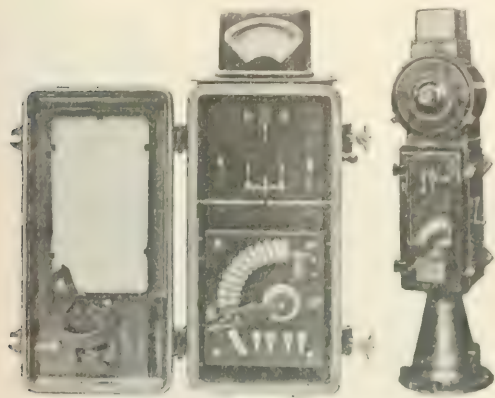


FIG. 1—INTERIOR OF MOTOR CONTROL BOX FOR WALL MOUNTING. FIG. 2—MOTOR CONTROL PILLAR.

rigid cast-iron weatherproof boxes and all parts are inter-changeable.

These boxes and pillars are made either for wall or floor mounting, in various combinations, such as the following: Double-pole, overload circuit-breaker and motor starter with no-voltage release; double-pole, overload circuit-breaker, motor starter with no-voltage release and field rheostat; double-pole, quick-break, single-throw knife switch, two single-pole cartridge fuses and motor starter with no-voltage and overload releases; double-pole, quick-break, single-throw knife switch, two single-pole cartridge fuses, motor starter with no-voltage and overload releases and field rheostat. To any of these combinations extra attachments can be added, such as slow-motion starting gear on starter, weak field interlocking device on starter, moving iron ammeter, moving coil ammeter and others.

The boxes are arranged for containing either a circuit-breaker and a motor starter or a switch, fuses and a motor starter, as may be required. When a field rheostat, ammeter or a combination of these is required the apparatus is mounted on top of the box as shown in Fig. 2.

Up to the room-size the circuit-breakers are of the double-pole fixed handle type and above that size they are of the loose-handle type; that is, they cannot be held in the closed position while there is an overload on the motor. Two overload release coils are provided, one on each pole and these are adjustable from approximately full load current to 100 per cent above full load. Since the overload trip is on the breaker, the circuit is broken there and not on the starter when an overload occurs. A magnetic blow-out can be fitted when required. When the switches and fuses are mounted in the boxes the circuit-breaker is, of course, dispensed with.

The switch is of the double pole, quick-break, single-throw knife type and is mounted on a slate base in the box above the motor starter. It is operated from outside the box by means of a lever mounted at the side.

The motor starters are generally of standard type but somewhat modified to render them suitable for being mounted in the boxes. The face plates are provided with contacts, renewable from the front; a separate collector ring is fitted so that no current is carried through the hub

and center post; carbon sparking tips are provided for the final break. The resistors of the starters are either of ordinary unit type or of the cast grid type, according to the size of the starter.

When the starters are mounted in boxes together with a circuit breaker they are provided only with a no-voltage release, but when arranged in boxes with switches and fuses they are generally provided with both no-voltage and overload release coils.

### Double-Inclosed Flame-Arc Lamps

The principle of the double-inclosed lamp with ordinary electrodes is, as is well known, to increase the time during which the lamp will burn without re-trimming, and increase the electrode consumption by preventing access of air to the arc. The properties of flame arc lamps, when given about five times as much light as ordinary incandescent lamps, are opposed to the application of this principle to flame arc lamps. While ordinary carbon electrodes leave a residue at the tips of hard particles, flame electrodes give off a daily deposit where they meet, thereby giving the lamp a given opportunity of cooling. In addition to this, the gases tend to corrode the glass of the globe, thereby decreasing even further the efficiency of the light source a short time of burning. This difficulty has been overcome in open-arc lamps by artificial ventilation.

Though it was impossible to export this method to inclosed-flame lamps, long-burning inclosed-flame arc lamps are now manufactured by the Siemens-Schuckertwerke, Berlin, and by the Siemens Brothers Dynamo Works Ltd., London, which lamps are said to exhibit all the qualities of freedom from deposit, weathered, strong beams and illuminating qualities.

Electrodes made by Siemens & Co., Germany, white or yellow, are used; the unconsumed particles of these electrodes are said not to produce any sensitive effect whatsoever, and by their special composition the energy consumption is kept low, notwithstanding the inclosedness of air. The deposit is found to occur on certain parts only, so that the difficulty of the light is not hindered.

The casing, as illustrated in Fig. 3, consists of an outer

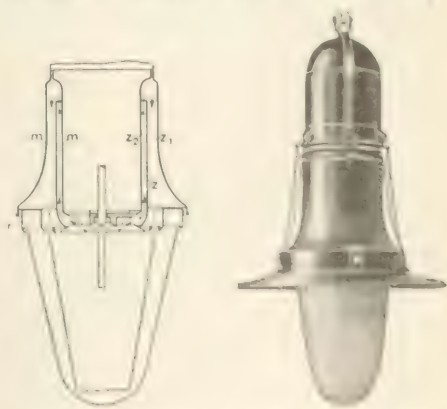


FIG. 3—VERTICAL SECTION OF DOUBLE-INCLOSED FLAME ARC LAMP.

and inner casing, the cylinder  $a$ , and the globe ring  $b$ . The cylinder  $a$  divides the space between the globe ring  $b$  into two chambers, the upper chamber, bounded by the outer and inner casings, and the lower chamber, bounded by  $a$ ,  $b$  and  $c$ . It is found by the most accurate means that a layer of carbonizing and softening gas surrounds the electrodes, and is excluded from the air that the circulating chamber  $a$  draws out of the globe ring  $b$  and passing into the chamber  $c$ .

they are then drawn down in a purified condition into the inner globe. The cooling effect obtained by this means causes the solid matter in suspension in the gases to settle on the inner surfaces of the circulating chambers. The small amount of solid matter which passes back into the globe with the gases is deposited on the coolest portion of the inner globe, namely, the lower third of the globe. This is of no consequence as far as the emission of light is concerned, as the upper portion of the globe through which the light is emitted remains practically free from deposit. The inner globe is inclosed in an outer globe, which serves to prevent it from becoming cool and to protect it against wind and rain.

### Horn-Gaps for Aluminum Lightning Arresters

An improvement in the construction of horn-gaps for aluminum lightning arresters has been made by the addition of charging resistors. The discharge paths to the cells consist of a main gap and an auxiliary gap, with a low-resistance unit in parallel with the main gap.

The auxiliary gap has a smaller setting than the main gap and is fitted with a short-circuiting contact which at times of charging bridges the auxiliary gap and charges the cells through the resistors.

In the normal operation of the arrester this arrangement of horns introduces selective paths for the discharge of lightning or other forms of potential surges. One path consists of a small auxiliary gap, a low-resistance unit and the aluminum cells. The other path consists only of the main gap and the aluminum cells. All discharges will first spark across the auxiliary gap and pass to ground through the resistor and the cells. If, however, the quantity of the discharge is too great to be dissipated through this path, the discharge automatically shunts to the main gap where it is not impeded by the resistors. The resistance is low in

oscillations may be harmless or may result in local high potentials as a result of resonance. This same phenomenon in a very mild form has been noticed at times of charging aluminum arresters. By the addition of charging resistors and short-circuiting contacts for the horn-gaps the possibility of troubles due to the charging of arresters is said to be greatly minimized if not entirely eliminated.

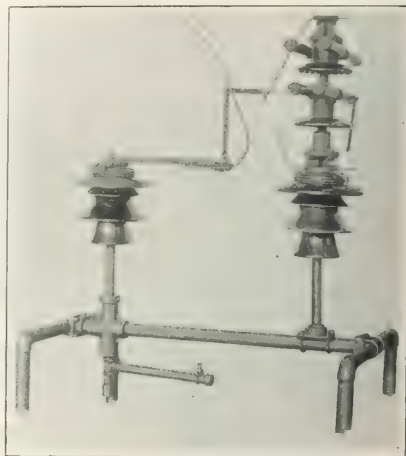


FIG. 2—DETAILS OF GAP

These horn-gaps are manufactured by the General Electric Company, Schenectady, N. Y.

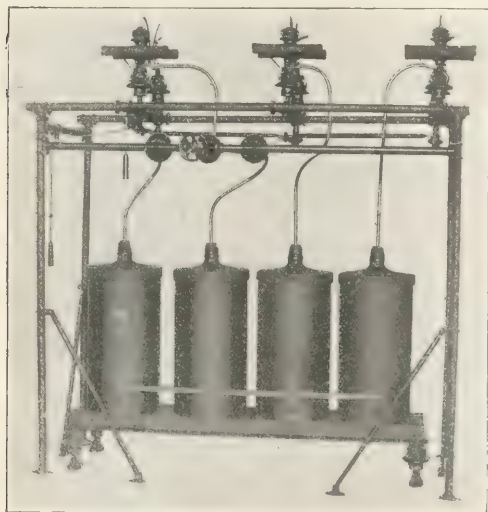


FIG. 1—BATTERY OF LIGHTNING ARRESTERS

value, and consequently all but the heaviest discharges are taken care of by this auxiliary path.

It is well known that any arc on a high-voltage circuit, especially if it alters the electrostatic condition of the circuit, is accompanied by oscillations. An example of this is noted when an arc takes place over a line insulator or from a transmission line to an adjacent tree. The resulting

### Boiler Cleaning by Oxy-Acetylene Flame

A new process for cleaning boilers from scale has been invented by Mr. Adolph Schror, of the Pyro Boiler Cleaning Company, 37 Essex Street, Strand, London. This method employs the heat generated by an oxy-acetylene flame, which, on application to the scale, causes it to become detached from the boiler plate owing either to the expansion of the scale or to the generation of steam between it and the plate. At a recent demonstration on an old boiler it was shown that after the flame had been applied for a few seconds the scale fell away from the plates.

It is claimed that the plates are not injured by the process. This point was demonstrated by placing a piece of boiler scale about 6 in. square and  $\frac{3}{8}$  in. thick flat on the hand and applying the flame for a full minute without causing any inconvenience to the hand underneath. Apart from the interest attached to this method of boiler scale removal, this demonstration indicates the urgent necessity of keeping boilers as free from scale as possible. It has been shown that an oxy-acetylene flame applied for a few minutes does not heat boiler plates covered with scale and consequently the amount of heat transmission must be greatly retarded.

After being cleaned by this process a boiler may be coated with a special paint, which, it is stated, enables subsequent deposits of scale to be removed at intervals of three months by means of a hand-operated tool, and also prevents pitting and corrosion of the plates.

The consequent saving in fuel is claimed to be between 15 per cent and 40 per cent according to the amount of scale removed, in addition to the saving effected by prolonging the life of the boiler. Another advantage claimed is that with this system all parts of the boiler, including those which are usually inaccessible to the chipping hammer, may be cleaned easily.



## Most Powerful Electric Locomotive in the World for New York Central Lines

The New York Central & Hudson River Railroad recently placed in service an electric locomotive of novel form, and as a result of an exhaustive series of tests upon it a contract has been awarded the General Electric Company for nine additional locomotives of the same design. The electric locomotives at present in service on the New York Terminal weigh approximately 115 tons, and while the new locomotive is considerably lighter, as it weighs only 100 tons, it is much more powerful, being provided with ample forced-air ventilation and designed with a view to continuous high-speed service. All the weight is carried on motor-driven axles, while the original locomotives have only 70 tons weight on the driving wheels. The new engines will exert sufficient tractive effort to haul a train weighing 1000 tons at 60 miles per hour. In regular service they have a capacity for developing 1400 hp continuously and can develop as high as 5000 hp for short periods.

At the present time the New York Central & Hudson River Railroad is operating forty-seven electric locomotives in the New York Terminal service. Of these, thirty-five were built in 1906 and twelve in 1908. They are all of the 115-ton type and each is equipped with four bipolar,

which can be changed from parallel to series and the series and parallel connections can be changed from series to parallel.

The general principle of the new locomotive is the General Electric Type M. The external regulating resistors, divided into four parts, are directly connected, each part to a pair of motors permanently grouped in parallel. The pairs of motors with their respective resistors are connected all in series on the first point of the controller. The resistance is varied through eight points on the controller and finally short-circuited on the ninth or running point. The pairs are then operated similarly in series-parallel with all resistance cut out on the seventeenth point. Finally all the pairs are connected in parallel, with the twenty-fourth step a running point. This provides a control with nine steps for series, eight steps for series-parallel and seven steps for parallel. The transition between all four parts of motors in series to series-parallel is accomplished by short-circuiting two of the pairs of motors during the instant of transfer. The transition between series-parallel and parallel is effected by means of the standard bridge method.

The motor-cut-out switches are connected so that any pair of motors may be cut out of circuit. The locomotive will operate when a pair of motors is cut out with two groupings of the motors, the first with two pairs of motors in



MOST POWERFUL LOCOMOTIVE IN THE WORLD

gearless motors. The new locomotive also has the bipolar gearless design, but it is equipped with eight motors. Each of the motors has approximately three-fourths the rating of the motor used on the previous engines, making the aggregate rating of the locomotive approximately 50 per cent greater than before and affording approximately 25 per cent higher speed.

There are four independent magnetic circuits in the locomotive corresponding to the four trucks. The magnetic flux path on each truck passes in series through the fields and armature of one motor, through the center transom and the fields and armature of the second motor to the end frame and then returns to the starting point through the two side frames and a reinforcing magnet bar lying parallel with the frames.

Each motor at its one-hour rating has a capacity of 325 amp on 600 volts, or a continuous rating of 260 amp on 600 volts under forced ventilation. For the complete equipment of eight motors this corresponds to a capacity of 13,500-lb. tractive effort at 54 miles per hour for the one-hour rating and 10,000-lb. tractive effort at 60 miles per hour continuously.

Electrically the motors are connected permanently in parallel in pairs, and the pairs can be connected in three combinations: viz., series, series-parallel and parallel. They are insulated for 1200 volts, so that if at any future time it should be desired to operate the locomotive on 1200 volts, the permanent connections for the four pairs of motors

series and the second with three pairs of motors in parallel. An ammeter is located at each engineer's position and records the current in the circuit of one pair of motors.

Current is collected by eight under-running third-rail shoes, or by two overhead trolley wheels on gaps in the third-rail. The overhead trolleys are the pantograph type and are pneumatically operated. They can be put into service from either engineer's position by a foot-operated valve. The trolley is designed for intermittent use and is therefore arranged to be held in a raised position only while the valve is held open by the engineer's foot.

The blower set provided for ventilating the driving motors is located at the central compartment. It is arranged to deliver 20,000 cu. ft. of air per minute and is driven by a series-wound motor of the railway type. The air compressor is of the two-stage piston-driven type with a piston displacement of 100 cu. ft. of air per minute when pumping against a back pressure of 145 lb. per sq. in. The air is taken from the intake of the central compartment through a screen, which prevents the entrance of particles of dust. The compressed air in passing from the compressor to the driving motors is conducted through radiating pipes under the platform of the motor car. From the radiating pipes the air is delivered into a series of air reservoirs. There are four of these, each 10 in. x 10 in. They are located under the floor of the car and connected in series, which affords a further opportunity for radiating and condensing.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Day & Zimmerman Open New Offices in Philadelphia.**—On April 5 the firm of Day & Zimmerman, engineers, celebrated eleven years of activity in the industrial and mechanical engineering and public-utility fields by giving a housewarming at its new offices, 611-613 Chestnut Street, Philadelphia. The new offices were also formally opened for business at the same time. As a part of the occasion a reception was tendered to a large number of guests, among whom were many well-known manufacturers, bankers, railroad officials, both steam and electric, electrical and mechanical supply dealers and other friends and clients of the company. In addition to the new quarters, the equipment of which is thoroughly modern in every respect, the firm also has a branch office at 43 Exchange Place, New York, and offices in various sections of the country where public-utility properties are operated under its management. With the engineering organization which it maintains, the firm is in a position to handle industrial commissions of any magnitude and variety, from examinations, reports and recommendations to erecting buildings for industrial purposes and installing the necessary equipment. In the public-utility field the firm operates the Penn Central Light & Power Company, which furnishes electric service in the State of Pennsylvania in Altoona, Hollidaysburg, Juniata, Duncansville, Huntingdon, Petersburg, McVeyton, Lewisport, Burnham, Yagerstown, Reedsville, Portage and Gallitzin, and artificial gas to Lewistown and Huntingdon. The firm also operates the Lewistown & Reedsville Electric Railroad, the system of which extends from Lewistown Junction to Reedsville, including local service in Lewisport, and an important branch of this line extends to Burnham, Pa., where the works of the Standard Steel Company are located. The Citizens' Traction Company of Venango County, Pa., serving the cities of Oil City and Franklin, Pa., and intervening territory, is another property operated by this firm. As this company serves one of the most prosperous localities in Pennsylvania, Oil City being the most important crude-oil center in the State, it has been deemed expedient to make extensive improvements and extensions to the property in the near future. The firm is also interested in the Citizens' Light & Power Company, which supplies electrical energy in Oil City and vicinity. Among some of the engineering and construction contracts handled by the firm may be mentioned the advisory work done by it in connection with the electrical installation required for eight large Lidgerwood cableways purchased by the Isthmian Canal Commission for the building of the Gatun locks. Subsequently the firm assumed entire charge of the shop inspection, assembling and shipment of materials to the Canal Zone, the erection of cableways and their tests for acceptance. Some of the engineering and construction work, aside from that already mentioned in the industrial line, has included the building of a 45,000-volt transmission line extending from Altoona to Twin Rocks, Pa., a distance of forty miles; a 45,000-volt transmission line extending from Eldorado to St. Benedict, a distance of twenty-five miles; a 45,000-volt transmission line from Warrior Ridge to Lewistown, thirty-five miles long; approximately seventy-five miles of 6600-volt and 2300-volt secondary line for various properties; a number of high-tension step-down transformer-stations, including the buildings and their equipment; the change in the distribution system in Altoona from overhead to underground, necessitating entire change of switching stations; extensive additions and changes to the power plants of the Penn Central property, including installation of large boiler plants, steam turbo-generators and all the equipment incidental thereto; new power plant for the Citizens' Traction Company and extensive alterations to the carhouses and the lake.

**Orders Axle-Lighting Equipment.**—The Atchison, Topeka & Santa Fé Railway Company has recently ordered from the Electric Storage Battery Company sixty-two axle-lighting equipments. The Electric Storage Battery Company has for some time been developing a new axle-lighting outfit involving a number of radical departures. The dynamo is of the Rosenberg type, which has been extensively used abroad, modified, however, to give constant voltage characteristic rather than constant current. The field excitation is controlled by a Wheatstone bridge combination of circuits without any moving parts or contacts. The decision to place this order with the Electric Storage Battery Company was based on the results of a test of this system begun last fall by the Santa Fé Railway. The equipment which was put in service for the purpose of demonstration has now gone over 60,000 miles without a failure, and the result of this demonstration has been most gratifying to the Railway Company and to the manufacturer.

**Will Extend Ontario Transmission Line.**—Work is to be started within a few weeks upon an extension of the transmission line of the Hydroelectric Power Commission of Ontario from St. Thomas to Windsor, Ont., a distance of about 130 miles. Contracts amounting to approximately \$750,000 for high-tension transmission equipment have been awarded by the commission for this extension. The Canadian Bridge Works Company, of Walkerville, Ont., has been awarded the contract for towers and footings and the Canadian Porcelain Company will supply all of the insulators. The Galt Malleable Iron Company has received the contract for malleable-iron clamps and the Canadian Westinghouse Company is to furnish a large amount of equipment. W. H. Dunne, Toronto, has received a contract for pressed steel clamps. The construction work is to be started at four or five points along the line between St. Thomas, Chatham and Windsor.

**Quick Shipment by Gregory Electric Company.**—At 11:30 a. m. April 2 the master mechanic of the Pennsylvania Railroad Company's shops at Logansport, Ind., telephoned the Gregory Electric Company, Chicago, that he needed a 100-kw, 250-volt generator immediately and asked that one be shipped to him in a baggage car attached to a limited train leaving the Union Station, Chicago, at 4:15 the same afternoon. This station is about 2 miles from the Gregory Company's works. The machine was delivered at the station one hour before the train left and was installed and placed in operation on the night of April 2.

**Dayton Fan Manufacturer Saved Finished Stock in Flood.**—In the recent catastrophe at Dayton, Ohio, the factory, offices and machine shop of the D. L. Bates & Brother Company, electric-fan manufacturer of that city, were flooded and the company's stationery, catalogs and other printed matter were destroyed. The finished stock of fans, however, was on the fourth floor of the company's building and escaped injury. The company stated early this week that it would be in a position to ship goods by April 5 or 6 and asks that its customers overlook the lack of the usual printed matter sent out at this time of the year.

**Halifax Company Plans Hydroelectric Developments.**—A bill to incorporate the Halifax (N. S.) Tramways & Power Company, Ltd., with a capital of \$5,000,000, has been introduced in the Provincial Assembly. The promoters of the new enterprise are the directors of the Halifax Electric Tramway Company, and their object is said to be the development of hydroelectric energy and the merging of the Halifax Electric Tramway into the new company. The acquisition of the Nova Scotia Power Company, which controls the falls on the Gaspeaux River, is also understood to be part of the plan.

**Controversy Over Toledo Railway & Light Reorganization.**—At a meeting of the directors of the Toledo Railway & Light Company held on April 3 Morris Allen was elected president and L. E. Bielstein general manager of the company, these two officials succeeding F. R. Coates, who remains as a director. Mr. Allen is a young attorney of Toledo and son-in-law of Barton Smith, counsel for the company and attorney for the stockholders' reorganization committee. It is said that the action taken at the directors' meeting was contrary to the advice of Henry L. Doherty & Company, representatives of over 80 per cent of the stock of the company. Rumor has it that a difference arose between the attorneys of the bondholders' and stockholders' reorganization committees and that Henry L. Doherty & Company, as representatives of the new interests, have declined to take part in the controversy. This action has nothing to do with the ownership and control of the Toledo company or the eventual operation of this property by Henry L. Doherty & Company.

**Meeting of Electrical Supply Jobbers' Association.**—On the evening of April 8 the Atlantic Division of the Electrical Supply Jobbers' Association held a dinner at the Hotel Nassau, Long Beach, L. I. Over one hundred electrical manufacturers were among the guests of the association on the occasion. Following the dinner an excellent vaudeville was enjoyed by those present. Among the electrical supply jobbers represented at the dinner were the Alpha Electrical Supply Company, Brooklyn Electrical Supply Company, The Burnet Company, Central Electrical Supply Company, Fletcher Stanley Company, Fullerton Electric Company, Hudson Electrical Supply Company, W. F. Irish Electric Company, E. B. Latham & Company, Manhattan Electrical Supply Company, Newark Electrical Supply Company, Northwestern Electric Equipment Company, Royal Eastern Electrical Supply Company, Sibley & Pitman, Stanley & Patterson, Western Electric Company and Charles W. Leveridge.

**Cleveland Municipal Lighting Bonds Fail to Sell.**—The sinking fund commission of the city of Cleveland recently endeavored to sell the \$500,000 municipal lighting bonds purchased six months ago by competitive bidding, but not a single bid was received. It was at first thought that this was one of the effects of the flood and that investors desired to place their money where it would aid in rebuilding the ruined cities, but the administration now believes that a higher rate of interest will have to be offered, since the bonds are now taxable. These bonds bear a per cent interest. If the bonds had been sold it was the intention of the commission to purchase \$500,000 more of the issue in order that the construction work on the new plant might be continued. As it is, the work will have to be suspended until some disposition is made of the bonds.

**Central Colorado Power Reorganization Effected.**—A reorganization of the Central Colorado Power Company, the assets of which were sold recently by the receivers, has been effected by the incorporation of the Colorado Power Company. This is capitalized at \$2,000,000, of which \$5,000,000 is preferred stock and \$15,000,000 is common stock. Only the bondholders of the old company are shareholders in the new. The unsold stock will be held in the treasury, subject to sale, for the purpose of providing funds for extensions and the purchase of other concerns. The offices of the company will be in Denver, as in the past.

**Active Demand for Central Station Service in Indianapolis.**—The Merchants' Heat & Light Company of Indianapolis, Ind., a subsidiary of the American Public Utilities Company, operated by Kelsey, Brewer & Company, of Grand Rapids, Mich., within the past thirty days has closed contracts with twenty-five manufacturing concerns at Indianapolis for 500 additional hp of electric energy, and has added to its heating and lighting contracts twenty-eight business buildings, including theaters, churches, stores and apartment houses.

**Change in Name of St. Louis Company.**—The Suburban Electric Light & Power Company of St. Louis is now known as the Electric Company of Missouri, and its capital stock has been increased from \$850,000 to \$1,750,000. The company is a subsidiary of the North American Company. In addition to the increase in capital stock, the

Electric Company of Missouri has filed a certificate with the Bankers' Trust Company, New York, increasing a large issue of 2 per cent bonds of which \$5,000,000 will be issued at once.

**Corning (N. Y.) Gas & Electric Company Reorganization.**—The Corning Gas & Electric Company has filed a petition to the Public Service Commission for the Second New York District, asking permission to accept and transfer the franchise and assets of the Corning Gas & Electric Company. Authority to raise \$500,000 and other funds, \$372,000 stock and \$128,000 debentures is requested. The move is in accordance with a plan for reorganizing the Corning (N. Y.) Gas & Electric Company.

**Central-Station Service for Copper-Mining Company.**—The Inspiration Copper Company, Miami, Ariz., recently entered into a ten-year contract for a supply of electrical energy from the hydroelectric station on the Salt River reclamation project. The company is to use 12,000 kw. for this energy and will construct a transmission line to its mine and mill at Miami, Ariz., at its expense. It is stated that contracts have already been made for the use of about 20,000 hp from the Salt River hydroelectric plant.

**Public-Utility Financing.**—During the month of March the corporate financing in the United States amounted to \$150,000,000. Of this, railroads led with \$60,000,000 and public utilities were second, with \$44,000,000 in new financing. Industrials were third, with \$45,000,000. In view of the fact that public utility securities were little known a few years ago as compared with railroad and industrial securities, the foregoing is a noteworthy indication of the rapid financial growth of the utility industry.

**New York State Companies Consolidate.**—The Empire Gas & Electric Company of Albany and General Electric have just acquired the entire capital stock of the Central New York Gas & Electric Company, which operates plants in Newark, Palmer, Poughkeepsie, Watkinson, Genesee, Seneca, Castle, Phelps and Clyde, in New York State. This transfer is subject to the approval of the Public Service Commission for the Second New York District.

**Postpone Consolidated Gas, Electric Light & Power Company Meeting.**—The April meeting of the directors of the Consolidated Gas, Electric Light & Power Company, of Baltimore, scheduled for April 8 was postponed until April 25. The question of issuing 4½ per cent debenture stock, which was to have been considered at the meeting, is postponed to their officers' March 25, will be taken up on April 25.

**Bronx Gas & Electric Company to Issue Bonds for Improvements.**—The Bronx Gas & Electric Company has applied to the Public Service Commission for the Second New York District for permission to issue bonds to the amount of \$200,000. The proceeds are to be used for acquisition of property, plant construction, and replacement of street already expended, and for other improvements. The commission has on April 18 not yet heard on the application.

**Transformers for Chicago Street-Lighting Service.**—A second contract for street-lighting transformers has been awarded by the Chicago Board of Public Works to the Allis-Chalmers Company, Chicago, for the Twenty-Third Ward of that city. These will bring the total number of transformers of this type in use in connection with Chicago street-lighting service up to fifty-eight.

**Sell Chicago Properties of Allis-Chalmers Company.**—On April 8 a resolution was passed by the directors of the Allis-Chalmers Company, Chicago, to sell the properties of the Allis-Chalmers Company in Chicago, including the Allis-Chalmers Company Building, to the Chicago Board of Public Works, for the purpose of selling the properties of the reorganization committee to the city.

**New Cincinnati Offices for General Electric Company.**—The eleven-story office of the General Electric Co. and First Company's Building, at the corner of Sycamore and Vine Streets, Cincinnati, Ohio, has been leased by the General Electric Company for office purposes.

**Robbins & Myers' Ohio Factory Not Injured in Flood.**—The Planters' Trust Company of the Robbins & Myers Company, Springfield, Ohio, has just received word that flood waters in the latter city have actually receded and that the factory has been getting ready to resume operations.



**Syracuse (N. Y.) Electrical Manufacturers Move Into Larger Quarters.**—Following the removal of the Crouse-Hinds Company from its plant at West Jefferson and Walton Streets, Syracuse, N. Y., to its new factory building in Wolf Street, in the same city, the Dyneto Electric Company, manufacturer of electric starting and lighting systems for motor vehicles, has moved its plant from Elbridge, N. Y., into the old plant of the Crouse-Hinds Company. A special meeting of the stockholders of the Dyneto Company will be held at that company's new office, 308 West Jefferson Street, on April 15 for voting upon a proposition to increase the capital from \$70,000 to \$350,000.

**Appoint Receivers for Irrigation Company.**—The Hanford Irrigation Company, of central Washington, has been placed in the hands of receivers on a complaint of the American Power & Light Company, which asserts that \$498,000 is due it on promissory notes.

## March Statement of Copper Producers' Association

The March statement of the Copper Producers' Association, issued on April 8, showed stocks of marketable copper of all kinds on hand in the United States on April 1 of 104,269,270 lb., as compared with 122,302,198 lb. on hand on March 1, a decrease of 18,032,928 lb. The February and March statements compare as follows:

	March, Pounds—	February, Pounds—
Stocks on hand in the United States on first of month.....	122,302,198	123,198,332
Production.....	136,251,849	130,948,881
	258,554,047	254,147,213
Domestic deliveries.....	76,585,471	59,676,492
Export deliveries.....	77,699,306	72,168,523
	154,284,777	131,845,015
Stocks on hand at the end of this month.....	104,269,270	122,302,198

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	April 2	April 9
Allis-Chalmers, t.r., 3d pd.....	\$15,501,800	.....	.....	3 1/2	3 1/2
Allis-Chalm., pf., 3d pd.....	14,115,800	.....	.....	7 1/2	8 1/2
Amalgamated Cop.....	153,887,900	1 1/2	.....	7 1/2	7 1/2
American Tel. & Tel.....	344,457,400	2	.....	13 1/2	13 1/2
Electric Storage Battery, c.....	16,074,425	1	.....	51	50 1/2
General Electric.....	101,285,100	2	.....	140 1/2	141
Mackay Cos., c.....	41,380,400	1 1/2	.....	8 1/2*	8 3/4
Mackay Cos., pf.....	50,000,000	1	.....	67 1/2	68 1/2*
Western Union Tel.....	99,747,200	1 1/2	.....	70	69 1/2
Westinghouse E. & M., c.....	34,017,100	1 1/2	.....	66	65 1/2
Westinghouse E. & M., pf.....	3,998,700	1 1/2	.....	117*	117*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

	April 1 Bid.	April 1 Asked.	April 8 Bid.	April 8 Asked.
<b>Copper:</b>				
Standard, spot.....	14.75	to 15.25	14.75	to 15.25
London, standard, spot.....	67	to 68	68	to 69
Prime Lake.....	15.10	to 15.25	15.45	to 15.55
Electrolytic.....	15.10	to 15.20	15.35	to 15.45
Casting.....	15.00	to 15.10	15.20	to 15.30
Copper wire, base.....	16.25	to 16.25	16.25	to 16.50
Lead.....	4.35	to 4.35	4.35	to 4.35
Nickel.....	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter.....	8.00	to 8.00	8.00	to 8.00
Spelter, spot.....	6.00	to 6.00	5.90	to 6.00
Tin, spot.....	48.00	to 48.00	48.00	to 48.00
<b>Aluminum:</b>				
Prompt delivery.....	26.75	to 27.50	26.75	to 27.50
Future.....	26.75	to 27.50	26.75	to 27.50

## OLD METALS

Heavy copper and wire.....	14.25	14.50
Brass, heavy.....	9.37 1/2	9.37 1/2
Brass, light.....	8.25	8.25
Lead, heavy.....	4.25	4.25
Zinc, scrap.....	5.12 1/2	5.12 1/2

## COPPER EXPORTS IN APRIL

Total tons to April 9..... 7,060

## Personal

**Mr. E. E. Kirtley** has become superintendent of the municipal electric plant at Clayton, N. M.

**Mr. K. Heiberg** has become superintendent of the municipal electric light plant at Mahanomen, Minn.

**Mr. Edward Doocy** has been made manager for the Central Illinois Public Service Company at Clayton, Ill.

**Mr. W. H. Daufendiek** has been appointed secretary and manager of the De Witt (Neb.) Electric Light & Power Company.

**Mr. W. E. Wolmagott**, city electrician of Peoria, Ill., has been elected president of the Peoria Electrical Club, recently formed by members of the Jovian Order in that city.

**Mr. B. M. Grant** is the president and manager of the Light, Power & Manufacturing Company of Willow Springs, Mo., which succeeded the Willow Springs Water & Light Plant.

**Mr. L. L. Edgar** has recently been elected secretary-treasurer of the New England Section of the Electric Vehicle Association of America, succeeding Mr. W. E. Holmes, resigned.

**Mr. C. O. Mailloux**, nominee for the presidency of the American Institute of Electrical Engineers, addressed the Schenectady (N. Y.) Section of the Institute April 1, contrasting electrical conditions in Europe and in the United States.

**Mr. Harry B. Wales**, formerly of Grand Rapids, Mich., has been appointed general manager of the Pontiac Power Company and the Pontiac Light Company, succeeding Mr. F. W. Humphreys. Mr. Wales was connected with the Grand Rapids central-station company for ten years.

**Mr. Arthur Williams**, president of the American Museum of Safety, has been decorated by King Alfonso as a Knight of the Royal Order of Isabella the Catholic, which was founded in 1817 by Ferdinand VII of Spain. The honor has been bestowed in recognition of Mr. Williams' work in the interests of safety.

**Mr. John J. Kirkpatrick** has been appointed manager of the municipal gas and electric department at Holyoke, Mass., succeeding Mr. William H. Snow, who resigned several months ago to become manager of the New Bedford (Mass.) Gas & Edison Light Company. Mr. Kirkpatrick is a native of South Hadley, Mass., and is a civil-engineering graduate of Ottawa University. He served as city engineer of Holyoke for twelve years and since 1907 has been at the head of the water department.

**Mr. Franklin T. Griffith**, general attorney of the Portland (Ore.) Railway, Light & Power Company, has been selected by the board of directors for vice-president of the company and will on July 1 succeed Mr. B. S. Josselyn as president of the company. Mr. Griffith has been a resident of Oregon for twenty-two years, during all of which time he has practised law, and he has been connected with the Portland Railway, Light & Power Company for the past nineteen years. He is forty-three years old and is regarded as one of the prominent men of the State. Having been associated with the company for so many years, his knowledge of policies and operating methods is by no means limited.

**Mr. Benage S. Josselyn**, who for the past six years has been president of the Portland (Ore.) Railway, Light & Power Company, has tendered his resignation, effective July 1. Mr. Josselyn is well known in public-utility fields and was formerly vice-president of the Baltimore (Md.) Electric Power and Maryland Telegraph & Telephone companies. During 1902 and 1903 he was general manager of the Hudson Valley Railway, Glens Falls, N. Y., and during the following three years he was general manager of the Union Terminal Railway, Sioux City, Ia. Mr. Josselyn is a native of Illinois, having been born at Heyworth Feb. 7, 1858. He has been associated with the railroad field from early youth, but his greatest work has been that which he now relinquishes. During his incumbency the Portland Railway, Light & Power Company has expended over \$24,000,000 in betterments and extensions, the greater part of which has been spent on the hydroelectric developments at Estacada, Cazadero, Bull Run and Sandy River. The





## Construction

### New England

**CONCORD, N. H.**—The Concord El. Co. has submitted a proposition to the Board of Water Commissioners offering to furnish electricity for pumping the city water. The company agrees to replace the two steam pumps now in operation with electrically driven centrifugal pumps of equal capacity or greater, without any expense to the city, and to furnish electricity to operate the same, with a guaranteed minimum payment of \$2,500 per year under a ten-year contract. Upon the expiration of the contract the pumps and equipment will be turned over to the city. Allen Hollis is president and Levin J. Chase manager.

**BELLOWS FALLS, VT.**—The capital stock of the Bellows Falls El. Co., recently incorporated, has been increased from \$150,000 to \$250,000, the proceeds to be used to obtain a lease of the Bellows Falls Pwr. Co. for a term of years ending Dec. 1, 1935, at which time the leased company will become the property of the Bellows Falls El. Co.

**CHELMSFORD, MASS.**—The installation of a municipal electric-light plant in Chelmsford is under consideration.

**HINSDALE, MASS.**—At the annual town meeting held March 31 it was voted to appropriate \$800 for the installation of an electric street-lighting system. A committee has been appointed to negotiate with the Pittsfield El. Co. in relation to the company extending its transmission line from Dalton to furnish the service. The street-lighting system will consist of 40 lamps.

**LENOX, MASS.**—The Selectmen in their annual report have recommended that the town take action toward lighting the streets with electricity.

**MERRIMAC, MASS.**—At a town meeting held recently the citizens authorized the electric light board to extend the municipal electric-light service to Lake Attitash if sufficient patronage is guaranteed to justify the expenditure.

**PAXTON, MASS.**—The Selectmen have called a special town meeting to be held April 11 to vote on the proposition of establishing a municipal electric-light plant.

**TAUNTON, MASS.**—The Southern Massachusetts Pwr. Co., of Fall River, is said to be seeking a franchise in Taunton.

**WORCESTER, MASS.**—Proposals will be received by the city of Worcester at the office of the Mayor, City Hall, Worcester, until April 21 for the sale of the following electrical apparatus: Two 550-volt, three-phase, 60-cycle, 250-hp induction motors complete with rails, pulleys, controllers and complete panels, with pipe work, switching apparatus, meters and current transformers; six oil-cooled 100-kva, single-phase stationary transformers, high-potential coil 6600-13,200 volts, low-potential coil 605 volts. These are all General El. Co.'s goods bought in October, 1911, and have not been used. George W. Batchelder is water commissioner.

**TERRYVILLE, CONN.**—The Andrew Terry Co. is contemplating the construction of a new power plant in connection with its works, plans for which are being prepared.

### Middle Atlantic

**BEAVER FALLS, N. Y.**—The Beaver River Pwr. Co., recently incorporated to manufacture paper and pulp and to develop electrical energy on the Beaver River, it is reported, proposes to build an electric railway from Beaver Falls to Castorland, and it is said that it will ultimately extend the railway to Carthage and possibly to Watertown. W. B. Van Allen, of Carthage, is attorney for the company.

**FRANKLINVILLE, N. Y.**—Joseph Mayer, of New York, N. Y., has taken an option on the property of the Empire El. Co., of Franklinville. The option is for 30 days and includes the entire properties, valued at \$50,000.

**MEXICO, N. Y.**—The Mexico El. Co. has applied to the Public Service Commission for approval of the exercise of franchises in the village of Mexico and in the town of Palermo.

**MONTICELLO, N. Y.**—The Public Service Commission, Second District, has authorized the Murray El. Lt. & Pwr. Co. to exercise franchises for furnishing electricity for lamps, heaters and motors in the villages of Monticello and Centerville and the towns of Thompson and Fallsburg.

**NEWARK, N. Y.**—The Empire Gas & El. Co., of Auburn and Geneva, has acquired the capital stock of the Central New York Gas & El. Co., which operates plants in Newark, Palmer, Lyons, Waterloo, Geneva, Seneca, Castle, Phelps and Clyde, subject to the approval of the Public Service Commission.

**OGDENSBURG, N. Y.**—The distributing system of the Ogdensburg Pwr. & Lt. Co. was badly damaged by the ice storm recently. A large part of the system will have to be rebuilt. E. E. Hawkins is president of the company.

**OSWEGO, N. Y.**—Niagara power will be used in operating the machinery on barge canal contract No. 37, which includes the construction of the new high dam in this city. A cable-way to carry 5-ton loads is being erected across the line where the new dam will be located. S. S. Smith is general superintendent.

**PHOENIX, N. Y.**—The Seneca River Pwr. Co. is replacing the present

arc-lamp street-lighting system with tungsten incandescent lamps. About 5 miles of No. 6 weatherproof wire will be used and 60 250-watt tungsten lamps. S. B. Stover, 724 University Block, Syracuse, has charge of the work.

**TROY, N. Y.**—The contract for installing the wiring system in the Samaritan Hospital has been awarded to the firm of Barnes & Taylor, of Troy, at \$16,000.

**WATERTOWN, N. Y.**—The Public Service Commission, Second District, has authorized the Deer River Pwr. Co., of Watertown, to issue \$45,000 in bonds to discharge liabilities incurred for capital purposes.

**WATERTOWN, N. Y.**—Plans are being prepared by the Watertown Lt. & Pwr. Co. for the erection of an electric transmission line from South Edwards to Edwards, which will ultimately be extended to Natural Bridge, where it will connect with the transmission line running from Carthage to Watertown. The Watertown company will furnish electricity to the Northern Ore Co. in Edwards.

**BLOOMSBURG, PA.**—The property of the Columbia Gas & El. Co., including the 25-mile high-tension transmission line from Berwick to Danville, has been taken over by the Columbia-Montour El. Co.

**HARRISBURG, PA.**—Application has been made to the State Department by L. S. Munroe, L. C. Lamb and W. B. Crawford for charters for the Franklin-Westmoreland El. Co., the Lower Burrell Township El. Co., the Penn Township El. Co., the Export Borough El. Co. and the Upper Burrell Township El. Co.

**MAUCH CHUNK, PA.**—The Carbon Transit Co., of Mauch Chunk, is contemplating extensive improvements to its entire system and also to its park at Flagstaff.

**NEW KENSINGTON, PA.**—Bids will be received by the Board of Directors of the school district of the Borough of New Kensington until April 15 for heating, ventilating, plumbing, vacuum cleaning, electric wiring and fireproofing for the new high school building, now being erected in New Kensington. Charles J. Reiger, Germania Savings Bank Building, 421 Wood Street, Pittsburgh, Pa., is the architect and Charles M. Best, of New Kensington, secretary.

**NEWMANSTOWN, PA.**—The Newmanstown El. Lt. Co. has awarded a contract to the Metropolitan El. Co., of Reading, to furnish energy for its system in the eastern part of Lebanon County. The Newmanstown company furnishes electricity in Richland, Kleinfeltersville, Sheridan, Shefferstown, Newmanstown and intermediate points.

**PITTSBURGH, PA.**—The Model Gas Engine Works, of Peru, Ind., has decided to remove its plant to Pittsburgh. The company will take over a large portion of the Carr property in Homewood and will erect a large plant equipped with electrically driven machinery, at a cost of about \$200,000.

**PITTSBURGH, PA.**—Application will be made to the State Department, Harrisburg, by Thomas L. Bedell, Charles Walsh and others for charters for four electric companies, to be known as the Wexford Electric, Warrendale Electric, Ingotom Electric and Perrysville Electric Co. These companies will operate in counties and townships adjacent to Pittsburgh.

**PITTSBURGH, PA.**—Application will be made to the State Department by C. E. Theobald, of Pittsburgh; H. C. Seidel and G. R. Speer for charters for 31 electric companies, which are named after the boroughs or townships in which they are located, all of which are suburbs of Pittsburgh, as follows: The Green Tree, Upper St. Clair, St. Clair, Lower St. Clair, Bridgeville, Heidelberg, Neville, Kilbuck, Bellevue, Westview, Ben Avon, Emsworth, Avalon, McKee's Rocks, Knoxville, Union, Dormont, Carnegie, Crafton, Bethel, Snowden, Thornburg, Ingram, Scott, Ross, Chartiers, Kennedy, Coraopolis, Baldwin, Carrick and Mount Oliver.

**PITTSBURGH, PA.**—Application will be made to the State Department at Harrisburg on April 14 for charters for the electrical companies whose names follow: Pittsburgh Standard, East Pittsburgh Standard, Millvale Standard, Clairton Standard, Wall Standard, Turtle Creek Standard, Versailles Standard, McKeesport Standard, Shaler Standard, Sharpsburg Standard, Homestead Standard, West Homestead Standard, Munhall Standard, Indiana Standard, Spring Garden Standard, North Braddock Standard, Pitcairn Standard, Wilson Standard, Etna Standard, Glassport Standard, Rankin Standard, Hays Standard, Trafford Standard, Braddock Standard, Swissvale Standard, Duquesne Standard, South Versailles Standard, North Versailles Standard, Edgewood Standard, Wilkinsburg Standard, Patton Standard, Wilkins Township Standard, Braddock Township Standard, Mifflin Standard, Penn Standard, Oakmont Standard, Wilmerding Standard, Whitaker Standard, Port Vue Standard. The companies will operate in the boroughs and townships from which they receive their name.

**SHARPSVILLE, PA.**—The Borough Council has accepted the report of Sidney B. Martin, of Pittsburgh, for the construction of maintenance of a municipal electric-light plant. The report estimates the cost of the plant not to exceed \$17,000 and provides for 100 street lamps.

**YORK, PA.**—Plans have been completed for the construction of an electric railway between East Berlin and York, a distance of about 20 miles. The East Berlin Trolley Co. has been organized to build the line.

**ASBURY PARK, N. J.**—The Beach Commissioners have ordered the necessary equipment for the ornamental lamps for the Boardwalk, at a cost of \$7,000.



ELIZABETH, N. J.—The City Council has appropriated \$500 for the purpose of investigating the feasibility of establishing a municipal electric-light plant.

IRVINGTON, N. J.—The Town Council is considering the installation of a municipal electric-light plant and water works system and has authorized the water and light committee to have estimates of cost on preliminary plans prepared.

**NUTLEY, N. J.**—The town commission has authorized Arthur R. Carr, director of streets, to enter into a contract with the Public Service El. Co. for increasing the street-lighting service. The plans proposed provide for the installation of 22 arc lamps, of which there are none in the town at present, and for 336 tungsten lamps of 40 w.

PERTH AMBOY, N. J.—The City Council is considering the installation of ornamental arc-lamp standards in City Hall Park, plans for which have been prepared by Jay B. Franke, city electrician.

BALTIMORE, MD.—The Consolidated Gas, El. Lt. & Pwr. Co. is planning improvements to its Westport power plant. The output of the plant will be increased by 15,000 kw., an extension will be built to the boiler house, 80 ft. by 97 ft. and 50 ft. high, of reinforced-concrete construction.

MARTINSBURG, W. VA.—The capital stock of the Martinsburg Pwr Co. has been increased from \$1,500,000 to \$5,000,000.

McMECHEN, W. VA.-The Brook El Co., of Warwood, has applied to the City Council for a franchise to construct and operate an electric light plant in McMechen.

MOUNDSVILLE, W. VA.—The County Court has granted the Wheeling Electrical Co., of Wheeling, a franchise to erect transmission lines along the public roads for the distribution of electricity for lamps and motors. J. B. Garden, of Wheeling, is general manager.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 21 for furnishing the signal corps with 2,500,000 ft. of bare and outside distributing wire, as per specifications 557. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 23 for furnishing the following supplies: Item 1—For 300 camp telephone phones, in accordance with specification No. 577; (2) 10 camp telephone switchboards, in accordance with specification No. 576. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 29, for furnishing at the various navy yards and naval stations the following supplies: Norfolk, Va., Schedule 5322—nine batteries for 5-ton general vehicle truck and three transformers; Schedule 5320—32 trolley hoists, etc.; Brooklyn, N. Y., Schedule 5329—38 trolley truck frogs, miscellaneous chain and trolley hoists; Schedule 5320—nine trolley hoists. Portsmouth, N. H., Schedule 5316—furnishing and installing new hoisting machine and controller for elevator. Schedules can be obtained upon application to the navy pay office nearest each navy yard named. T. J. Cowie is paymaster general, U. S. N.

## North Central

DETROIT, MICH.—The city of Detroit is planning to install a 500-kw steam-driven turbo-generator unit in the municipal electric light plant. About 1000 additional arc lamps will be erected throughout the city; extensions will be made to arc lamp circuits and also to underground conduits, to cost about \$50,000. Bids for construction will be received in July, 1913. Frank Mistersky is superintendent of the municipal electric plant.

GRAND RAPIDS, MICH.—Plans for a lighting plant for the Grand Rapids were suggested at the first meeting of the new village held on April 1. Thomas B. O'Keefe is president.

**READING, MICH.**—Plans are being prepared for the installation of new equipment in the municipal electric light and water works plant, including boilers, engines and generator. B. K. Gaudin is chief engineer.

**CLEVELAND, OHIO**—Proposals will be received in the office of the clerk of the Board of Education, East Sixth Street, Cleveland, Ohio, until April 28 for furnishing material and construction of buildings on the Chesterfield property, to be known as the Chesterfield School, including plumbing, gas-fitting, sewers, heating and ventilating and electric wiring, in accordance with plans and specifications on file in the office of the architect of the board, East Sixth Street. Specifications may be secured on application to the above office. T. W. G. Higgins is designer of schools.

**NAPOLEON, OHIO.**—The Henry County Mutual Tel. Co., recently incorporated with a capital stock of \$50,000, proposes to build an exchange in Napoleon and cooperate with eleven mutual companies of the county.

TOLEDO, OHIO—The Toledo Trac., Lt. & Pwr. Co. has awarded a contract for a 1200 kw turbo-generator set, to be installed on the Water Street plant, to the General Electric Co.

FRANKFORT, KY.—The State Board of Prison Commissioners of Kentucky and the Commissioners of the Sinking Fund of Kentucky, of

Frankfurt, are continuing to grow. All sorts of projects for gas and power plant and increasing demand to supply electricity for homes and markets and for passenger cars and trucks, and for the interstate prison and also for the State, contribute to the growing demand.

FRANKFORT, Ky., Dec. 10.—(AP)—The Kentucky Electric Co. has been awarded a contract by the Louisville & Nashville Electric Co. for furnishing and installing all electric fixtures in the new hotel building at the corner of Third and Main streets. The new hotel building, which will be the largest hotel in the city, is being constructed by the Louisville & Nashville Electric Co. and is expected to be completed in the spring of 1928.

TRAVIS, R. V. — *Supplies and uses of the riparian communities of Irving in El Paso County, New Mexico*. In: *The benefits of riparian and riparian communities and watersheds*. *Proceedings, 1988 Symposium*. *Water, land, and the future of the riparian zone*. Edited by J. R. Rasmussen. *Water, land, and the future*.

**YENNERVILLE, INO.**—It is more than three years since the first attempt to make an electrical power line along the main highway, and will consist of six light lines. Estimated the cost of the project will be \$100,000. It is not an official one, but has been the subject of a lot of interest in the community. W. A. Smith is town clerk.

**CORRECTION.** In the September 1994 issue of *Contemporary French Civilization*, the article "The United Gulf and the Gulf of Arab Affairs" was incorrectly cited as "United and United States of the Gulf Region" (p. 19). It is, of course, signed by Thomas R. Weir. The full title of the study is "United Arab Emirates and the United States: that section have been seen" (p. 19). The article is signed by Thomas R. Weir. The title of the article is "United Arab Emirates and the United States: that section have been seen" (p. 19). The article is signed by Thomas R. Weir. The title of the article is "United Arab Emirates and the United States: that section have been seen" (p. 19).

ELKHART, IND.—The installation of an automatic signaling system is contemplated. The present plan provides for using the standard, traveling live between loop system, as is described by under ground wires. James Lancaster, Jr., superintendent of police, desires a further extension of the system.

CISCO 111-110-01 covers the general use of the Cisco 111-110-01 switch and router, covered in Table 8.

**DECLARATOR**, III-1-1-1 (1980), R. & L., Inc. II. *Business records*.  
Consistent to its nature as "business record," this map has long been ex-  
hibitive of litigation.

DIXON, ILL.—The Illinois Northern Utilities Co., of Dixon, has recently closed a contract with the National Sales Co., of Chicago, to furnish electrical energy to the present or future electrical lighting plant will be transmitted from the Dixon power station. C. B. Yonts is contract agent.

CALISBERG, N. J.,—Prof. A. F. Hesse, associated with the Gunders' group at Galesburg, has been chosen as the director of the Gunders' group at Galesburg to Galesburg. As a result of this arrangement, Hesse's scientific work will have a new home, and the Gunders' group will begin at once. Hesse, a German-born biologist, has been recruited from the Fraunhofer Institute, and his work will be supported and continued by the Gunders' group. The Gunders' group at Galesburg is headed by Dr. Gunders.

**HILLSBORO, N.J.**—The Hillsboro Bulletin has changed its name to the Southern Jersey Daily Bulletin. The new name is effective Jan. 1, 2000. The new name will appear on the masthead of the first issue.

KNOXVILLE, HI.—W. J. Stewart, Jr., 100 Broad Street, Boston, Mass., is president of the Knoxville El. Lt. & Pwr. Co.

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This article published online in Wiley InterScience, September 11, 2001.

**MELROSE PARK, ILL.**—The company works with its branch in the Village River, Melrose and also in the big business district in the center of the city, comprising over 100,000 sq. ft. of space. In all systems, large American-made yellow pine and brass switchboard, transformer, and other electrical equipment.

NIPON STEEL CORP., Yokohama, Japan, kindly has donated the Vol. 1 Chemical Thermodynamics for Steels, Trans. No. 97 (1968) for publication of this review and discussion.

SPRINGFIELD, 10<sup>th</sup> APRIL 1964. The weather was fine and the sun shone brightly. The temperature was 60° F. The wind was light and from the north. The humidity was 60%. The precipitation was 0.0 inches. The cloud cover was 10%. The visibility was 10 miles. The barometric pressure was 30.0 inches. The dew point was 50° F. The wind speed was 10 mph. The wind direction was north. The wave height was 10 feet. The wave period was 10 seconds. The wave direction was north. The wave speed was 10 mph. The wave height was 10 feet. The wave period was 10 seconds. The wave direction was north. The wave speed was 10 mph.

CASVILLE, WIS.—The Union Fly has its influence here and has noticed a procession in the Village Park. It was a funeral procession for fighting the village.



**MARSHFIELD, WIS.**—The Wausau Street R. R. Co., of Wausau, has submitted a proposition to the town of Marshfield offering to take over the municipal electric-light plant. If the Wausau company takes over the plant, electricity for operating the local system will be furnished from the power station at Wausau. M. C. Ewing, of Wausau, is manager of the railway company.

**RACINE, WIS.**—Plans are being considered for the installation of an ornamental street-lighting system on State Street from Forest Street to the bridge. The West Side Improvement League has appointed a committee to take up matter with the property owners and tenants on State Street and with the Milwaukee El. Ry. & Lt. Co. The present plans provide for the installation of 125 lamps at a cost of about \$6,000.

**SUPERIOR, WIS.**—The contract for wiring the Northern Pacific ore docks has been awarded to Riley S. Hartley, of Superior. Sherarduct, 30 per cent Para wire, 25-kva transformers, panels included, and Benjamin reflectors for 150-amp lamps will be required for the work. The cost of the work is estimated at about \$6,000.

**WAUMANDEE, WIS.**—Plans are being considered to establish an electric-light plant in Waumandee. It is proposed to install the plant in the engine room of the Waumandee Mills.

**CROOKSTON, MINN.**—The City Council has adopted an ordinance authorizing the city clerk to advertise for bids for the installation of an ornamental street-lighting system in the business district.

**EAST GRAND FORKS, MINN.**—The installation of a new electric-light plant here is under consideration.

**ELLSWORTH, MINN.**—The question of rebuilding the local electric light plant, recently damaged by fire, is under consideration.

**FERTILE, MINN.**—The village of Fertile is considering the question of establishing a municipal electric-light plant. For the past two years the village has been without electrical service.

**GRAND MEADOW, MINN.**—The installation of an electric-light plant in Grand Meadow is under consideration.

**HERMAN, MINN.**—The village of Herman has voted to install an electric-lighting system. Electricity for operating the system will be transmitted from the Fergus Falls plant.

**VIRGINIA, MINN.**—The Mesaba Lt. & Pwr. Co., of Virginia, has secured water-power rights on the Vermillion River between Crane Lake and Lake Vermillion and proposes to build several power plants. The company also proposes to construct a central power plant in Virginia within a year and perhaps another at some point on the Mesaba range and will supply electricity for all purposes to practically every city on the Mesaba range. A. McMillan, of Chicago, Ill., is interested in the company.

**WADENA, MINN.**—Steps have been taken toward the installation of an ornamental street-lighting system in the business district. The cost is estimated at \$1,000.

**WINSTED, MINN.**—Application has been made to the City Council by H. B. Rutledge, president of the Glencoe El. Lt. Co., for an electric light franchise in Winsted.

**BLOOMFIELD, IA.**—Plans have been prepared by J. B. Hill, of Iowa City, consulting engineer, for the construction of a new power plant in Bloomfield, to cost approximately \$10,000.

**BUFFALO, IA.**—At an election held recently the proposition to have the town lighted by electricity was carried. The service will be supplied by the Davenport & Muscatine Ry. Co., of Davenport. Arc lamps will be used for street lighting.

**BURT, IA.**—Steps have been taken to organize a company to install an electric-light plant in Burt.

**DAVENPORT, IA.**—The People's Lt. Co. has increased its capital stock from \$1,500,000 to \$2,500,000.

**DAVENPORT, IA.**—A company is being organized to establish a light plant in Davenport. C. C. Farmer, of Davenport; C. Klink, Adam Schoerlin and I. L. Goldsmith, of Aurora, Ill., are interested.

**NEVADA, IA.**—The Iowa Ry. & Lt. Co., of Cedar Rapids, Ia., has taken over the property of the Nevada El. Co. It is understood that new equipment has been ordered for the Nevada plant. William G. Dows, of Cedar Rapids, is president and general manager of the Iowa company.

**OSKALOOSA, IA.**—The City Council has granted the Oskaloosa Lt. & Trac. Co. a 25-year franchise, subject to the approval of the voters.

**OSKALOOSA, IA.**—The property of the Oskaloosa Trac. & Lt. Co. and the Oskaloosa & Buxton Interurban Co. has been purchased by William B. McKinley, president, and H. E. Chibbuck, manager, of the Illinois Trac. Co.

**RUSSELL, IA.**—The City Council is considering the proposition of installing an electric-light system in Russell, and may call a special election to submit to the voters the proposition to issue bonds for erecting a transmission line to Charleston.

**WELDON, IA.**—At a special election held recently the proposition to install an electric-light system was carried.

**WHITING, IA.**—Proposals will be received by B. L. Foss, town clerk. Whiting, Ia., until April 21, for furnishing material and constructing an electric light and power plant for the town of Whiting, in accordance with plans and specifications.

**FORSYTH, MO.**—At an election to be held soon the proposition to issue from \$7,000 to \$10,000 in bonds, the proceeds to be used for in-

stalling an electric-light plant and water-works system, will be submitted to the voters.

**POPULAR BLUFF, MO.**—The property of the Popular Bluff Lt. & Pwr. Co., owned by the Light & Devel. Co., of St. Louis, has been purchased by the Missouri Public Utilities Co., of St. Louis. The price paid for the plant is said to be \$350,000.

**LA MOURE, N. D.**—The Bennett Engineering Co., of Sioux Falls, S. D., is constructing an electric-light plant in La Moure. The proposed plant will be equipped with one 100-hp gas engine and producer and one 60-kw, 2300-volt, three-phase generator, directly connected. A 24-hour service will be established. Machinery and equipment have already been purchased. I. I. Bennett, of Sioux Falls, S. D., is interested in the company.

**LANSFORD, N. D.**—A committee has been appointed to look into the question of installing an electric-light plant in Lansford. C. A. Adams is chairman.

**LISBON, N. D.**—The installation of an electric-light plant in Lisbon, to cost about \$40,000, is under consideration. It is expected that an ornamental street-lighting system will be established in the business district in connection with the proposed plant.

**MOTT, N. D.**—S. Stewart, of Morris, Minn., is making investigations here with a view of establishing a flour mill and electric-light plant in Mott. The proposed plant will furnish electricity to light the entire city and to operate a pumping station for fire protection.

**NEW SALEM, N. D.**—The New Salem El. Lt. Co. has been granted a franchise to construct and operate an electric-light plant in New Salem. Work will begin on the proposed plant at once.

**ST. THOMAS, N. D.**—A special election has been called for April 28 to submit the proposition to install a municipal electric-light plant in St. Thomas to the voters.

**KIMBALL, S. D.**—A franchise has been granted by the City Council which provides for the installation of an electric-light plant to cost \$10,000.

**HILDRETH, NEB.**—C. E. Sturtevant, engineer of Holdrege, will have charge of the installation of an electric-lighting system and extension to water-works system, for which bonds were recently voted.

**BLUE RAPIDS, KAN.**—The Marshall County Pwr. & Lt. Co., recently organized, has purchased the Elastic Plaster Company's water-power and electric-lighting system in Blue Rapids and will repair the dam in the Big Blue River. Dr. William Hunter is secretary and treasurer, and J. G. Strong is manager of the Marshall County Pwr. & Lt. Co., both of Blue Rapids.

**ESBON, KAN.**—It is understood that work will soon begin on the installation of an electric-lighting system here, for which a franchise was recently granted.

**LEBANON, KAN.**—A franchise has recently been granted to an electric company to furnish electricity in Lebanon. It is understood that work will soon begin on the installation of the system.

**MILTONVALE, KAN.**—The contract for the installation of the proposed municipal electric-light plant has been awarded to Brooks & Sons Co., Scarritt Building, Kansas City, Mo. The equipment of the plant includes two 50-hp Solar oil engines and two 37½-kw direct-current generators. E. T. Archer & Co., of Kansas City, Mo., are engineers.

**NICKERSON, KAN.**—The city of Nickerson is contemplating the purchase of the transmission line erected by the United Water, Gas & El. Co., of Hutchinson, from Nickerson to Hutchinson. The city has decided either to purchase the line or make a contract for energy to be delivered at the switchboard in Nickerson.

**SALINA, KAN.**—The City Council has approved the contract submitted by the Salina Lt. Gas & Pwr. Co. for installing and maintaining an ornamental street-lighting system in the business district. The plans provide for the erection of 56 ornamental lamp standards, carrying five-lamp clusters. The cost of installing the system is estimated at \$5,700 and the maintenance at \$1,640 per year.

**WICHITA, KAN.**—Proposals will be received at the office of the supervising architect, Washington, D. C., until April 29, for conduit and wiring system and interior fixtures for the United States post office and court house at Wichita, Kan., in accordance with plans and specifications, copies of which may be had at this office or at the office of the custodian, Wichita, Kan. O. Wenderoth is supervising architect.

## Southern States

**SPENCER, N. C.**—At an election to be held May 6 the proposition to issue \$50,000 in bonds for the installation of an electric-light plant and water-works system will be submitted to the voters.

**MCCOLL, S. C.**—At an election held recently the proposition to issue \$10,000 for the installation of an electric-lighting system was carried.

**ALBANY, GA.**—The Albany Pwr. & Mfg. Co. has decided to increase the output of its steam plant here. New machinery, including two new boilers and auxiliaries, will be installed, at a cost of about \$20,000. The company has also decided to build a dam across the Flint River at Porter's Shoals and conduct it through an aqueduct or canal across the old Ball plantation to the present dam on the creek. E. S. Killebrew, of Albany, is superintendent.

ATHENS, GA.—The Athens Ry. & E. Co. is extending its lighting system throughout the city.

ATLANTA, GA.—The Franklin L. & Par. Co., recently organized, has received authority from the State Railroad Commission to raise \$150,000 in capital stock. The company proposes to erect transmission lines and furnish electricity to towns in Franklin, Hart, Madison, Banks, Jackson and Elbert Counties. The main office of the company will be located in Atlanta.

FORSYTH, GA.—Extensions to the municipal electric-lighting system are contemplated.

WILKINSON, GA.—A special election has been called for April 18 to submit the proposition to issue \$6,000 in bonds for a municipal electric-light plant to the voters.

HAWTHORN, FLA.—The Hawthorn Mfg. Co. contemplates installing an electric plant.

KEY WEST, FLA.—J. A. Willis, of Key West, Fla., would like to receive prices on electrical equipment for a \$100,000 hotel.

PENSACOLA, FLA.—A special committee has been appointed by the City Council to secure information relative to the cost of installing, maintenance, etc., of a municipal electric-light plant. The ordinance authorizing a \$100,000-bond issue is being held up, pending the report of the committee. Adrian E. Langford is city clerk.

TALLAHASSEE, FLA.—At an election to be held April 15 the proposition to issue \$9,000 in bonds for extensions to electric light, water and gas plants will be submitted to the voters.

JACKSON, TENN.—An effort is being made to raise \$10,000 for the installation of an ornamental street-lighting system in Jackson.

BIRMINGHAM, ALA.—The Alabama Power Co. has issued an official statement disclosing its proposed operations. The statement indicates that the company will build 11 dams, which will develop 1,257,000 hp to be distributed in Alabama and other states. The plants are announced and which will be built from time to time are as follows: Coosa River, Lock 7, 45,000 hp; Coosa River, Lock 12, 105,000 hp; Coosa River, Lock 14, 100,000 hp; Coosa River, Lock 15, 80,000 hp; Coosa River, Lock 18, 100,000 hp; Tallapoosa River, Cherokee Bluffs site, 115,000 hp; Tennessee River, Muscle Shoals site, 400,000 hp; Sandy Creek, 6000 hp; Town Creek, 7000 hp; Little River, 52,000 hp; Chickasaw Creek, 2000 hp.

In addition to the foregoing power stations the company is building a plant at Gadsden which will have an output of about 15,000 hp for emergency purposes and to furnish Gadsden, Anniston and other places with electricity. Surveys have been made by the company for lines from Lock 12 to Montgomery, from Lock 12 to Selma, from the latter place to Talladega, from Talladega to Anniston, from Lock 12 to Calera, from Calera to Helena, and thence to Birmingham, by the way of Osmon. A line is to be erected from Bessemer, by Gadsden, to the coal fields and from Bessemer to Tusculoo. The plan provides for the erection of a total of 239 miles of transmission lines, to cost about \$3,000,000.

FORT PAYNE, ALA.—L. C. Nichols, of the Alabama Cogenage Co., has taken over the plant and franchise of the Alabama El. Service & L. Co. under a five-year lease. The power plant will be retained from its present location on Lookout Mountain to the emergency plant at Fort Payne.

GAINESVILLE, ALA.—Contracts have been awarded by the Board of Public Works for the construction of an electric-light plant and extensions to water-works system, the cost of both plants not to exceed \$2,173. The J. B. McCarry Co., engineers, of Atlanta, Ga., will have charge of the work.

ALTUS, OKLA.—The City Council has submitted a proposition to the town of Altus, 10 miles distant, to furnish electricity from the municipal electric-light plant in Altus to that town for lamps and motors.

ENID, OKLA.—The Enid El. & Gas Co. contemplates improvements to its two plants in Enid involving an expenditure of over \$75,000.

ALICE, TEX.—A franchise has been granted to P. A. Personal to install and operate an electric-light plant in Alice.

BRENNHAM, TEX.—The Brenham El. L. Co. is making extensive additions and improvements to its plant and service here.

EL PASO, TEX.—The El Paso El. Ry. Co., a subsidiary of the Stone & Webster Corp., of Boston, Mass., is planning to construct a system of transmission lines at points in the valley and the foothills of western electricity to the farmers and others for irrigation, power, heat and other industries.

EL PASO, TEX.—The E. S. Pearson, Secretary of New York, London, Eng., and Mexico, will install a large power plant in El Paso, Tex., at its large wood-working plant in El Paso. The power plant, 80 ft. by 110 ft. by 150 ft. and will be equipped with two 100-hp engines, two generators, two boilers, motors, pumps and a turbine. Work will have been on the project.

FENNIS, TEX.—The property of the Texas L. & P. Co. is reported to have been purchased by the Texas L. & P. Co., of Dallas. The ice plant will be retained by the present owner.

PARIS, TEX.—The Texas L. & P. Co. is installing a new electric plant in Paris and is making other important improvements to its system.

SAN BENITO, TEX.—Steps have been taken by the business men to provide for the installation of an ornamental street-lighting system in the business section of the town and Houston Boulevard. The San

Benito El. Co., of Dallas, has been granted a proposition to install an ornamental street-lighting system in the town.

SLABOFF, TEX.—J. A. Slaboff, of Slaboff, Tex., has been granted a franchise to construct and operate an electric-light plant here. The franchise will be held up until the town has decided on the matter.

SULPHUR, TEX.—The Sulphur El. Co. has been granted a franchise to construct and operate an electric-light plant here. The franchise will be held up until the town has decided on the matter.

TEAGUE, TEX.—The Teague El. Co. has been granted a franchise to construct and operate an electric-light plant here. The franchise will be held up until the town has decided on the matter.

TEXAS CITY, TEX.—The Texas City El. Co. has been granted a franchise to construct and operate an electric-light plant here. The franchise will be held up until the town has decided on the matter.

## Pacific States

BERLINGTON, WA. B.—The Pacific Northwest Trust Co. of Seattle has recently been awarded a contract for lighting the streets of Burlington. The street lamps will be located at a cost of about \$7,000.

SPokane, WASH.—The Spokane El. Co. has been granted a franchise to construct and operate an electric-light and power plant and steam heating plant to supply electricity for street and motor and steam for heating purposes in the city. The company has also applied for a franchise to construct and operate a telephone system in the business part of the city.

TOLLEDO, WASH.—The Independent El. Co., which recently purchased the Toledo El. Co., will construct a plant and line from Westport to Toledo. When completed the line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

KLAMATH FALLS, ORE.—The Klamath Falls El. Co. is contemplating the construction of a plant and line from Klamath Falls to Klamath Falls.

OSCEOLA, ORE.—The Osceola El. Co. is contemplating the construction of a plant and line from Osceola to Osceola. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

PORTLAND, ORE.—The Portland El. Co. is contemplating the construction of a plant and line from Portland to Portland. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

PORTLAND, ORE.—The Portland El. Co. is contemplating the construction of a plant and line from Portland to Portland. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

PRESTON, CAL.—The Preston El. Co. is contemplating the construction of a plant and line from Preston to Preston. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

GLENDOME, CAL.—The Glendome El. Co. is contemplating the construction of a plant and line from Glendome to Glendome. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

LOS ANGELES, CAL.—The Los Angeles El. Co. is contemplating the construction of a plant and line from Los Angeles to Los Angeles. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

LOS GATOS, CAL.—The Los Gatos El. Co. is contemplating the construction of a plant and line from Los Gatos to Los Gatos. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

PALO ALTO, CAL.—The Palo Alto El. Co. is contemplating the construction of a plant and line from Palo Alto to Palo Alto. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

HELAND, CAL.—The Heland El. Co. is contemplating the construction of a plant and line from Heland to Heland. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

FOURMOUNTAIN, CAL.—The Fourmountain El. Co. is contemplating the construction of a plant and line from Fourmountain to Fourmountain. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

SAN LEONARD, W. I.—The San Leonards El. Co. is contemplating the construction of a plant and line from San Leonards to San Leonards. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.

SAN FRANCISCO, CAL.—The San Francisco El. Co. is contemplating the construction of a plant and line from San Francisco to San Francisco. The line will be 10 miles long and will have two generating stations and two substations. The line will be 10 miles long and will have two generating stations and two substations.



**VALLEJO, CAL.**—Plans for the proposed electrolier lighting system on Georgia Street recommended by the Merchants' Association have been approved and adopted by the City Council. Bids will be advertised for at once.

**VENICE, CAL.**—The contract for the erection of 385 ornamental lamp standards on Ocean Front has been awarded to W. F. Rabineau, at \$14,900.

**CALDWELL, IDAHO.**—The Idaho-Oregon Lt. & Pwr. Co., of Boise, is securing rights-of-way from the Swan Falls power plant, on Snake River, to the site of the power plant of the Gem Irrigation district. The company has secured the contract for furnishing electricity for the Gem Irrigation project. Work will start at once on erecting transmission lines, etc.

**MIAMI, ARIZ.**—The Inspiration Copper Co. has entered into a ten-year contract for electricity to be supplied by the hydroelectric plant connected with the Salt River reclamation project. The company is to pay 4½ cent per kw-hr. for energy and to erect a transmission line from its mine and mill to the power plant at its own expense.

**CUTBANK, MONT.**—The town of Cutbank will advertise for bids for the installation of an electric-light plant and water-works system, to cost about \$50,000. The Gerharz-Jaqueth Engineering Co., of Billings, has charge of the engineering work.

**GREAT FALLS, MONT.**—Proposals will be received at the office of the United States Reclamation Service, Great Falls, Mont., until April 30, for furnishing five (more or less) 70-ton electrically operated power shovels for use on the Milk River and Sun River projects, Montana. For particulars address the United States Reclamation Service, Washington, D. C., or Helena, Mont.

## Canada

**CALGARY, ALTA.**—A by-law was passed on March 5 authorizing the sum of \$400,000 for the erection of additional substations and equipment, also for the underground cable and light and power extensions in various parts of the city. Estimates prepared for street lighting show that \$105,000 will be required for 1913, as compared with \$59,000 for 1912.

**EDMONTON, ALTA.**—The city of Edmonton will make extensions to its telephone system this year, the greater part of which will be cable work, involving an expenditure of about \$1,000,000. Underground conduits will be installed in both North Edmonton and South Edmonton, and also considerable underground and aerial cable work. W. R. Griffith is superintendent of the telephone department.

**TABER, ALTA.**—The contract for the installation of an electric-light and power plant for Taber has been awarded to H. T. Lloyd, of Taber. The cost of the plant is estimated at \$25,000.

**MATSQUI, B. C.**—The Western Canada Pwr. Co. has begun work on the erection of transmission lines to supply electricity throughout the entire Fraser Valley district. The company has also made arrangements with the municipality of Matsqui whereby the high-tension transmission line from its main generating station at Stave Lake will pass through Matsqui to Sumas.

**NEW WESTMINSTER, B. C.**—Plans have been filed by the Westminster Pwr. Co. at the provincial government offices at New Westminster for an extensive hydroelectric power project, located on the Indian River, close to the upper end of the North Arm of Burrard Inlet. The plan involves the harnessing of numerous streams at a high elevation above the power house and piping water down to the plant, thereby securing a head of about 1800 ft. G. E. Corbould and J. R. Grant, of the firm of Corbould, Grant and McColl, of New Westminster, are representing the company.

**NEW WESTMINSTER, B. C.**—The provincial government of British Columbia is endeavoring to make an arrangement with the Western Canada Pwr. Co., of Vancouver, whereby the company will agree to install the lamps and furnish electricity to light the southern half of the Fraser River Bridge at New Westminster, thus completing the lighting equipment of the structure. The proposal to utilize the city lighting service was abandoned owing to the New Westminster City Council refusing to furnish the service at less than 5 cents per kw-hr., which the government authorities considered exorbitant.

**PORT MANN, B. C.**—The Canadian Northern Pacific Ry. Co. has announced that it proposes to supply electricity for lamps and motors in Port Mann and other points on its railway as well as to operate the entire railroad from Yellowhead Pass to Port Mann and ultimately between Port Mann and Vancouver. The company proposes to build two dams across the valley just east of Hope, where the Nicolaum River empties into the Coquahalla River, and erect a hydroelectric plant at the confluence of the two streams; it is estimated that 30,000 hp can be developed under a head of 1800 ft. The company also proposes to drive a tunnel through the divide to the Smallow River level, and this stream will be diverted in part from the Skagit River to the Nicolaum. The water will be held in a storage reservoir with a capacity of 10,000 acre-ft., from which it will be conveyed to the generating plant by penstock or tunnel. The generating plant will be located about 4 miles east of the Hope station on the Canadian Northern Pacific Railway. Plans are being prepared by L. N. Jenssen, division engineer. Application for water rights has already been made to the water recorder at Ashcroft, B. C. Port Mann has not a post office.

**SILVERTON, B. C.**—A contract has been closed with the New Denver El. Lt. Co. to erect a transmission line to Silverton to furnish electricity for lamps and motors.

**VANCOUVER, B. C.**—The Western Canada Pwr. Co., of Vancouver, has placed contracts with Escher, Wyss & Co., of Montreal, Que., for two 13,000-hp double Francis turbines and two inlet drum gates. The dam at Stave Falls will be raised, making a total elevation of 240 ft., so as to create additional storage capacity in Stave River and Stave Lake.

**VANCOUVER, B. C.**—The Fourth Avenue Ratepayers' Association has instructed the city electrician to install erect luminous arc lamps on ornamental standards on that thoroughfare between Granville Street and Alma Road, a distance of about 2 miles. About 200 arc lamps will be required. The city electrician has recommended that the light brackets be placed on the trolley poles of the British Columbia El. Ry. Co., thereby reducing the number of poles on the thoroughfare. The property owners on Broadway have also expressed themselves in favor of the new lighting system, and it is probable that lamps similar to those on Fourth Avenue will be installed on that street.

**VERNON, B. C.**—By-laws have been passed by the ratepayers as follows: For reconstructing the electric-lighting system, \$35,000; extensions to the electric-light plant, \$50,000, and \$15,000 for construction of power house.

**VICTORIA, B. C.**—Plans are being considered to remove all poles on Government Street, between Humboldt and Cormorant Streets, and to support all wires from the walls of the buildings along the street.

**WINNIPEG, MAN.**—The Grand Trunk Pacific Ry. Co. is planning to install a telephone system from Edmonton, Alta., through to the Pacific Coast for operating its trains and for handling commercial messages. Work will soon begin on the installation from Edmonton to Fitzgibbon.

**BERWICK, N. S.**—The installation of an electric-light plant, to cost \$15,000, is contemplated.

**BERLIN, ONT.**—Arrangements have been made between the light commission and the Hydro-Electric Power Commission whereby the transformer capacity of the local substation will be increased from 2500 hp to 5000 hp. This is required to meet the additional demand for 1300 hp from local industries.

**GLENCOE, ONT.**—George Cook, of Glencoe, is contemplating the construction of a dam and installing a power plant at Battle Creek.

**KINGSTON, ONT.**—The light, heat and power department is preparing a report on the local water-works, for which an additional 6,000,000-gal. pump will be required. It has not yet been decided whether steam-driven or electrically driven pumps will be installed, but extensions must be made during the present year. Other electrical work contemplated includes placing all wires underground on the main thoroughfares in view of the adoption of permanent pavements; also the erection of new lamps in the paved sections. C. C. Folger, general manager of the light, heat and water departments, will have charge of the work.

**OTTAWA, ONT.**—The Ottawa Lt., Ht. & Pwr. Co. contemplates the purchase of equipment, fixtures, etc., to cost about \$250,000.

**TEESWATER, ONT.**—The town of Teeswater is contemplating extensions to the electric-lighting system.

**TORONTO, ONT.**—Contracts have been awarded by the Hydro-Electric Power Commission for material for the high-tension transmission line from St. Thomas to Windsor, amounting to approximately \$750,000. Work will be started on the erection of the line within 30 days.

**WELLAND, ONT.**—The Town Council has contracted with the Hydro-Electric Power Commission for 5000 hp. The municipality recently took over the complete distribution system and contracts of the Ontario Pwr. Co., of Niagara Falls, in Welland.

**WINDSOR, ONT.**—Tenders have been called for a 200-kw generator and 100 ornamental lamp standards to carry five-lamp clusters. The lighting circuit will be maintained by an underground distributing system.

**WINDSOR, ONT.**—The installation of an ornamental street-lighting system throughout the business section is under consideration by the City Council. If the system is installed it will be maintained by the municipal electric plant, to be changed when Niagara power reaches the city.

**MONTREAL, QUE.**—The Saraguay El. & Wtr. Co., of Montreal, has changed its name to the Montreal Pub. Ser. Corp. The company has acquired the property of the Paul, El. Lt. & Pwr. Co., the Dominion Lt. & Pwr. Co. and the distribution lines of the Canadian Lt. & Pwr. Co. The Montreal Pub. Ser. Corp. secures energy to operate its system from the Canadian Lt. & Pwr. Co. and is controlled by the Montreal Tramways & Pwr. Co. The officers are: E. A. Roberts, president; H. R. Mallison, secretary and treasurer, and K. B. Thornton, chief engineer and operating manager.

**MONTREAL, QUE.**—Tenders will be received by L. N. Senecal, secretary Board of City Commissioners, City Hall, Montreal, Que., until April 25 for the construction of a system of underground conduits, main and service manholes, transformer chambers, etc., in, upon and adjoining that portion of St. Catherine Street between Guy Street and Papineau Avenue. Plans may be inspected and form of tender obtained at the offices of the electrical commission, 136 James Street, Montreal. A complete set of plans may be obtained upon deposit of \$500, which will be refunded upon return of same. L. A. Herdt is chairman of the electrical commission.





## Business Notes

**D. C. & WM. B. JACKSON**, consulting engineers, have moved their Boston offices from 81 State Street to 248 Boylston Street.

**THE DALE COMPANY**, manufacturer of lighting fixtures, will soon occupy the new six-story building at 107-109 West Thirteenth Street, New York.

**S. R. FRALICK & COMPANY**, 15 South Clinton Street, Chicago, have taken the agency for the Middle West for the "Tap-on" manufactured by Jordan Brothers, Inc., New York.

**THE STANDARD ROLLER BEARING COMPANY**, Philadelphia, Pa., has opened an office in Indianapolis in charge of Mr. L. M. Watkin, Jr., whose headquarters will be in the State Life Building.

**THE KERR TURBINE COMPANY**, Wellsville, N. Y., manufacturer of the Economy steam turbine, has appointed F. A. Mazzur & Company, 141 Milk Street, Boston, its New England representative.

**THE SPLITDORF ELECTRICAL COMPANY**, of Newark, N. J., has opened a European branch and service station at 6 City Road, Finsbury Square, London, E. C. A similar branch is to be opened in Atlanta, Ga., within the next sixty days.

**WOODMANSEE & DAVIDSON, INC.**—Mr. E. A. Sessions having withdrawn from Woodmansee, Davidson & Sessions, consulting engineers, Chicago, as previously noted in our columns, the name of the firm has been changed to Woodmansee & Davidson, Inc.

**MR. SIEGMUND STRAUSS**, of Vienna, a member of the Oesterreichischer Ingenieur von Architekten-Verein, is visiting this country for

the purpose of establishing business relations with American manufacturers and inventors who desire to be represented in his country. His address is Hotel Nederland, New York, N. Y.

**THE TUCKER AGENCY**, New York City, has been organized by Mr. W. Gaylord Tucker, Jr., to handle the publicity business of the New York Edison Company, the New York Electrical Exposition, the Edison Electric Illuminating Company of Brooklyn, the United Electric Light & Power Company, the Metropolitan Engineering Company, the New York Service Company and the New York Electric Vehicle Association.

**THE LINE MATERIAL COMPANY**, of South Milwaukee, Wis., is the new name of the Ajax Line Material Works. The company is engaged in the manufacture of all kinds of line material, such as brackets, street hoods, tungsten fixtures, self-locking windlasses, hangers, mast-arms, ornamental lighting posts, malleable-iron pins, bolts, washers and other pole-line hardware. A new galvanizing plant has just been installed. Mr. F. L. Sivy, the new president of the company, is also chief executive of the Sivy Steel Casting Company and the Northwest-ern Malleable Iron Company.

**FREDERICK RALL**, 19 Park Place and 16 Murray Street, New York City, general sales agent for E-Z lamp-locking devices, has appointed sales representatives covering territories as follows: George C. Richards, 629 West Jackson Boulevard, Chicago, Ill., for States of Illinois, Indiana, Missouri, Wisconsin and Texas; W. I. Otis, 629 Howard Street, San Francisco, Cal., for States of California, Oregon and Washington; W. W. Geisse company, McKnight Building, Minneapolis, Minn., for States of Minnesota, North Dakota and South Dakota; Raymond Ackerman, 204 Scott Building, Salt Lake City, Utah, for States of Utah, Idaho, Montana, Nevada and Wyoming.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 1, 1913.

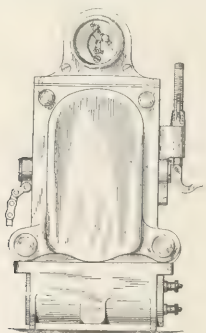
[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,057,415. **MEANS FOR PHOTOMETERING ELECTRIC LAMPS**; H. S. Dunning, New Dorp, N. Y., and W. G. Houskeeper, Philadelphia, Pa. App. filed May 16, 1910. Ammeter and voltmeter having indicating devices moving in intersecting paths, with a scale or chart.

1,057,428. **ELECTRICAL COUPLING**; J. L. Hinds and J. J. Dossert, Syracuse, N. Y. App. filed Oct. 5, 1910. Line tapper having a movable clamp actuated by a nut.

1,057,436. **SPEED CONTROL APPARATUS**; M. E. Leeds, Philadelphia, Pa. App. filed Sept. 11, 1911. Centrifugal governor shifts a movable contact into engagement with a rigid contact.

1,057,500. **LOCK-OUT SWITCH FOR PARTY-TELEPHONE LINES**; J. G. Roberts, Chicago, Ill. App. filed July 26, 1906. Polarized magnet and ratchet mechanism by which two or more stations of a party line may be connected for conversation to the exclusion of other stations on the line.



1,057,904.—Electrical Vulcanizer.

1,057,516. **TELEPHONE SET**; A. B. Allen and L. Day, New York, N. Y. App. filed Oct. 11, 1910. Of essential character; circuit controlled by a movable receiver-supporting platform.

1,057,595. **TELEPHONE SYSTEM**; D. L. Temple, Chicago, Ill., and C. L. Goodrum, Atlantic City, N. J. App. filed March 1, 1902. Of the complete metallic-circuit, central-energy type (40 claims).

1,057,608. **AUTOMATIC ELECTRIC RELEASE FOR FIRE DOORS**; T. H. Wurm and R. Baumann, St. Louis, Mo. App. filed Aug. 29, 1910. Trip magnet controlled by thermal circuit-controlling device.

1,057,638. **AUTOMATIC LAMP-LIGHTER AND CONTROLLER**; W. C. Hamilton and W. L. Bird, Indianapolis, Ind. App. filed March 23, 1912. For lighting gas lamps of automobile.

1,057,640. **MAXIMUM-DEMAND INDICATOR**; V. S. Hardey, Chicago, Ill. App. filed July 17, 1911. Has ordinary indicator hand positively driven and a maximum-demand indicator hand movable by the positive hand; both hands travel across face of dial.

1,057,669. **ELECTRIC FURNACE FOR IRON AND STEEL**; A. L. J. Queneau, Philadelphia, Pa. App. filed Aug. 3, 1911. Has working hearth made up of rammed body of magnesite and tar with graphite; special electrode holder, water-cooled.

1,057,689. **DEVICE FOR BRANDING CASKS AND SIMILAR ARTICLES**; E. Uhlmann, Albany, N. Y. App. filed Aug. 12, 1912. Support for cask and electrically heated branding plates.

1,057,745. **ELECTRIC HEATER**; M. M. Kohn, New York, N. Y. App. filed Feb. 5, 1912. Comprises a base, a housing or casing and a plurality of independently removable heating units.

1,057,749. **SWITCH LOCK**; O. M. Lockwood and A. A. Stout, Rochester, N. Y. App. filed May 22, 1912. For ignition circuits of automobile and launch engines.

1,057,752. **SIGNALING DEVICE**; R. H. Manson, Elyria, Ohio. App. filed Nov. 25, 1910. Electric horn; character of resonator is modified to change the sound produced by the horn.

1,057,753. **ELECTRICAL RESISTANCE ELEMENT**; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. For withstanding high temperature; formed of an alloy consisting of iron and aluminum.

1,057,754. **ELECTRICAL RESISTANCE ELEMENT**; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. For high temperature; formed of iron chromium alloy in which the chromium is at least 20 per cent.

1,057,755. **ELECTRICAL RESISTANCE ELEMENT**; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. Formed of alloy of nickel and silicon.

1,057,756. **ELECTRICAL RESISTANCE ELEMENT**; A. L. Marsh, Detroit, Mich. App. filed Sept. 30, 1912. Formed of alloy of iron and chromium with added quantity of material having properties of silicon and aluminum.

1,057,759. **DYNAMO-ELECTRIC MACHINERY**; A. H. Midgley and C. A. Vandervell, Acton Vale, England. App. filed July 11, 1910. Dynamo for train lighting.

1,057,760. **AUTOMATIC ELECTRIC WATER HEATER**; L. Miles, San Francisco, Cal. App. filed Jan. 29, 1912. Piston subjected to water pressure controls the switch; resistance coil is kept submerged.

1,057,766. **COMBINED DOOR BELL AND BURGLAR ALARM**; C. B. Pace, Jackson, Tenn. App. filed April 20, 1912. Movement of door knob in either direction closes circuit through bell.

1,057,772. **BALANCE FOR THREE-PHASE ELECTRICAL SYSTEMS**; A. H. Pickler, Montclair, N. J. App. filed Nov. 29, 1911. A neutral conductor is established at the point of current consumption when it is not practicable to lead a neutral conductor direct from the generator.

1,057,784. **AUTOMATIC FIRE ALARM**; W. and F. Topp, Granby, Quebec, Canada. App. filed Feb. 8, 1911. Spring contact normally held out of contact with contact plates by a fusible prop.

1,057,807. **APPARATUS TO INDICATE THE PROXIMITY OF ICEBERGS AT SEA**; W. G. Day, Baltimore, Md. App. filed May 14, 1912. Hard-rubber strip exposed to air on one side so as to be warmed by cold air and close an alarm circuit.

1,057,817. **APPARATUS FOR FAULT LOCATION ON ELECTRICAL CONDUCTORS**; H. M. Friendly, Portland, Ore. App. filed June 10, 1907. Galvanometer and adjustable resistances.

1,057,819. **GALVANIC CELL**; A. J. Frankfort-on-the-Main, Germany. App. filed Jan. 3, 1911. Depolarizing mass containing manganese hydrate and manganese dioxide hydrate.

1,057,878. **PRODUCTION OF ZINC AND THE LIKE**; A. B. Pescatore, London, England. App. filed Nov. 20, 1911. Electrically heated furnace and process.

1,057,879. **ALARM FOR PREVENTING THEFT**; J. R. Quain, Westminster, England. App. filed Oct. 4, 1912. Has a sensitive spring member.

1,057,904. **ELECTRICAL VULCANIZER**; W. H. Welch, London, Eng. App. filed July 25, 1912. Metallic sections with heat distribution.

1,057,962. **MOTOR CONTROLLER**; C. T. Henderson, Milwaukee, Wis. App. filed Sept. 6, 1907. Motor-generator brake system.

1,058,009. **FREE-ARMED POLE CHANGER**; A. H. Weiss, Chicago, Ill. App. filed Nov. 15, 1906. Party-line telephone system with rotating-current enunciators.

# Electrical World

The Consolidator of *Electrical World* and *Engineering and Architecture* Publications

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**Regulation and Municipal Operation** The tendency manifested in nearly all public-utility measures now pending before the various state legislatures to exempt municipally owned and municipally operated systems from the provisions of the acts is vicious and certainly against public policy. Such flesh and red-herring legislation can only react to the detriment of the consumer in whose interest it is apparently framed; for experience has shown that of all utilities those operated by municipalities are most in need of regulation, especially as regards quality of service and financial methods. The consolidation of properties and the realization on the part of electric-railway companies that it is more economical to purchase energy than to generate it mean that the day is not far off when there will be fewer, but larger, generating stations. Then, owing to the intenser development and to the diversity-factors of the loads, rates for service will reach a point where small or municipally operated systems can no longer compete for business because they cannot obtain more favorable load-factors or diversity-factors than the community affords. Such, however, is not the case with a large system catering to the needs of many communities and carrying a more diversified load. Naturally, the tendency of the municipally operated system will be to ward off the inevitable as long as possible and in doing so to resort to measures that would not be tolerated by a public service commission. This condition points to the need of some competent body to conserve the interest of the taxpayers and shows the fallacy of rendering municipally operated utilities immune from public-service regulation.

## **Simplicity in Consolidation**

The wholesale consolidation of numerous small public-service communities during the last twelve months is bringing into prominence the importance of eliminating as much "red tape" as possible from the general supervision and management of such groups of small units. While syndicate management of central stations operating in communities of 20,000 or more inhabitants has been common for many years, the wholesale acquisition of small properties by syndicates is comparatively recent. It must be obvious that, as compared with city systems, greatly simplified methods must be pursued in the records and management of a company composed of many such small units, otherwise the "red tape" necessary to manage these small plants from a central office will be out of proportion to the gross receipts. The records kept of small properties have frequently been insufficient. The incoming consolidated management taking hold of such plants is likely to go to the

other extreme on account of the complexity of the work at the head of affairs with the operation of such small units and of a desire to carry the minutely kept records proper to the smaller units. If the consolidation of the smaller plants are to be successful, it is essential to eliminate unnecessary expenditure if time and money bearing little on records. The best of judgment is needed to determine how much red tape and system can be done away with without affecting the net results of management. The best effect of too much red tape shows up most strongly in connection with the small plant on the bookkeeping and the making out of reports. To be sure, it is better to have too many records than too few, but a study of the reports and systems of most plants will show that some records and reports are costing much more than they are worth.

## **Flat-Rate Problems**

We have often referred to the successful working of the flat rate campaign for small residences conducted by Mr. A. C. Dunham, of Hartford, Conn., who, despite his years, has been on the firing line of progress for more than two decades. Since his retirement the same policy has been carried on, until now nearly 75,000 flat-rate lamps are used in Hartford residences and there is a much greater general utilization of electricity in Hartford than in any other of most cities of very much larger size. The same type of flat rate which has been brought to our attention is in force in a neighboring city where the system is reduced to the rudimentarily simple form of furnishing energy in tungsten lamps for \$1 a month, and power at the same rate if needed. This arrangement enables the customer to know in advance exactly what he will be going to do and to distribute his available lighting sources in such form as suits his convenience. The original Hartford system contemplated the use of energy in both of incandescent lamps, while the modified system now referred to might well, for example, be applied to the kind of incandescent lamp and three or four watt or smaller incandescent or high-voltage incandescent. Of course, if all these lamps were used continuously the customer would lose money, but the whole plan is based on the use of power as needed or during hours when there is no power on, would use his lamps continuously for hours of his privilege, there are two or three who appreciate their benefits enough to increase the rate considerably on the use of energy after that time would if the time were marked with a meter. Now the point has been reached that the advantage of customers trying to give their lamps that and the convenience of Hartford has shown that the period when the flat-rate lighting was reduced to a minimum



hour basis are remunerative ones. The hundred-candles-for-a-dollar proposition ought, under ordinary circumstances of use, to result in from 8 to 9 cents per kw-hr., which, considering the simplicity of accounting and the absence of all meter expense, is a very satisfactory figure. It is particularly advantageous by reason of the fact that the load thus taken on is added to that which may be reasonably expected on a strictly meter basis and is very largely off-the-peak load, which of itself would justify some concession in price. It is, too, a load of low demand, since at a fixed price only lamps intended to be used regularly will be installed and there is no chance of unusually high peaks. Of course, the plan is one that appeals only to the small user, who is the very person who hesitates to accept the meter basis of charge. The plan is unscientific from the standpoint of the maker of rates, but it provides new business which is reasonably profitable and it goes one step further toward making electric service a general necessity. The ordinary dwelling of fair size could more cheaply adopt the meter basis of charge, for the total number of lamps is likely to be from 25 to 50, which, even if of small size, would result in a monthly bill on the contract basis greater than any probable meter bill. But with small apartments and the little houses of workmen the balance goes quite the other way. The contract plan is, therefore, one to be used rather as auxiliary to the ordinary system of rates than as a general basis of lighting sales, but in this auxiliary function it looks decidedly promising.

### A Study of Street Lighting

One of the most important contributions to the problem of street-lighting design which have appeared in a long time is a paper before the British Institution of Electrical Engineers by Messrs. Pearce and Ratcliffe, noted in our *Digest*. It deals with the experiments carried on in Manchester, some of which have already been referred to in our columns. The particularly important phase of the investigation is that some time ago a careful comparison was instituted on a practical scale between high-pressure gas-lighting and flame-arc lamps, as regards both effect and economy. In each case the lamps were spaced at a little over 100 ft. and at a height of 27.5 ft., the gas lamps being Keith three-burner units, rated at 4500 cp, and the electric lamps yellow-flame arc units of the magazine type taking 11 amp. The expense of maintenance on both these systems was very carefully studied and thorough measurements of the illumination were made. The investigation showed that from the economic standpoint gas is quite out of the game, being considerably higher than electric lighting both in fixed charges and operating costs. In fact, for equal illumination the arc lighting costs less than 40 per cent of the press-gas lighting.

The authors of the paper go so far as to say that electric lighting possesses all the practical advantages, although they state that the press-gas lamps were slightly steadier and less glaring than the arc lamps. It is a little difficult from the facts given to evaluate the difference in cost between the two illuminants with precision, inasmuch as one is dealing with a municipal plant, and it is clear

that the figures, particularly those relating to fixed cost, are not accurately ascertainable unless when dealing with a much larger number of lamps than were here used. It is equally clear, however, that the discrepancy in the figures given is far too great to be obliterated by any of these considerations. It is not a question of one lamp costing a few shillings a year more than the other, but of the one costing several times as much as the other. One of the conspicuous reasons for the practical economical failure of the press gas was that not only the particular lamps here used but a number of others, of which tests were available, showed a great deficit in actual candle-power below the rating, all the press-gas lamps tested giving roughly only about half their reputed output. The 4500-cp lamp used in the test gave only as the average maximum reading about 2300. The flame-arc lamps did relatively very much better. The raw results of this comparison are thoroughly in line with those we have at various times indicated on the basis of experience elsewhere. The press-gas lamps certainly give a beautiful light, but at the prices charged for energy in America they seem to stand a very small chance of economic success.

Incidentally, the Manchester investigation brought out many points of technical interest. In the first place the photometric work by the somewhat unusual method of flicker photometry, to obviate the differences in color, seems to have been thoroughly done. The flicker instrument was found somewhat troublesome to use, but otherwise satisfactory. The illumination was measured on the horizontal, a meter above the ground, and in the arc-lighted street the minimum intensity was found to be about 0.5 ft.-candle, while the ratio of minimum to maximum, referred to as the variation-factor of the illumination, was 3.75. Tests were also made with a reading lumenometer. These tests, which are, of course, less precise than photometric readings but still not without value in conjunction with photometry, showed consistently the curious condition of something like 25 per cent greater apparent illumination from the arc lamps than was derived from the candle-power readings. This difference must probably be charged to the quasi-monochromatic character of the light from a yellow-flame arc lamp. The same phenomenon is even more strongly marked in comparing the mercury-arc lamp with a source giving a continuous spectrum.

Another interesting phase of the study was the testing of globes with reference to their effect on the distribution. The first installation was with clear inner globes and opalescent outer ones, the latter serving in a measure to improve the distribution; but this arrangement was found unsatisfactory and it was advisable later to substitute an etched globe of somewhat different shape. The best results were obtained by a graduated etching, light in the upper part of the globe and stronger at its base. The change effected by this modification of the glassware was very striking, the angle of maximum candle-power being raised considerably nearer the horizontal. Dioptric inner globes were also tried both with clear outer globe and with the graduated etching referred to, and also with slightly opalescent outer globe. With the aid of diffusion the dioptric inner globes performed well but were found

somewhat hypersensitive to the position of the arc, so that the way it was looked upon as of a somewhat dubious advantage.

All things considered, the Manchester experiments seem to have made it very plain that flame-arc lamps when judiciously used can be made to give considerably more economical street lighting when intense illumination is required than can high-pressure gas lamps, but that there is considerable yet to be learned about the best way of installing very high-power illuminants. The intensity of illumination reached was higher than is familiar in American practice, and the figures for cost would require considerable revision if applied here. There is little doubt, however, that the balance would still remain on the same side, and that under present conditions there is little to encourage any American municipality in undertaking high-pressure gas lighting.

### More Light on the X-Rays

Experiments made within the last few months on the reflection of X-rays from cleavage planes of crystals, based on the theory that natural cleavage planes approximate to that molecular degree of smoothness necessary for the reflection of extremely short wave-lengths, have proved successful, and for the first time definite and well-marked reflection of the X-rays has been secured. In a paper recently read before the Physical Society in London, Professors Barkla and Martyn presented the results of a further extension of this line of work. It is hardly necessary to remind our readers that the actual character of the X-rays has been a puzzle from the very beginning of experiments with them. They have been in turn supposed to be electromagnetic disturbances of enormously small wave-length, physical emission of some extraordinary and peculiar kind, and irregular pulses in the same medium which transmits other electromagnetic radiations but broken and devoid of anything like systematic periodicity.

The experiments seem to throw new light on the very puzzling phenomena and to afford a basis for a definite answer as to the identity of the X-rays and their relation to other forms of radiant energy. Barkla and Martyn made an investigation of the reflection of X-rays from a crystal of rock salt. Rock salt crystallizes in the cubic system; its cleavage planes are correspondingly simple, and it is unusually transparent to most of the known forms of radiation. The experiments were carried on chiefly at nearly grazing incidence, and it was definitely established that the reflection obeyed the ordinary laws which hold for electromagnetic radiations of visible wave-length. The reflected radiation had approximately the same penetrating power as the incident radiation and was fairly homogeneous after having traversed 5 mm of rock salt in the course of its reflections. Moreover, a definite system of interference fringes was established in the reflected ray owing to interference of the pencils reflected from equally spaced cleavage planes, the maxima observed by photographic methods corresponding to spectra of various orders. In fact, the cleavage planes might almost be said to serve in this case as an echelon grating. At all events,

the system of interference fringes observed is thoroughly comprehensible on the theory that the radiations producing them are simple electromagnetic waves of extraordinarily short wave-length.

Quantitative figures in a case of this kind must be accepted with some caution. In the particular instance before us the wave-length was figured on the theory that the crystal molecule in the cleavage plane was merely a simple molecule of sodium chloride and not a polymer. This hypothesis would lead to a minimum value for the wave-length, and collateral evidence makes it quite certain that one cannot assume such simplicity in the molecule of rock salt. In a general way, the computation of the wave-length required to account for the interference phenomena observed led to a value of an order of magnitude no more than a few hundred-millionths of a millimeter; in other words, a few ten-thousandths, at the most, of the wave-length of visible light.

The shortest ultra-violet wave-lengths obtained by Schumann and by Lyman are at least a thousand times as long as those attributable to the X-rays from these latest experiments, and these shortest ultra-violet radiations are completely absorbed by a few millimeters of air and can be obtained only by working *in vacuo*. Below the Schumann region, therefore, there must exist, if the present experiments are confirmed, huge absorption bands in all gases yet investigated, rendering them opaque to short electromagnetic waves until a certain unknown inferior limit is reached, at which they again become transparent. Such absorption however strange it seems at first thought is not unknown within the wider range of radiation. Water, for instance, obstructs an enormous range of the longer wave-lengths, while beautifully transparent through the entire visible spectrum and far into the ultra-violet. A thin layer of asphaltum on the other hand, almost opaque to visible light, is transparent to the ultra-violet.

There is no great improbability in supposing the existence of a region of exceedingly short wave-lengths to which substance opaque to radiation of length commensurate to their molecular dimensions may be wonderfully transparent. If one looks upon absorption as a phenomenon of resonance, it should not seem too unlikely that frequencies immensely greater or less than those that would produce resonance in structures of the same size should produce resonance in structures of the same size. The waves of the longest radiations emitted by Schumann and the X-rays which produce the interference fringes found by Barkla and Martyn remain yet to be discovered. The latter phenomenon opens a huge unknown region in which numerous observations are due. Mapping the region now should be regarded as justified in making out that inasmuch as there are here lines of evidence and that a considerable fraction of the radiation is of the dimensions of the wave-lengths. The work of nature, however, that we are on the point of doing is somewhat different. It has been found that light of 2 mm yellow sodium pattern the same relation to the distance that ordinary red light does to the same, and the distance

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Ontario Legislature Appropriates \$2,500,000 for Extensions to Hydroelectric Systems

An appropriation of \$2,500,000 for the Hydroelectric Power Commission has passed the Ontario Legislature. The Hon. Adam Beck, chairman of the commission, informed the House that the estimated expenditure for the year would be approximately \$2,500,000, and that before the work now under way was completed \$2,500,000 more would be spent. At least \$250,000 will be required for new offices in Toronto with other incidentals. For extensions to the Niagara district \$400,000 will be required, and for the Windsor extension \$200,000. The transmission lines and equipment for this will cost \$750,000; \$150,000 will be expended on the Severn system, and \$20,000 on the Port Arthur system. For the St. Lawrence system \$250,000 will be required, for the Newmarket and the system north of Toronto \$100,000, for the Cannington and Beaverton system \$75,000, and for the Clinton service and the district about Goderich \$250,000. The commission has decided that the extension of the Niagara system to Goderich offers more advantages than any other plan. It has also found it more economical to do its own construction work and has secured tenders for towers at \$3.68 per 100 lb. of steel, against \$4.30 for the same material put into towers when the first transmission line was built.

### Scranton Railway Contracts for Central-Station Energy

The Scranton Railway Company, a subsidiary of the American Railways Company of Philadelphia, has signed a contract with the Scranton (Pa.) Electric Company for all electrical energy required by it for the operation of its street-railway system. The contract becomes effective Oct. 1 and is operative for twenty years. The load will range from 5000 kw to 6000 kw, and by the terms of the contract the Scranton Electric Company will take over the 1500-kw station of the railway company on lease and will also acquire a culm bank owned by the latter company. The 1500-kw station is comparatively new and contains a single Rice & Sargent engine and railway generator. The equipment is operated non-condensing and the coal from the culm bank costing about 50 cents a ton in the bins, the cost of energy at the switchboard is about 8 or 9 mills. The old station of the railway company will be dismantled, but the 1500-kw station will be held in reserve and for use on peak loads.

The Scranton Electric Company will deliver the direct-current energy at four points and will make extensions to its system in order to take care of the load. Motor-generator sets will be installed with Tirrill regulators on the exciters of the synchronous motors so that the general power-factor of the system can be improved. The suburban station of the lighting company has been entirely rebuilt within the past year and a 10,000-kva unit is now being installed, the output of which will more than meet the demand occasioned by the railway load. The river station, which is ordinarily operated only during the steam-heating season, will be equipped with the motor-generators and converted into a combination generating and substation. Mr. Duncan T. Campbell is the general manager.

### Ohio Utilities to Be Reimbursed for Flood Losses

Although no well-defined plan looking to the solution of the problem in detail has been formulated, it is the feeling of the authorities in Ohio that the utilities that have sustained great damage through the recent floods should be permitted to issue securities to cover the losses, instead of being compelled to make replacements out of surplus and future earnings. Governor Cox has been quoted as saying that the policy of the State should be one of sympathetic construction and that companies serving the public should be permitted to capitalize the replacements which they are forced to make through flood damages and spread the payment through a term of years. He is in favor of some plan that will cause a minimum of hardship. The attitude of the Public Service Commission is reflected by Commissioner O. H. Hughes, who has expressed a desire to help the utilities affected and who is of the opinion that if the laws of the State are not broad enough to give power in the premises to the commission, the Legislature now in session ought to give the proper authority to it. At the same time, in view of the blow which many of the properties have also received in the loss of present and future earnings, the commission, in his estimation, ought also to have the right to adjust rates to help make up the losses. This would have to be very carefully handled, however, he said, and the proposition will be entertained only in especially severe cases. Personally, Mr. Hughes favors a conservative policy at all times. He realizes that the reconstruction problem confronting the properties in Ohio at this time is very complex and should be solved in the light of reason.

### A. I. E. E. Affairs

Upon recommendation of a special committee on organization of technical committees, the board of directors of the American Institute of Electrical Engineers at its meeting on April 9 authorized President Ralph D. Mershon to appoint a committee on marine electrical engineering. President Mershon was also authorized to appoint an Institute representative upon the advisory board of the National Conservation Congress.

The public policy committee recommended the passage of the following resolution for the guidance of the standards committee, the resolution having been suggested by the latter committee:

"Resolved, That it is the sense of this board that co-operation between the standards committee of the Institute and the standards committees of other national societies dealing with units and standards appertaining to or applicable in electrical engineering, or in the allied arts and sciences, is desirable, and it suggests that the standards committee shall take no action on any subject matter outside of the field of electrical or magnetic standardization, and within the field of the standards committee of another national society, before coming to an agreement with the standards committee of that society, provided that a reciprocal courtesy is extended by such standards committee of such society."

The special committee appointed in January to examine applications for transfer to the grades of member and fellow, filed under the special section of the constitution, re-





ready to enter a ten-year contract to operate these lamps at \$21.50 per lamp per year, and the city would furnish only the equipment which it now maintains upon the streets. The Edison company offers a ten-year contract to furnish 60-cp lamps at \$21.14 per lamp per year and 40-cp lamps at \$18.33. The 40-cp tungstens give practically the same illumination as the upright gas-mantle lamps now in use, but with a better distribution of light. If the city should replace the gas lamps with tungstens under the Edison company's offer it would obtain at least one-third more light with the saving of nearly \$70 per day over the present cost. Many gas lamps have been gradually replaced by tungstens in Boston, but at present Mayor Fitzgerald is withholding consent to the complete changing over of the equipment at a single stroke.

### The Garage Problem

In a short paper read before the Chicago Section of the Electric Vehicle Association on April 8, Mr. R. Macrea, of the Commonwealth Edison Company, said that it is not strange that electric-garage service is not always what might be desired. Nevertheless, the question of garage service is of great importance to the electric-vehicle industry. While there are a number of good garages, there is an urgent need of improvement in most of them. The speaker made some humorous references to the exploits of "ready-made electric-vehicle experts." It has been asked if it would not be better if there were no public garages, but the answer must be in the negative, because what happens in private garages is often worse. The electric vehicle seldom fails; failure is caused by improper methods of operating.

This condition of affairs, in Mr. Macrea's opinion, appears to be due to lack of authoritative instructions on the subject. The manufacturers of electric automobiles provide little help in relation to operating. The remedy is an admission on the part of vehicle manufacturers that operating instructions are needed. It should not be thought that the term "kilowatt" is too academic for daily use. Instructions given by battery manufacturers are not sufficient, for they cannot be applied to all types of vehicles. The electric vehicle is still a long way from being foolproof, and the manufacturers should recognize this fact. Careful and minute instructions given to owners and garage keepers will do much to bring about an ideal standard of service.

Of the several garage men who took part in the discussion, one criticised the instructions of storage-battery manufacturers as not clear enough. Another laid blame on the generalities used by salesmen of electric automobiles in selling the cars. The mechanism and manner of operating should be explained carefully and in detail to the buyer. Salesmen should have a fair measure of technical knowledge. Another gentleman said that often the electric car is brought in late at night and the customer demands it early the next morning. With this situation there is a temptation to send out the car improperly charged. In fact, one garage owner said that the trouble is due largely to impatient and inconsiderate customers. This speaker said that his troubles were caused less by battery charging than by complaints, often unreasonable, that cars are not cleaned properly.

Mr. W. J. McDowell, of the General Vehicle Company, declared that the salesmen of that company endeavor to explain minutely the machine to the prospective customer. The salesmen find out first if the customer is prepared to handle an electric truck. The company has a service department and sends out inspectors who spend from two days to two weeks with the buyer or his employees, showing how to charge the batteries and how to make all mechanical adjustments. In addition, a book of printed instructions is left with the owner or operator of the truck

Both oral and printed instructions should be given when a truck is sold. The company has a force of inspectors who go around every thirty days inspecting trucks in service.

Mr. D. C. Arlington, of the Philadelphia Storage Battery Company, said that Mr. Macrea's contention referred particularly to manufacturers of pleasure vehicles; electric trucks are well taken care of. There are 2000 pleasure electric cars in Chicago, and the owners, or a large proportion of them, change from one garage to another at frequent intervals to get better service. The trouble is almost always the fault of the attention given to the battery and not of the battery itself.

Mr. McDowell added that one trouble was that customers often fail to follow instructions. A garage operator contended that sometimes the so-called inspection made for the manufacturers is only perfunctory. He added that in selling vehicles claims for long life for the batteries are frequently made that cannot be substantiated in practice. Furthermore, he asserted that sometimes the salesmen draw glowing pictures of a machine that will run two or three years without repairs. This is an exaggeration which does harm.

There was a brief but rather interesting discussion of the life of storage batteries in vehicle service. Mr. Arlington said that the batteries would last two years or more if they were not overworked. Mr. George H. Jones, of the Commonwealth Edison Company, suggested that it might be well to state the life of a vehicle battery in mileage. One garage man spoke of an electric car that was run nearly 1500 miles in a month, and another member told of one that had a record of 15,000 miles in eleven months with one set of batteries. He stated that it is the charging that wears out the battery, not the number of miles run.

### Electron Theory of Metallic Conduction

In the last of the series of lectures before the American Institute of Electrical Engineers, delivered by Prof. E. P. Adams, of Princeton University, in New York on April 16, the subjects discussed were metallic conduction, the indication afforded regarding the structure of an atom by the study of radioactivity, optical phenomena in moving bodies, and the principle of relativity.

In outlining the application of the electron theory of metallic conduction Professor Adams said that all of our previous ideas of conductivity had been centered about Ohm's law and all known facts had been deduced from experimental work which followed this trend. In the electronic theory it is assumed that all metallic conductors contain free electrons which are not a part of any atom. The movement of these electrons in the metal is manifested as electric current, the direction of which is opposite that of the motion of the corpuscles. The particles are negatively charged and the flow of positive electricity must be in the opposite direction.

The relation of heat conductivity and electric conductivity was shown, and mathematical proof was submitted to substantiate the claim that both heat and electricity are carried in the metals by the free electrons. The ratio of thermal conductivity to electric conductivity has been proved mathematically to be a constant. These results have been verified by experimental work.

The application made by Professor Adams of the electronic theory to explain the action of an ordinary thermocouple proved very interesting. Each metal of the couple contains a different number of free electrons per unit of volume. As heat is applied the electronic pressure at the junction point becomes higher in one metal than in the other. To equalize this pressure the free electrons flow from one metal to the other. The manifestation of this circulation of charged particles is called electric current.







## Economics of Monopoly as Exemplified by Group-Control Electric Service

A picture that aroused enthusiasm was drawn by Mr. Samuel Insull, president of the Middle West Utilities Company and the Commonwealth Edison Company, in addressing the N. E. L. A. Company Section of the latter company in Chicago on April 15. The large audience embraced a number of visitors prominent in the financial, legal and administrative departments of the electric-service industry. Mr. Insull's subject was "The Economics of Monopoly in Public-Service Business," and his address was, in many respects, similar to the one on "The Production and Distribution of Energy," which he delivered before the Franklin Institute of Philadelphia on March 19. (See *Electrical World* of March 22.) It contained, however, some new material, or a different presentation of the facts bearing on this very important subject, as they appeal to the far-seeing mind of Mr. Insull.

The speaker began by declaring that monopoly is an economic necessity in the electric-service industry. Competition does not make for cheap energy; competition has been replaced by regulation to a very great extent. Regulation of monopoly by the community is more in accord with scientific methods than regulation by unrestrained competition. The great principles embodied in these statements have been borne in upon central-station men by experience, and men engaged in the electric-service industry have been and are being educated on the vital aspects of this question; it is not the public alone that needs to be educated. Electrical men have learned the lessons of load factor, of massing of production, and of diversity factor, in the hard school of experience. They have been trying recently to discover the economic laws governing the business of producing, distributing and selling electricity.

Mr. Insull devoted most of his remarks to the application of these general principles to the service of small communities through the group or unified system of control, such as is manifested by the modern operating syndicates. He showed the great advantage of supplying electrical energy for town light and power, for interurban and local railways, for drainage, mine operation, general manufacturing, farming operations, water pumping, ice-making, etc., from one source of supply. As in the Philadelphia lecture he drew many of his illustrations from Lake County, in northeastern Illinois, but he also made a number of estimates in relation to the possible electrification of the whole State of Illinois. One interesting statement in relation to Lake County (which is served by the Public Service Company of Northern Illinois) was that, taking the average of sixty-eight farms containing an average of 162 acres each, the income from them to the electric-service company was 60 cents per acre. Statistics were given contrasting the cost of giving various classes of service in rural communities from individual sources of supply with similar costs from unified control, greatly to the advantage of the latter. Various load diagrams were given showing, among other things, the great importance of the diversity factor.

Next the speaker used curves plotted on one sheet to show what might be the entire load of the State of Illinois, outside of Cook County, for the services named. It is estimated that the total maximum demand would be about 306,000 kw, but to meet this demand, owing to the diversity of the demand, it would be necessary to provide an installation of but 226,000 kw. This shows a saving of 80,000 kw in investment by utilizing the diversity factor in the manner possible with unified control. If we imagine Illinois, outside of Cook County, served from one source of electrical supply, or from several sources acting in unison, the total annual consumption is estimated at about 960,000,000 kw-hr. The largest item would be for the interurban and street railways, which would take 34.8 per cent; the next would be town lighting and power, taking

24.9 per cent; water pumping would require 13.4 per cent; farming 10.6 per cent, and so on. These figures, said Mr. Insull, show not only the economic necessity of monopoly in electric service, but they also present a very strong argument against the operation of small and scattered municipal plants, where the cost of producing energy is so high.

It is believed that the small central-station plants of Illinois have about 78 per cent of reserve capacity. This, of course, is very much greater than is necessary. If the various services, as town light and power, railway operation, farming, pumping, etc., mentioned as aggregating 306,000 kw, were operated from separate utilities with large modern plants the average reserve required would still be about 43 per cent. However, by combining the supply for all these requirements from one source, the maximum demand of 226,000 kw required in that case would need only an additional reserve of about 20 per cent.

There are 326 communities, large and small, in the State of Illinois, outside of Cook County, supplied with twenty-four-hour electric service from uniform-control, group-service systems. Mr. Insull estimates that if all the requirements for energy in the whole State of Illinois were supplied through the medium of electricity, about 1,350,000 kw would be required. Nearly half of this would be for the steam railroads of the State. The saving in coal by operating the present steam railroads electrically, in connection with all the other energy needs of the state, would be tremendous, and is to be considered as an important factor in the possible conservation of natural resources.

In closing Mr. Insull said that unquestionably future years would see the entire territory from the Mississippi Valley to the Atlantic Ocean covered with a network of transmission and distribution lines with large generating stations at points where it is found economical to produce electrical energy, either in steam plants or by hydroelectric development. When cheap energy is widely available in this manner the effect on many of the sociological problems of modern life will be pronounced. It is not too much to expect that conditions of life and labor and of the upbringing of children away from the grime and distraction of cities will be materially affected by a wise system of distributing energy in rural communities. If the great system or systems of supplying electrical energy embrace the supply of energy to the railroads, the cost of commercial power will be so low that a manufacturer can settle in any rural community. The expense of transporting persons and goods will be much diminished. The possibilities of cheap power are very great, and Mr. Insull said, as his last word, that he saw no reason why these advantages should not be carried at least to every home in Illinois.

## Jury Awards \$500,000 Damages for Pole-Line Right-of-Way

Half a million dollars is the sum set by a jury in the federal court at Louisville, Ky., as a fair price to be paid by the Western Union Telegraph Company for the use of the right-of-way of the Louisville & Nashville Railroad Company in maintaining its telegraph service in the South. The verdict concludes the condemnation proceedings instituted by the telegraph company against the railroad, seeking to establish a fair price whereby it might secure the privilege desired. Mr. Milton H. Smith, president of the railroad company, declared in his testimony during the trial that \$4,200,000 would about cover the damage sustained by the railroad company through the continued use of the plaintiff's lines along its right-of-way. The telegraph company considered \$200,000 a fair and maximum price, although Mr. A. P. Humphrey, chief counsel for that corporation, placed the price at \$3,500. Whether or not an appeal will be taken from this verdict has not been decided.

The proceedings involve the use of 1,400 miles of right of way, from which the railroad company sought to oust the Western Union upon the expiration of its contract for telegraph service with that corporation in August, 1912.

### Incorporation of Numerous Electric Companies in Pennsylvania

Pending public utilities legislation in the State of Pennsylvania has been the means of causing more incorporations of electric companies during the last month than the Secretary of the Commonwealth has known in years. Of the 291 manufacturing companies chartered, 173 obtained letters patent to furnish electricity or gas. In February the number of manufacturing companies chartered was 171, and in January 186 received letters patent. It is believed that a public utilities bill will be reported from the House committee within the next week, and as amended the measure will provide for seven commissioners to serve ten years. The object of the incorporation of so many electric companies prior to the adoption of a public utility measure is, of course, to enable the companies to float their securities before a commission exercises supervision of all issues of stocks, bonds, etc.

### Report on Toronto Hydroelectric System

The annual report for the year ended Dec. 31, 1912, issued by the Toronto Hydro-Electric Commission shows that, after charging up \$212,643.88 against interest on current operations, management and repairs and providing for sinking fund, the net profits for the year were \$13,555.41. Together with this statement is one to the effect that next year the debt incurred last year in construction work will be wiped out and that there will undoubtedly be a decrease in the rates charged by the commission. The gross earnings of the commission for the year were \$726,763.55. The cost of the electrical energy, operation, management and repairs for the year amounted to \$500,564.26, leaving a balance of \$226,199.29. Included in the expenses and charges which have been detracted out of the year's income is the cost of getting new business, which, including the cost of advertising, was over \$53,000. The sinking fund accruing to the construction period ended on Dec. 31, 1911, and carried from that date as against future profits, amounts to \$509,854.91. Only \$37,430.08 of this is carried forward as an obligation against future earnings. The estimated cost of the completed plant as finally decided upon by the commissioners was \$4,500,000. Of this amount \$3,734,914.33 was expended to the end of 1912, leaving an unexpended balance of over \$765,000. The meters in use on Dec. 31, 1912, were 13,888, lamps in use 306,024, street lanterns 33,824, connected load 54,655 hp, peak load 17,198 hp. Toronto has a population of approximately 250,000 and the municipal system operates in competition with the Toronto Electric Light Company.

### Merging of Louisville Utilities Halted

A citizens' suit has been brought against the Mayor of Louisville, other officials of the City of Louisville & Company, of Chicago, and the local public service corporations to prevent the merger of the local utilities according to the terms of ordinances recently passed by the Board of Aldermen and the Board of Commissioners, claiming that it is proposed to oust the litigation as settlement as rapidly as possible, as negotiations looking toward the merger of all public-service corporations under Byllesby management in Louisville have progressed practically to the consummation of the project save for the opposition of the citizens.

The chief contention of the citizens is that rates higher than those allowed in the merger ordinance may eventually be charged for gas and electricity in Louisville. Objection to the suit as a public utility case to quash the injunction forbidding the sale of the Kentucky Electric Company is also made, and it is charged that several sections of the merger ordinance violate the state constitution. The plaintiffs insist upon the right of free bidding for the merger franchise when the plan is to sell and declare that the Byllesby plan has not received the great advantage. The plan of the latter in organizing a large holding company in Kentucky, the Louisville utility, are also attacked.

### Additional Powers for New York Public Service Commissions Proposed

Three bills embodying the idea of giving to the state platform of the Progressive party to give additional powers to the Public Service Commissions were introduced at Albany, N. Y., this week. The measures have passed to the commissions similar to those accorded to the Interstate Commerce Commission over that question. The measures provide that in any hearing by the commissions as to change in rates or service the burden of proof to justify the change shall be upon the company, but in any proceeding as to the reasonableness of any rate or the adequacy of any service the burden of full disclosure of all the facts as to said rate and service shall be upon the company, and when a schedule is filed changing a rate or a service afforded by a public utility corporation the commission may suspend the taking effect of such a schedule pending an investigation of the reasonableness and propriety of such change. Priority would be given to cases in which such suspension is granted. Another bill is designed to limit the power of the courts in reviewing orders of the commissions as questions of fact alone. It also nullifies the dilatory writ of certiorari as a means of blocking orders of the commission, provides that no injunction against an order of the commission shall be granted except on notice to the commission, and definitely places in the party asserting the invalidity of an order of the commission the burden of proof to establish such invalidity. The Justice of the Appellate Division of the Supreme Court have exclusive jurisdiction to suspend the taking effect of orders of the commission but in order that to be enforced must move that the order, subject after its hearing by the Appellate Division, be nullified.

### Pomona Voters Reject Rates Proposed by Socialists

The people of Pomona, Calif., in April voted by a majority of about two to one against socialist reforms in the rates for gas and electricity charged by the company serving that city—the Southern California Edison Company. This plan had been proposed and presented in large measure by the socialist movement in Pomona, which is employed by the Edison company.

Persons in a city of about 12,000 residents and 10,000 votes last month in a recent election in Pomona, Calif., voted against the socialist reforms in the rates for gas and electricity charged by the company serving that city—the Southern California Edison Company. This plan had been proposed and presented in large measure by the socialist movement in Pomona, which is employed by the Edison company. The socialist movement in Pomona, which is employed by the Edison company, had been proposed and presented in large measure by the socialist movement in Pomona, which is employed by the Edison company.



Council, so they drew up ordinances and presented them. The Council had the option of enacting the ordinances or referring them to the citizens and chose the latter course at the regular municipal election. The ordinances so summarily defeated, as recited above, proposed to make the gas rate 90 cents instead of \$1, the base rate for electricity  $5\frac{1}{2}$  cents per kw-hr. instead of 8 cents, and a reduction of about 25 per cent in the water rates. The proposed rates were determined, apparently, without special investigation or knowledge as to whether they would produce a fair return upon the investment.

In the newspaper publicity campaign carried out by the Edison company through its publicity department, in charge of Mr. Charles H. Peirson, the company laid before the people sworn operating statements of the Pomona district for 1912; also figures bearing upon the investment values as appraised by Mr. Bion J. Arnold. The rate of return earned upon the investment was shown, contrasted with the prevailing rates upon which money could be borrowed in southern California. The entire proposition was discussed very frankly much as one business man would present a business proposition to another. The result amply justifies the general policies and methods pursued by the Southern California Edison Company and also indicates the fair-mindedness of a majority of the people in a part of California where the socialists are supposed to have obtained a considerable following.

### Corporation Commission to Supervise Utilities in North Carolina

Electric light, water and gas companies other than those municipally owned or conducted and all persons, companies and corporations now or hereafter engaged in the business of furnishing electricity or gas in North Carolina have been placed under the supervision of the Corporation Commission, which now exercises control over railroad and other corporations. The Corporation Commission is to have full power and authority to fix, establish and regulate the rates or charges of such persons, companies or corporations, to make such investigations and orders and to establish and enforce rules and regulations, fines and penalties, as in the cases of railroads. When any such charges or rates are fixed or established by the commission they shall be deemed proper and any rate or charge made and collected by any such person or corporation other than that fixed by the commission shall be deemed unjust and unreasonable. The Corporation Commission is required to make reasonable and just rules and regulations, first, to prevent discrimination in furnishing electricity or gas, and, second, to prevent the giving, paying or receiving of any rebate or bonus, or the misleading or deceiving of the public in any manner as to real rates or charges for these commodities.

### Illinois Public Utilities Bill

The public utilities bill backed by Governor Dunne and introduced in both branches of the General Assembly at Springfield, Ill., this week abolishes the railroad and warehouse commission and merges that department with the proposed public utilities commission. The following are the salient provisions of the measure: (1) A commission of five members, the salary of each to be \$10,000 per annum; (2) abolition of the present State Railroad and Warehouse Commission; (3) provisions for appeals to the Circuit Courts and then the Supreme Court from all rulings of either the state commission or the local municipal commission; (4) the law to become operative in all cities of the State under 25,000 population upon its going into effect, leaving it optional with the cities of more than 25,000 population whether they will avail themselves of

the enabling legislation and establish local commissions for the regulation of all utilities; (5) provisions whereby cities of more than 25,000 population which have adopted the commission method of dealing with the utilities may surrender their rights and come under the state commission control; (6) cities of more than 25,000 operating under a local commission to have jurisdiction only over the local utilities within municipal limits; (7) regulation of the issuance of all stocks, bonds and securities of all corporations, local utilities or otherwise, to belong to the state commission; (8) the act not to apply to municipally owned utilities in any city, such as water-works, gas and electric plants; (9) the powers of the commission to be made plenary and applicable to all public-service corporations of every kind and character in Illinois; (10) the commission to have authority to regulate the service of all public-service corporations with particular respect to schedules, quality of service and rates.

### New Public Service Utilities Measure for Ohio

It is said that an entirely new public service bill will be presented to the Ohio Legislature in time for action before adjournment. Representative Mills, of Cleveland, is to report the substitute. It will provide for the physical valuation of properties, as originally advocated by Governor Cox, and it is believed that this will be left to the Interstate Commerce Commission, which is to make a valuation for the United States government. The bill will not include any changes in the present law relating to the indirect control of local companies by means of appeal to the Public Service Commission when the municipality and company fail to agree upon an extension or renewal of franchise. It is said that Mayor Baker of Cleveland and other home-rule advocates believe that the amendment to the constitution adopted last summer is self-operative and that under its provisions supervision over local public-service corporations will be denied without putting a special negation in the statute.

### Oklahoma Utilities Bill

Although the Corporation Commission of Oklahoma has been in service several years, some doubt has been expressed concerning its powers over electric-lighting and railway, gas and water-supply companies, and the commission has therefore hesitated to give orders regarding rates and other subjects in connection with the operation of such plants. To define the commission's powers, a bill, prepared under the authorship of the commission's secretary, was recently passed by the Oklahoma Legislature and signed by the Governor.

This special statute gives the corporation commission "general supervision over all public utilities, with power to fix and establish rates and to prescribe rules, requirements and regulations affecting their services, operation and management and the conduct of their business." Although municipal plants of all kinds are explicitly excluded from coming under the provisions of the new law, the commission has with respect to privately owned utilities "full visitatorial and inquisitorial power to examine such utilities and keep informed as to their general condition, their capitalization, rates, plants, equipments, apparatus and other property owned, leased, controlled or operated, the value consumed, the management, conduct, operation, practices and service," with respect to the adequacy, security and accommodation afforded by their service as well as their compliance with the provisions of the act. The commission is also to have powers to specify accounting methods and to institute examinations, meter tests, etc.

The committee in the State Senate recommended insertion in the bill of an amendment providing that in case



the owner or operator of any public utility is engaged in carrying on any other business in connection with the operation of the utility the commission may require the cost of operation and gross revenues of such joint business to be kept as prescribed by the commission, so that the operating expenses and gross revenues of the public utility may be ascertained.

On the last day of the legislative session Senator Thomas, who introduced the bill, offered an amendment bringing municipal plants under the jurisdiction of the commission, but this measure failed by one vote. At the present special session the matter has been considered, on the "initial importance" to justify bringing before the Legislature again at this time, although it is hoped to get the amendment passed two years hence. The municipal-plant provision was omitted in the original draft because the commission feared its insertion might arouse more opposition than actually appeared, and it did not want to put the whole bill in jeopardy on account of a single provision.

### Organization of Missouri Public Service Commission

Governor Major of Missouri announced on April 13 that he had decided on four of the five members of the new Missouri Public Service Commission. Those appointments are Mr. John M. Atkinson, of Doniphan, former Assistant Attorney-General, Mr. John Kenneth, of Kansas City, former Supreme Court judge, Prof. H. B. Shaw, of Columbia, dean of the engineering department of the University of Missouri, and Mr. Frank A. Wightman, of Moberly, who is a member of the present railroad commission. Two of the four gentlemen named are Democrats in politics, and two are Republicans. It is said that the fifth man will be a Democrat. Mr. E. J. Bean, of De Soto, is named as the probable attorney for the commission. It is reported that Mr. Thomas M. Bradbury, until recently secretary of the State Board of Railroad and Warehouse Commissioners, which went out of existence on April 15, will be appointed clerk of the new commission. The salary of each commissioner is \$3,500, those of the attorney and clerk being \$4,500 and \$3,600 respectively. The commission will establish headquarters in the temporary capitol at Jefferson City. It is said that Kansas City will probably offer the first demands upon the services of the commission, as there is trouble there with the street-railway company and the gas company. The Missouri & Kansas Telephone Company may make an application for authority to raise its rates.

### Public Service Commission News

#### MASSACHUSETTS COMMISSION

Chairman Barker of the Gas and Electric Light Commission appeared before the legislative committee on public lighting on Tuesday and advocated that all companies producing electricity for any purpose whatever be placed under the supervision and regulation of the board. He pointed out that the time is near when the sale of electricity for lighting will be but a minor part of the business of energy distribution and stated that the proposed codification of the laws would do much to clarify the existing statute and give the commission uniform powers over all utility service companies. Chairman Barker also pointed out the proposed extension of the board's authority to cover gas companies as those selling hydroelectric power on a large scale would not hamper their present efforts and tend to give the securities of such concerns additional value on account of the added stability accompanying proper regulation.

#### NEW YORK COMMISSIONERS

Most of the large railroad companies entering in New York City and the manufacturers and distributors of elec-

tricity were represented at a hearing before the Public Service Commission for the First District on a resolution adopted by the commission for the creation of a code of rules to insure public safety and safety in supplying to all departments of companies either producing or operating with electricity. A code of thirty-one rules, drawn up by the electrical engineer for the Public Service Commission, was submitted and the representatives present were asked to submit comments on rules which would be applicable to their respective firms.

To facilitate the movement of coal between its plant and the Long Island Railroad Company, the Long Island Electric Light Company intends to construct a switch track, and has filed an application with the Public Service Commission for the Second District for permission to issue \$25,000 of bonds to carry out the proposed work, including the cost of this commission. At the present time the lighting company intended to build and by means of these points.

#### HYDRO-ELECTRIC POWER DEVELOPMENT IN ONTARIO

The report of the Hydro-Electric Power Commission of Ontario submitted to the Ontario Legislature at its present session contains some interesting and useful information of the work already done in the distribution, transmission, and distribution, municipal advising and hydraulic investigation, and other work, a detailed statement of expenditures. The total capital expenditure, as announced by the chairman, the minister of power, on the part of the province of Ontario is \$14,000,000. The expenditure on lines and transformer stations of the Niagara system. The provincial expenditure during the year was \$123,751 on current account, in which figure was included the expenditure to municipal authorities on the construction of the Province was \$2,722. The figures of the population, cost and sale of energy are illustrated in the report by charts showing the monthly consumption of electricity in each of the municipalities in the province. A detailed report is given on the power, transmission, distribution and the progress of work under the municipal department is reviewed with respect to each municipality that has notified the province. The report gives the result of the hydraulic investigations to determine suitable locations for power developed in sufficient quantity.

## Current News Notes

**DEPARTS TO TRIP TO TEXAS.**—Mr. John Fitzpatrick, district commercial representative of the Western Union Telegraph Company in Chicago, is expected to have left his home in the Ohio and Indiana State about the middle of April, on a tour of visit and inspection, and also in making temporary profits. It is estimated that the trip to the points of the Western Union system will amount to over \$5,000.

**REPLY TO TELEPHONE.**—A number of the members of the commission in London in relation to the introduction of the Home Telephone Company in that city, passed at a local paper and they after the paper had indicated "Sale of shares in the Home Telephone Company," and the appeal, to the public a firm and easily available the commission of telephone companies by providing the telephone system in London, and of others. Whenever telephones have been installed and one upon that subject we shall greatly appreciate it if you will be good enough to put them into a convenient form, and will be glad to call for them at the earliest possible moment. It is convenient for our subscribers to often permit to do so, we shall be very grateful if they will bring with instructions to our office."

**WIRELESS IN FLOOD REGION.**—A wireless-telegraph system for flood relief work is to be opened at Vicksburg, Miss., by the United States Signal Corps. Wireless stations will be located in remote sections which are liable to be cut off from other communication by high water.

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**PUBLIC SERVICE COMMISSION, SECOND DISTRICT, NEW YORK, TO RETAIN CONTROL OF TELEGRAPH AND TELEPHONE COMPANIES.**—The Fitzgerald bill transferring the jurisdiction over telephone and telegraph companies from the Public Service Commission of the Second District to the Commission of the First District, New York, was defeated in the Senate on April 15.

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**STUDENTS AID IN REBUILDING HAMILTON (OHIO) PLANT.**—The University of Cincinnati shortly after the flood detailed Prof. A. Wilson and six senior students of the electrical course to go to Hamilton, Ohio, and assist in the rehabilitation of the power plant and water-works there. The students rendered valuable assistance in getting both systems in operation again within the week.

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**REPORT OF RAILROAD COMMISSION OF GEORGIA.**—The Railroad Commission of Georgia has issued its 1912 report on the street railway, gas and electric corporations operating in the State for the year 1912. The statements of forty-eight public utilities are included, and of these only four show a deficit. The companies' gross earnings for the year were \$9,998,490, against \$8,868,223 in 1911.

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**FEDERAL DEPARTMENT OF PUBLIC WORKS PROPOSED.**—At the National Drainage Congress in St. Louis on April 10 Mr. Isham Randolph, the well-known engineer of Chicago, suggested that the national government needs a department of public works, the head of which should have a seat in the President's Cabinet. Mr. Randolph holds that the regulation of the flood waters is a federal duty and that this duty could be carried out by the government department which he suggested.

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**TELEPHONE COMPANY OUSTED.**—The controversy over rates assessed against mutual telephone companies in Henry County, Ohio, by the Napoleon Telephone Company, and dissatisfaction with the latter's service in Napoleon, culminated in the passage of an ordinance terminating the company's franchise. The ordinance was classed as an emergency measure and will go into effect on May 13. The telephone company was organized a year ago and has about 1000 telephones besides exchanges in six villages in Henry County.

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**ELECTRIFICATION OF RAILWAY TERMINALS AGAIN UNDER DISCUSSION IN CHICAGO.**—The electrification of the railway terminals of Chicago is a subject that has been up for discussion in that city intermittently for the last ten years or more. A new City Council came into office on April 14, and one of its first acts was consideration of an ordinance introduced by Alderman Long requiring all railroad companies to operate their cars by power other than that of steam, or in such a manner as not to produce smoke or noxious gases. This ordinance set July 1, 1914, as the date for the electrification to be completed. It was referred to a new aldermanic committee known as that on railway terminals, of which Alderman Geiger is chairman.

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#### SOCIETY MEETINGS

**COMING REJUVENATIONS.**—A rejuvenation of the Jovian Order will be held on April 24 at Waterloo, Ia., during the convention of the Iowa Electrical Association. The next rejuvenation in St. Louis will be held on May 23.

**CHICAGO SECTION OF ELECTRIC VEHICLE ASSOCIATION.**—The annual meeting and banquet of the Chicago Section of the Electric Vehicle Association will be held on the evening of May 6. Officers for the ensuing year will be elected at that time.

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**JOVIAN ACTIVITY IN PHILADELPHIA.**—Following a luncheon which drew a large number of Jovians to the Bingham Hotel, Philadelphia, on Thursday of last week, a dinner and rejuvenation were held at the Continental Hotel on Friday evening, April 11. The arrangements were under the supervision of Statesman J. Crawford Bartlett and included an enthusiastic reception to Jupiter Frank E. Watts.

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**SPRING MEETING OF NEW ENGLAND SECTION, N. E. L. A.**—In place of the usual spring convention, the executive committee of the New England Section of the National Electric Light Association has voted to hold an informal dinner and "get together" meeting at the American House, Boston, Mass., on the evening of May 2. The dinner will take place at 6.30 p. m., after which two addresses will be given by speakers not yet announced. Miss O. A. Bursiel, 149 Tremont Street, Boston, Mass., is secretary of the New England Section.

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**JOVIAN REJUVENATION AT CHICAGO.**—At a rejuvenation held April 15 at the Hotel Sherman, Chicago, 67 candidates were initiated into the Jovian Order. Statesman G. C. Richards had charge of the affair, the attendance at which numbered 162. At the luncheon following the ceremonies Mr. A. A. Gray officiated, and Mr. Sam A. Hobson, past Jupiter, spoke. A cabaret show closed the evening's entertainment. Statesman Richards has announced the plans for the Chicago rejuvenation to be held in connection with the National Electric Light Association convention in June, when the Chicago Jovians expect to entertain 2000 members of the order. The ballroom and casino at "White City" have been reserved for the occasion.

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**ORGANIZATION OF PEORIA ELECTRIC CLUB.**—At a meeting of electrical men of Peoria, Ill., held on April 5, the Peoria Electric Club was organized with the following officers: President, Mr. C. A. Hoppen, Peoria Gas & Electric Company; vice-president, Mr. W. E. Wolgamott, city electrician; secretary, Mr. E. H. Joseph, Mills Electric Company; treasurer, Mr. Charles E. Stapp, Stapp Electric Company; executive committee, Messrs. H. J. Vance, Illinois Traction System; Louis B. Van Nuys, Central Electric Company of Peoria; T. E. Keltner, Central Union Telephone Company, and T. D. Buckwell, Peoria Gas & Electric Company. The initial membership consists of thirty of the representative electrical men of Peoria. Meetings will be held on the first and third Saturdays of each month at the Jefferson Hotel.

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**PROGRAM OF IOWA ELECTRICAL CONVENTION.**—The thirteenth annual convention of the Iowa Electrical Association (now affiliated with the National Electric Light Association) will be held in Waterloo, Ia., April 23 and 24. The morning session of April 23 will be devoted to routine business. In the afternoon there will be papers by Mr. E. M. Walker, of Dubuque, on "Welfare Work," and by Mr. C. W. Drake, of Pittsburgh, on "Off-Peak Possibilities." In the evening there will be a banquet and social entertainment. Two sessions will be held on Thursday, and papers are scheduled as follows: "Feeder and Voltage Regulation," Mr. V. A. Hain, Chicago; "Rural Line Extensions," Mr. John M. Drabelle, Cedar Rapids; "High-Tension Transmission Lines," Mr. H. W. Garner, Oskaloosa; "Operation of High-Tension Lines," Mr. Rufus Lee, Clarina; "Keokuk Hydroelectric Development," Mr. Dexter Cooper, Keokuk.



## Central-Station Practice at Cambridge, Mass.—I

**Installation of low-pressure turbo-units in extending the generating facilities of original reciprocating-engine plant—Test of 625-kw low-pressure turbine**

ONE of the most progressive central-station organizations in New England is the Cambridge (Mass.) Electric Light Company, which serves a total population of about 115,000 persons in the municipalities of Cambridge and Belmont, forming one of the most important groups of consumers of electric service in the Greater Boston district.

As the seat of Harvard University and Radcliffe College and the future home of the Massachusetts Institute of Technology, the city of Cambridge is known throughout the educational world as an intellectual capital, as the possessor of a historic past the community is one of the most noted tourist centers of America, and as a center of diversified manufactures it furnishes one of the most varied outputs of commodities to be found in any city of the same size in the country. Its intimate connection with Boston proper, which lies on the opposite side of the Charles River and which looks upon the "University City" as one of the nearest of its residential suburbs, is a striking feature of its social and industrial life.

The central-station service of Cambridge is correspondingly varied. At present there are 314 manufacturing establishments in the city, employing 21,000 persons and having a yearly payroll of about \$11,500,000. The value of the city's manufactured products is now about \$60,000,000 per annum and there are 207 different lines of manufacturing carried on in the town. The assessed valuation is now \$114,000,000 and the value of unassessed property is \$40,000,000.

### HISTORY OF CAMBRIDGE PLANT

The Cambridge Electric Light Company was incorporated in 1880, with a capital of \$800,000, as a result of the interest awakened in the suburbs of Boston by the greater security to life and property in that city afforded by street arc lighting. By the fall of 1887 the company was supplying seventy-seven public and seven commercial arc lamps and 847 incandescent lamps. By Jan. 1, 1913, the total connected load of the system had risen to 93,048 so-watt equivalents in carbon lamps, 18,463 40-watt equivalents in tungstens, 8752 hp in electric motors and 130 kw in energy-consuming appliances of small individual capacity, there being 306 motor customers and 3280 lighting customers. The capital stock of the Cambridge Electric Light Company on the latter date was \$850,000.

The first station of the company was a small plant near

the West Boston Storage on Water Street. Here were installed two 100-hp boilers, and at first a 250-hp Buckeye twin engine. Later a 100-hp Armington & Sims engine and a 90-hp New York Safety engine were added, making a total engine capacity of 440 hp. The method of lighting used was known as the New England Western pattern and proved satisfactory. The foundations of the building were resurveyed soon for the small engine.

In 1887 the company purchased a tract of land adjoining the Charles River on Western Avenue and erected a brick station at a total cost of about \$250,000. This was occupied in the fall of 1888. It contained a flat four 125-hp horizontal-return tubular

boilers, to which were later added five more of the same type. The engines were removed from the old plant and were installed in the new plant with three 100-hp Thompson-Houston gas engines, three 100-hp horizontal-return tubular boilers, a 40-hp generator and two 100-hp motors at two and one hours rating. From time to time three engines were changed to the tandem compound reinforcing type, with high-speed operation, and sometimes were added until there were seven engines with a total capacity of 1000 hp every 240,000 kw.

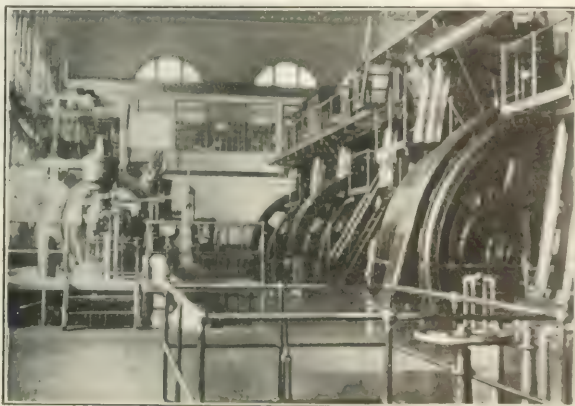


FIG. 1.—ENGINE AND TURBINE ROOM OF CAMBRIDGE ELECTRIC LIGHT COMPANY.

ner being filled with machinery. All of these engines were directly belted to their common shaft, a notable advance in practice for those days.

In 1887 the company furnished the storage line storage batteries with which the local street railway department experimented in connection with car propulsion. These experiments were unsatisfactory, but in 1889 the newly invented overhead trolley system was installed on the horse-car line from Bowdoin Square, Boston, to Arlington, via Harvard Square, and the Cambridge Electric Light Company furnished the energy for this service, which was the first successful line of street cars operated in the suburbs of Boston. In 1890, however, the company ceased to furnish power for transportation.

### CONSTRUCTION OF BUILDING

By 1898 it became evident that the company would soon have to build a new plant, and the present building was erected according to the plan of the engineering firm of Shedd & Jackson, at that time in business in Boston. The building faces the Charles River Parkway and is entered by the accompanying illustration, was designed to harmonize with the surrounding.

The plan is a well-balanced structure with pink granite



foundations and is 100 ft. by 165 ft. in plan, its height being 85 ft. At present the space between the station and the river is occupied by a coal pocket. Eventually the company's coal-storage facilities will be located upon land bordering Broad Canal, and the space between the station and the river will be provided with a lawn and shrubbery.

#### RATING OF PLANT

It is noteworthy that the present installation of engines and low-pressure turbines, the latter representing one of the first applications of its kind in central-station practice in the East, has been made without enlarging the building from its original dimensions. The plant to-day contains eight Babcock & Wilcox boilers, each of 440-hp rating; two 600-kw. one 1500-kw and one 2000-kw vertical cross-com-

the top and are passed through the boiler room so far as possible without doubling back upon their paths except when moved out for refilling. About 60 tons of bituminous coal are at present burned daily in the plant, the output at the switchboard being about 40,000 kw-hr.

Under the boiler-room floor and below the grates an ash tunnel 8 ft. wide extends the full length of the building. On this narrow-gage track runs an ash car. Ashes are discharged through hoppers into the car and raised in the latter on a hydraulic elevator to the ground level, whence teams remove them to dumps. All ashes are weighed before being disposed of outside the building. Draft for the stoker installation is provided by two 75-hp motor-driven fans in the boiler room. Natural draft is furnished by a brick chimney 255.5 ft. high and 9 ft. in inside diameter

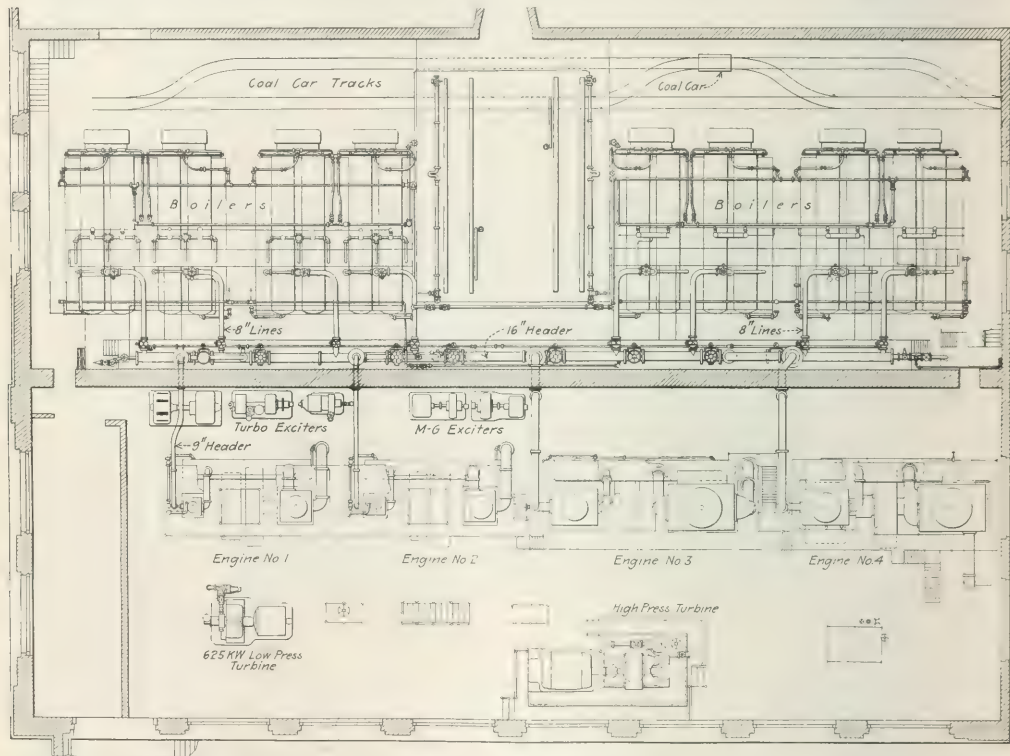


FIG. 2—PLAN VIEW OF STATION

pound condensing engine-driven unit, and two low-pressure turbo-generators of 625-kw and 1500-kw rating, the smaller outfit being connected to the exhaust of one of the 600-kw sets and the larger to the 1500-kw engine exhaust. The total rating of the station is 6825 kw.

Coal is delivered at the station by barges and is handled by a steam crane which unloads into a storage area holding about 8000 tons. From the coal pocket the fuel is transported, over a track of 20-in. gage, to the boiler room, in hand-cars of 2300-lb. capacity, twenty-four of these cars being in service. The boilers are installed in four batteries in a single row facing a firing aisle about 13 ft. wide, two narrow-gage tracks being carried past the batteries.

The tracks are provided with cross-overs and a set of platform scales upon which all fuel is weighed and then hand-fired into the hoppers of an installation of Taylor three-retort stokers recently added to the station equipment. The coal cars are usually filled to a level about 12 in. above

carried on a solid concrete foundation 25 ft. square at the top, 44 ft. square at the bottom and 14 ft. deep.

#### BOILER AUXILIARY EQUIPMENT

Between the adjacent pairs of boiler batteries in the center of the boiler room are installed two Green fuel economizers with motor-driven tube scrapers. The chimney is located outside the building on the side of the boiler room away from the engines, and a direct by-pass is provided around the economizers. In the space at the ends of the boiler batteries under the chimney flues are two Blake 65-in. by 8-in. by 12-in. duplex outside-packed feed pumps, each capable of providing water for 8000 hp of boilers.

The pumps draw water from the city mains through a receiving tank in the basement which also holds water from the turbine hot-wells. City water, used mainly for make-up service, is taken at about 40 lb. pressure. After the water leaves the feed tank it passes through the heaters, which



## ADOPTION OF LOW-PRESSURE TURBINE

At this point a résumé of the more important points involved in the adoption of the low-pressure turbine installation may properly be included. The initial investigation was conducted about four years ago by Prof. I. N. Hollis of Harvard University, consulting engineer for the Cambridge Electric Light Company, and the selection of low-pressure equipment and such tests as have thus far been made upon it have been in his immediate charge. The discussion given below and the test data printed are obtained from reports submitted by Professor Hollis to the company and from a paper by Mr. Walter R. Eaton, electrical engineer of the company, before the New England Section of the National Electric Light Association. The engineering work in connection with the installation of the low-pressure turbines and piping within the station, and includ-

vacuum as possible by speeding up the air pump; second, with a very moderate vacuum, and, third, at atmosphere. It was not possible to weigh the feed water used under these different conditions. Enough data were available from a previous test to determine with close accuracy the amount of steam used per indicated hp-hour. This was done, and a combined card made of the third case in order to figure out the amount of energy available for the steam turbine. During the run the exhaust steam from the air pump and feed pump was weighed, in order to determine the expenditure for the auxiliaries. While the main engine was on the atmospheric pressure, there was, of course, no exhaust of steam from the air pump. Table I shows the results of these tests.

TABLE I—ENGINE TESTS UNDER VARIOUS BACK PRESSURES, CAMBRIDGE, MASS.

	BACK PRESSURE (LB. PER SQ. IN. ABSOLUTE)		
	1.5	3.3	16
Indicated hp.....	803	836	1001
Kw load at generator..	540	563	673
Lb. steam per ind. hp-hr	13.21	14.10	21.58
Lb. steam per kw-hr....	19.64	20.96	32.07
Lb. steam per ind. hp-hr., including air and feed pump	14.97	14.96	21.94
Lb. steam per kw-hr., including air and feed pump.....	22.26	22.24	32.60

The table shows that with the greatest vacuum—27 in.—the indicated power developed by the engine was 803 hp; with the vacuum of 23.3 in. the indicated hp was 836, and with atmospheric exhaust, amounting to 16 lb. back pressure, it was 1001. The paradoxical character of these figures is explained by the fact that in this case the cut-off naturally responded to the greater demand for steam, and consequently the power was increased in proportion to the demand at the switchboard. Further, the load was purposely increased during the atmospheric exhaust in order to show that it was entirely feasible to run the engine with an overload. There was no gain by increasing the vacuum beyond 23 in. or 24 in. with the station as then arranged, as the amount of steam used in the auxiliaries offset the gain in the engine.

The steam per kilowatt-hour as given represents practically the total outlay of steam per unit of output for the station, as shown in the table for the three conditions of back pressure.

The greatest amount of power was, then, 1001 indicated hp, or 673 kw at the switchboard, obtained from one of the smaller units. A combined card was made, in order to enable the power available for a low-pressure turbine to be determined in case the steam were turned into the nozzles of such a machine instead of being thrown away into the air. This power amounted to 1069 hp, which, added to the output from the engine, gave a total of 2070 available indicated hp, or 1392 kw, as against the normal output of 500 kw for which the engine was designed.

Investigation showed that this great increase in power could be obtained without any further increase in steam consumption than would be obtained with the main engine exhausting into the atmosphere. It was estimated that the amount of steam per kilowatt-hour would be 15.51 lb. excluding auxiliaries, or 16.77 lb. including the latter, the allowance for auxiliaries being the maximum obtained on a run for a vacuum of 27 in. These preliminary studies indicated a saving of 5.47 lb. per kilowatt-hour in one unit by the use of a low-pressure turbine, or a gain of 24.6 per cent in economy of operation.

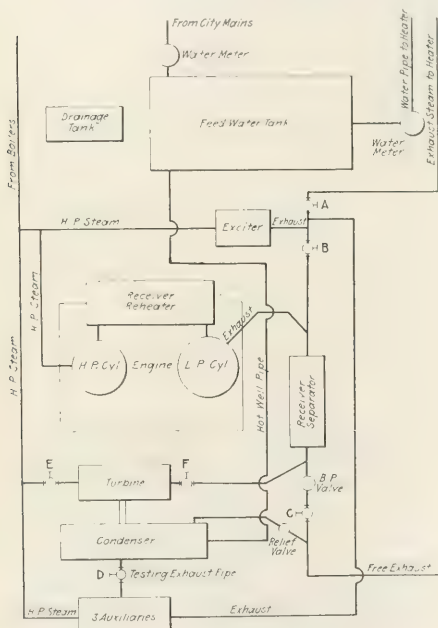


FIG. 5—PIPING DIAGRAM FOR 625-KW LOW-PRESSURE TURBINE

ing various changes in the switchboard equipment and apparatus, has been carried out with the assistance of Hollis, French & Allen Hubbard, engineers, of Boston.

At the time the investigation began there were four engine-driven generators in the station, and these were designed to run with a possible overload of 50 per cent for a short time. This gave an overload output of about 6750 kw. The steam was then taken from the boilers at about 145 lb. pressure and exhausted into ordinary jet condensers after passing through a heater. The condensed steam and the injection water were removed from the condensers by an ordinary bucket air pump in each case. The proposition at that time was to run the engines on about 15 lb. back pressure, and to utilize this in driving a low-pressure turbine installation, this amounting to the making of the engines so connected into triple-expansion units with their third cylinders replaced by the turbines.

## PLAN OF PRELIMINARY TESTS

In order to determine with fair accuracy the possible economy with this combination, one of the 600-kw sets was run under three back pressures; first, with as great a



## INSTALLATION OF 625-KW TURBINE

In making the installation the small feed-water heater into which the 600-kw engine set originally exhausted was replaced by a Cochrane separator and there was also put in a 625-kw Curtis horizontal mixed-pressure turbine running at 1800 r.p.m. and exhausting through a 28-in. Wainwright expansion joint into a Worthington surface condenser. The turbine stands upon the floor with no special foundation except a reinforcement of the floor I-beams by two vertical columns in the basement. The condenser has 2750 sq. ft. of cooling surface. It is supported above the basement floor and directly under the turbine, and is equipped with an inner cooler for drying air and a hot well from which the condensation is pumped. The circulating pump is a Worthington volute equipment having a capacity of 2400 gal. per minute and it is driven by a 6-in. by 6-in. Blake engine running normally at 240 r.p.m. After placing this pump in service so much foreign matter reached the condenser tubes from the river that a twin strainer was installed in the intake.

The outboard-discharge pipe is about 150 ft. long and 12 in. in diameter. Its lower end is water-sealed by being carried below the river level, thus giving a siphon system of circulation. The wet-vacuum pump is a 2-in. two-stage

TABLE II.—INITIAL COST COMPARISON ON ENGINE LOW-PRESSURE AND HIGH-PRESSURE UNITS

	Main Engine	Exhaust Turbine Generator	High Pressure Turbine Generator
Engine	\$18,475	\$12,000	\$14,000
Foundations	1,644		800
Generator	10,650		
Total	\$30,669	\$12,000	\$14,800
Condenser	2,700	4,124	6,000
Piping	5,500	8,405	6,000
Exciter	2,175	1,450	1,250
Total	\$11,044	\$26,289	\$23,250
	26,289		2,250
Grand total	\$67,333		\$40,305

turbine hot-well pump, driven by a 4-hp Terry steam turbine running 1500 r.p.m. The reclaimed water from the hot-well is sent to a feed tank in the basement, and, as outlined above, this tank acts as a reservoir from which all the water evaporated by the boilers is pumped through a hot-water meter. The city water used in the make-up is fed into the tank through a separate meter, so that the amount of water required and saved can be determined at any time by deducting the readings of one meter from those of the other.

Vacuum is maintained in the condenser by a 6-in. by 14-in. by 12-in. single, horizontal, straight-line rotative dry-vacuum pump with a 6-in. suction and a 4-in. atmospheric discharge.

## ARRANGEMENT OF PIPING

As shown in the accompanying diagram (Fig. 3), the general piping provides that the exhaust of the exciter and auxiliaries can be turned either into the feed-water heaters or to the engine exhaust, and, when the turbine throttle is closed, into the atmosphere. In addition, for testing purposes, the condenser auxiliaries have an exhaust into the condenser. By closing valve *A* and opening *B* all the exhaust steam is turned through the separator into the turbine, and by reversing the operation the steam goes through the heaters into the boiler room. By opening valve *C* and closing *P* everything goes to the atmosphere. When *D* is opened the exhaust from the auxiliaries goes into the condenser.

Table II gives the costs of these units, compared with the estimated cost of a high pressure turbo-generator of the same capacity as the combined unit. Omitting duplications,

the first cost in round numbers for the combined unit is about \$70,000, which is about two and one-third times the cost of a high-pressure machine of the same capacity.

In testing the engine and its low-pressure turbine a large number of runs were made through a thirty-hour period during which the water discharged from the condenser was weighed. The drains from the receiver and separator were also weighed from time to time as seemed necessary. As no resistance barrels were used, the runs at full load were confined to periods of the day when the load was constant. During the final run, which was taken as giving the correct tested water rate of the turbine, the steady pressure near the turbine was 16.77 lb. absolute, with moisture 2.46 per cent by calorimeter and a vacuum of 0.883 lb. absolute. The data in Table III give the essential results bearing upon the economy of the turbine.

The correction for moisture was taken from the records of the manufacturer. This was 2 per cent on the steam consumption per kilowatt-hour for every 1 per cent of moisture. A correction of 1/16 in. for every inch of vacuum was

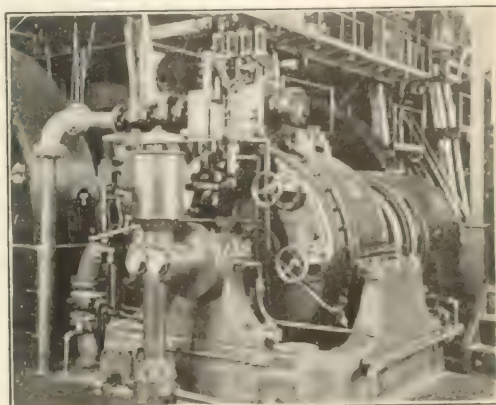


FIG. 6.—625-KW CURTIS TURBINE

also made. The following results are compiled for the corrected steam consumption of the turbine:

Steam at the turbine inlet, corrected for moisture, per hour	17.28
Steam corrected for moisture, per hour	16.40
Steam corrected for moisture, per kilowatt-hour	26.83
Steam corrected for moisture, per kilowatt-hour	13.83
Steam corrected for moisture, per kilowatt-hour	11.8

A number of runs were made with the turbine at varying loads, and the more important data are presented in Table IV.

The tests showed that the full load for these conditions is within the guarantee, as well as for other loads.

A compressor between the feed and the entire unit at full load and that obtained for the corrected steam consumption per kilowatt-hour, including the steam consumption resulting from the use of the low-pressure turbine. With the turbine half load, the steam consumption per kilowatt-hour, including the steam consumption per kilowatt-hour, is 17.3 lb. per kw-hr.

When turbine is running, the steam entering condenser without the hot-water pump is 17.3 lb. per kw-hr.; with the air-pump in operation, 17.3 lb. per kw-hr. Taking the steam consumption of the hot-water pump at 1 lb. per kw-hr., the total steam consumption is 18.3 lb. per kw-hr. The difference between the steam consumption of the unit, making no allowance for the interest on its investment or the increased cost of financing. The net saving due to the introduction of the turbine was estimated by the following data: Steam per kw-hr.

## RESULTS FROM PRACTICAL OPERATION

In the practical operation of the low-pressure unit it has been found that the most economical results are obtained when the exhaust of the auxiliaries is discharged into the turbine. The tests showed that the moisture in the tur-

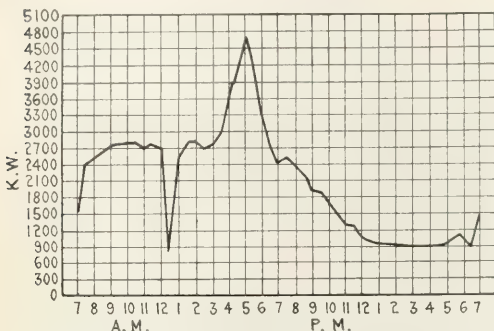


FIG. 7—TYPICAL DECEMBER LOAD CURVE

bine should in practice be kept down as low as possible by draining the receiver and separator. Any moisture entering the turbine lessens the amount of dry steam on the one hand

TABLE III—DATA ON TURBINE ECONOMY

Weight of water from condenser, lb. per hour.....	18,398
Moisture by calorimeter, per cent.....	2.46
Moisture by calculation, per cent.....	3.27
Drain from receiver, lb. per hour.....	173
Drain from separator, lb. per hour.....	408
Steam to circulating pump, lb. per hour.....	475
Steam to wet vacuum pump, lb. per hour.....	250
Steam to dry vacuum pump, lb. per hour.....	150
Steam to all auxiliaries, lb. per hour.....	875
Steam to high-pressure cylinder, lb. per hour.....	18,104
Steam to low-pressure cylinder, lb. per hour.....	17,932
Steam pressure at engine throttle, gage, lb. per sq. in.....	158
Steam pressure at receiver, absolute, lb. per sq. in.....	39.37
Steam pressure at turbine throttle, absolute, lb. per sq. in.....	16.77
Pressure in condenser, absolute, lb. per sq. in.....	0.883
Barometer, in. ....	29.65
Temperature of steam at engine throttle, Fahr.....	421.3
Superheat of steam at engine throttle, Fahr.....	51.6
Temperature of steam in receiver, Fahr.....	260.7
Temperature of steam at turbine throttle, Fahr.....	218.5
Temperature of injection water, Fahr.....	68
Temperature of discharge water, Fahr.....	86
Temperature of condensed steam, Fahr.....	90
Temperature of engine room, Fahr.....	95
Speed of main engine, in r.p.m.....	119.2
Speed of turbine, in r.p.m.....	1,795
Piston speed, in feet per minute.....	834.4
Bucket speed, in feet per second.....	425
Indicated hp, high-pressure cylinder.....	606
Indicated hp, low-pressure cylinder.....	308
Total engine indicated hp.....	914
Percentage of power in high-pressure cylinder.....	66
Electrical load on engine-driven generator, kw.....	603.5
Electrical load on engine-driven generator, hp.....	809
Electrical load on turbine, kw.....	493.5
Total load on unit complete, kw.....	1,097
Power factor, per cent.....	79.56
Steam per indicated hp-hr. in engine, lb.....	19.81
Steam per kw-hr. in engine, lb.....	30
Steam per kw-hr. in turbine, lb.....	37.28
Steam per kw-hr. in unit, excluding auxiliaries, lb.....	16.8
Steam per kw-hr. in unit, including auxiliaries, lb.....	17.30
Steam per kw-hr. in auxiliaries, lb.....	0.80

and increases the resistance to the turbine disks on the other.

Since the installation of this unit the station records have been carefully examined and special runs made to ascertain its value under operating conditions and to obtain data that would help in making future extensions to the station along the same lines. The first winter's log of service shows a

total saving of just 10 per cent in plant coal consumption compared with the previous winter. This saving was attributed to three causes, namely, the installation of automatic stokers, the efficiency of the low-pressure turbine set and a better loading of the engines. The company's electrical en-

TABLE IV—RESULTS OF RUNS AT VARYING LOADS

Water from condenser, lb. per hour.....	10,949
Moisture by calorimeter, per cent.....	2.25
Moisture by calculation, per cent.....	2.4
Steam to high-pressure cylinder, lb. per hour.....	10,493
Steam to low-pressure cylinder, lb. per hour.....	10,320
Indicated hp, high-pressure cylinder.....	374
Indicated hp, low-pressure cylinder.....	133
Indicated hp, total.....	507
Percentage of power in high-pressure cylinder.....	74
Electrical load on engine, kw.....	302.5
Electrical load on engine, hp.....	406
Electrical load on turbine, kw.....	256.5
Electrical load on unit, total kw.....	559
Power factor, per cent.....	72.7
Steam on turbine as weighed, per kw-hr., lb.....	42.67
Steam corrected for moisture by calorimeter, per kw-hr.....	40.75
Steam corrected for vacuum by calorimeter, per kw-hr.....	41.35
Steam corrected for moisture by calculation, per kw-hr.....	40.63
Steam corrected for vacuum by calculation, per kw-hr.....	41.23

gineer states that the exhaust turbine is without doubt responsible for the last two items and should have credit for about one-half the saving.

That this is not too large a percentage is proved by a week's run without the turbine, when the coal consumption per kilowatt-hour increased 6 per cent. With the unit excited by a motor-driven set, 1200 kw at 76 per cent power-factor is the full capacity of the outfit. When excitation is provided by the independent steam set and its exhaust is turned into the turbine, 1250 kw can easily be handled.

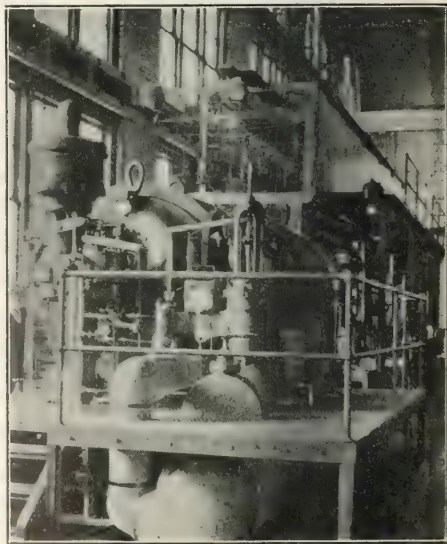


FIG. 8—1500-KW LOW-PRESSURE TURBINE

With a power-factor under 76 per cent the capacity of the turbo-generator is not over 375 kw to 400 kw.

## STUDYING STATION CONDITIONS

The results obtained from the tests and operation of the engine and low-pressure combination indicate that the most important points in the selection of the complete outfit are a study of station conditions, in order to obtain the proper



size and type of turbine to give the highest station efficiency. Further, the cost of the outfit should be compared with the cost of a high-pressure turbo-generator of double capacity, and unless the engine units are in first-class condition, much can be said in favor of the high-pressure equipment. For the Cambridge conditions, which include engines in excellent shape, an established boiler plant which it was not considered desirable to enlarge until absolutely necessary and an engine room of restricted width, the utilization of the low-pressure turbine idea was regarded favorably from the outset and the purchase of a second unit soon followed the installation and test of the first.

The accompanying diagram shows a typical load curve of the plant for a December day and night. Table V shows the net cost of production at the station, excluding distribution, management expenses, taxes and miscellaneous costs, but including fuel, water, repairs and labor costs within the plant, for the year ended June 30, 1912. This cost represents the bare expense of manufacturing and should not be compared with the selling prices of the company.

TABLE V—MANUFACTURING COSTS

Fuel .....	\$61,531
Oil and waste .....	1,454
Water .....	3,637
Wages at station .....	19,831
Station building repairs .....	1,866
Steam plant repairs .....	6,651
Electric plant repairs .....	5,465
Tools and appliances, approximately .....	768
Total (equal to 0.85 ct. per kw-hr.) .....	\$101,203

In the above period the plant delivered at its switchboard 11,929,427 kw-hr., and the station labor account listed the services of one chief engineer, four assistant engineers, seven firemen, four coal passers, three oilers, one engine wiper and four switchboard men, or a total of twenty-four in the operating department of the plant. The cost of coal, as given above, was \$4.06 per ton.

Recent improvements at the plant provide for the relocation of the operating switchboard on a gallery at one end of the engine room and the installation at that place of fifteen panels controlling all electrical circuits. At present there are seven lighting feeders of the 2300-volt, single-phase type, six 2300-volt, three-phase power feeders, one 500-volt, direct-current circuit and sixteen street-lighting circuits operated from constant-current transformers in the station basement. Oil switches in the 2300-volt circuits are placed under the switchboard gallery and two Tirrill regulators have been installed on the switchboard panels.

Two exciter buses and two 2300-volt buses are provided, the equipment being transferred from one to the other in case of emergency. Seventeen constant-current transformers are now in service, ranging in rating from fifty lamps to seventy-five lamps each.

A later article will describe the commercial practice of the company, giving data upon its operation and earnings on a total and unit basis, and will take up the electric-vehicle service and meter-testing facilities, connected load and system data.

### Water Resources of the Pacific Coast

The Geological Survey has published, as Water-Supply Paper 311, its annual volume for 1911 showing the results of the measurements of the principal streams of the Pacific Coast in California. The field work has been carried on by the federal survey in co-operation with the State of California, and gaging stations were maintained during the year at about 200 points. These records of the behavior of rivers throughout the year, and year after year, are of the utmost importance in the consideration of all projects relating to the development of water supply for irrigation, power, etc.

### Electrical Equipment of a North Carolina Mountain Resort

By H. MINOR FRIEND, JR.

In the Blue Ridge Mountains of North Carolina, in the southwestern part of the State, is Lake Toxaway, an artificial body of water formed by placing a dam across the

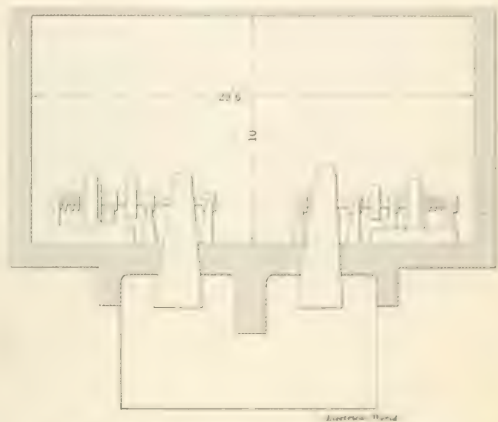


FIG. 1—SECTION THROUGH GENERATING STATION

Toxaway River. On the bank of the lake is a modern summer resort known as Toxaway Inn, and this is supplied with electricity from a small hydroelectric plant utilizing the water from the lake. The latter, which has an area of 580 acres and an average depth of 20 ft., is fed by three mountain streams besides the river after which it is named, but their flow is so small that no coffer-dam was needed in building the dam. After the dam was completed, it required six months for the lake to reach its present level.

The dam is made up of a concrete core wall 300 ft. long and 72 ft. high, covered with broken stone and earth, and a wagon road has been constructed along the top of it. The spillway is constructed on a small auxiliary dam built at an angle to the main dam.

The penstock penetrates the dam near the spillway, 6 ft. below the level of the lake. At its lower end the penstock



FIG. 2—MAIN DAM AT LAKE TOXAWAY

divides into two 14-in. pipes which lead through hand-operated valves to the turbines. Owing to the irregular topography of the country in this section it has been possible so to locate the small stream power house that a head of 180 ft. has been secured.

The present equipment of the station consists of two 100-kw., 230-volt, three-phase, 6-cycle Westinghouse generators driven by S. Morgan Smith water turbines of



the horizontal type; two pumps which supply the oil pressure for the Lombard governors, and two commutating pole exciters rated at 3 kw, 125 volts, 2620 r.p.m. Both the pumps and the exciters are driven from the shafts of the turbines through belts. Connections have been provided for operating the generators in parallel, but at present



FIG. 3—POWER STATION AND OUTGOING TRANSMISSION LINE  
one machine is able to supply the load and one set is held in reserve.

The entire output of the station is delivered at 2300 volts to a three-phase line leading to the hotel. The line is constructed on 35-ft. wooden poles spaced 150 ft. apart. The stranded copper conductors are strung on pin insulators on a single cross-arm, and at the top of the pole a stranded steel ground wire is carried. For protection against lightning a set of multi-gap lightning arresters has been installed at the station and at six equidistant points along the  $1\frac{1}{2}$  miles of line. The ground wire is connected to earth at each pole and at each end of the line.

The transformer equipment at the hotel consists of two delta-connected banks, the smaller rated at 25 kva each, reducing the voltage of the line to 110 volts, for lighting purposes, while the larger bank, consisting of three 30-kva transformers, supplies the 220-volt motor circuits. The transformers are of the Westinghouse oil-insulated, self-cooled type. The 110-volt circuit supplies the lamps in the 200-room hotel and in the various outbuildings, some cooking utensils in the kitchen and the electric heaters with which some of the suites are equipped. The 220-volt circuit feeds the motors of the laundry and the refrigerating plant.



FIG. 4—MOTOR-DRIVEN LAUNDRY

A 15-hp, three-phase induction motor is mounted on the ceiling in the laundry and drives the line shaft which operates all of the machines and rolls. The smaller rolls are electrically heated, but the large ones used for flat work are heated with steam. The laundry equipment consists of two washing machines, one ringer, one tumbler, five large

rolls and one set of small rolls. It is claimed that one attendant does the same amount of work with this installation as was formerly accomplished by ten.

In the refrigerating plant a 15-hp, three-phase induction motor drives a Frick ice machine which has a daily output of 1250 lb. of ice. The brine for refrigerating the several cold-storage rooms is circulated by a pump which is direct-connected to a 5-hp induction motor.

The installation was put into service last June and sup-  
planted an antiquated steam-driven system which operated at 250 volts. In the near future the line will be extended to encircle the lake and supply electrical energy to all of the cottages along the shore.

## The Reactance of Stranded Conductors

By H. B. DWIGHT

In the calculation of transmission-line constants it is necessary to distinguish between stranded cables and solid wires, especially as regards reactance. For example, the reactance of a No. 0000 cable of seven wires at 60 cycles and with a spacing of 18 in. is 0.552 ohm per mile. The reactance of a solid wire of the same sectional area is 0.560 ohm, or 1.5 per cent greater, while the reactance of a solid wire of the same diameter as the cable is 0.544 ohm, or 1.5 per cent less than the reactance of the cable.

It is therefore advisable to use special formulas to calculate the reactance of cables. The derivation of the formula for a seven-wire strand is indicated in the following paragraphs, and formulas are also given for strands of other numbers of wires for use in overhead transmission-line calculations.

The reactive voltage drop in an alternating-current circuit is due to alternating magnetic flux surrounding the conductors. Since flux which cuts both conductors does not produce a difference in voltage between them, and therefore does not produce any reactive drop in the circuit, only that part of the flux must be considered which cuts one cable and not the other. It is necessary to calculate the voltage induced in each small wire of the cable *A* (Fig. 2) by the flux in the space *s* produced by each of the wires of cable *A*. The radius of the cable is considered small compared with the distance *s*. Round wires may be considered to be replaced by very small conductors located at the centers of the wires, as far as the inductance of one wire on another is concerned. The correction in inductance due to skin effect may be neglected, as it is very small for ordinary cables at 25 or 60 cycles.

Suppose that the current in each small wire has unit value. Then the flux density due to that current, at a distance *x* from the center of the wire, is  $\frac{2}{x}$

If *t* is the distance between any two wires of the cable, the required voltage induced in the second by the first, per centimeter, is

$$2\pi f \int_t^s \frac{2}{x} dx = 2\pi f \times 2 \log \frac{s}{t} \\ = 2\pi f M$$

where *f* is the frequency and *M* is the inductance for the pair of wires.

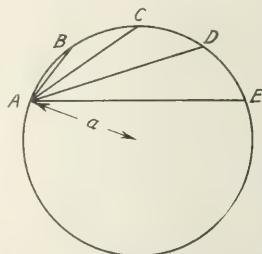


FIG. 1—GEOMETRICAL DIVISION OF THE CIRCLE

The inductance of a wire due to its own current is given by the usual formula

$$L_1 = 2 \log_e \frac{s}{r} + \frac{1}{2}$$

in which  $r$  is the radius of the wire and in which  $\frac{1}{2}$  expresses the effect of the flux inside the wire.

The inductance per centimeter of cable of a single-phase circuit composed of seven-wire cables (Fig. 2) is proportional to

$$L' = 7 L_1 + 12 M_1 + 30 M_2$$

where  $L_1$  is the inductance of each wire due to its own current,  $M_1$  is the inductance for pairs consisting of the

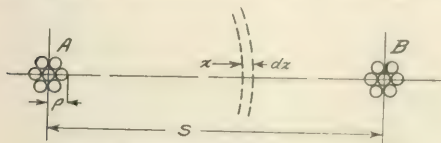


FIG. 2—STRANDED CONDUCTORS IN CIRCUIT

center wire and an outer wire, and  $M_2$  is the average inductance for pairs consisting of two outer wires.

Then,

$$L_1 = 2 \log_e \frac{s}{r} + \frac{1}{2}$$

and

$$M_1 = 2 \log_e \frac{s}{2r}$$

For the third term it is convenient to use the following theorem:

If a circle of radius  $a$  (Fig. 1) be divided into  $m$  equal parts at  $A, B, C, D$ , etc., then

$AB, AC, AD$ , etc. (to  $m-1$  factors)  $= ma^{m-1}$

Thus the mean value of  $\log r = \log \left( \frac{1}{am^{m-1}} \right)$ .

The average value of  $M_2$  is therefore

$$2 \log_e \frac{s}{2 \cdot 6 \cdot 6a}$$

Therefore,

$$L' = 98 \log_e \frac{s}{r} + \frac{7}{2} = 24 \log_e 2 = 60 \log_e 2 = 12 \log_e 6$$

In the above the voltages induced in the seven wires have been added together and unit current has been assumed for each wire. Considering the cable as a single conductor, its inductance will be

$$L = \frac{1}{49} L'$$

Changing to practical units and referring to the maximum radius of the cable,

$$\rho = 3r,$$

Then,

$$L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

henries per mile of conductor.

Applying the above method to a strand of  $n$  wires composed of  $p$  layers around a center wire (Fig. 3,  $b$  and  $c$ ),

$$n = 1 + 6 + 6 \times 2 + 6 \times 3 = 6 \times p^2$$

and

$$L = 2 \log_e \frac{s}{\rho} + \frac{1}{2n} + 2 \log_e (2p+1) = 2 \left( \frac{n-1}{n} \right) \log_e 3 + \frac{24}{n} \left\{ 4 \log_e 2 + 2 \times 1.3 \log_e 4 + 3 \times 2.8 \log_e 6 + \dots + p(n-3p) \log_e (2p) \right\}$$

This gives

$$\text{for } n = 7 \text{ and } p = 1, L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

$$\text{for } n = 19 \text{ and } p = 2, L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

$$\text{for } n = 37 \text{ and } p = 3, L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

$$\text{for } n = 61 \text{ and } p = 4, L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

and for solid wire

$$n = 1 \text{ and } p = 0, L = \left( 103.3 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$$

A three-wire strand (Fig. 3a) is a special case, since there is no central wire. The inductance is

$$L = 2 \log_e \frac{s}{\rho} + \frac{1}{6} = 2 \log_e \left( \frac{s}{\rho} \right) + \frac{1}{6} \log_e 2 \text{ (per cm)}$$

Therefore  $L = \left( 12.2 + 741.13 \log_e \frac{s}{\rho} \right) 10^{-9}$  henries per mile, where  $\rho$  is the radius of the circumscribing circle of the cable.

The above equations may be put in the following simplified form, which is more convenient for calculating

No. of Wires in Strand	Inductance per Unit Length
3	$L = 741.13 \log_e \frac{s}{\rho} + 12.2$
7	$L = 741.13 \log_e \frac{s}{\rho} + 103.3$
19	$L = 741.13 \log_e \frac{s}{\rho} + 260.6$
37	$L = 741.13 \log_e \frac{s}{\rho} + 407.9$
61	$L = 741.13 \log_e \frac{s}{\rho} + 555.2$
1 (single wire)	$L = 741.13 \log_e \frac{s}{\rho} + 103.3$

where  $\rho$  is the radius of the cable measured at the same units as  $s$ , the spacing between cable centers.



FIG. 3—ARRANGEMENT OF WIRES IN THREE-WIRE STRAND AND SEVEN AND NINETEEN WIRE STRANDS

The significance of the above equations is best appreciated by consideration of the following examples of calculated reactance. The values calculated are in ohms per mile at 60 cycles, where

$$\text{Reactance in ohms} = 2\pi \times 60 \times L$$

REACTANCE PER MILE AT 60 CYCLES OF 741.13 WIRE AND 119 WIRE CABLES

Wires in Strand	Radius of Cable, $\rho$	Spacing, $s$	Reactance, $X_L$	Reactance, $X_L$	Reactance, $X_L$
1	0.001	0.001	0.001	0.001	0.001
3	0.001	0.001	0.001	0.001	0.001
7	0.001	0.001	0.001	0.001	0.001
19	0.001	0.001	0.001	0.001	0.001
37	0.001	0.001	0.001	0.001	0.001
61	0.001	0.001	0.001	0.001	0.001

The reactance of the cables is less than that of the wire because the diameter is larger though the sectional area is the same.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Exhibition Room in St. Louis

The Union Electric Light & Power Company, of St. Louis, is contemplating elaborate changes in its exhibition and demonstration rooms for electric appliances. Mr. C. E. Michel, formerly manager of the automobile department of this company and now manager of the electric-appliance department, will have charge of the work. He has planned to install wall-cases lined with black velvet and lighted from the interior by special showcase lamps. Access to the cases will be had by sliding the front glass toward the ceiling. Individual showcases for single articles will be another feature of the change. These cases will have the Union Electric trademark worked in the glass.

The room adjoining the exhibition room is to be used for demonstrating economical electric household necessities and other electric appliances, such as glue-pot heaters and small refrigerating machines. These changes are being introduced in order that the salesmen may interest their prospective customers in electrical appliances. About \$4,000 is to be expended on the improvements.

## Combination Ice-Electric Plant Minimizes Operating Expense

A local company in a Southwestern town of 2500 population bought a combination ice-electric plant as a going business. The maximum output of which the plant was capable was 20 tons daily and there was storage capacity for 250 tons of ice. It is estimated that the portion of the investment chargeable to the ice plant is approximately \$20,000. The data in the accompanying table show that even a "second-hand" ice plant can be a money-maker:

Gross annual income .....	\$10,243.49
Total yearly expense .....	8,528.32
Net income from ice business.....	\$1,715.17

That the manager of this concern is well satisfied with the 8.5 per cent net profit which the plant is showing is evidenced by the statement he makes concerning the ice business in general. In substance he says: "In towns of 7000 inhabitants or less combining the lighting and ice business under one head provides a harmonizing industry over the entire twelve months of the year. It presents an excellent opportunity to concentrate working forces and minimize the operating expenses of both branches of the work."

## Electric Service and the Safety of the Child

The child of well-to-do parents in a prosperous suburban town was seriously burned and considerable damage was done to the house the other day, when the youngster got hold of some matches carelessly left lying about. While the usually vigilant mother was busy in another room he started a fire with the contents of a waste-paper basket, which practically destroyed the nursery, endangering the lives of the family.

Soon after the accident the central-station solicitor urged that, inasmuch as the upper story would have to be rebuilt anyhow, the time was now opportune to have the entire

house so wired that it would become indeed a "matchless" home. Anything that would be likely to prevent a recurrence of the recent mishap made, of course, a forcible appeal to the parents. Electricity was accordingly installed from garret to cellar, and no more matches are allowed in that home under any circumstances.

This gave the solicitor an excellent talking point with other parents, and as a result a number of houses installed complete electric outfits. The philoprogenitive instinct is so dominant in the average parent that he can often be reached through being shown the safety to the children where electricity is used, as well as the comfort of the household in general. This avenue of appeal is one often overlooked by the solicitor.

## What Can the Motor-Service Salesman Earn?

The value of a given motor-service contract to the central station is very much like the value of a policy to a life-insurance company, and the amount the central station could afford to pay to get the contract can be figured upon similar lines. Unfortunately, however, the idea generally prevalent seems to be that a utilities company will make the most money by paying as little as possible to get contracts. It is, nevertheless, easily possible to increase energy sales 50 per cent at a trebled selling cost and still make more profit on the whole transaction. Until central-station salesmen and sales managers are paid in proportion to the business done, companies will not get the maximum possible profitable business.

This policy of paying salesmen adequately has been so fully demonstrated in other analogous lines that proof is hardly necessary. The most troublesome point is arranging a proper scale. Some striking contrasts could be drawn between various cities, among which the remuneration paid in the company sales departments is as different as the increase in connected motor load. Under the generally prevalent straight-salary system the higher salaries are not paid because the department is getting good business, but, rather, it is getting that business because the corporation was wise enough to offer such salaries as would attract the class of men capable of getting results.

Utilities corporations look far ahead in providing fuel supplies and in making franchise arrangements. If they will similarly carefully analyze the future value of a motor-load contract and capitalize this value, they will find they can afford to pay much more to secure the contract than is generally done at present. In other words, even paying a considerable amount to a productive and efficient sales department there will still be a very handsome selling profit for the company over and above the reasonable operating profit which should be considered part of the gross cost of producing the energy.

It is surprising that some public-service companies still take the attitude that they will eventually get all the motor-load business anyhow, and that it is up to the consumer to come to them and take it at their terms. Of course, such companies usually maintain a feeble sales force, but successful selling is made difficult by that position, which precludes sufficient flexibility in rates or contract forms really to help get the good business, and likewise precludes pay-



ing enough to get good salesmen. In one large city, for example, there are at least twenty salesmen of engines, boilers, pumps, and even feed-water heaters, earning more money than the manager of the central-station sales department. In fact, anyone who wishes to learn the comparative progressiveness of central stations in various cities can get reliable information from the sales records of the high-speed engine builders. Their sales show pretty clearly where canvassing for the disposal of electrical energy in industrial service has been efficiently carried on and where, on the other hand, it has been neglected.

### Central-Station Pumping of Flooded Basements at Dayton

Second in importance to restoring light to Dayton, Ohio, after the disaster that visited that city, was the service rendered by the local central-station company in pumping from basements in the business section the water left by the receding flood. As soon as the streets were cleared centrifugal pumps and motors were collected from all available sources and put to work freeing the basements of the stagnated waters. Taps were taken from the nearest service wires to operate the motors and temporary pipe connections were rigged up as shown, discharging into the gutters. Motors and pumps were mounted on rough skids and the controlling arrangements were pretty crude, but the pumps worked and rapidly freed the flooded cellarways of water.

Alert to the opportunity afforded for advertising cen-

### Emergency Service Connections at Dayton

As the flood receded from the streets of the business section of Dayton most of the basements were left filled with water, rendering useless the regular underground-cable service connections with the Dayton central-station company's distribution system. As rapidly as possible, however, the company's manholes were freed of water and



TEMPORARY CONNECTIONS FROM MANHOLE TO CONSUMER, DAYTON



MOTOR-DRIVEN PUMP AT WORK IN DAYTON

tral-station service despite the distractions of the moment, Mr. T. F. Kelly, sales manager of the Dayton company, had a number of placards printed with the words, "Electric Pump, the Dayton Power & Light Company," as shown in the illustration, and one or more of these cards were affixed to each emergency-pumping installation as soon as it got into operation.

lines were run up through the open towers to temporary connections through the second-story windows of adjacent office buildings. The accompanying illustration shows an emergency service run at this kind, supported by dead-ends to a trolley pole. The building at the left receiving this rough-and-ready service is the Rike-Kumler store.

A protecting barrier was built about the wires and open manhole, and a member of the military was left to guard the public against possible accident. In other instances the wires from the manholes were carried up on temporary poles set into barrels filled with rocks and bricks. In this way hurried connections were made with such clear circuits as remained in service, restoring light to the stricken city at the earliest possible moment. This emergency service also proved of great usefulness in operating the pumps with which basements were freed of water.

### Helping the Competitor

A startling example of the results of the industry's artificial ice plant to cope with the manufacturing industry in which by-product ice is made is shown by the following statement: "During the off-peak period, which comes in the ice business throughout the winter months, we have been selling several thousand tons of refrigeration steam in this district. One of these consumers is our most active competitor in this city, yet the fact is, which we are able to supply it with the frozen product justifies it in shutting down its plant through the winter months and as far from the spring as we are able to continue to furnish ice to it. The combination of these two companies from which this statement was obtained had recently treated a new absorption ice

plant. That it is obtaining enviable results along the line of economic production is clearly shown by the foregoing.

By shipping ice in its own ice cars, which are operated over the electric interurban lines in the surrounding territory, a wide market is opened to this company. In this manner the ice plant is maintained in operation at nearly rated output throughout the entire year.

### Securing Full-Schedule Business from "Break-Down" Prospects

Frequently the isolated-plant owner who applies to the central station for "break-down" or emergency connection can be convinced of the advantage and economy of purchasing his entire energy requirements outright from the central station, if careful study is made of his conditions and proper arguments advanced by the company's sales representative. The list of customers who already have contracts for break-down service will also prove a fertile field for full-schedule contracts if the solicitor is prepared to prove to the break-down customer that money can be saved for him if he will abolish his unreliable isolated equipment and depend on central-station service exclusively.

In computing the total cost of break-down auxiliary service the factors to be considered are: Break-down service charge on installation per month, kilowatts-hours consumed per month, and isolated-plant generating cost per month. The actual cost ( $C$ ) per kilowatt-hour to the consumer for the combined sources of supply is given by the formula:

$$C = G + \frac{B}{K}$$

where  $G$  is the isolated-plant generating cost per kilowatt-hour at service wires,  $B$  is the monthly break-down service charge on the installation, and  $K$  is the kilowatt-hour consumption per month.

Inspection of the formula will show that as long as the total cost of the customer's service  $C$  is higher than the regular service rate charged by the central station, the customer will save money by shutting down his plant and trading his break-down contract for complete regular service. If the value represented by the formula is less than this standard service charge, the customer is justified in considering break-down service only, and the solicitor can save his efforts for some more promising prospective customer.

Following is an example of the use of this formula in a case where the customer finally followed the central-station representative's advice and completely shut down his plant. In this instance the "prospect" had sent in an application for a break-down service connection, but when the sales representative arrived the customer explained that he had changed his mind in favor of a gas installation.

Using diplomacy, the solicitor set out first of all to get acquainted with his "prospect," although he did not press the object of his visit or indeed mention it after hearing the customer's expressed preference in favor of industrial gas. He succeeded in getting permission, however, to examine the premises, and the first visit closed pleasantly with the treat of a good cigar for the customer.

The central-station rate for regular service was 10 cents per kw-hr., while the isolated-plant cost,  $G$ , was 3 cents per kw-hr. Break-down service connection was costing at the rate of 10 cents per month for each 50-watt equivalent. Hence, for the 10-kw load  $B$  had a value of 2000. Transposing the formula, and substituting:

$$K = \frac{B}{C - G} = \frac{2000}{10 - 3} = 285$$

This put the representative on his guard to see that in making any calculations with the customer he used values for the total consumption well within 285 kw-hr. per month, or else his arguments would be pointless. Since the monthly average consumption agreed upon was 200 kw-hr., the cus-

tomers was shown that his combined service was costing him

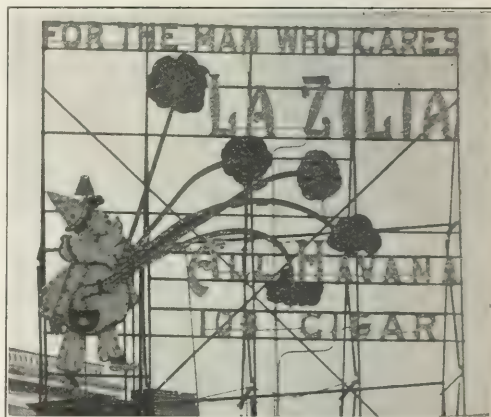
$$C = \left[ G + \frac{B}{K} \right] = \left[ 3 + \frac{2000}{200} \right] = 13 \text{ cents.}$$

As the central-station proposed to furnish all required energy for 10 cents per kw-hr., permitting the shutting down of the private plant, the economy of taking central-station service exclusively was proved and the contract was closed on the regular schedule basis. It might be added that the company had been after this business for eight years, but until the problem received this simple analysis the central station had never been able to secure the contract.

### Spectacular Electric Sign at Springfield, Ill.

The accompanying illustration shows a large and very effective spectacular electrical display recently installed at Springfield, Ill., by Messrs. Ogg & Snell, cigar manufacturers. The sign, which is 26 ft. high, 20 ft. wide and contains 750 five-watt lamps, was built by the Greenwood Advertising Company, Knoxville, Tenn. Its cost, including color caps, flasher and back bracing, but without lamps, was \$850.

When in operation the display shows the clown reaching



ELECTRIC SIGN AT SPRINGFIELD, ILL.

into his pocket five times in succession, each time tossing a ball toward one of the display lines. As the ball reaches its destination it explodes with a burst of light, and the line lights up. All of the words then remain illuminated until the story is told, when the whole display is extinguished and the operation is repeated. The period of action is thirty seconds, the entire electrical effect being controlled by a Betts & Betts flasher driven by a 0.33-hp motor.

The sign above described is one of 200 local displays now supplied with electrical energy by the Springfield Light, Heat & Power Company, which, with the co-operation of sign manufacturers, has recently had under way a very successful electric-sign campaign. The plan has been to pair off members of the sign manufacturer's sales staff with the central-station company's new-business men and let them interview prospective customers together.

In one such campaign of four days' duration contracts were obtained for twelve electric signs averaging 140 five-watt lamps each. The largest sign for which a contract was closed during this time contained 246 five-watt lamps. Mr. C. L. Owen, superintendent of the Springfield company's new-business department, jointly with the sign manufacturer's representative, holds a record, he having obtained eight contracts in one day.



# Illumination and Wiring

## An Electrically Lighted Balloon

Habitues of the "Great White Way" district of New York City during the last few months have had their attention distracted from the bright lights nearer at hand to the unusual spectacle of an electrically lighted balloon sailing serenely over Broadway near Thirty-seventh Street. The captive gas-bag is used for advertising purposes and is lighted from within by a 500-watt tungsten lamp inclosed in the impervious envelope which affords an excellent diffusing surface. By means of an anchor cable and reel the balloon can be raised and lowered. Ordinarily cable is paid out to a height of 500 ft., at which elevation the 20-ft. illuminated sphere with its advertising legend is a prominent feature against the night sky of Manhattan. Energy to light the unique display is furnished by the New York Edison Company, doubtless the first application of central-station service to so unusual a purpose. The photograph



ELECTRICALLY LIGHTED BALLOON USED FOR ADVERTISING.

shows the balloon weighted with sand-bags preparatory to making the ascent. A separate pair of conductors is provided for the lamp, it will be noticed, all mechanical strains of anchoring being met by the special cable on the hand reel shown.

## Who Was to Blame?

A layman sends to the *Electrical World* the following little tale which he thinks points the moral that in the large city where he lives there is room for improvement either in the methods of the central station or in those of the working electricians, or perhaps in both.

Having just moved into a two-story apartment where the previous tenant used electricity and desiring to do likewise, he notified the central-station company, which after the usual preliminaries sent up two men, who installed the meter and connected to the service mains. It was then found that only the lamps in the rear of the first floor would operate, the others on that floor and all on the second floor remaining dark. After some fruitless experi-

menting the men left, saying that there was a short-circuit somewhere which the landlord should remove. On being appealed to, the landlord promptly sent an electrician, who repeated the central-station men's experiments with equal lack of success, and departed—to return in a day or two with another man. The two that spent half a day in testing and hunting, the only results being a long-continued and general daylight illumination from all the lamps that would burn—perhaps intended to prove that the meter at any rate was working—and a very much disorganized condition of the various boxes. The second called company of a short-circuit in the wall, but before either of these said they would return with a suggestion.

After a week's rest and study they came again, bringing this time a third man, who, the instant he entered, might be the subject of a short-story. If so he was a qualified one, for before a great while he was heard to shout from the second-story hall: "I've got it, Jim! There's a cut-out on this floor." Sure enough, in a rather dark passageway there was recessed into the wall a mysterious apparatus which it was hard to see, particularly from down their best to conceal. The wall-paper had been torn, broken away near the ceiling, and the family were aware of the affair, the existence of which they would certainly have called to the men's attention had they supposed for one instant that the electrical experts were ignorant of it. After this discovery it was the work of only five minutes to get all the lamps in circuit.

The chief sufferer was the landlord, who received a bill for \$20 from the electrician. What is swarting the tenant—whose alleged complaint even his landlord and who, besides, has disturbing visions of increased rent and deferred repairs—is why, assuming that no one showed stupidity, there should not have been affixed to the meter shelf a plate or card explaining the wiring scheme of the house.

## New Lamps on Dearborn Street, Chicago

New special street-lighting lamps on Dearborn Street, Chicago, were lighted for the first time on April 5, illuminating both sides of the street in the long distance for ten blocks. The light from these 107 flaming arc lamps presented quite a contrast to that given by the twenty-two arc lamps previously provided by the city for lighting the same district. The new long-arc illuminating arc street lighting lamps are the recent production of the General Electric Company and have been suspended from ornamental brackets secured to extensions set in the top of the existing tubular support poles supporting the traffic signal wires. The illustration (Fig. 1) shows a street-viewing pole in front of the Federal Building equipped with one of the new lamps. This

INSTALLATION AND OPERATING COST OF PROPOSED ALTERNATE SYSTEM.

Proposed System	Installed Cost	Operating Cost
General Electric 500-watt alternators	\$11,000	\$11,000
General Electric 500-watt alternators	\$11,000	\$11,000
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system of connecting the lamps was selected, but it was thought best to provide the use of additional poles. The old lamps also were removed and made use of the new ones which the city had supplied. The poles are approximately 10 ft. apart and are spaced evenly, each other. Arranged



in this manner, the lamps are about 25 ft. above the street surface and 12 ft. from the face of the buildings, thus illuminating the buildings without interfering with window-display lighting.

Heavily insulated No. 6 cable furnished by the Standard Underground Cable Company has been used throughout the system. No spliced joints were made in the circuits, so that there are continuous cables between lamps. All cables enter through the bottom of the poles and are securely fastened beneath the sidewalks between poles.

Improved lighting for Dearborn Street has been under the consideration of the Dearborn Street Improvement Association for a year and until recently has been in the trial stage. Mr. Herbert A. Seward acted as consulting engineer for the association. Valuable assistance was received from the Chicago Association of Commerce's committee on downtown streets. The lamps were installed by the Sanitary District of Chicago, which will also furnish electricity for lighting them.

After the Dearborn Street Improvement Association had assessed property owners and tenants on the street according to their frontage, the co-operation of the city

An idea of the installation and operating costs of each of these systems, as stated by Mr. H. A. Seward, may be of interest and is given in the accompanying table.

A contract with the city of Chicago makes the system, when completed, the property of the city. Under the agreement the city furnished the 107 lamps installed and will operate and maintain them. The expense of operating and maintaining seventy-eight of these lamps will, however, be charged to the association at cost and will amount to about \$32 per lamp per year. On this basis the association obtained a finely lighted street for about \$2,500 a year.

Other propositions are now before the improvement association. The first one is that of having all of the large buildings light up the sky line of their structures. The second is to place circular flower boxes on the poles and window sills. Removal of projecting signs is also favored.

## Recent Telephone Patents

### EXCHANGE SYSTEMS

The dimensions of manual multiple switchboards are limited by two factors. One is the limit of reach of the operator and the other is the minimum practicable spacing of jacks. At one time, in an endeavor to concentrate a maximum number of lines in one central office, multiple switchboards were made in several divisions, each with its own particular proportion of the multiple. Each line had an answering terminal on the division and the subscriber had to determine in advance what signal to throw and manipulate his set accordingly. Mr. E. E. Clement, of Washington, D. C., who has applied automatic apparatus to such a system, has had granted to him a patent which he has assigned to the North Electric Company. According to this system the subscriber's set is equipped with a sender and the line is terminated at the switchboard in a single answering terminal. The subscriber sets the sender and lifts his receiver. This lights a calling lamp, to which the operator responds by connecting an idle trunk. The sender is then released through automatic switching devices in the trunk and a calling signal is displayed upon the desired switchboard division. Here the call is then responded to and completed.

An improvement in automatic systems is described in a patent granted to Mr. E. Neuhold, of Germany. This system dispenses with any grounds at the subscriber's station and all operation is effected by varying the current in the line in response to the sending apparatus. Thus the impulses are caused by the momentary short-circuit of a resistor. The complete opening of the line circuit causes disconnection. The operation is brought about through the agency of two relays in series. One follows the current impulses while the other remains in the operating position even though the current is pulsating.

Mr. F. R. McBerty has obtained a patent, assigned to the Western Electric Company, which covers a "busy" test system for switchboards serving party lines. In this system each station has its own jack or terminal assigned to it, so that for four parties there are four terminals. The sleeve or test terminals are connected in pairs according to the connection of the stations to the sides of the line. The use of any terminal not only caused the establishment of a reduced potential upon this terminal and its mate, but through the agency of an auxiliary relay similar conditions are caused upon the other two terminals.

The patent granted to Mr. E. R. Hobbs, of Buhl, Idaho, also describes a "busy" test system. In this case a magneto switchboard is used and the novelty lies in arranging the drop so that a "busy" test is established as soon as a drop falls. The test is arranged upon a special test ring of the jack and is maintained by the plug in the jack after the drop is restored.



FIGS. 1 AND 2—FLAME-ARC LIGHTING ADOPTED, AND TRIAL INSTALLATION OF INVERTED MAGNETIC UNITS

was solicited. Mr. Ray Palmer, city electrician; Mr. E. B. Ellicott, electrical engineer of the Sanitary District, and Mr. L. A. Dumond, engineer for the committee on downtown streets of the Chicago Association of Commerce, were asked to be present at a meeting and several systems of illumination were considered. Among the methods discussed were tungsten boulevard lamps, four-armed brackets supported on street-railway poles with tungsten lamps, and ornamental arc-lamp posts (Fig. 2). Two-armed brackets bearing arc lamps and supported on the street-railway poles constituted a fourth proposed system.

The first scheme considered was dropped on account of the numerous posts already on the street. It was found impracticable to use the four-armed bracket with tungsten lamps on street-railway poles on account of insufficiency of light and breakage due to vibration. The third system, tried but not adopted, showed a consumption of only 15 in. of carbon for 176 hours of service, while the General Electric Company guaranteed only 100 hours per carbon. System No. 4 was similar to No. 3 except that Stave flaming-arc lamps were figured on instead of General Electric.

# Letters to the Editors

## Factors Involved in the Use of the Flicker Photometer

To the Editors of the *Electrical World*:

SIRs.—In the issue of the *Electrical World* for March 22, 1913, an editorial on the writer's paper on "The Purkinje Effect and Comparison of Flicker and Equality-of-Brightness Photometers" brings out some points worthy of further discussion. As all this work, including Dr. Herbert E. Ives' extensive researches, was done at the physical laboratory of the National Electric Lamp Association, the writer is familiar with all the conditions and has access to the data which are necessary for a comparative discussion. As noted in the paper, the reversed Purkinje effect found with the flicker photometer accords with Dr. Ives' results which have been published in the *Philosophical Magazine* during 1912. A study of this phenomenon was the original object of the writer's investigation; therefore red and blue-green lights were used.

As the data from which Dr. Ives concludes there is a reversed Purkinje effect with the flicker photometer were not all obtained on the same day and as he is the only one who had previously noted this phenomenon, it seemed worth while to investigate it by an independent method and to obtain a whole series of observations throughout the large range of illuminations on the same day. Moreover, it seemed desirable to test this point with a flicker photometer differing in design from his. Series of observations on various days were consistent with each other.

Why this reversed Purkinje effect should obtain with the flicker photometer is as yet unknown, but the idea that color differences should likewise make themselves felt in studies of Talbot's law such as those carried out by Dr. Hyde is not necessarily true. In using the sector disk high speeds are used regardless of the illumination.

In using the flicker photometer there is only one speed at each illumination at which the instrument is the most sensitive. This speed is always the minimum speed at which flicker can be made to disappear, and it decreases with the illumination, becoming quite slow at very low illuminations. This is in accord with the fact that at high illumination the eye is more sensitive to flicker. When the speed is slow, as at low illuminations, the time relations of color stimuli might possibly introduce variations in apparent intensity of considerable magnitude. This, however, will bear investigation.

In the *Electrical World* for Jan. 27, 1912, Dr. Louis Bell discussed the effect of simultaneous contrast in heterochromatic photometry. It is well known that a green field viewed simultaneously in juxtaposition to a red field appears greener than when viewed alone. Likewise the red field appears redder. The conditions obtaining in a photometric field are favorable to the production of the contrast effect. Dr. Bell suggests the possibility of a shift in luminosity with the shift in hue and illustrates this by means of the luminosity curve of the eye. This, if true, would explain the lower ratio of the brightness of the red lamp to that of the green lamp obtained by the equality-of-brightness photometer. But this actual shift in luminosity with the shift in hue is not yet completely established, although Dr. Bell's experiments suggest its reality. The writer has this point under consideration at the present time.

The editorial mentioned above suggested that the writer's results regarding the lower brightness ratio of the red lamp to the green lamp obtained by the equality-of-brightness method is in contradiction to the results obtained by Dr. Ives, as indicated in this statement: "Our readers will remember that in some recent researches by Dr. Ives it appeared that while at considerable intensities fairly concordant readings could be obtained by the flicker and by

the equality-of-brightness photometers, yet at low values of the luminosity discrepancies appeared, sometimes showing the Purkinje effect, and in the case of the flicker instrument sometimes a small reversed Purkinje effect." This statement is not thoroughly in agreement with Dr. Ives' conclusions on pages 177 and 178 of his papers already cited. This is especially shown by comparing the foregoing statement with Dr. Ives' conclusion number six which is as follows: "The curves [spectral luminosity] are most different at low illuminations with large fields; nearest together at high illuminations and with small fields. They may under certain conditions coincide, and the mean curves of several observers show close agreement in position of maxima and shape at the two curves at high illuminations *although the areas are not the same.*" The italicized phrase, together with data on page 847 and the accompanying discussion, indicates that different relative values for lights of different colors are to be expected from the use of the two methods.

Dr. Ives' method of plotting his data as spectral luminosity curves has many advantages in a general study of heterochromatic photometry. However, when investigating the Purkinje effect or the special case of photometry of lights of widely different color such as comparing red and green lamps with each other or with a standard white source the great differences in the two methods as found by the writer are not liable to be suspected unless his luminosity curves are carefully scrutinized.

The writer in comparing a bluish-green light with a red light found a great difference in the ratios of the intensity of the red light to that of the bluish-green light by the two photometers. Luminosity curves obtained by the two methods might appear to coincide fairly, but if the ratio of the luminosity of a certain monochromatic red light to that of a monochromatic blue-green light (say at 664 $\mu$  and 532 $\mu$  respectively) be taken for the two methods a large difference between the two ratios might readily appear. This is illustrated by computations from Dr. Ives' data.

Computations from his data which are given in the *Philosophical Magazine*, 1912, on page 183, reveal agreement as far as conclusions can be drawn from two investigations conducted under different conditions. Dr. Ives compared pure spectral colors with a white standard. Under these conditions it is likely that there is less shifting in hue than in the case of the writer's method, where a green field was viewed in juxtaposition to a red field. The red light used by the writer was quite monochromatic with a maximum of transmission when used with a tungsten lamp of normal efficiency 0.64 $\mu$ . The bluish-green glass was likewise monochromatic, having a maximum of transmission for tungsten light near 0.51 $\mu$ . For the purpose of comparison Dr. Ives' data for his own eye at wave-lengths 0.64 $\mu$  and 0.51 $\mu$ , as given in Table I of his paper are compared for both the flicker and equality-of-brightness methods at the three field sizes used by him. It will be noted that the field sizes used by the writer were about the same. The larger field used by Dr. Ives more nearly corresponds to that used by the writer.

From the table it will be seen that colors of third and first show a pronounced reversed Purkinje effect with the flicker photometer at low illuminations under certain conditions, while the regular Purkinje effect is present in the equality-of-brightness method. There exist on large differences between the ratios of the red to the green luminosity by the two methods is also shown in the third and fourth columns. The last two columns show that ratio is smaller than that by the flicker method, which is taken as the reference in all cases. It is evident that the results are not the same. As the writer has made great use of the large field used by Dr. Ives is more comparable. The data shown in the bottom of the table are the mean values from the results obtained by five observers. The same general characteristics are shown here with the medium field, although



only two values of illumination were used. These data appear on pages 186 and 187 of Dr. Ives' paper.

While the data shown in the table were obtained under different photometric conditions, it is significant to note that the results obtained by the writer are in accord with them. For a long range of illumination the ratio obtained by the writer for the intensity of the red light to that of the bluish-green light was by the equality-of-brightness method only 62 per cent of that obtained by the flicker method. In some cases this is a somewhat greater difference than indicated by Dr. Ives' data at the same illuminations, but it must be remembered that in the writer's work the red and green fields were viewed in juxtaposition while in Dr. Ives' investigation they were separately compared with a white standard.

It is further shown in the writer's work that the two observers obtained different results with the flicker photometer. Owing to the fact that Dr. Ives finally recommends the use of the flicker photometer, it might be assumed by those not thoroughly acquainted with the work that concordant results are obtained with this photometer by observers with normal color vision. In Dr. Ives' last paper, on page 859, data obtained by eighteen observers are presented. On making the same computations as in the foregoing table great differences will be found even with the flicker method. For instance, observers 10 and 14, two men in the same laboratory in which all this work was done, found ratios of the brightness of the monochromatic red

method the various spectral colors against a green standard that the positions of the spectral luminosity curves thus obtained varied considerably. He describes the results as follows: "One of the most significant things about these curves is that no system or regularity has been found in their manner of deviating from the 'normal.'" However, the writer's data indicate fairly consistent results obtained throughout several weeks. In fact, computations from five series of observations by the two photometric methods made by the writer during an interval of seven weeks showed a greater fluctuation in the results by the equality-of-brightness method, while there was always a decided difference between the results by the two methods and always in the same direction. This point is under further consideration at the present time.

In closing, the writer does not wish to be understood as opposed to the use of the flicker photometer. Dr. Ives recommends its use not because it is free from perplexities but because in general it has stood the tests to better advantage than has the equality-of-brightness photometer. However, as emphasized by the writer's work, it must be used with caution and with a comprehensive realization of its shortcomings. If Dr. Ives has placed the flicker photometer on a sound basis, its foundation is none the less sound now, for this discussion shows little conflict between his data and those obtained by the writer.

M. LUCKIESH,

Physical Laboratory National Electric Lamp Association.  
Cleveland, Ohio.

COMPUTATION OF DR. IVES' DATA

	Illumination (Arbitrary Units)	Approximate illumination (Meter Candles)	RATIO OF LUMINO- SITY AT 0.043 n TO THAT AT 0.517 n		SAME REDUCED IN TERMS OF FLICKER VALUE	
			Flicker	Equality-of- Brightness	Flicker, per Cent	Equality-of- Brightness, per Cent
Large field— 8.6 deg. by 5.16 deg.	270.0	27.0	0.784	0.596	100	76.0
	68.0	6.8	0.913	0.815	100	89.3
	8.9	0.9	1.357	0.634	100	46.7
	2.85	0.3	1.115	0.452	100	40.5
Medium field— 4.58 deg. (circular)	270.0	27.0	0.818	0.774	100	94.6
	68.0	6.8	0.817	0.832	100	101.8
	8.9	0.9	1.145	0.747	100	65.2
	2.85	0.3	1.300	0.654	100	50.3
Small field— 1.86 deg. (circular)	270.0	27.0	0.782	0.827	100	105.7
	68.0	6.8	0.966	1.075	100	111.3
	8.9	0.9	1.198	1.092	100	91.2
	2.85	0.3	1.279	1.016	100	79.5
Medium field— 4.58 deg. (circular)*	250.0	25.0	1.120	1.002	100	89.5
	10.0	1.0	1.380	0.831	100	60.2

\*Mean from five observers.

light to that of the monochromatic blue-green light which differed by 100 per cent, that of one being double that of the other. It is evident that these two observers would obtain widely different results when photometering lights differing greatly in color, such as red and green lamps, though they might obtain fairly concordant results with lamps differing in color only as much as do the "4-watt" carbon and the tungsten lamp. Dr. Ives realized this, as indicated by his recommendation of a method for correcting the observers' results, on page 862.

The facts brought out by the writer so far are found to verify Dr. Ives' results. However, the object of the investigation being somewhat different from that of his more general research, the writer's data give emphasis to certain points which were not so conspicuously emphasized in Dr. Ives' papers.

It might seem to some that Dr. Ives' data plotted on page 746 indicate that the results with the equality-of-brightness method published in the writer's paper might be accidental. Dr. Ives found on comparing by the same

## Establishing the Date of Invention

To the Editors of the Electrical World:

SIRS:—Sooner or later inventors are apt to be called upon to prove when they made their inventions. Judging from hosts of cases, they are very delinquent in their efforts to establish competent evidence of the earliest date of invention. For example, one foolishly offers a notebook containing an undated, unwitnessed and almost illegible pencil sketch. Another confidently presents one or more witnesses, some of whom are not electrically educated and therefore do not even understand the invention. As an illustration of the inadequacy of personal testimony may be mentioned the noted telephone suit, where the testimony of scores of witnesses was counted for naught, thus giving Bell the victory. Another inventor exhibits documentary evidence acknowledged on a certain date before a notary public, but even such evidence is not absolute, especially if an opponent have more powerful proof.

"Why should one be so particular about clinching the date of invention simply because two inventors, by mere coincidence, occasionally make the same invention simultaneously?" one may ask. Allow me to answer that up to a few years ago there had been the astounding number of 25,000 interferences in the United States Patent Office. Besides, it is not unusual for a contest to take place between more than two applicants for patents. In one instance at least there were seven claimants; namely, such well-known electrical men as Schuyler S. Wheeler, Rudolph M. Hunter, H. Ward Leonard, Merle T. Wheatman, Albert Blauvelt, James Burke and Granville T. Woods.

The discouraging consequences of not having competent evidence are the high cost of fighting an interference case before the Patent Office and the danger of losing the patent. Therefore, the date should be fixed so absolutely that the first inventor cannot, by any possible means, be deprived of the benefit of the date of invention or discovery. It is evident that if he is not obliged to be at the expense of proving such a date, the interference will cost him nothing. He can rest on his oars and let the others do the racing. He becomes entitled to the patent if no one else can prove an earlier date than his filing date.



So many inventions have undoubtedly been lost to the really first inventor, and appropriated by the legally first inventor, that it occurred to me that it must be a fact that many electrical men are unfortunately negligent in regard to protection, although so enthusiastic while creating their inventions. As the *Electrical World* readers probably include all electrical men, it seems to be a suitable medium in which to emphasize the point in their behalf that the only way in which to avoid the heavy cost of an interference, and yet prove the earliest date of one's invention, is to file the application for a patent in the Patent Office immediately after making the invention. The filing date becomes absolute evidence. Nothing can annul the efficiency of this date.

No consideration should stand in the way of securing the earliest official filing date.

Washington, D. C.

EDWARD P. THOMPSON

### Fuse Economy

To the Editors of the *Electrical World*

SIR:—In connection with the statement which appeared on page 554 of the *Electrical World* for March 12 with regard to an analysis made by the writer of the claim that the use of reloadable inclosed fuses results in a large saving to the consumer, the following analysis may prove of interest.

From estimates made by some of the large users of inclosed fuses, it would seem that to per cent renewals a year is a fair estimate of the number of new fuses necessary in any well-regulated installation. It is possible that in a new installation, particularly of induction motors or railway motors, more fuses may be used for a short period after the installation has been made, owing to the fact that the particular conditions governing the installation may have rendered it difficult to select fuses of the proper capacity in the first place. As soon as these conditions are fully demonstrated from actual experience and fuses of proper capacity are installed the data would indicate that to per cent renewals per year is ample. If more than to per cent fuse renewals per year are being used, some attention should be given to the condition of the apparatus and the installation.

From the data available on reloadable inclosed fuses the list prices in most cases are practically double the prices of standard inclosed fuses, and the accompanying tables would indicate that with to per cent renewals a considerable number of years must elapse before a saving can be effected

250-volt fuses, which at the present time are reloaded by the manufacturer. It will be appreciated, of course, that the figures given for reloading the reloadable fuses do not include any labor or any filling material outside of the fuse links themselves.

It is the writer's belief, in spite of the fact that the saving is all on the side of the standard inclosed fuse, that the original cost of installation and the maintenance cost are matters of small moment, considering the fact that a fuse which is reloaded in an improper manner by an irresponsible party may cause thousands of dollars of damage, as well as loss of life, such as might occur in case of a crowded sweatshop.

The writer believes also that the agitation which has

TABLE I—COST OF 30-AMP, 250-VOLT FUSES AT LIST PRICE

	Standard	Reloadable
100 fuses	\$10.00	\$20.00
End of first year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$10.00	\$20.00
End of second year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$20.00	\$30.00
End of third year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$30.00	\$40.00
End of fourth year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$40.00	\$50.00

come about through the pressure which has been brought to bear on the electrical committee of the National Fire Prevention Bureau has resulted in considerable good, as immediate thought will be given to so constructing the standard inclosed fuse that it will be practically impossible to reload it and that tampering can be readily detected. Moreover, it will probably result in the smaller fuses being reloaded by the manufacturer or an allowance being made for them if returned to the manufacturer.

Sincerely, N. Y.

HUGH H. SAWCER

### Insulators of United States Navy Radio Station

To the Editors of the *Electrical World*

SIR:—In the article which appeared in the *Electrical World* April 5, 1913, under the title "United States Navy Wireless Station" referring to the service trails and interesting features of the high-powered radio station at Arlington, Va., in the statement "These insulators are so installed by means of porcelain hooks, which are not commonly employed in the construction of high tension lines," the insulator lines, arranged to follow, by means of not being employed to provide the necessary support."

In this connection attention should be called to the fact that for some months past electric insulator type safety-circuit insulators have been installed on the same type of the electric station in place of the porcelain insulator formerly employed. The very remarkable results resulting in both saving and retaining insulators month thereafter properly be credited to the later types of insulator. The insulators employed on the above station are of the standard 7.5-in. disk safety-circuit type, the same being mounted in series. The ultimate breakdown test of each of the above insulators was in excess of 10,000 lb. and the ultimate mechanical strength 20,000 lb.

It is extremely also that the *Common Safety* is provided with electric insulators of various types.

Yours faithfully,

President and General Manager, Electric Manufacturing Company

New York, N. Y.

TABLE I—COST OF 30-AMP, 250-VOLT FUSES AT LIST PRICE

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100 fuses	\$10.00	\$20.00
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Total	\$10.00	\$20.00
End of second year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$20.00	\$30.00
End of third year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$30.00	\$40.00
End of fourth year, 10 per cent re-loads	\$10.00	\$10.00
Total	\$40.00	\$50.00

by the use of the reloadable fuse. After this period of time, in all probability, the reloadable fuses are in such condition that from the standpoint of protection new fuses should be put in.

Table I is based on standard fuses of sizes up to 30 amp, 250 volts, which at the present time are not reloaded by the manufacturer. Table II is based on standard 200-amp,

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Overload Test of Boiler at 250 per Cent of Rating

During a recent test the No. 12 boiler in the plant of the Narragansett Electric Lighting Company, Providence, R. I., produced for eight hours very nearly 250 per cent of its rated boiler-hp at an over-all efficiency of boiler and grate of 73 per cent. This test, which was witnessed by Messrs. James D. Andrew and Fred B. Freeman, of the Boston Elevated Railway; Charles W. Clarke, of the Stone & Webster Engineering Corporation; Arnold and Sarckey, of the Westinghouse Machine Company; M. Alpern, of the American Engineering Company; H. L. Breaker, of the B. F. Sturtevant Company; B. F. Allen, of Westinghouse, Church, Kerr & Company; J. Brown, of the Foster Superheater Company; William Pastell, superintendent of power stations of the Rhode Island Company, and M. W. Kern, of the Narragansett Electric Lighting Company, was made for the purpose of determining the capacity of a Riley self-dumping underfeed stoker of five retorts installed under the boiler.

The boiler, which is twelve years old, is a Babcock & Wilcox unit, twelve tubes high, eighteen tubes wide and sixteen tubes long. No special effort was made to prepare it for this test. As a matter of fact, its companion boiler in the group of two was cold. The boiler was of such a size that a stoker of seven retorts could have been installed under it, which would have resulted in the burning of more fuel and a considerable increase in the capacity obtained. As the stoker is of the self-dumping type, working automatically, there was not the periodic dumping which is a necessary feature of other types; hence the steadiness of the steam pressure (174.1 lb. average) and other operating conditions. The fire appeared to be in the same condition from one end of the test to the other, all clinker being broken up automatically during its process of formation, and the boiler was kept on the regular line for some hours after the test. The total amount of coal consumed was 25,450 lb., or an average of 3181 lb. per hour. The water fed amounted to 251,170 lb., or an average of 31,396 lb. per hour, thus giving an evaporation of 9.87 lb. of water for each pound of coal. The water was fed at a temperature of 196 deg. Fahr., and the equivalent water evaporated per hour from and at 212 deg. Fahr. was 33,437 lb. per hour. This is equivalent to a total of 969.2 boiler-hp developed, which is 248.5 per cent of the builder's rating. The equivalent evaporation per pound of coal as fired was, then, 10.51 lb. of water, and the factor of evaporation was 1.065.

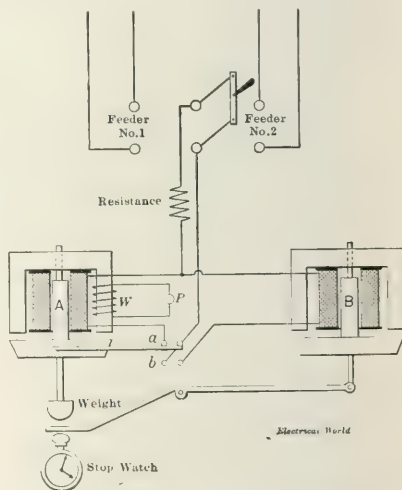
The coal analysis showed 74.13 per cent fixed carbon, 14.95 per cent volatile matter, 6.52 per cent ash and 4.40 per cent moisture. The calorimeter test determined the heating value to be 14,600 lb.-Fahr. units per pound when dry, or 13,957 units as fired. That the coal was thoroughly consumed is shown by the flue-gas analysis, which gave 16 per cent CO<sub>2</sub>; 0.12 per cent CO, and 2.7 per cent oxygen.

At one time during the test a piece of 4-in. by 6-in. timber was purposely dropped into the center hopper to determine the effect upon the stoker. This timber, of course, blocked the plunger in that hopper and sheared the safety pin located on the connecting rod. The plunger was then automatically withdrawn from the stoker upon the return stroke of the connecting rod and left at its outermost position. Upon the removal of the obstruction and the insertion of the new pin, all of which was done without stopping the

stoker, operation was resumed as if nothing had happened. The feed of coal into the middle retort was interrupted, of course, until the adjustment had been made. The power used by the blower was determined as 20 hp, while 1.4 hp was required to operate the stoker. Separate motors were used to drive blower and stoker.

## Stop-Watch Record of Service Interruption

Often it becomes of importance to an operating company to know exactly the duration of a given service interruption when making explanations or dealing with municipal authorities, regulative bodies, customers, etc. The sketch shows an arrangement of a pair of relays and a stop-watch, which



RELAY OPERATION OF STOP WATCH RECORDING SERVICE INTERRUPTION

preserves an accurate record of the time the voltage is off the system. A device of this kind is now being used by the Yonkers (N. Y.) Electric Light & Power Company with thorough satisfaction.

Ordinarily, the relay *A* is in circuit, and it remains excited as long as potential is on the feeder. In case of an interruption *A* is de-energized, allowing its weighted armature to drop and deliver a slight blow on the stem of the stop-watch, setting the timing hand in motion. Incidentally the fall of the armature disconnects at *a* the circuit to relay *A*, bridging, instead, the relay *B* across the dead feeder. When service is restored *B* picks up, and its armature in closing presses on the watch stem through the crank arm, this time stopping the moving hand. Service interruptions are thus recorded with an accuracy down to one-fifth of a second.

A small pilot lamp, *P*, burns as long as relay *A* is in circuit, thus indicating at a glance that no service interruption has yet occurred. This little 2.5-volt lamp is supplied

with energy from secondary windings wrapped on the frame of relay *A*. An ordinary 8-cp lamp is used as resistance in series with the relays. By means of the double-pole double-throw switch, the recording device can be connected to either one of two feeder lines which it is desired to supervise. A pair of springs hold the stop-watch in place, minimizing jarring and helping to receive the blows of the falling weight and the relay movement.

## Restoring Submerged Electrical Apparatus to Service After Flood

By GEORGE H. MORSE

The Ohio reached its high-water mark at Wheeling, W. Va., on March 29. Next day it receded sufficiently to uncover the electric generators and motors in the several plants belonging to a large steel and iron company, and the electrical engineer regularly employed being ill, the company sought the services of an outside expert in re-

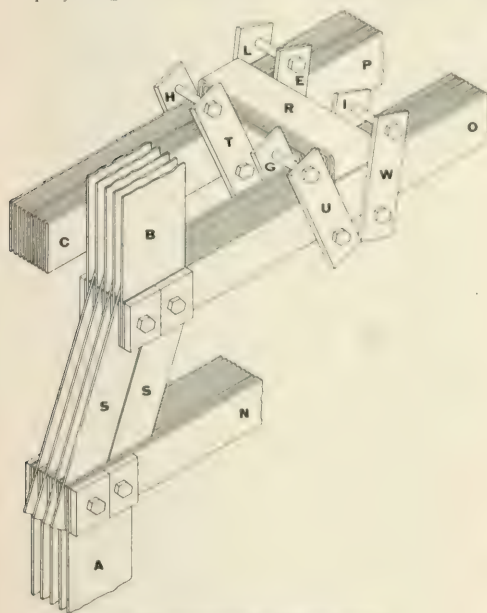


FIG. 1—SHORT-CIRCUITING BARS

storing service. The writer accordingly arrived on the scene at nine o'clock on the morning of March 31 and examined the 1000-kw, three-phase alternator shown in Fig. 3. The arrows to be seen on the rotor were painted there with white lead before the rotor was turned at all, in order that it might be known at all times just which coils had been under water. As the rotor stands in the picture, its upper part, from arrowhead to arrowhead, was immersed for several days, and of course a corresponding portion of the lower part of the stator was likewise under water.

The generator delivers 220 volts at 60 cycles, its normal full load per phase being 2000 amp. The first thing done was to place four large gas flames in the pit directly under the frame of the machine, in such position that the flames played against the iron surface, and the gas was kept burning for the following five days and nights. Two smaller direct current units which had escaped inundation supplied energy at 125 volts, and this was led, through an improvised lamp bank and a number of rheostats, to the

exciter field, the exciter's armature circuit being isolated and used to excite the field of the alternator after its engine was started. The same rheostat equipment was used in exciting the alternator from the 125-volt bus previous to starting its engine. Very perfect control was thus had of the current circulating through the rotor winding, and it was found possible to maintain the temperature of the



FIG. 2—DRYING ROTORS WITH GAS FLAME

latter just within the softening point of the insulation. The rotor was thus heated with electricity all of Monday and Monday night. Meantime a competent machinist was set to work to prepare the short-circuiting copper bars *S*, *S* and *R* shown in Fig. 1.

In this figure the busbar connections *a* and *b* are attached to the two circuit-breakers which protect the alternator and the third phase receives its current by way of connection *A*. *P*, *O* and *N* are the feeder ends of the busbars.

The short-circuiting pieces *S* and *S* take the place formerly occupied by blank spacers which were introduced to adapt the five members of terminal *A* to the ten members of busbar *X*, all being of the same thickness. The clamping pieces *H*, *I*, *E*, *G*, *J*, *H* and the bolts are of iron, while pieces *T* and *L* are of copper. The very material addition to the heating at connection *K* which a pair of complete magnetic circuits surrounding busbars *P* and *O*



FIG. 3—ALTERNATOR IN THREE-PHASE ALTERNATOR

would have had it placed at some point where the short-circuiting current was to flow, was obtained by introducing these two magnetic paths *L* and *T*. The machinist arrived at the plant at 5 o'clock Tuesday morning, bringing the short-circuiting copper which had taken him all night to make. Having put in position the eight bars at *S*, *S* and the nine V-shaped bars at *N*, the exciter was separately



excited, its current after starting the engine being cut down to nearly zero by means previously referred to.

It was soon found that normal full load of 2600 amp per phase produced but little heating effect and a current of 3300 amp, rising to 3500 at times, was maintained during a large part of the operation of drying out the stator. It



FIG. 4—TOP OF LARGE DRYING OVEN

was sometimes necessary, however, to reduce the current to 2500 amp when the stator became too hot.

The circuit-breakers heated considerably, as did the main switches and all busbar connections. Cloths wrung out of cold water were continually applied while compressed air and electric fans were used to cool the other parts. A large quantity of bare copper wire was wound between the circuit-breaker studs on the back of the switchboard in order to relieve them of a part of the current which they were carrying.

A large number of induction motors of all sizes up to 200 hp had been submerged. Fig. 4 shows the top of a large gas oven used for drying pipe before it is placed in the galvanizing tank, to be seen just at the left of the large motor on the right-hand side of the picture.

About fifty motors were placed, as ordered, upon this oven, those near the galvanizing tank being partially protected from excessive heat by a loose pavement of brick



FIG. 5—BRICK OVEN FOR DRYING DIRECT-CURRENT MACHINES

laid down for the purpose, while those above the cooler parts of the oven were covered with corrugated sheets found ready to hand.

The stators of many of the larger motors were placed on their sides, a gas fire surrounded by a section of large pipe being placed at the center and corrugated sheets being used to protect the sides of the motors which had not been

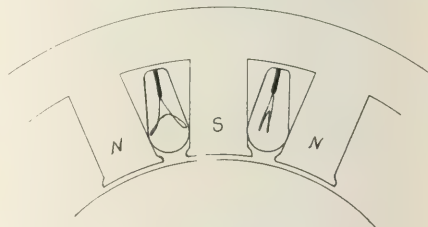
wetted. Three of the stators thus arranged are to be seen in Fig. 2. On the left of the same picture is a long line of rotors being heated by two parallel pipes at the floor level, holes having been bored every six inches to act as jets. In the picture a number of corrugated plates have been removed in order to expose the interior to view. The rule given the numerous attendants on duty day and night throughout the week was to keep all metal parts so hot that the hand could not comfortably bear the heat for more than ten seconds. Gaging of the temperature was by no means left entirely with the men, as the electrical engineer remained constantly at hand and made frequent rounds during the day and night. Fig. 5 shows the method used to dry large direct-current generators. Ovens of brick were built around the generator ends of these direct-connected units and each oven was served with two large gas jets. The temperature of the commutator was ascertained by feeling it from time to time and excessive heating avoided.

On Friday evening the short-circuit was removed from the large alternator. The stator and rotor were found free from grounds and the machine fully excited and the feeder circuits thrown on. The following morning heating of motors was ordered stopped and the motors were gradually returned to their places. On Sunday the direct-current generators had their brick ovens removed and were tested out. On Monday morning one week after the flood subsided all of the electrical equipment in all of the company's plants was ready for operation, without a single exception.

### Testing Polarity of Field Coils

By E. R. SHEPARD

In testing the polarity of the poles of an alternator an ordinary carbon-filament lamp carrying a direct current was found to give very striking and definite results. By placing the lamp in the region of the leakage flux between



FILAMENT POSITION UNDER FLUX ACTION

adjacent pole tips the two loops of the filament will separate widely or draw close together, depending on the direction of the flux. By progressing around the fields with a lamp in this manner a reversed pole or a dead pole can be instantly detected. The behavior of the lamp is indicated in the accompanying illustration.

### Atlantic Telegraph Cables

How many telegraphic cables are now embedded in the Atlantic Ocean? What voltage is used for signaling over these cables? R. J. L.

The transatlantic cables which are in service at the present are not embedded as you imply, but are strung in long spans upon the mountain peaks and high plateaus which protrude from the ocean's bottom. Fourteen such cables are now strung between American and European points. The potential used for signaling over these cables is approximately 50 volts.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Improvements of Two-Pole Rotor Windings.**—KARL WELTZL.—An illustrated description of an improvement in the construction of two-pole rotor windings which results in a much more effective cooling so that the overload limit

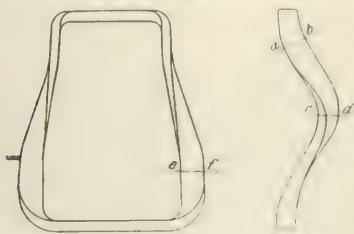


FIG. 1—COIL FOR TWO-POLE WINDING

due to temperature rise can be advanced by 20 per cent to 25 per cent. Fig. 1 shows the form of the two-pole coil winding and Fig. 2 shows the wound drum. Both are self-explanatory. This form of winding can be used even with the smallest machines so that their ventilation becomes much better on account of the peculiar form of the coil heads. Attention is called especially to the ventilation space  $V$  in Fig. 2. In spite of the improved cooling effect the coils of this winding are smaller than the usual

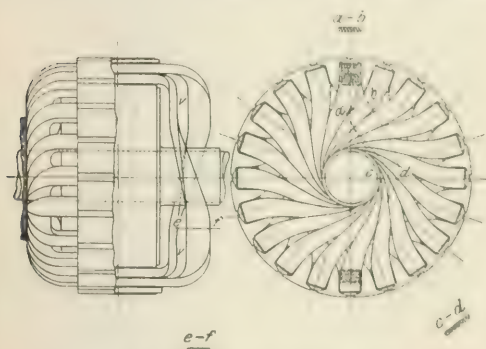


FIG. 2—WINDING OF TWO-POLE ROTOR

coils. They can easily be manufactured and mounted.—*Elek. Zeit.*, March 27, 1913.

**Repulsion Motor.**—E. SCHULZ.—A paper read before the Electrical Society of Cologne on small repulsion motors made by a German company. Their high starting torque is pointed out. In order to prevent the speed from increasing beyond a certain limit, a centrifugal switch is provided on the axle. It short-circuits three points of the armature winding when the machine has reached the limit of speed. The machine is then an induction motor running nearly at synchronous speed. Regulation of the speed of the repulsion motor is possible within rather wide limits by displacement of the brushes.—*Elek. Zeit.*, March 27, 1913.

**Alternating-Current Commutator Motor.**—A note on a recent British patent (No. 21,471, 1912) of the Siemens-Schuckert company. To improve the running of the motor a transformer is placed between the stator and the rotor. The transformer winding connected to the stator is joined in star, and that connected to the rotor is in mesh.—*London Elec. Enging.*, March 27, 1913.

**Iron Losses.**—J. WILD.—A thesis presented at the Institute of Technology at Stuttgart on the causes of the additional iron losses in rotating smooth-ring armatures.—No. 125 of *Mittel. über Forschungsarbeiten auf d. Geb. d. Ingenieurwesens, insbes. aus d. Labor. d. techn. Hochschulen*; abstracted in *Elek. Zeit.*, March 27, 1913.

### Lamps and Lighting

**Flux and Light Intensity of Line Sources of Light.**—K. NORDEN.—The formula of the flux from a linear source of light, as given by Pole, is  $\Phi = \pi^2 HL$ , where  $L$  is the length of the linear source of light and  $H$  the light intensity of the unit length measured in a direction perpendicular to the line source. This formula is correct. But the author states that Pole's statement that the calculation of the light flux from a linear source of light is indefinite as long as the surrounding illuminated surface is not given is a mistake. The spherical flux from any point, surface or body is definitely fixed under any circumstances. The mean spherical candle-power of a linear source of light is  $HL/\pi^2$ , the mean hemispherical candle-power is also  $HL/\pi^2$ . For the rating of incandescent lamps the horizontal candle-power is usually employed, and for metallic-filament lamps (without reflector) the ratio of the spherical to the horizontal candle-power is 0.79, which practically equals  $\pi/4$ . If, therefore, a metallic-filament lamp and a linear source of light have the same spherical intensity, the horizontal candle-power of the former corresponds to the total-length light intensity of the latter. The same is true for the hemispherical candle-power if the metallic-filament lamps are arranged horizontally, since in that case the mean hemispherical candle-power equals the mean spherical candle-power just as is the case with the linear source of light. Or, in other words, if a surface is to get a certain mean horizontal illumination and if the surface is large enough to absorb the whole hemispherical flux of the source of light, a horizontal linear source of light of  $L$  units of length with a candle-power of 1 candle perpendicular to the source of light is equivalent to 2 metallic-filament lamps, each of 1 candle, arranged horizontally.—*Elek. Zeit.*, March 13, 1913.

**Street Lighting at Manchester.**—S. J. FRANK and H. A. RATCHFORD.—The street lighting at Manchester and the competition between gas and electricity are referred to generally. A description is given of a high-pressure gas and of a flame arc installation. An account is given of the photometric work undertaken and comparisons are made between the rival systems. Relative costs, the photometric problems and the various types of globe, diffuser and reflectors are discussed. Safety considerations are noted. Purely from the point of view of illuminating effect there is much to be said in favor of both gas and electricity for the electric lighting system possesses all the practical advantages, a few of the more important of which are: (a) lower cost; (b) simplicity of switching operations; and



possibility of dispensing with lamp-lighters; (c) flexibility and ease of erection; (d) lamps not affected by vibration when suspended from traction poles; (e) possibility of reliable check on running costs (that is, energy consumptions and electrodes); (f) negligible leakage; (g) absence of globe breakages due to heating, etc. All of the above advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use: (a) extensive and highly dangerous leakage of high-pressure gas; (b) the detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candle-power just at a time when it is most required; (c) partial and occasional complete failure in frosty weather.—*London Electrician*, March 7 and 14, 1913.

**Metallic-Filament Lamps for Lighting Street-Railway Cars.**—*RAU.*—An abstract of a paper read before the Electrical Society of Cologne pointing out the advantages of tantalum lamps over carbon lamps for street-railway car lighting in Cologne. Experiments with the 1-watt osram lamp were also made for this purpose. (In an editorial footnote it is said that the osram lamp is being used successfully on the Berlin street railways).—*Elek. Zeit.*, March 27, 1913.

**Hygienic Properties of Lamps.**—*DE RECKLINGHAUSEN.*—An article on the hygienic properties of artificial sources of light and particularly of mercury-vapor lamps. As to the effect of ultraviolet rays emitted from mercury-vapor lamps (if not absorbed by the glass globe), they have no detrimental effect on human beings so long as the mercury-vapor lamp is at a sufficient distance. So long as they are installed at a considerable height no dangerous effect may be expected even if the globe should be accidentally broken. As to the greenish-blue color of the light of the mercury-vapor lamps, the author thinks that it is less fatiguing to the eye than that from other artificial sources of light. He finally discusses the distribution of light from lamps and expresses the opinion that a general application of indirect lighting is not the ideal solution of the lighting problem.—*La Lumière Elec.*, Feb. 22, 1913.

**Arc Electrodes.**—A note on a recent British patent (No. 15,483, 1912) of the British-Thomson Houston Company and the General Electric Company. To steady the magnetite arc the current is led into the electrode at right angles to the arc and in equal symmetrical branches. The positive electrode is of disk shape.—*London Elec. Eng'g*, March 27, 1913.

**Arc Producing Ultra-Violet Rays.**—According to the *Engineer*, the Zeiss Optical Works have recently produced a rather curious form of apparatus. A so-called iron arc—that is, an electric arc with its electrodes impregnated with salts of iron—gives out light rich in ultra-violet rays. Then screens are used so as to cut off all the heating and luminous rays, leaving nothing but ultra-violet invisible radiations. In these pure ultra-violet radiations nearly all substances fluoresce, and the light they give out is greatly affected by the degree of their purity, so that this provides a new and very powerful means of examining the chemical purity of substances.—*London Electrician*, March 7, 1913.

**Reflectors for Metallic-Filament Lamps.**—*L. BLOCH.*—An English translation in abstract of his recent German paper on special designs of reflectors for metallic-filament lamps for interior lighting.—*London Electrician*, March 21, 1913.

#### Generation, Transmission and Distribution

**Economies in the Use of Electric Power.**—*W. E. MILNS.*—An illustrated abstract of a paper read before the Birmingham Section of the (British) Institution of Electrical Engineers. The heaviest item in a manufacturer's expenses is usually the wages bill. The power arrangements should therefore be designed to affect the wages account rather than the power account; that is, the designer of the arrange-

ments for distributing power in a factory should not allow his engineering views to override the commercial considerations of the case. The author emphasizes that too much importance is usually attached to the cost of energy. "When a manufacturer asks for the cost of electricity per horse-power hour and says that such a figure will enable him with his own knowledge of his work to estimate his costs, it is wise to ignore the question. The author's experience is that the manufacturer has a very vague idea of horse-power, is ignorant of both his maximum and average load, and cannot estimate his horse-power-hours. A better method of estimating the cost of driving is based on figures actually obtained from existing manufacturers' installations." For the benefit of power users and engineers engaged in developing motor loads, the author gives some figures obtained from the analysis of power cost of gas, steam and electric driving in the same plant. The following figures are from a large pen factory, the owners of which have made very careful tests on the cost of steam, town gas, suction gas and electricity. The horse-power installed was 250. The cost of steam driving with Corliss compound condensing engines is \$47.50 per hp per year; with gas from the corporation mains, at 35 cents per 1000 cu. ft., \$36.04 per hp per year, and with suction gas \$24.31 per hp per year. The cost of electric driving with energy at 2 cents per kw-hr. came to \$18.43 per hp per year. These figures include energy maintenance, wages and repairs, interest, depreciation and all other charges. Another method of comparison which will appeal to a manufacturer with an elementary knowledge of engineering is to obtain load curves for the steam engines by means of continuous recorders, or from electric motors by means of recording ammeters, and to submit such curves to a power user. A last argument which, unfortunately, is rarely taken into consideration is that the conditions of labor and employment in electrically equipped factories are usually far superior to those found in works utilizing any other form of power.—*London Electrician*, March 14, 1913.

**Energy Supply on the Rand.**—*A. E. HADLEY.*—A paper read before the (British) Institution of Electrical Engineers. Particulars are given of the Victoria Falls and Transvaal Power Company and of the history of electric energy supply on the Rand. Details are given of the transmission system and of the Rosherville station, together with some account of the substations and a compressed air supply scheme.—*London Electrician*, March 14 and 21, 1913. An editorial discussing one special feature in Hadley's paper, namely, the use of reactors in alternating-current systems.—*London Electrician*, March 21, 1913.

**Independent Steam-Condensing Plants.**—*W. A. DEXTER.*—An illustrated paper in abstract, presented before the New Castle section of the (British) Institution of Electrical Engineers, giving comparative notes on independent steam-condensing plants. Surface and jet-condensing plants are discussed and compared, chiefly those used in connection with steam turbines. Air-pumps are also considered, both reciprocating and rotary, with some remarks incidental to their efficient working and maintenance.—*London Electrician*, March 28, 1913.

**Diesel Engine.**—*J. H. BAUER.*—A long paper read before the Electrical Society of Cologne on the Diesel engine, the kinds of oil which can be used for its operation, and the economical results obtainable in commercial work.—*Elek. Zeit.*, March 20, 1913.

#### Traction

**Single-Phase Alternating-Current Commutator-Motors for Railways.**—*M. LATOUR.*—An illustrated English translation in abstract of his article in *Elektrotechnik und Maschinenbau* and *Elektrotechnische Zeitschrift*. The various types of single-phase commutator motors tested by the Compagnie des Chemins de Fer du Midi are compared, especially those which possess a cross-flux, either



as an inherent property (repulsion motors) or produced artificially (series motors). The superiority of the series motor with a resistance in parallel with the auxiliary pole is shown. Use is made of the current diagram, which enables the interpole excitation to be calculated for this arrangement. Finally an equivalent arrangement is given whereby all complications in the construction of the motor are avoided and a desirable degree of simplicity is obtained. *London Electrician*, March 28, 1913.

#### Installations, Systems and Appliances

**Electricity Supply in Bavaria.**—TILMETZ.—A long abstract of a paper by Ph. Arnold in the *Zeit. d. k. Bayer. Statist. Landesamts* on the use of electricity in Bavaria with special reference to Munich and suburbs. The first part deals with the uses of electricity in general, the second with the uses of electricity in factories and workshops, and the third with the uses of electricity in agriculture. A great many statistical figures are given.—*Elek. Zeit.*, March 27, 1913.

**German Electrical Industries.**—A continuation of the reviews of the status of the different fields of the German electrical industry in 1912. Bercovitz-Schmiel discusses measuring instruments and methods including meters, P. Humann overhead conductors and underground cables for heavy currents and the manufacture of cables, A. Steinhaut electric lighting (see abstract above), A. Steinhart electric heating and cooking, Thierbach electric drives in factories, Krohne the applications of electricity in agriculture.—*Elek. Zeit.*, March 27, 1913.

#### Electrochemistry and Batteries

**Advantages of Small High-Speed Electric Furnace.**—CARL HERING.—A paper pointing out the importance of the rate (speed) of melting on the economic results obtainable with an electric furnace. Calculations are given for a series of brass furnaces operated with the same charge but at different rates of melting, and also the results for a series of brass furnaces operated with the same rate but with different charges. The results are shown by means of diagrams. With a given furnace of any stated capacity of hearth it pays well to force it as much as other conditions permit. For the same rate of melting the smaller the furnace the more economical it will be in energy consumption.—*Metall. and Chem. Eng'ng*, April, 1913.

**Measuring the Density of Storage Battery Acid.**—L. KRETZSCHMAR.—To determine the condition of charge or discharge of a storage battery the measurement of the density of the acid is the simplest means. In order to make use of an aerometer particularly convenient and suitable for this purpose, the author has devised a simple arrangement for mounting the aerometer in the battery, a magnifying concave mirror being mounted at an angle of 45 deg., which permits one to read the aerometer scale directly from above in the mirror.—*Elek. Zeit.*, March 27, 1913.

#### Units, Measurements and Instruments

**Electrical Units.**—R. T. GLAZEBROOK.—A Kelvin lecture delivered before the (British) Institution of Electrical Engineers on "The Ohm, the Ampere and the Volt—A Memory of Fifty Years, 1862 to 1912." The historical sketch given is concise and seems complete. The same issue contains a long editorial on the fundamental electrical units.—*London Electrician*, March 7, 1913.

**Units and Notation.**—A joint committee of various technical and scientific German societies (including the German Association of Electrical Engineers) proposed changes in the notation of units. A list of these units and their notation is given with explanations by K. Scheel and K. Strecker.—*Elek. Zeit.*, March 13, 1913.

**Series Transformer.**—A. R. ANDERSON AND H. R. WOODROW.—A bulletin of forty-five pages on the characteristics

and limitations of the series transformer. The authors give a discussion of the fundamental principles of the series transformer and a representation by vector diagrams of its operation. A deduction of current relations by the method of complex quantities and a discussion of conclusions that may be derived therefrom follow. The derivation of current relations by the use of instantaneous current values is then given. Particular stress is laid upon the application of the series transformer for the purpose of recording transient phenomena. Some of the more general and important results of their investigation are as follows: The transformation ratio and phase angle of a series transformer having a core of constant permeability (such as air) are constant under given conditions for all values of primary current, but this is not so with a transformer having an iron core. With an iron-cored series transformer the form of variation depends upon the shape of the saturation curve and upon the range over which the transformer operates. The range over which the permeability remains most nearly constant is the range over which the ratio remains most nearly constant. In a transformer of constant core reluctance the so-called magnetizing current is proportional to the primary current and its phase position is constant. The introduction of resistance in the secondary circuit of a series transformer has the effect of increasing the phase angle, and this increase in phase angle is practically proportional to the secondary resistance for reasonable values. Increasing the secondary resistance decreases only slightly the transformation ratio. Hence, in general, the introduction of secondary resistance is very objectionable when the transformer supplies current for a wattmeter, but is not seriously objectionable when the transformer supplies current for an ammeter. The effect of secondary reactance and the equivalent effect of magnetic leakage is to reduce the phase angle slightly and the transformation ratio very considerably. The phase angle increases with decreased permeability, and consequently in a transformer with an iron core the phase angle increases as the line current decreases. The effect of changes in frequency within a range of a factor is not generally serious. However, in addition to the effects of frequency, in a transformer with an iron core, decreasing the frequency raises the point of operation on the saturation curve and hence increases the core loss and alters the form of variation of transformation ratio and phase angle with primary current. The desirability of a high number of turns is pointed out. With a reasonable high number of turns and a not excessive value of secondary resistance the effect of frequency over a considerable range is negligible. The effect of core loss is to decrease the secondary current, this effect being lessened by inductive secondary load. Increased core loss decreases the phase angle, and this effect is magnified as inductive secondary load. In an iron-core series transformer the value of flux density should be kept very low at full load. This means a low value of magnetizing current. To avoid excessive secondary impedance should be avoided, increased impedance requires an increase in flux to give equally direct proportion to the impedance. Some of the effects of magnetic leakage is ascribed to the effect of secondary reactance, the equivalent should be designed with a view to minimum magnetic leakage. The equivalent is well described in circuit. The proposed construction of a series transformer is proposed in accordance with the commercial series transformer, and it is shown that it is adequate and cannot be improved upon. It should be noted that the use of a series transformer in recording apparatus is recommended, because all alternating quantities measured by it are primary quantities, and the secondary quantities are derived from the primary quantities. In these circuits the secondary quantities are derived from the primary quantities by the use of the series transformer.—*Elect. Eng'ng*, No. 41, Vol. 10, No. 9).

### Telegraphy, Telephony and Instruments

**Transposition of Wires in Telephone Cables.**—F. LANGE. —A paper on an investigation carried out by the German government telegraph experimental station. The author points out that the opinions of experts do not yet agree as to the best way of arranging the transposition of the wires in telephone cables carrying a number of pairs of wires, in order to prevent "cross-talking." Generally, transposition is considered to be most favorable if the distances between two complete turns are short. This is, for instance, American practice. On the other hand, another method is also used in which the distances between complete turns are made longer but are varied from pair to pair. The author compares the methods. In the present paper only the induction effects are considered. On the basis of the formula of the mutual inductance between parallel conductors a formula is derived for the mutual inductance of parallel conductors with transposition, the transposition being uniform and in the same direction and long distances between complete turns being used. It is found that the coefficient of mutual inductance equals zero only if the phases of the transposition are in quadrature as shown in Fig. 2. This represents successive cross-sections through two pairs of conductors side by side and the two planes through the pairs of conductors are always perpendicular to each other. A change in the distance between complete turns from pair to pair always improves the protection against induction. The results of measurements of the differences of the partial capacities of such pairs which show a particularly strong mutual effect on each other prove that when cross-talking takes place there are usually capacity differences.—*Elek. Zeit.*, March 20, 1913.

**Semi-Automatic Telephony.**—GRABE.—An illustrated description of the semi-automatic telephone exchange system of the Siemens & Halske Company.—*Elek. Zeit.*, March 27, 1913.

**Wave Detector.**—A note on an investigation by Leithäuser on the application of the unilateral conductivity of flames to the design of a central wave detector. The experimental apparatus employed comprised a small induction coil connected to a 5-mm gap between two 1.5-m wires with end capacity plates. At a distance of from 33 ft. to 65 ft. a similar receiving circuit was connected to the electrodes of a flame detector. A Bee-Meker burner was used to provide a steady flame of great intensity, with a small bright blue inner cone. The electrodes used were a 1-mm copper wire and a ring of sheet platinum covered with a potassium salt (the object of which was simply to increase the conductivity of the flame). These electrodes were connected through a high-resistance telephone to the terminals of a resistor of some few ohms resistance across which a suitable potential difference could be maintained and varied by a local battery in series with an adjustable resistor. Later, a high-sensitivity moving-coil galvanometer was also connected in the detector circuit and at times the telephone was replaced by an Edelmann vibration galvanometer. Experiments showed that the efficacy of the detector depended largely on the dimensions and relative positions of the electrodes and on the size of the flame and its temperature around about the electrodes. A current-voltage curve was prepared when working under the most favorable adjustments, and the steep rise and sharp change of the current proved the rectifying action of the detector to be very pronounced. That phase corresponding to which the platinum electrode was positive was almost entirely suppressed, but the other phase was carried with high con-

ductivity. The delicacy of the detector was at least equal to that of a sensitive electrolytic valve and was usually greater.—*Phys. Zeit.*, No. 18, 1912, and *Zeit. f. Schwachstromtechnik*, No. 2, 1913; abstracted in *London Elec. Review*, March 14, 1913.

**Electrolytic Detectors.**—PAUL JAGOU.—A paper on the phenomena taking place in an electrolytic detector without auxiliary emf. A theory of the operation of electrolytic detectors is given.—*Comptes Rendus*, Feb. 3, 1913; abstracted in *La Lumière Elec.*, Feb. 22, 1913.

**Slide Rule for Wireless Telegraphy.**—A description of a simple modification of the ordinary slide rule by which it is rendered possible to make in a quick and simple way the complicated calculations needed in wireless telegraphy.—*Elek. Zeit.*, March 20, 1913.

**Horizontal Antennas.**—LOUIS COHEN.—A conclusion of his mathematical paper on the inductance and capacity of linear systems of conductors. In the present instalment he applies the method to the determination of the inductance and capacity of horizontal antennas.—*London Electrician*, Feb. 21, 1913.

### Miscellaneous

**German Association of Electrical Engineers.**—The twenty-first annual meeting will be held in Breslau from June 18 to 21. E. Frischmuth will present an address on the economical importance of electric traction of trunk railways. Reports will be presented by S. Ruppel on protection of houses against lightning, by Weidig and Jaensch on phenomena on high-tension overhead lines, and by Monasch on modern electric lamps. A discussion of the distribution of large amounts of energy over extended districts will be opened by an address by G. Klingenberg. There will be a large number of excursions.—*Elek. Zeit.*, March 27, 1913.

## Book Reviews

**STUDIES IN LIGHT PRODUCTION.** By R. A. Houstoun, M.S. New York: D. Van Nostrand Company. 116 pages, 22 illus. Price, \$2.

The book is virtually a lengthy essay on the fundamental scientific principles of luminous sources compiled and collated by the author from the technical literature of the past fifteen years. The plan of the work is thus mainly systematic and historic. The twelve chapters of the book relate to the following subjects: The energy spectrum, the black body, flames, the Welsbach mantle, the carbon glow lamp, the arc, the nerst lamp, metal-filament lamps, the mercury arc, the light of the future, on the absolute measurement of light, apparatus and experimental methods. The book is more than a mere compilation. It contains some new experimental data and treats the subject in a very logical manner. The chapter on the absolute measurement of light is especially original in treatment. The book will be useful to advanced students of the theory of light.

**ESSENTIALS OF ELECTRICITY.** A textbook for wiremen and the electrical trades. Direct Currents. By W. H. Timbie. New York: John Wiley & Sons. 272 pages, illus. Price, \$1.25.

A very elementary textbook of applied electricity suitable for the use of wiremen, electric artisans and all who desire to acquaint themselves with the fundamental principles of electricity without the use of mathematics beyond simple arithmetic. The book is divided into nine chapters on the following subjects: Ohm's law, simple electric circuits, combinations of series and parallel systems, electric power, wire and wiring systems, generators and motors, locating and correcting "troubles," batteries, wiring diagrams. A number of easy numerical problems for solution are scattered throughout the work.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Luminous-Bowl Indirect-Lighting Fixtures

The Hub, Chicago, a store devoted to the sale of men's clothing and furnishings, occupies the first eight floors and basement of the Lytton Building and is equipped throughout, except on the eighth floor, with the so-called



FIG. 1.—MAIN FLOOR OF THE HUB STORE, LIGHTED BY LUMINOUS-BOWL INDIRECT FIXTURES

"eye-comfort lighting system" of the National X-Ray Reflector Company, Chicago.

The installation on the ground floor is said to be the first luminous-bowl indirect-lighting system. The manufacturer claims that the reason for the existence of the



FIG. 2.—PLAIN INDIRECT FIXTURES IN THE HUB STORE

so-called semi-indirect lighting is that while people want indirect lighting, they also want to see where the indirect light comes from.

With the so-called "eye-comfort lighting system" the indirect light is obtained with a standard X-ray reflector equipment, and the luminous-bowl effect is obtained by

screwing into a socket in the bottom of the luminous bowl of the equipment for indirect lighting a low-wattage lamp which softly illumines the glass bowl. It is said that in this manner the best obtaining of the semi-indirect lighting system is retained and no visible light comes through the glass bowl.

### Single-Phase Induction Watt-Hour Meter

In a single-phase induction-type watt-hour meter which has recently been put on the market by the Hoke Manufacturing Company of Indianapolis there are some interesting features. Two of these relate to the design and arrangement of the rotating element and of the permanent magnets. The rotating element is an aluminum disk of small size but of sufficient thickness to give it great



METHOD OF REMOVING FINGER AND OTHER FOREIGN MATTER

strength in proportion to its weight. The disk is mounted on a short shaft, pivoted at top and bottom, and the rotary moving element has a few minutes of freedom. The short shaft and the bottom end strength of the disk are connected to give protection against damage by accident or short circuits. The top piece is a spring tempered piece of steel, set in the body, and it will resist bending and be subjected to rough handling or treatment.

The inspection of the meter is made without removing the cover from the meter without touching any other part. No tools are necessary, but this work is made long and difficult to make the spring at the bottom of the meter post, and it is not possible to get into the top of the meter and remove it from the meter by simply unscrewing it out. A diamond ring set in the meter is used to remove the meter without touching the meter in the meter in the meter.



The permanent magnet has a single long tempered steel magnetic circuit with a single air-gap, and it is declared that this design will give a stable, steady magnetic field with a minimum amount of demagnetization. The magnet is removable from the meter by simply loosening the holding screws at the top without disturbing any other part of the mechanism, and all magnets are interchangeable. It is provided with a coarse, quick adjustment and a fine micrometer adjustment for full-load calibrating. The final adjustment is against a stop which acts as a gage, so that the permanent magnet when once set may be taken off for inspection and cleaning and replaced in exactly the former position without any necessity for recalibration. The light-load adjustment is also a micrometer adjustment against a gage.

The complete meter is light in weight but strongly made, with case of pressed metal. The weight of the 5-amp size is  $5\frac{1}{2}$  lb. The meter is provided with a full glass front and the method of sealing in combination with the design of the case is such as to prevent tampering of any kind with the meter. The H. & H. meter was designed and is being manufactured under the supervision of Mr. G. A. Scheeff, known to the electrical industry as the inventor of the first induction-type watt-hour meter on the market.

### Composition-Glass Reflector

The Holophane Works of General Electric Company, Cleveland, Ohio, have just placed on the market a new product called the "Sudan glass reflectors in panelex design." The glass is said to be of a new chemical composition,



BOWL-TYPE REFLECTOR

of very delicate amber tint when lighted, and translucent. Its smooth surface, which is said to be practically dustproof, has no polish or glare. The design of this reflector is without marked ribs or hollows that would catch and hold dust, and the lamp filament is hidden from the ordinary line of vision. This reflector is said to demonstrate the large possibilities of light diffusion and redirection without loss of artistic effect.

The reflectors are made in both the bowl and shallow types and are particularly adaptable for use in office buildings, retail stores and some rooms of residences.

### Miniature Precision Instruments

The Weston Electrical Instrument Company, of Newark, N. J., has recently placed upon the market a line of miniature direct-current instruments of the permanent-magnet movable-coil type, in both portable and switchboard forms.

The line comprises voltmeters, battery-testing voltmeters, ammeters, volt-ammeters, millivoltmeters and milliamperes meters, in various combinations of single, double and triple ranges. They are finished in dull black, with nickel-plated trimmings.

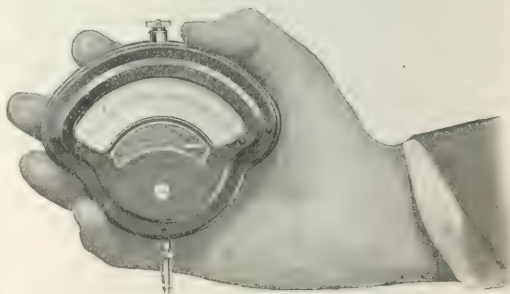
The outside dimensions of the portable form are 4.4 in. by 4.6 in. They weigh less than 1 lb. each and may easily be carried in the pocket. They have a knife-edged pointer, which enables close readings to be made. The scale has a length of  $2\frac{3}{4}$  in.

The working life of an instrument depends on the proper design of the movable system, which must be very light and at the same time rigid, and the spring torque must be high in comparison to the weight and moment of inertia. The movable system in these miniature instruments weighs less than 0.2 gram (less than the weight of two ordinary

pins), and its parts are so well distributed that the time required for the pointer to come to rest after the application of or a change in the current or voltage is about 0.2 second, which for all practical purposes is instantaneous. The movement of the pointer is damped, "dead-beat," by means of the aluminum frame on which the wire forming the movable coil is wound, in a manner similar to that in the larger types of Weston instruments.

It is stated that this line of instruments has been subjected to the most severe conditions in use, and that they are being successfully employed on the dashboards of automobiles, where the vibration and jar are far in excess of that which would be encountered in ordinary testing. Both portable and switchboard forms are shielded against external magnetic fields and are practically unaffected by changes in temperature.

By means of a triple-range portable voltmeter any direct current from 30 amp to 0.05 amp and any emf from 150 volts to 0.02 volt can be measured. The switchboard form of meter has the same general characteristics as the portable form. A switchboard voltmeter is designed for use with storage-battery charging outfits on or for automobiles and with other small storage-battery installations where it is desired to use a single instrument to indicate both volts and amperes. It indicates the charging or discharging current, and on pressing the contact button it indicates the voltage of the cell or battery.



VOLTMETER FOR BATTERY TESTING

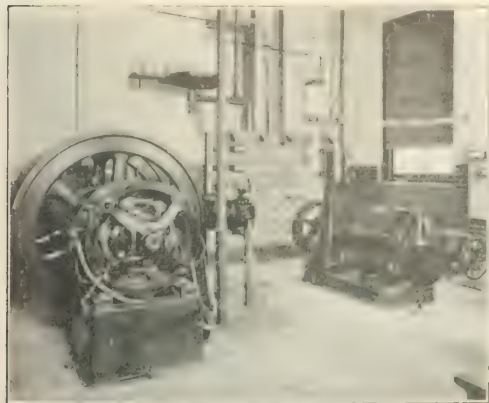
The battery-testing voltmeter shown herewith is provided with a steel point as one of the terminals to facilitate making contact to one of the plates or terminals of the cell to be tested. The other terminal consists of a flexible lead also provided with a point. They have knife-edge pointers and are made with the zero in the center, so that the voltage may be read regardless of the polarity.

### Electrical Laboratory for High School

Modern high schools and academic institutions, more especially those where manual training is a part of the curriculum, are installing completely equipped electrical laboratories for the benefit of students. The illustration shows a corner of the electrical laboratory of the West Philadelphia High School, Philadelphia. On the left is shown a 10-kw, 125-volt, 250-r.p.m. direct-current generator coupled to an Otto gas engine. On the right is shown a 10-kw, 125-volt, 400-r.p.m. 60-cycle, single-phase alternating-current generator, on the shaft extension of which is mounted a  $1\frac{1}{2}$ -kw exciter. This apparatus is mounted on the same bedplate with and coupled to an A B C steam engine. Students are thus enabled to study the characteristics of both alternating-current and direct-current generation and can observe the relative merits of steam and gas-engine drive.

The switchboard consists of three panels, on which are mounted the necessary instruments, field rheostats,

switches, ammeters, voltmeters, wattmeters, etc. The panel on the left controls the output of the direct-current generating set and the one on the right the alternating-current set. The central panel acts as a neutral distributing board having receptacle inlets numbered identically with those in the alternating-current and direct-current



ELECTRICAL LABORATORY OF WEST PHILADELPHIA HIGH SCHOOL

boards respectively. These numbers correspond with receptacles placed at convenient points about the laboratory and in close proximity to the students' benches.

## Two-Speed Motor Drive for Refrigerating Machine

The advantages of motor drive for refrigerating machinery are so conspicuous that motors are now used when ever the conditions permit. The accompanying illustration of a motor-driven refrigerating machine in a large brewery shows the simplicity, compactness and cleanliness of such an installation. Another important advantage is the fact that



MOTOR-DRIVEN REFRIGERATING MACHINE

the motor requires practically no attendance. It runs continuously without other attention than an occasional oiling.

This particular installation is especially interesting, however, because the motor is a two-speed alternating-current machine and can be operated at either 103  $\frac{1}{2}$  p.m., developing 245 hp., or at 247  $\frac{1}{2}$  p.m., developing 174 hp. and it is said

it will operate at equally high efficiency at both speeds. Consequently, in cold weather the refrigerating machine can be run at low speed with a considerable saving in operating expenses.

The refrigerating machine shown here has been made by the Westinghouse Electric & Manufacturing Company.

## Outdoor Substations

High-tension transmission lines are often erected near small towns or industrial plants which wish to purchase energy in comparatively small amounts. To provide such service, key equipment must be used that is not too costly and yet must meet very rigid requirements. The station must operate without outside assistance. If any trouble occurs, the equipment must be automatically disconnected from the line, apparatus must be made accessible to the high-tension circuit when inspection or repair are required, and finally, the main line carrying away must be protected to interruption.

In order to meet and maintain the Public Utility Service Company standards, the line is called at least twice along the transmission line with type substations, one of which is shown in the illustration.

The equipment of this station consists of three 22,000-volt Westinghouse outdoor-type 22,000-2300-volt transformers supported on a steel frame which is constructed of structural steel.

Concrete footings are provided and in constructing the steelwork bolts are used instead of rivets, thus simplifying the erection. Barbed wire enclosures are used so that it

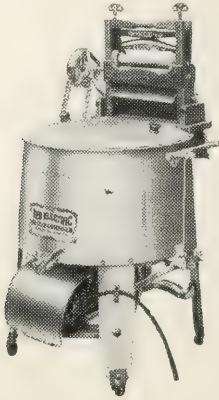


OUTDOOR SUBSTATION

is possible to open the transmission line, which may be protected by the power line, without the use of any other means, which will save the cost of the line. The line is protected by the barbed wire fence, which is used to protect the line from lightning.

### Washing and Wringing Machine

The so-called "Red Electric" washing and wringing machine, which is made by the Hurley Machine Company, South Clinton and Monroe Streets, Chicago, is claimed to be absolutely water-tight and rust-proof. The tub is made of galvanized sheet steel, and the machinery which is placed

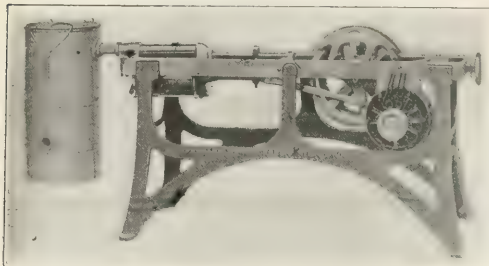


ELECTRIC WASHING MACHINE

below the tub is protected by a galvanized-steel shield. The two-roll reversible wringer, which is of a comparatively new design, is operated by a  $\frac{1}{8}$ -hp motor. This motor can operate simultaneously both the washer and the wringer if desired. All the machinery is out of the operator's way and the top of the machine can be used as a table when running the clothes back through the rinsing water.

### Suction Cleaner with a Multi-Duty Motor

The usefulness of the small electric motor for doing many of the hard, disagreeable tasks around the home has become so well recognized that one suction cleaner manufacturer has designed his machine in a way allowing full advantage to be taken of the motor when the cleaner is not in use. When the motor is driving the cleaner a pinion on the inner end of the motor shaft meshes with the large gear wheel, which operates the air pump through a con-



MOTOR-DRIVEN SUCTION CLEANER

necting rod. To make the motor available for other purposes, the hand-wheel on the end of the cleaner frame is turned, thereby drawing the motor forward and disengaging the pinion. A pulley on the outer end of the motor shaft provides means for belt drive.

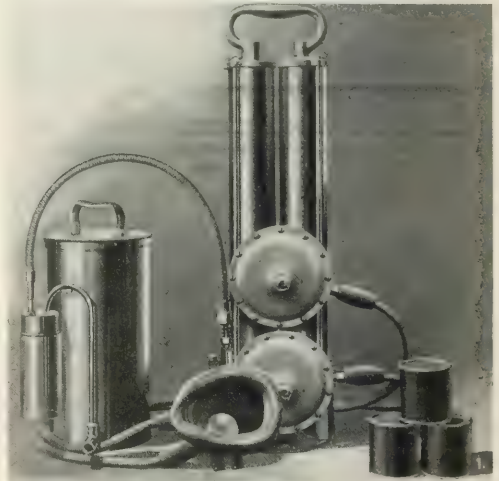
The cleaner, being of the stationary type, has pipe connections to outlets on each floor to which the hose with the

cleaning tool is attached. The motor can be controlled from any floor.

The cleaner is manufactured by the Clayton-Marlbrough Manufacturing Company, Rochester, N. Y., the electrical equipment being furnished by Westinghouse Electric & Manufacturing Company.

### Lungmotor for Resuscitation

An artificial respirator, called the lungmotor, weighing less than 25 lb. complete in a strong carrying case, is being manufactured by the Life Saving Devices Company, of Chicago. The apparatus is operated by hand power and consists of a mechanical pump, an oxygen generator and a rubber face mask with the necessary connecting tubing. The pump has two cylinders, one for supplying a mixture of air and oxygen to the subject and the other for removing devitalized air from the patient's lungs. Any desired mixture of air and oxygen can be obtained by adjusting a valve, and the manufacturer says that danger of excessive pressure in the patient's lungs is prevented by diaphragm



ARTIFICIAL RESPIRATOR AND OXYGEN GENERATOR

valves located between the pump and the face mask. An indicating dial on the top of the pump can be set to limit the stroke of the pistons, thus regulating the volume of air according to the requirements of the individual under treatment. Oxygen is generated in the small portable tank shown on the left of the picture by the action of water on fused sodium peroxide, and any minor impurities which may exist in the gas are taken out in a washing bottle fastened to the side of the generating tank. The sodium peroxide is furnished in sealed cartridges which will last from thirty-six to sixty minutes according to the amount of oxygen required. Two flexible tubes connect the pump cylinders with the face mask. An upward movement of the handle of the lungmotor draws oxygen and air into one cylinder and at the same time empties the patient's lungs of air. The reverse movement of the handle pumps fresh air into the lungs.

One of the advantages of this device, as stated by Mr. F. T. Fowler, is that when the subject struggles for breath the operator can help him by manipulating the handle of the pump without removing the face mask. In case the supply of oxygen gives out, the lungmotor can still be used with air alone.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

### Change in Distributing Policy of Holophane Works.—

In order to promote closer relations between itself and electrical supply jobbers, the Holophane Works of General Electric Company has instituted a new policy for distributing its commercial types of glassware. Commercial glassware will no longer be kept in stock at the company's district offices, but will be kept on sale at the offices of electrical supply jobbers. The policy of the company in handling its ornamental type of glassware is contrary to that of many other manufacturers in the same line of business as itself, in that the ornamental glassware is being sold through the medium of fixture manufacturers. The fixtures used in connection with its glassware are not marketed by the Holophane Works, but this business is diverted to the fixture manufacturers, who, the company feels, are the logical distributors of the complete ornamental fixtures and glassware, inasmuch as it is the fixture manufacturer with whom architects co-operate in designing the decorative features of buildings. The company's business in steel reflectors is expanding rapidly and between 150 and 200 per cent more business has been done thus far in the current year than was the case in the corresponding period of 1912. On this account it has been found necessary to erect a new factory in Cleveland for the manufacture of steel reflectors. The factory building, which is nearly completed, is 320 ft. long by 80 ft. wide. Two floors of it will be used in manufacturing the reflectors. The metal-reflector manufacturing carried on heretofore at Newark, Ohio, is to be transferred to the new plant.

**Allis-Chalmers Manufacturing Company Begins Operations.**—The Allis-Chalmers Manufacturing Company, which was formed recently to succeed the Allis-Chalmers Company as a result of the reorganization of the latter, as noted in these columns March 22, took over the properties and began operations on April 16. J. H. McClement, chairman of the board of directors of the Allis-Chalmers Manufacturing Company, stated to a representative of the *Electrical World* this week that the receiver would be discharged shortly. He said, also, that no changes whatever are contemplated in the personnel of any of the departments of the former Allis-Chalmers Company. The business of the company during the receivership has been very good. During February, under Receiver Falk, a balance of \$37,000, after \$35,000 depreciation, was earned. The net earnings in January, after the same amount for depreciation, were \$10,000. Otto H. Falk, the receiver, is president of the new company. Other officers are: Max W. Babb, vice-president and general attorney; L. F. Bower, secretary, and F. Woodland, treasurer. All are Milwaukee men and were officers of the former company.

**Trump Manufacturing Company Not Seriously Affected by the Floods.**—J. F. Trump, Jr., of the Trump Manufacturing Company, Springfield, Ohio, hydraulic engineer and manufacturer of water-power machinery, says that statements that Springfield, Ohio, and its manufacturing establishments suffered severely during the recent floods in Ohio are erroneous. "Springfield was very slightly affected," Mr. Trump states, "and her factories are operating as heretofore. With possibly one or two exceptions, none of them was obliged to close even temporarily. Aside from a short delay in receiving mail, our company experienced no embarrassment from the recent disasters. This, with slight freight delays due to the washing out of several railroad bridges outside of Springfield, since restored, was our only trouble."

**New Canadian Plant for Analysis and Treatment of Feed Water.**—Owing to the rapid growth of its Canadian business, the Dearborn Chemical Company, of Chicago, which specializes in the scientific analysis and treatment of boiler-feed water for railroad and stationary plant use, has organ-

ized a Canadian company with the same factor to carry on its business in the Dominion. A combined concrete manufacturing plant, which with its equipment, site, etc., will represent an investment of more than \$100,000 when completed, is now in course of erection for the company at West Toronto. A. W. Crouch, who has been affiliated with the Dearborn company for fifteen years, and during eight of these has been district manager at Pittsburgh, in charge of a number of branch offices, is the vice-president and general manager of the Canadian company.

**Says Motor Business Has Been Irregular Since First of Year.**—The manager of one of the well-known motor and generator manufacturing companies in the East made the following comment this week upon electrical trade conditions: "While the last part of the year 1912 was the most prosperous season we ever experienced in our business, and our December sales, for example, were about 75 per cent above normal, business dropped off considerably in January and we did only the normal amount. Business was poor in February, falling to 25 per cent below normal. The March volume was in normal proportions, and April bids fair to be 10 per cent or 15 per cent better than March."

**Cleveland Orders Equipment for Its Municipal Plant.**—The city of Cleveland, Ohio, has awarded a contract to the C. H. Wheeler Manufacturing Company, of Philadelphia, Pa., for surface condensers for its new municipal plant. The initial generating equipment of the latter will consist of three 5000-kw. Allis-Chalmers turbines. The Wheeler condensers which will be used in connection with these will have motor-driven Mullan patent vacuum pumps, together with motor-driven centrifugal circulating and hot well pumps. The awarding of the contract was based to a large extent upon the performance and low-maintenance guarantees given by the condenser company.

**San Joaquin Light & Power Company to Enlarge Its System.**—J. G. White & Company, 31 Exchange Place, New York, have received, through their San Francisco office, a contract for doing about \$1,250,000 of construction work upon the system of the San Joaquin Light & Power Company, of Fresno, Cal. The work is to be done during 1913. The improvements include additions to the company's stations and substations. An appraisal of the properties of the San Joaquin company was made by J. G. White & Company last year, as noted in these columns May 18, 1912.

**Will Build Hydroelectric Plant Near Minneapolis.**—Plans are being made by the Northern Mississippi River Power Company for the erection at Coon Rapids on the Mississippi River, near Minneapolis, of a hydroelectric station which is to have an initial rating of 100,000 kw. The Northern Mississippi company, which was formed recently, is a subsidiary of the Northern States Power Company, Chicago. When the plant is completed it will be rated for a term of forty-eight years to the Mississippi General Electric Company.

**Conditions Excellent in the Transformer Business.**—Discussing the transformer business, W. J. Hickey, of the Portland Transformer Company, said this week: "Business conditions are excellent with no real lull here for a long time. If our sales indicate anything as to general trade conditions, we believe that there is no lull here or of general business. We have stayed with our excellent conditions existing in the transformer business before. And business is good and going on strong."

**Crocker-Wheeler Company Reports Good Business.**—According to the Crocker-Wheeler Company, August 2, J. demand for electrical machinery continues to be firm and has not been affected by the temporary business depression of the month. As a result of the boom in the Middle West the company has received many fresh orders.

**Electrical and Mechanical Equipment of Great Northern Railway Station in Minneapolis.**—Contracts have been awarded by Neiler, Rich & Company, of Chicago, engineers for Charles S. Frost, the architect, for much of the lighting, heating and power equipment for the passenger station of the Great Northern Railway Company now under construction on Hennepin Avenue, opposite High Street, in Minneapolis. A power house will be built on the premises and will contain three 300-hp Edgemoor water-tube boilers each equipped with a Foster superheater made by the Power Specialty Company. Each boiler will be fired by a Murphy automatic furnace. The coal and ash-handling machinery in the power house will be supplied by the Webster Manufacturing Company, while Henry R. Worthington has the contract for the condensing apparatus. There will be three Buckeye reciprocating engines, the largest one of the cross-compound, horizontal type and two simple engines of smaller size. Three 250-volt, direct-current generators will be driven by these engines. The largest generator will be of 250-kw rating and each of the others of 150-kw rating. All of these units will turn at 150 r.p.m. The generators and two balancer sets, as well as a number of electric motors for use throughout the power house and railway station, will be supplied by the Sprague Electric Works of General Electric Company. These motors include those operating the coal and ash-handling machinery and the fans used for the ventilating system. The contract for wiring the entire station building, which has been awarded to the Minneapolis Electric Equipment Company, includes the conduit and wiring as well as the transmission circuits from the power house to the distributing room in the basement machinery room of the station building. It also includes the distribution switchboard, telegraph and telephone conduits and fixtures other than those in the public rooms of the station. The heating and ventilating contract has been awarded to the Mehring & Hanson Company, of Chicago. This contract includes also the house pumps for the circulating of drinking water and the hot-water circulating pumps. These are Worthington pumps and are to be driven by Sprague motors. The refrigerating machine to cool the drinking water will be furnished by the Kroeschell Brothers' Ice Machine Company, of Chicago, and will be driven by a 25-hp Sprague motor. A stationary vacuum-cleaning plant will be driven by a 10-hp motor. Arrangements have been made for charging the batteries of electric baggage trucks, which are now used in several modern railway stations. R. Budd is the chief engineer of the Great Northern Railway Company and has general supervision of the erection of the new station. J. D. Mason is looking after the details of the work for Mr. Budd.

**Electric Service Supplies Company Busy.**—J. V. E. Titus, second vice-president of the Electric Service Supplies Company, Philadelphia, manufacturer of railway material and electrical supplies, said this week that never before in the history of the company have business conditions been as satisfactory as they have since the first of this year. "Since Jan. 1," he said, "our business has been approximately 35 per cent greater than that in the corresponding period of any previous year, and we see but few signs of slackening of activity. Our lightning-arrester business, which is our most important business with the electric-lighting field, has been particularly good this year. We booked orders up to April 1 for more than twice as many lightning arresters as have been sold by us in a like period. Our last year's business in this particular line was 42 per cent greater than in any previous year, and as a result we are having some trouble to make shipments as promptly as customers could desire. Our whole trouble, however, has been in getting materials, as our facilities are ample to take care of practically any demand. Materials are now coming in nicely. All of our manufactured lines are particularly active at the present time."

**General Electric Doing a Record Business.**—If the rate at which new business is being placed with the General Electric Company is maintained during the rest of the year the total business of the company in 1913 will show a large increase over that in 1912, which was the largest in the history of the company. During the three months ended March 31, 1913, incoming orders were at the rate of \$129,000,000 for the year, as compared with \$102,000,000 in the year ended Dec. 31, 1912. Several unusually large orders

were received by the company during January and February. One of these orders called for \$4,000,000 of equipment for use in Australia. Owing to the large increase in its business, the company has found it necessary to formulate plans for enlarging its manufacturing facilities. Many of the departments are now booked six to eight months ahead. These plans include the erection of a new lamp factory at East Boston, Mass., and large expansion of the facilities at Pittsfield, Mass., where the number of employees will be increased in the next two years from 6000 to 11,000. Over \$1,000,000 will be expended upon new factory facilities this year at that place. The transformer business of the company is now so large that orders are being taken six months ahead of deliveries.

**Westinghouse, Church, Kerr & Company's Contracts.**—Among recent contracts awarded to Westinghouse, Church, Kerr & Company, 10 Bridge Street, New York, was one from the Central Railroad of New Jersey, Communipaw, N. J. This contract calls for the design and construction of a power house, 134 ft. by 92 ft., to contain equipment with a rated output of 1300 kw, steel water tanks and cooling towers, a machine shop 200 ft. by 80 ft., a storehouse 100 ft. by 60 ft., both of which are to be of brick, concrete and steel; a 90-ft., thirty-two-stall concrete roundhouse and a 100-ft., thirty-four-stall roundhouse, together with turntables, concrete coaling stations, a sand house and cinder pits. A contract placed with the same engineers by the Moore & Thompson Paper Company, Bellows Falls, Vt., calls for the installation of hydraulic equipment and a power-transmission system. For the Worcester (Mass.) Electric Light Company, Westinghouse, Church, Kerr & Company are to install a 4500-kw turbo-generator and two 700-hp boilers, together with the necessary auxiliaries.

**Manufacturing Concerns Increasing Their Electrical Equipment.**—Winslow & Company, of Portland, Me., have arranged to install additional equipment for electric drive in their brick plant. The new apparatus includes a 312-kva generator with a 15-kw exciter and switchboard, together with six motors ranging from 15 hp to 150 hp. All of the equipment has been ordered from the General Electric Company. The Edison Storage Battery Company, Orange, N. J., has placed an order with the same manufacturer for additional power-station equipment. This order includes two 500-kw rotary converters, two 200-kw, three-unit, four-bearing motor-generator sets, four 250-kva transformers and a quantity of switchboard apparatus. Another manufacturing concern which has made plans to place electric-drive equipment in operation is the Pittsburgh (Pa.) Screw & Bolt Company, which has ordered a 100-kw, two-unit three-bearing motor-generator set and sixteen motors ranging from 5 hp to 50 hp from the General Electric Company.

**City of Portland (Ore.) Sues for Share of Lighting Companies' Receipts.**—The city of Portland, Ore., is suing the Portland Railway, Light & Power Company and the Portland Gas & Coke Company for a 3 per cent tax on gross receipts and asserts that the first-named lighting company is selling electrical energy without having a franchise. This is the second time the city has sued the companies for a share of their gross receipts. The companies are opposing the suits on the ground that the city's charter gives it no authority to impose an occupation tax.

**Refinancing Plan for Northern Colorado Power Company.**—In order to care for securities maturing May 1, plans are being made for a reorganization of the Northern Colorado Power Company, Denver, Col. An issue of \$853,000 in notes falls due at that time, and although the company's earnings are fair, it will be necessary to arrange new financing to the amount of about \$1,000,000 to meet the notes. A committee is at work on a financing plan which is to be submitted to the stockholders at a meeting on April 24.

**Award Contract for Large Canadian Hydroelectric Development.**—Fraser, Brace & Company, contractors, 1328 Broadway, New York, have been awarded a contract to construct a three-million-dollar hydroelectric development for the Cedar Rapids Manufacturing & Power Company, Montreal, Que.

**Pacific Gas & Electric Directors and Officers Re-elected.**—All directors and officers of the Pacific Gas & Electric Company were re-elected at the annual meeting and an issue of \$8,000,000 6 per cent debentures was approved.



**Philadelphia Electric Made a Satisfactory Showing in 1912.**—The report of the Philadelphia Electric Company for the year ended Dec. 31, 1912, shows gross earnings of \$7,051,497, which represents an increase of \$556,740 over the receipts of the preceding year. Net income was \$1,666,189, an increase of \$257,458, and the surplus for the year was \$601,520, which is \$182,513 in excess of that for 1911. At the end of 1912 there were 45,127 consumers of electrical energy upon the books of the company, an increase of 6476 for the year. The total commercial connected load on Dec. 31, 1912, in 50-watt equivalents was 2,839,884, an increase of 359,981, as compared with that at the end of the year 1911. In addition to supplying the foregoing customers, the company is also turning large surplus of electrical energy to street railway companies. In the *Electrical World* for April, page 571, in an item discussing the plans of the Pennsylvania Railroad to electrify its main line from Philadelphia to Paoli, it was stated that the railroad company would buy energy locally, at least for the next few years. President McCall of the Philadelphia Electric Company said last week, in reply to a question as to the probability of his company supplying the necessary energy to the Pennsylvania Railroad: "I am inclined to think the prospects are rather bright." In his report to the stockholders he said in part: "The increase in the general business is gratifying, especially when we consider the reductions made in the downtown district and to the city by the Philadelphia company. The increased business in the territory in which the reduced rates are applicable has almost met the reductions in receipts, and we believe it will all be made up in a few months. We feel that the policy adopted in the past of voluntarily reducing rates and improving terms and conditions is a sound, practicable policy which should be continued whenever it is found possible. We made a reduction to the city in the price of street lighting for the year 1913 amounting to \$47,726 on the number of lamps erected Jan. 1, 1913. During the present year, our Philadelphia company will remove one old-type engine and generator, and will install new turbo-generators which will give additional generating capacity of 30,000 kw. Plans are now being prepared for the construction of a further addition to the Christian Street Station, to include turbo-generators aggregating 50,000 kw in rated output. This latter installation should be completed by the fall of 1914 and will enable your Philadelphia company at that time to meet any increased demands for general business or the requirements of other utility or railroad companies." All the retiring directors were re-elected at the annual meeting.

**Chicago Partnership Receipts from Street-Railway Operation.**—By the terms of the ordinance under which the Chicago street railway companies are operating, the city is entitled to 38 per cent of the "net divisible receipts." The amounts which have just been paid to the city, through this arrangement, for the year ended Jan. 31, 1913, were \$2,474,104 from the Chicago Railway Company and \$1,416,888 from the Chicago City Railway Company. The total receipts from this source were \$2,891,000 for the year mentioned, and for the six years these ordinances have been in operation the payments have amounted to \$16,000,000. The amount turned over by the Chicago Railway Company for the year 1912-1913 was 72 per cent more than for the preceding year, while the increase in the payment from the Chicago City Railway Company was 65 per cent. Under the law the city must use this money for street-railway purposes, such as creating a fund for purchasing the properties or building subways.

**Interstate Public Service Company Enlarges Its Holdings.**—The Interstate Public Service Company, of Indianapolis, which is the holding company for utility properties in Indiana, has purchased the electric lighting and street-railway systems of the Central Indiana Lighting Company, of Columbus, Ind., and is planning to acquire other properties in the same State. In accordance with plans for consolidating all of the Indiana properties controlled by it, the Interstate Public Service Company has increased its capital stock from \$3,000,000 to \$8,000,000.

**Combine Lighting Companies in the Pittsburgh District.**—The Duquesne Light Company, Pittsburgh, which is owned by the Philadelphia Company, of Pittsburgh, has taken over a number of lighting companies in Allegheny County, Pa.

The merger includes the Allegheny Company, the Fairbank City Light & Power Company, the Knoxville Electric Company, St. Clair Electric Company, Mount Oliver Electric Light Company, South Fork Company, Indian Township and Mount Lebanon Township Electric Light Companies.

**American Cities Company's Gains.**—The report of the American Cities Company, New Orleans, for the year ended Feb. 28, 1913, shows net profits of \$1,007,741. This represents an increase of \$174,108 over those in the preceding year. After payment of preferred dividends, there was a balance equal to 3.4 per cent on the common stock, as compared with 2.3 per cent on the same amount of stock in the preceding year. The income account shows a surplus on shares owned of \$1,212,444, an increase of \$122,000, and earnings after charges of \$1,508,321, and a balance after preferred dividends of \$552,633, an increase of \$174,108.

**Approve Reorganization Plan for Michigan Lake Superior Power Company.**—The reorganization committee for the Michigan Lake Superior Power Company, Sault Ste. Marie, Mich., has approved and adopted a plan for the incorporation of that company and has received orders on incorporation of deposit under the bondholders' agreement dated May 19, 1908, that transfers control of assets from the present stockholders with the day of the incorporation, May 12, 1913.

**Havana Company Increases Its Common Dividend Rate.**—The Havana Electric Railway Light & Power Company has declared a semi-annual dividend of seven cents on its common stock. This dividend is in excess of that paid in the preceding dividend. The regular semi-annual meeting of \$2 a share on the preferred stock has also been declared.

**Springfield (Ohio) Company to Issue Bonds.**—The Ohio Public Service Commission has authorized the Springfield (Ohio) Light, Heat & Power Company to issue \$100,000 general refunding bonds. The company must deposit its cash bond to the amount of \$100,000.

**Tennessee Utility Property Sold.**—The Tennessee Power Company, of Knoxville, Tenn., has been purchased by Henry L. Doherty & Company, 35 Wall Street, New York.

## Industrial Securities

NEW YORK METAL MARKET PRICES			
	Standard.	Electrolytic	Lead
Bar	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00

NEW YORK METAL MARKET PRICES			
	Standard.	Electrolytic	Lead
Bar	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00
Sheet	100.00	100.00	100.00
Cast	100.00	100.00	100.00
Wire	100.00	100.00	100.00
Tube	100.00	100.00	100.00



## Personal

**Dr. Albert C. Crehore** will sail from New York on April 26 to spend about two months in England.

**Mr. Fred B. Philbrick** is the new manager and contract agent of the New Market (N. H.) Electric Company.

**Mr. E. S. Jefferies** has been appointed electrical engineer of the Steel Company of Canada, Ltd., Hamilton, Ont.

**Mr. Alex. Speer** has recently been appointed general superintendent of the McCook (Neb.) Electric Company.

**Mr. E. Lowndes Rhett** has been elected second vice-president and a director of the Federal Utilities, Inc., New York.

**Mr. L. E. Best** has succeeded Mr. H. R. Holdeman as manager of the O'Neill Light & Power Company, O'Neill, Neb.

**Mr. George M. Mills** has been appointed district manager of the Goldfield plant of the Nevada California Power Company.

**Mr. Harry T. McDevitt** has been appointed treasurer and manager of the Ocean City Electric Light Company, Ocean City, N. J.

**Mr. H. H. Johnson** has succeeded Mr. B. C. Robinson as general manager of the municipal electric lighting plant at Clarkson, Neb.

**Mr. M. J. Howe** has succeeded Mr. E. V. Lombard as superintendent of the municipal electric-lighting plant at Lake City, Minn.

**Mr. G. G. Sawyer** has been appointed manager and Mr. E. N. Bonden superintendent of the new electric-lighting plant at Annandale, Minn.

**Mr. Jacob B. Walter**, after five years' superintendency of the municipal electric-light plant at Augusta, Ky., has retired from active business.

**Mr. Henry H. Berg** has recently been appointed to the new office of superintendent of the municipal lighting and water plant at Orange, N. J.

**Mr. W. H. Johnson**, first vice-president of the Philadelphia Electric Company, has been elected a member of the board of directors of that company.

**Mr. John T. Brady**, treasurer of the Denver Gas & Electric Light Company, Denver, Col., is confined to his room by a severe nervous breakdown due to overwork.

**Mr. A. G. Sangster**, formerly electrical superintendent at Saskatoon, Sask., has opened an office in that city as consulting engineer on electrical and hydraulic work.

**Mr. Paul Pracht** has succeeded Mr. W. A. Hill as manager of the municipal electric-lighting plant at South Stillwater, Minn., adding the duties of superintendent.

**Mr. R. J. Smith**, formerly with J. G. White & Company, Inc., New York City, has been appointed chief engineer of the Tri-City Railway & Light Company, Davenport, Ia.

**Mr. W. S. Dickerson** has assumed the management of the power development for the Big Falls Manufacturing Company, Big Falls, Minn., which is now under construction.

**Mr. David Riepe** is the new manager and superintendent of the municipal water and lighting plant at Higginsville, Mo., a position previously occupied by Mr. Frank Monser.

**Mr. Kenneth Myers** now combines the duties of secretary, treasurer and manager for the Gallup (N. M.) Electric Light Company, having succeeded Mr. George W. Burgess.

**Mr. William Marconi** has been presented with the Grand Cross of the Order of the Crown of Italy for his work in organizing the wireless system in the Italian-Turkish war.

**Mr. Howard L. Reichart** was on April 2 appointed assistant secretary of the Rochester Railway & Light Company, with headquarters in the Grand Central Terminal, New York City.

**Mr. Otto Snyder** has been appointed assistant superintendent of the Houghton County Electric Light Company of Houghton, Mich., and will assume charge of the Houghton division.

**Mr. John H. Smith** has resigned his position as commercial engineer of The Milwaukee (Wis.) Electric Railway & Light Company to engage in consulting engineering work in Milwaukee.

**Mr. T. C. O'Hearn**, city electrician of Cambridge, Mass., was presented with a gold badge on April 7 by friends in the local department, in recognition of his ten years' service at Cambridge.

**Mr. H. E. Sherman** has joined the San Francisco sales force of the Crocker-Wheeler Company, having recently resigned his position with the Great Western Power Company at Oakland.

**Mr. W. H. Tees** has resigned as chief electrician of the Canadian Consolidated Rubber Company, Montreal, Que., and is now assistant superintendent of the Sayer Electric Company of Montreal.

**Mr. Elmer Iverslin** has succeeded Mr. P. B. Renther as chief engineer of the municipal electric-lighting plant at Belgrade, Minn., and has in addition taken on the duties of manager and superintendent.

**Mr. H. H. Chilson** has become superintendent of the municipal electric-lighting plant at Buffalo, Minn., succeeding Mr. A. E. Anderson in that office. Mr. Anderson remains as engineer of the plant.

**Mr. W. A. Layman**, of the Wagner Electric Manufacturing Company, St. Louis, Mo., was elected president of the National Metal Trades Association at its fifteenth annual convention held in New York, April 9.

**Mr. C. E. McFarland**, formerly vice-president and general manager of the Nebraska Telephone Company, has become associated with the Pacific Telephone & Telegraph Company, succeeding Mr. C. C. Bradley, resigned.

**Mr. Carl A. Lohr**, electrical engineer of the New York office of the Siemens-Halske A. G. and Siemens-Schuckertwerke G. m. b. H., has been transferred to the patent department of the company in Berlin, Germany.

**Mr. M. J. Shugrue**, recently appointed assistant engineer of the engineering department of the Edison Electric Illuminating Company of Brooklyn, was formerly chief engineering draftsman for the company. His successor in this position will be Mr. E. B. Rannels.

**Mr. Herbert C. Porter**, for two years commercial agent for the Montgomery (Ala.) Light & Water Power Company, was the guest at a farewell dinner tendered by Montgomery friends upon his removal to St. Joseph, Mo., to take up new work with the Doherty interests.

**Mr. Oscar Sorenson** is superintendent of the Citizens' Light, Heat & Power Company, of Canby, Minn. Through an error Mr. Sorenson's location was recently given in this column as Cass Lake, Minn. For the company at that place Mr. Heber L. Hartley is secretary, treasurer and manager.

**Mr. William Kruse** has been appointed general manager of the Northumberland County Gas, Light & Power Company, of Sunbury, Pa., whose system serves seven cities and towns in the Susquehanna River Valley. Mr. Kruse was formerly superintendent of Public Works at Vineland, N. J.

**Mr. R. W. Hemphill, Jr.**, manager of the Washtenaw division of the Eastern Michigan Edison Company, which serves Ann Arbor, Ypsilanti and other nearby towns, is a candidate for member of the Michigan Board of Agriculture. Mr. Hemphill is a past-president of the Michigan Section of the National Electric Light Association.

**Mr. William E. Hodge** has been appointed deputy superintendent of street lighting, Springfield, Mass. Mr. Hodge is a graduate of the Massachusetts Institute of Technology and has worked for the Westinghouse Electric & Manufacturing Company, the Boston Elevated Railway Company and the New England Telegraph & Telephone Company.

**Mr. M. H. Bennett**, chairman of the Brooklyn Company Section of the N. E. L. A., and assistant superintendent of the meter department of the Edison Electric Illuminating Company of Brooklyn, has severed his connection with the latter company and accepted the position of research engineer of the Scovill Manufacturing Company, Waterbury, Conn.

**Mr. F. W. Humphreys** has resigned as general manager of the Pontiac Power Company, of Pontiac, Mich., after having been in charge of these local plants for the past fourteen months. He leaves to do consulting work for various corporations in Eastern Michigan, and, although

continuing to reside in Pontiac, will open an office in Detroit.

**Mr. Charles L. Clarke**, who was one of Edison's earliest associates in the introduction of the direct-current system and who has been more recently connected with the legal bureau in New York, has been appointed consulting engineer to the General Electric Company as associate with Dr. Steinmetz. Mr. Clarke will make his headquarters at Schenectady.

**Mr. J. A. Patten**, who has been appointed engineer for the La Crosse (Wis.) Gas & Electric Company, was formerly engineer and manager for the Winona (Minn.) Gas Light & Coke Company. He has also been stationed at Saginaw, Mich., Manitowoc, Wis., Holland, Mich., and Salt Lake City, Utah. The La Crosse company is planning to rebuild both its electric and gas plants.

**Prof. Henry H. Norris**, of the department of electrical engineering, Cornell University, and secretary of the Society for the Promotion of Engineering Education, is devoting a leave of absence to a special investigation of engineering books in all fields for the McGraw-Hill Book Company, New York. His work will cover both college text books and general technical reference books.

**Mr. Frank G. Bolles**, at one time commercial engineer of the Allis-Chalmers Company and later with the Reliance Engineering & Equipment Company, has been appointed by the Department of Commerce as commercial agent to investigate trade conditions abroad. Mr. Bolles, who was at one time secretary of the Manufacturers' Association of Racine, Wis., has made a special study of trade conditions and has made other trips abroad upon similar missions. Mr. Bolles will probably be absent in Europe for a number of months.

**Mr. E. H. McHenry** has resigned as vice-president of the New York, New Haven & Hartford Railroad and as vice-president of the Connecticut Company and other affiliated companies. He has had charge of engineering, maintenance and construction work of the New York, New Haven & Hartford Railroad, including the original electrification work between New York and Stamford and the extension of the electric zone from Stamford to New Haven, which work is now under way. Mr. McHenry's resignation takes effect on May 1.

**Mr. Frederic W. Hild**, general manager of the Portland (Ore.) Railway, Light & Power Company, has been elected president of the Pacific Coast Electric Railway Association, which was organized at San Francisco, Cal., April 1, 1913. Mr. Hild, who was educated at Union College, Schenectady, was for a time connected with the General Electric Company and was afterward assistant general manager and chief engineer of the Havana (Cuba) Electric Railway. While with the General Electric Company Mr. Hild assisted in the rehabilitation work carried out by the Twin City Rapid Transit Company, the Kansas City Railway & Light Company and the Chicago Edison Company.

**Mr. E. C. Deal**, general manager of the Augusta-Aiken Railway & Electric Company, Augusta, Ga., has been elected a vice-president of the company. Mr. Deal, who is a native of Atlanta, obtained his early experience in the utility field with the Georgia Electric Light Company, now the Georgia Railway & Power Company. He subsequently became connected with properties in Baltimore, Seattle, Brockton and Terre Haute, and previous to becoming connected with the Augusta-Aiken Railway & Electric Company was manager of the North Carolina Public Service Company at Greensboro, N. C. For a time Mr. Deal was also chief engineer of the Gas & Electric Company of Bergen County, N. J.

**Mr. E. D. Alexander** has been appointed assistant to the president of the Illinois Northern Utilities Company, with headquarters in Dixon, Ill. Mr. Alexander will have charge of the actual operation of the company, which controls a large number of electrical utilities in northwestern Illinois. He is an experienced and capable electric service manager, and for a number of years was vice-president and manager of the old Englewood Electric Light Company, of Chicago. Mr. Alexander subsequently became connected with the Insull group of electrical utilities, having for some time served with the North Shore Electric Company, and also with the Illinois Northern Utilities Company, of which he is now put in active charge.

## Obituary

**Rogers V. Scudder**, vice-president and general manager of the Wesco Supply Company of St. Louis, and for a number of years well known in business circles in that city, committed suicide at his residence home in St. Louis on April 12, 1913, as a result of that business worries caused a mental breakdown, which could be linked up with the explanation of the impulse that led the unfortunate man to take his own life.



ROGERS V. SCUDDER

Mr. Scudder was fifty-four years old. He began a wife and two children. He was a member on the Illinois Engineering Society, the Iowa Chapter of the St. Louis League of Electrical Engineers, and other electrical societies.

He also belonged to the St. Louis Club and was one of the directors of the Society for Mental Development.

**Francis B. Badt**, who died on April 12 after a protracted illness, was one of the prominent figures in electrical engineering and business circles in Chicago, although his activities had been curtailed of late by impaired health. He was born in St. Petersburg, Russia, Oct. 4, 1859. He spent a large portion of his early life in Germany, however, and was graduated from the Royal gymnasium of Prussia. He joined the artillery corps of the Prussian army in 1882 and two years later was graduated from the Government Military Academy. He served through the Franco-Prussian war and at its conclusion attended the school for officers of artillery and engineers. Graduating from the Imperial Technical High School in 1885, he was commissioned lieutenant of artillery in the German army, serving under the Minister of War and being posted to the United States in 1887. For services during the Franco-Prussian war he received the decoration of the Iron Cross, at which he was justly proud, and also the command medal of the German army. From 1887 to 1888 Lieutenant Badt was superintendent of the construction department of the United States Electric Light Company of New York. In the year last mentioned he moved to Chicago and became connected with the Western Electric Company. The following year he was made district engineer in Chicago in the United Edison Manufacturing Company. In 1891 he went with the Thomson-Houston Electric Company and was made manager of the power and lighting department of the Chicago office. This position later led to the Thomson-Houston Company was merged into the General Electric Company in 1892. From 1892 to 1898 Mr. Badt was general manager of the Siemens & Halske Electric Company of America. He then organized the firm of F. B. Badt & Company, which was organized about two years later in the Halcyon Western Electric Company, in which the business was president. His connection with the Western Electric Company was severed when the Western Electric and Halcyon Companies merged with the General Electric Company. Mr. Badt was a man of ability and force and had an extensive and successful career. He was a member of the American Institute of Electrical Engineers, the Western Society of Engineers and the Technical Club of Chicago, as well as the Young Men's Club of Chicago and the Mutual Aid Society of Chicago. In former years he did considerable writing for the technical press and was the author of several booklets.



FRANCIS B. BADT



## Construction

### New England

**GONIC, N. H.**—The Gonic Mfg. Co. will soon begin work on the construction of a 1000-ft. canal in connection with the installation of a power house in Gonic.

**SALEM, N. H.**—A bill has been introduced to the State Legislature asking permission to incorporate a company to be known as the Salem El. Lt. Co. for the purpose of generating and distributing electricity for lamps, heaters and motors in the towns of Salem, Hampstead, Island Pond, Windham and Atkinson, and if necessary to erect transmission lines across the town of Derry for the purpose of supplying electricity to said towns. The incorporators are: Frank P. Woodbury, Ernest R. Woodbury and Fred C. Buxton, of Salem.

**WARREN, N. H.**—The Warren Wtr. & Lt. Co. is contemplating extending its electric-lighting service to Wentworth, provided that sufficient patronage can be secured. Edgar S. Carbee is treasurer and manager.

**BENNINGTON, VT.**—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for installing electric conduits, wiring and interior lighting fixtures for the United States post office building at Bennington, Vt., in accordance with plans and specifications, which may be obtained from the above office or from custodian of site. O. Wenderoth is supervising architect.

**AGAWAM, MASS.**—The Amherst Pwr. Co. has purchased the property of the Agawam El. Co. from the Northern Connecticut Lt. & Pwr. Co. The Amherst proposes to build a large substation here as soon as the transmission lines to Feeding Hills, now under construction, are completed. The initial installation of the substation will provide for 5000 kw, with provisions to increase it to 20,000 kw. George W. Lawrence is general manager and F. L. Hunt chief engineer, both of Greenfield.

**CONCORD, MASS.**—At the annual town meeting held April 7 it was voted to issue bonds not to exceed \$15,000 to purchase and install a new 500-kva turbo-generator and condenser in the municipal electric-light plant. The turbo-generator will replace the following engine unit, which will be sold: one 125-hp, 9-in. by 17-in. by 12-in. tandem compound piston-valve Harrisburg engine directly connected to a 75-ku, 2200-volt, 60-cycle, two-phase, 300 r.p.m. Westinghouse revolving-armature generator. The engine is fitted with a speed-changing device for synchronizing the generator and adjusting the load. For further information address A. W. Lee, of Concord, manager.

**LENOX, MASS.**—At a town meeting held recently the citizens voted to abolish the present oil lamps and to contract with the Lenox El. Co. to install electric lamps on the main thoroughfares. The contract is for a period of 20 years and provides for 75 lamps of 32 cp, at \$35 each per year. The lamps will be maintained by underground wires.

**MIDDLEBORO, MASS.**—At a recent town meeting it was voted not to sell the municipal electric-light plant and to discharge the committee appointed to negotiate with the Edison El. Co. of Brockton in reference to purchasing the municipal plant.

**SPRINGFIELD, MASS.**—Plans are being considered by the city for the installation of an electric-light plant to furnish electricity for lighting the group of municipal buildings recently completed.

**SPRINGFIELD, MASS.**—The Amherst Pwr. Co. has applied to the State Harbor and Land Commission for permission to erect wires across the Connecticut River from West Springfield to Springfield. The plans filed with the commissioners provide for the erection of a 66,000-volt transmission line across the Agawam meadows directly across the river to the State Street station of the United El. Lt. Co. E. L. Clark is local representative of the company.

**TURNERS FALLS, MASS.**—The prudential committee of the Turners Falls fire district is contemplating substituting smaller lamps for the street arc lamps now in use. The five-year contract with the Franklin El. Lt. Co. for lighting the streets will soon expire.

**WALES, MASS.**—The town of Wales has voted to light the streets with electricity and has appropriated \$500 for that purpose.

**WORCESTER, MASS.**—Sealed bids will be received by the trustees of the Worcester State Asylum until May 5 for the construction of a number of buildings at the Grafton Colony. The general construction, plumbing, heating and electric wiring will be considered as separate contracts. Plans and specifications may be seen at the office of the Fuller & Delano Co., architects, 44 Front Street, Worcester.

### Middle Atlantic

**BREWERTON, N. Y.**—Fred J. Auburn, owner of the Cicero electric plant, has applied to the Public Service Commission, Second District, for permission to extend his transmission lines from Cicero to Brewerton, a distance of 2 miles, to supply electricity for street-lighting and commercial purposes.

**BROOKLYN, N. Y.**—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of 14th Avenue and Fifty-ninth Street, New York, N. Y., until April 28, for installing electrical equipment in new Public School 99, located on East Ninth

and East Tenth Streets, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent and also at the branch office, 131 Livingston Street, borough of Brooklyn.

**BUFFALO, N. Y.**—Bids will be received until April 30 by the State Hospital Commission, Capitol, Albany, for construction of tuberculosis pavilion, including heating, plumbing and electric work; addition to bakery, construction and plumbing work; remodeling cold-storage building, construction and electric work, at the Buffalo State Hospital, Buffalo, N. Y. Plans and specifications may be seen and blank forms of proposals obtained at the Buffalo State Hospital, Buffalo, and at the office of Charles A. Sussdorff, state architect, Capitol, Albany. T. E. McGarr is secretary of commission.

**CORNING, N. Y.**—The Corning Lt. & Pwr. Co., recently incorporated with a capital stock of \$500,000, will take over the property of the Corning Gas & El. Co. The reorganized company will erect a large power plant this summer of sufficient output to meet the growing demands in both Corning and Painted Post. The present power plant is leased from the Corning & Painted Post St. Ry. Co.

**HUDSON, N. Y.**—A new street-lighting system will be installed in Hudson to be ready for use on Sept. 12. The plans call for 850 new lamps of about 60 cp. About 115 ornamental standards will be erected on Seventh Street; each standard will carry two lamps; 15 standards, carrying three lamps each, will be erected in Franklin Park, Promenade Hill and Public Square. The remainder of the lamps will be erected on the present poles. The Albany Southern R. R. Co. furnishes the street lighting service.

**MALONE, N. Y.**—Preparations are being made for the construction of a hydroelectric power development at Chasm Falls during the coming summer. The work will include the construction of concrete dam, power house and penstock, which will be 3000 ft. long and 7 ft. in diameter. The plant when completed will furnish electricity for operating the mills of the Malone Paper Co. C. E. Eaton, of Watertown, will have charge of the engineering work. M. S. Wilder, of Watertown, and B. R. Clark, are principal owners and promoters of the project.

**NEW YORK, N. Y.**—The Bronx Gas & El. Co. has applied to the Public Service Commission for permission to issue \$200,000 in bonds, the proceeds to be used for the acquisition of property and improvements to its plant.

**ROCHESTER, N. Y.**—The lamps and electricity committee of the Common Council has passed favorably upon ordinances for installing inverted magnetite-arc lamps on Elm Street from Chestnut to Main Street, Clinton Avenue south from Main to Monroe Street, and South Avenue from Main to Court Street. Petitions have been received from several streets for Mazda lamps.

**SYRACUSE, N. Y.**—The Common Council has approved the proposition to issue \$65,000 in bonds for the completion of the fire-alarm system.

**SYRACUSE, N. Y.**—The Public Service Commission has authorized the Syracuse Ltg. Co. to issue \$239,000 in bonds, the proceeds to be used for extensions and improvements to its plant in Syracuse.

**SYRACUSE, N. Y.**—Bids will be received at the office of the Board of Contract and Supply of the city of Syracuse until April 28 for furnishing materials and constructing the addition to the Bellevue Heights School, including wiring, plumbing, heating and ventilating, in accordance with plans and specifications on file in the office of Board of Control. Bids will also be received until May 5 for furnishing material and construction of the new Genesee School Building, including wiring, plumbing, heating and ventilating, in accordance with plans and specifications on file in the office of the Board of Contract and Supply. John J. Halloran is secretary pro tem.

**ALTOONA, PA.**—Preparations are being made by the Penn Central Lt. & Pwr. Co., of Altoona, for the construction of a new steam-driven power plant. The initial installation will provide for 2100 kw. The site of the plant has not yet been decided upon, but it will be located in the heart of the coal district. The company is also extending its transmission lines through all parts of northern Cambria County. E. B. Greene is general manager.

**DAUPHIN, PA.**—The Harrisburg Lt. & Pwr. Co. has applied to the Borough Council for a franchise to erect transmission lines throughout the entire municipality to supply electricity for lamps and motors.

**HAUTO, PA.**—The power plant of the Lehigh Coal & Navigation Co., at Hauto, is nearing completion. The plant will supply electricity within a radius of 30 miles of Hauto. The initial installation will provide for 30,000 kw, which will be increased to 110,000 kw.

**LATROBE, PA.**—The Latrobe Steel Co., recently incorporated, will build a plant near the works of the Vanadium Alloys Steel Co. for the manufacture of manganese steel casting by the electric process. The company will install five 10-ton furnaces and will secure energy from the West Penn Trac. Co. Complete foundry equipment will be purchased and a large steel hammer will be installed. Marcus Saxman, of the Latrobe-Connersville Coal Co., is president of the company.

**NEW CASTLE, PA.**—At a special election to be held June 3 the proposition to issue \$200,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

**PHILADELPHIA, PA.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 5, for a freight elevator in the United States post office and court house in Philadelphia, Pa., in accordance with specifications, copies of which may be had at the above office or at the office of the custodian. O. Wenderoth is supervising architect.





ounced that it expects the business men and property owners to take up the question of ornamental lighting, as it wishes to change the entire street-lighting system of this shore.

**JACKSONVILLE, ILL.**—The County Commissioners are reported to be considering the question of issuing bonds to the amount of \$50,000 for the installation of a lighting plant.

**KENNEY, ILL.**—Application has been made to the Village Board by West & Veal, of Mount Pulaski, for a franchise to furnish electricity for lamps and motors in Kenney. If granted a franchise, a transmission line will be erected from the plant at Mount Pulaski to Kenney.

**MOLINE, ILL.**—The People's Pwr. Co. has increased its capital stock from \$2,000,000 to \$4,000,000.

**MONMOUTH, ILL.**—Walsh Brothers, who operate the Rock Island Southern R. R. Co. running between Rock Island and Galesburg, have applied to the City Council for a franchise to furnish electricity for lamps and motors in Monmouth for a period of 30 years.

**MOUNT PULASKI, ILL.**—The Mount Pulaski El. Lt. & Pwr. Co. will enlarge its power plant to provide for a day service for lamps and motors. New equipment will be installed, including one 100-hp boiler, one Bates Corliss engine, two belted generators, switchboard and new transformers. The generators, switchboard and transformers have not yet been purchased. The company will also purchase wire and poles for 20 miles of pole line and 75 meters. Two substations will also be erected. West & Veal are owners.

**PEORIA, ILL.**—The City Council is considering an ordinance extending the underground conduit system on South Adams Street from Oak Street to Cedar Street, also one block on Lincoln Street.

**ROCK ISLAND, ILL.**—Commissioner Reynolds contemplates making a change in the lamps for lighting the alleys. At present arc lamps are used.

**SPRINGFIELD, ILL.**—Sealed proposals will be received by John S. Shnepp, Mayor, until April 28 for improvement to the municipal electric-light plant, according to specifications now on file in the office of Willis J. Spaulding, commissioner of public property, and in the office of Arthur M. Morgan, Harris Trust Building, Chicago, Ill., consulting engineer, where copies of specifications may be obtained.

**DEER PARK, WIS.**—The village of Deer Park is contemplating the installation of an electric-light plant.

**DELAVER, WIS.**—The City Council, it is reported, has decided to install 25 ornamental street lamps.

**MADISON, WIS.**—The State Street Improvement Association is considering the installation of ornamental lamps on State Street. F. W. Huels is secretary.

**MADISON, WIS.**—Bids will be received by the secretary of the special building committee of the State Historical Society of Wisconsin, Madison, Wis., until April 28, for furnishing one electric elevator for the northwest wing of the State Historical Library Building in Madison. Plans and specifications may be obtained upon application to secretary.

**MILWAUKEE, WIS.**—The Milwaukee El. Lt. & Ry. Co. has submitted propositions to Fort Atkinson, Johnson Creek and Jefferson to furnish electricity in those towns from its power plant at Kilbourn, via Watertown.

**CROSBY, MINN.**—Plans are being considered for the installation of an ornamental street-lighting system in Crosby. It is proposed to install from 30 to 40 ornamental lamp standards, carrying five-lamp clusters. For further information address the secretary of the Commercial Club.

**EAST GRAND FORKS, MINN.**—The contract for construction of building for substation has been awarded to Kennedy & McCoy, of Fargo, N. D. The station when completed will be equipped with switchboard, etc., for distribution of electricity generated by the municipal electric plant.

**MINNEAPOLIS, MINN.**—A new company has been organized under the name of the Northern Mississippi River Pwr. Co. to construct and operate a hydroelectric power plant at Coon Rapids, on the Mississippi River, near Minneapolis. The plant, when completed, will develop 15,000 hp, and it will be leased to the Minneapolis General Electric Co. for a term of 48 years. The company is a subsidiary of the Northern States Pwr. Co., of Chicago, Ill.

**OWATONNA, MINN.**—Preparations are being made for the installation of an ornamental street-lighting system, for which \$10,000 in bonds have been issued.

**ST. CLOUD, MINN.**—The Public Ser. Co. is making arrangements to install luminous arc lamps in the business section of the city; also to rearrange other street lamps throughout the city. New equipment will be installed in the power plant to maintain the new arc lamps.

**ST. PAUL, MINN.**—Plans are being considered by the Seven Corners Commercial and the West End Clubs for the installation of an ornamental street-lighting system on Seventh Street from Wabash Street to Tuscarora Street. The plans provide for 250 lamp standards, to cost about \$34,000, to be paid by the property owners. The cost of maintenance is estimated at about \$18,000.

**CARSON, IA.**—The local electric light plant, recently destroyed by fire, will be rebuilt. Either a temporary plant will be installed or a transmission line erected from the plant at Glenwood to furnish electrical service in Carson until the new plant is completed. Joseph A. Bortenlanger, of Glenwood, is manager.

**CHARLOTTE, IA.**—The installation of an electric-lighting system in Charlotte is under consideration.

**FONTANELLE, IA.**—At an election held April 9 the proposition to issue \$10,000 for the installation of a municipal electric-light plant and \$12,000 for a water-works system was carried. H. J. Stuhlmiller is town clerk.

**FORT DODGE, IA.**—The Northern Pwr. Co. contemplates rebuilding its dam at Fort Dodge this summer and erecting a transmission line west through Barnum, Manson, Pomeroy, Fonda and Newell.

**FORT MADISON, IA.**—The Stone & Webster Corp., of Boston, Mass., has purchased the property of the Fort Madison El. Lt. Co. Announcement has been made that extensive improvements will be made to the system, involving an expenditure of many thousand dollars. The output of the plant will be increased and the transmission lines rebuilt throughout the city. J. A. Trawick is representative of the company.

**LE CLAIRE, IA.**—At an election held recently the proposition to grant the Iowa & Illinois R. R. Co. a 25-year franchise to furnish electricity for lamps and motors in Le Claire was carried. The company will also be given a contract to light the streets of the town.

**MCCALLSBURG, IA.**—The Iowa River Lt. & Pwr. Co., of Eldora, has applied for a franchise to supply electricity in McCallsburg.

**MEDIAPOLIS, IA.**—The City Council has decided to call a special election to submit the proposition to grant L. R. Sherrill, of Burlington, a franchise to furnish electricity for lamps and motors in Mediapolis. It is proposed to secure electricity from the power plant of the Mississippi River Pwr. Co., at Keokuk, Ia.

**OSSIAN, IA.**—We are informed that the town of Ossian does not contemplate the installation of an electric-light plant. Charles Green is town clerk.

**BROOKFIELD, MO.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 24, for the construction of the United States post office at Brookfield, Mo., including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches. Drawings and specifications may be obtained from the above office or from the custodian of site at Brookfield. O. Wenderoth is supervising architect.

**EDITH, MO.**—Surveys have been made for the construction of a hydro-electric power plant near Edith, to develop about 70,000 hp. The plans provide for the construction of dams 60 ft., 100 ft. and 120 ft. high, forming four lakes containing an area of from 300 to 400 miles. The cost of the two principal dams is estimated at \$1,500,000. C. R. Robertson and Walter Gray, of Springfield, Mo., are interested in the project.

**MAYVILLE, N. D.**—Plans and specifications for the proposed municipal electric-light plant for Mayville will be out about April 28. The plans were prepared by the Oscar Clausen Engineering Co., consulting engineer, National German American Bank Building, St. Paul, Minn.

**REYNOLDS, N. D.**—At an election held recently the proposition to install a municipal electric-light plant was carried.

**HURON, S. D.**—The Huron Lt. & Pwr. Co. is contemplating improvements to its plant this year.

**SIOUX FALLS, S. D.**—The Bennett Engineering Co., of Sioux Falls, is installing an electric-light plant here. The equipment will consist of two 150-hp gas engines and producers and two 100-kw alternating-current generators, directly connected, with full switchboard equipment. Equipment for plant has already been purchased. A 24-hour service will be established. L. I. Bennett is interested in the company.

**BENKELMAN, NEB.**—At an election held recently the proposition to issue \$5,000 in bonds for an electric-light plant and \$20,000 for a water-works system was carried.

**OHIOVA, NEB.**—The electric plant which is being installed in the new Lapsheka Building will supply electricity for lighting a number of other buildings as well.

## Southern States

**ELIZABETH CITY, N. C.**—The proposition to issue \$200,000 bonds for the installation of a municipal electric-light plant and water-works system will be submitted to the voters.

**WASHINGTON, N. C.**—At an election to be held May 5 the proposition to issue \$20,000 in bonds, the proceeds to be used for extensions to the municipal electric-light plant, will be submitted to a vote.

**FLORENCE, S. C.**—The Florence El. & Utility Co. is erecting a transmission line from Florence to Darlington and will furnish electricity for lamps and motors to residences and industrial plants along the route.

**ABBEVILLE, GA.**—At an election held April 8 the proposition to issue \$8,000 for the construction of a municipal electric-light plant was carried. The town has been without electrical service since the electric plant was burned about six months ago.

**AUGUSTA, GA.**—Work has begun on the addition to the power plant of the Augusta-Aiken Ry. & El. Co. This addition will provide space for the equipment to be used for distributing energy transmitted from the plant at Stevens Creek on the Savannah River. The cost of the building is estimated at \$20,000 and the equipment at \$80,000.



**COVINGTON, GA.**—The Georgia Ry. & Pwr. Co., of Atlanta, has applied to City Council for a franchise to erect its high-tension transmission lines through Covington, and also has submitted a proposition to supply the city with electricity for lamps in Covington.

**NEWMAN, GA.**—The Columbus Pwr. Co. is negotiating with the city of Newman to furnish electricity to operate the municipal electric light plant here.

**QUITMAN, GA.**—Plans are being considered for making improvements to the municipal electric-light plant. The city may secure electricity from the plant at Valdosta.

**DAVENPORT, FLA.**—Preparations are being made by the Davenport Lt. & Ice Co. for the installation of an electric-light plant in connection with its ice factory and bottling works. It is understood that arrangements have practically been made for machinery for the proposed plant. C. F. Farmer and others are interested.

**GAINESVILLE, FLA.**—An ornamental lighting system will be installed on 13 blocks in the business district in connection with the new lighting plant. Ornamental lamp standards carrying five-lamp clusters will be erected.

**TAMPA, FLA.**—Arrangements are being made for the installation of an ornamental street-lighting system in Tampa.

**CHATTANOOGA, TENN.**—The merchants have "signed up" for the installation of an ornamental street-lighting system covering about 150 miles.

**KENTON, TENN.**—At an election held recently the proposition to issue bonds for the installation of a municipal electric-light plant and water-works was carried.

**ROGERSVILLE, TENN.**—The Hydro Electric Pwr. Co., of Rogersville, is building a hydro-electric light plant at Big Creek, 4 miles east of Rogersville. The equipment of the plant will include two water-wheels, one governor, one alternating-current, three-phase, 60-cycle generator with standard switchboard equipment. About 4 miles of overhead lines will be erected and 5000 ft. of underground distribution system will be installed. Transformers, meters and lamps have not yet been purchased. Vance G. Hale, of Rogersville, is engineer in charge.

**ROANOKE, ALA.**—The proposition to issue \$20,000 in bonds, the proceeds to be used for extensions and improvements to the municipal electric-light plant will be submitted to the voters.

**ATKINS, ARK.**—Arrangements are being made to organize a company here to install an electric light plant and a cotton gin. W. H. Jones and others are interested in the project.

**MAGAZINE, ARK.**—Steps have been taken to organize a company to develop the water-power of the Petit Jean River to furnish electricity for lamps and motors in Magazine and other towns. Dr. H. Dacus is interested in the project.

**ABBENVILLE, LA.**—The City Council has granted the Louisiana Trac. & Pwr. Co. and the Southwestern Trac. & Pwr. Co. franchises to construct and operate electric railways over several streets in Abbeville.

**ESTHERWOOD, LA.**—The City Council has decided to install a municipal electric-light plant as soon as possible.

**RAYVILLE, LA.**—The city of Rayville, it is reported, is asking for bids for a franchise for installation of an electric-light plant and water-works system. For further information address C. A. Smith, secretary of Progressive League.

**LEHIGH, OKLA.**—The City Council has called an election to be held on April 22, to vote on the proposition to sell the municipal electric-light plant to A. Handgrave, for a consideration of \$185,000. Mr. Handgrave, it is stated, represents Chicago capitalists, and has purchased the electric plants in Atoka and Coalgate.

**MCLOUD, OKLA.**—Bonds to the amount of \$8,000 have been voted for the installation of an electric-light plant in Mcloud.

**WANFETTE, OKLA.**—At an election held recently the proposition to issue \$8,000 in bonds for establishing a municipal electric-light plant was defeated.

**BAY CITY, TEX.**—Preparations are being made by the James W. Rueggie Gin Co. of Bay City, for the installation of an electrically operated gin.

**DALLAS, TEX.**—Bonds to the amount of \$100,000 have been voted for the installation of a municipal electric-light plant. J. M. Preston is city engineer.

**MISSION, TEX.**—The Mission Ice, Wtr. & Lt. Co., recently organized, contemplates the construction of an electric plant for laundry and water-works system. The ice plant will have a daily capacity of 10 tons. The Robert M. McCandlish Engineering Co. of Kansas City, Mo., has prepared plans and will supervise construction.

Consolidated Electric and Ice Co. of Chicago, Ill., has been selected by the Board of Directors of the City of Mission to construct and operate the plant.

**SEATTLE, WASH.**—The city of Seattle has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system. The city has also voted to issue bonds for the construction of a municipal sewerage system.

**SEATTLE, WASH.**—The city of Seattle has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system. The city has also voted to issue bonds for the construction of a municipal sewerage system.

**TACOMA, WASH.**—The city of Tacoma has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

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**ASHLAND, OR.**—The city of Ashland has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**HOOD RIVER, OR.**—The city of Hood River has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**MERLIN, OR.**—The city of Merlin has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**ONTARIO, OR.**—The city of Ontario has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**REDMOND, OR.**—The city of Redmond has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**LEWIS, OR.**—The city of Lewis has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**BANNING, CAL.**—The city of Banning has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**TEHACHA, CAL.**—The city of Tehacha has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**LAKEPORT, CAL.**—The city of Lakeport has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**LODI, CAL.**—The city of Lodi has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**LOS ANGELES, CAL.**—The city of Los Angeles has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**LOS ANGELES, CAL.**—The city of Los Angeles has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**MONTICELLO, CAL.**—The city of Monticello has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**ONAHVALLE, CAL.**—The city of Onahvalle has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**PLEASANT, CAL.**—The city of Pleasant has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**SARASOTA, FLA.**—The city of Sarasota has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

## Pacific States

**EPURATA, WASH.**—The city of Ephrata has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.

**RIVERSIDE, WASH.**—The city of Riverside has voted to issue bonds for the construction of a municipal electric-light plant. The city has also voted to issue bonds for the construction of a municipal water-works system.



**SAN FRANCISCO, CAL.**—The Pitt River Pwr. Co. has applied to the State Railroad Commission for a certificate of public convenience and necessity to supply power in the northeast portion of Shasta County and in Modoc and Lassen Counties.

**SAN FRANCISCO, CAL.**—An agreement has been made between Messrs. Thurston and Wright, of San Francisco, owners of a large tract of land near Sheridan, in Placer County, and the Pacific Gas & El. Co., giving the latter the right to 10 acres of land on which to erect a substation. The station will be erected on the line running from Dutch Flat in this county through Placer, Nevada and Sutter Counties to Vernon, at the junction of the Sacramento and Feather Rivers. The substation will distribute electricity in the western part of Placer County.

**SISSON, CAL.**—George H. Johnson, owner of the local electric-light plant, has applied to the State Railroad Commission for permission to sell his electric-light plant to the California-Oregon Pwr. Co., of Medford, Ore.

**TULARE, CAL.**—The State Railroad Commission has granted the Big Four El. Ry. Co. permission to issue \$400,000 in capital stock, the proceeds to be used for the construction of an electric railway from Tulare to Porterville and from Tulare to Visalia.

**SODA SPRINGS, IDAHO.**—The Utah Pwr. & Lt. Co., of Salt Lake City, Utah, has applied for a franchise in Soda Springs.

**OGDEN, UTAH.**—Bids will be received at the office of the chief clerk, Department of Agriculture, Washington, D. C., until May 2, for furnishing stationery and office supplies, instruments, field equipment, furniture and telephone supplies to the Forest Supply Depot at Ogden, Utah, during the fiscal year beginning July 1, 1913. Proposals, blanks with full instructions and information may be secured upon application to the chief clerk. B. T. Galloway is acting Secretary of Agriculture.

**HELENA, MONT.**—The Mountain States Tel. & Teleg. Co. will make improvements to its system at a cost of about \$140,000. The wires will be placed underground in the business section and portions of the residence district, involving an expenditure of about \$40,000. E. M. Burgess, of Denver, Col., is vice-president and general manager.

**DENVER, COL.**—The Colorado Pwr. Co., recently incorporated with a capital stock of \$20,000,000, will take over the properties of the Central Colorado Pwr. Co. under the reorganization plan. The new company will take over the plants and transmission lines of the Central Colorado Pwr. Co., the Leadville Lt. & Pwr. Co., which was controlled by the Central company, and the Salida Lt. & Pwr. Co., recently purchased by interests identified with the reorganization committee. An extensive plan of development, including the purchase of other plants in the State, it is understood, will follow. The incorporators are: F. Gerhard, C. D. Robbins, L. B. Lord, Irving W. Day, Ernest B. Tracy, R. E. Coulson, Charles V. Graham, William M. Everts, George Foley, Ross A. Madsey and Harry M. Deming.

**DURANGO, COL.**—The properties of the San Juan Wtr. & Pwr. Co., the Durango Gas & El. Co., of Durango, and the Telluride El. Lt. Co., of Telluride, have been taken over by the Western Colorado Pwr. Co., which is allied with the Utah Pwr. & Lt. Co., of Salt Lake City, Utah. The new company will have its headquarters in this State and will have charge of the plants of the Utah company in Colorado. General Bulkeley Wells will continue as president of the company and J. A. Clay, manager of the San Juan and Durango companies, will be general manager.

**ROCKY FORD, COL.**—The Arkansas Valley Ry., Lt. & Pwr. Co. will erect a transmission line from Rocky Ford to Ordway, a distance of 11 miles. A new substation will be built in Ordway. The cost of the lines is estimated at \$10,000. W. F. Raber, of Pueblo, is general manager.

## Canada

**WINNIPEG, MAN.**—The City Council has passed a resolution for installing ornamental street lamps on Colony Street from Ellice Avenue to Assiniboine River, to cost about \$7,500. M. Peterson is city engineer.

**ST. JOHN, N. B.**—A charter has been granted the St. John Suburban Ry. Co. giving it the privilege to construct and operate street railways in the suburbs of the city of St. John. The proposed railway is part of the large development for New Brunswick which is planned by John R. Graham, of Bangon, Maine, and associates. The same interests are interested in the New Brunswick Hydroelectric Co., which proposes to develop power sites near Magaguadavic and at Lepreaux. The power company will furnish electricity to operate the proposed railway.

**ST. STEPHEN, N. B.**—The charter of the St. Stephen El. Ry. Co. has been amended by the government, giving it the privilege of generating and distributing electricity for commercial purposes.

**HALIFAX, N. S.**—The government has introduced a bill providing for the establishment of a rural telephone system. It is proposed that the government should give a subsidy of \$20 per mile, the farmers to furnish and erect the poles and the government to undertake the stringing of the wires. It is also proposed that the farmers purchase their own telephones and pay a small charge for connecting with exchanges in the neighborhood.

**HALIFAX, N. S.**—A bill has been introduced in the House of Assembly to incorporate the Halifax Tramways & Pwr. Co. The incorporators are the directors of the Halifax El. Tramway Co. The company proposes to take over the tramway company and to develop hydroelectric power. It is proposed to acquire the Nova Scotia Pwr. Co., which controls the

falls on the Gaspareaux River. The capital stock of the new company is placed at \$5,000,000.

**BRANTFORD, ONT.**—Residents of Echo Place, a suburb of Brantford, have petitioned for the installation of hydroelectric power. Parkdale, Grandview and other suburbs will follow suit. The Township Council will be asked to enter into a contract with the Hydro-Electric Power Commission of Ontario to furnish the service.

**FORT FRANCES, ONT.**—A report has been made by the Hydro-Electric Power Commission of Ontario on the possibilities of the Sand Island Falls, which are said to be capable, under proper storage conditions, of developing 3000 hp.

**ISLINGTON, ONT.**—The Town Council has decided to accept the proposition of the Hydro-Electric Power Commission for furnishing electricity for lamps and motors to the district in the vicinity of Humber Bay. Transmission will be erected from the station at Mimico to supply the service here.

**KINGSTON, ONT.**—The Board of Trade has asked the City Council to take up with the Ontario Hydro-Electric Commission the advisability of securing power from the Madawaska River for the city.

**NORTH TORONTO, ONT.**—The Hydro-Electric Power Commission is planning to extend the street-lighting system through the Glebe Manor, and provision is to be made for serving 100 houses there. The present bracket lamps now in use for street-lighting will be replaced by lamps similar to those in Toronto. About \$35,000, is to be spent for improvements to the electric system in North Toronto.

**PETERBORO, ONT.**—The city of Peterboro has a bill before the Ontario Legislature to appropriate the plant of the Peterboro Lt. & Pwr. Co.

## Miscellaneous

**HAVANA, CUBA.**—The Havana El. Ry., Lt. & Pwr. Co. has awarded a contract to the Westinghouse El. & Mfg. Co., of Pittsburgh, Pa., for complete electrical equipment for its large power plant, now being built in Havana. The contract calls for three 12,500-kw Westinghouse-Parsons alternating-current turbo-generators, four 100-kw direct-current generators, nine 2000-kw transformers, 20 100-lamp regulators, 2000 new-type flame-arc lamps, one complete switchboard for control of this apparatus and 24 automatic switches, together with a complete condenser equipment.

**PANAMA.**—Bids will be received at the office of the purchasing officer of the Isthmian Canal Commission, Washington, D. C., until May 2, for furnishing steel, iron, wire cable, nails, nuts, etc. Blanks and general information pertaining to this circular (No. 771) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Bagg is general purchasing officer.

## New Industrial Companies

**THE APPLER REFILLABLE FUSE COMPANY**, of Syracuse, N. Y., has been incorporated by Grafton W. Appler, Harold C. Beatty and Owen J. Coughlin, of Syracuse, N. Y. The company is capitalized at \$40,000 and proposes to manufacture electric fuses, cartridges and blocks.

**THE BELLOWES TALK ELECTRIC COMPANY**, of Boston, Mass., has been chartered with a capital stock of \$150,000. The incorporators are: N. C. Young, A. R. Graustein and F. P. Hill, of Boston, Mass.

**THE CULMER ENGINEERING COMPANY**, of New York, N. Y., has been incorporated by William C. Fisher, Frank G. Richl and Edward C. Hollis, 197 Hawthorne Street, Brooklyn, N. Y. The company is capitalized at \$10,000 and proposes to do an electrical, hydraulic, mechanical and civil engineering business.

**THE DORRIS ELECTRIC SPECIALTIES COMPANY**, of Babylon, N. Y., has been incorporated with a capital stock of \$2,000 by F. R. Knowlton, E. J. Forhan and D. A. Cashin, all of New York, N. Y.

**THE ELECTRIC SALES COMPANY**, of Columbus, Ohio, has been incorporated with a capital stock of \$10,000 by O. L. Jeffries, M. L. Jeffries and N. E. McCleery.

**THE W. C. FRITZ COMPANY**, of Newark, N. J., has been incorporated with a capital stock of \$125,000 by W. G. Fritz, of Orange; H. C. Van Buskirk, of Dumont, and H. C. Soldan, of Oradell. The company proposes to manufacture air compressors, electrical machines, etc.

**THE FULLER MOUTHPIECE CORPORATION**, of New York, N. Y., has been incorporated with a capital stock of \$25,000 to manufacture mouthpieces for telephones. The incorporators are: C. V. Fuller, N. D. Moulds, of New York, and F. W. Miller, of Newark, N. J.

**THE OHIO DISTRIBUTING COMPANY**, of Chicago, Ill., has been incorporated by H. J. Russell, Vincent C. Mooney and Harry P. Simon. The company is capitalized at \$12,000 and proposes to deal in electrical supplies.

**THE SERVICE ELECTRIC COMPANY**, of Evansville, Ind., has been granted a charter with a capital stock of \$40,000 to do an electrical supply business. The incorporators are: Harry A. Robertson, Ray C. Straight, Ernest H. Wood and Merrit W. Smith.

## New Incorporations

**LOS ANGELES, CAL.**—The San Joaquin El. & Pwr. Co. has been incorporated with a capital stock of \$2,000,000 by A. H. Smith, S. A. Kitchner, of Los Angeles, and A. B. Moore, of Pasadena.

**PEORIA, ILL.**—The Central Illinois El. Co. has been incorporated with a capital stock of \$750,000 by A. D. Furlong, H. T. Willett and P. B. Warren. The company proposes to operate light and power plants.

**WARREN, ILL.**—The Warren El. & Pwr. Co. has been incorporated with a capital stock of \$250,000 to construct and operate an electric light, heat and power plant. The incorporators are: A. I. Johnson, G. W. Scheidecker and F. T. Morrissey.

**EVANSVILLE, IND.**—The Shafter El. Co. has been incorporated with a capital stock of \$10,000 by Frank W. and Leo Spencer and Gust W. Stocker.

**SHOALS, IND.**—The Shoals El. Co. has been chartered with a capital stock of \$100,000 to generate and distribute electricity. The incorporators are Charles O. Williams, B. C. Johnson and J. E. Torrey.

**WILLIAMSTOWN, KY.**—The Williamstown El. & Pwr. Co. has been incorporated with a capital stock of \$1,000 by J. M. Riley, J. W. Shields, R. L. Webb, W. P. Stratton and G. S. Webb. The company proposes to operate an electric-light plant and grid rail.

**MUSKOGEE, MOH.**—The French El. & Pwr. Co. has been incorporated with a capital stock of \$20,000 for the purpose of generating electricity to be distributed in the northern part of Madison County. Frank H. Speese, Martin W. Canfield and Albert Speese are the incorporators.

**STIGLER, OKLA.**—The Stigler El. & Pwr. Co. has been incorporated with a capital stock of \$1,000 by J. N. Ward, Claud C. Ward and F. C. Ward, all of Fort Smith, Ark.

**HARRISBURG, PA.**—Charters have been granted by the State Department to the People's El. Co., of Ontonagon Township, the People's El. Co., of West Leespott, the People's El. Co., of Centre Township, and the People's El. Co., of Centreport. Each company is capitalized at \$5,000 and the incorporators are: David S. Wolt, Allan A. Bivens and Grant E. Allen.

**FORT WORTH, TEX.**—The Eugene Ashe El. Co. has been incorporated with a capital stock of \$7,000 by Eugene Ashe, H. S. Adley and C. E. Clements.

**BELLOWS FALLS, VT.**—The Bellows Falls El. Co. has been incorporated with a capital stock of \$150,000 by Norval C. Young, Archibald R. Graustein and Fenimore P. Hill.

**BELLOWS FALLS, VT.**—The Fall Mountain El. Co. has been granted a charter with a capital stock of \$125,000. The incorporators are: Norval C. Young, Archibald R. Graustein and Fenimore P. Hill.

**MORGANTOWN, W. VA.**—The Eastern Pwr. & L. Co. has been incorporated with a capital stock of \$20,000,000 to control electric light, power and gas properties, railways, etc., in Morgantown, Wheeling, W. Va., Reading, Pa., and Vincennes, Ind., to be operated by W. S. Barstow & Co., 50 Pine Street, New York. The officers are: W. S. Barstow, president; J. B. Taylor, vice-president, both of W. S. Barstow & Co.; G. H. Walbridge, vice-president, and A. P. Talbot, treasurer, both of W. P. Bonbright & Co., of New York. N. Y. Improvements and to be made to the West Virginia properties during 1913 which will involve an expenditure of about \$350,000.

**WINDSOR, ONT., CAN.**—The Essex County El. & Pwr. Co. has been organized with a capital stock of \$250,000 and five directors: Robert F. Stewart, president; A. C. Macdonald, vice-president; J. A. Dickey, secretary, and George Wiley, treasurer, all of Windsor, Ont. The company now has a plant in Sandwich, Ont. and has completed a power house whereby it takes over the property of the Amherstburg El. Co. El. & Pwr. Co., of Amherstburg, Ont. \$14,000; the Essex El. & Pwr. Co., of Essex, Ont. for \$13,750; the Kingsville El. Co., El. & Pwr. Co., of Kingsville, Ont. \$11,300; and the Leamington El. & Pwr. Co., of Leamington, Ont. \$7,000.

## Trade Publications

**SPLICING SLEEVES.**—Hickey & Son, Inc., 220 Union Street, New York, have issued a circular containing illustrations of methods and the results of tests on H. & S. seamless copper-plating sleeves for electric transmission-line conductors.

**SNAP SWITCHES.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular interesting to its "Circuit Breaker" switches. The single-pole, double-pole, three-pole and four-pole switches are illustrated and briefly described.

**PUSH-BUTTON SWITCHES.**—A recent bulletin of the Fenbush Electric Manufacturing Company, Plainville, Conn., lists all of the C. H. push-button switches, attachment plug receptacles, cord connectors, sockets and plates.

**CLAY PRODUCTS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**FLASHLIGHT BATTERIES.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**ELECTRIC LIGHTS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**ELECTRIC POWER.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**ELECTRIC TRACTION.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**ELECTRIC WELDING.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**REFRIGERATING MACHINES.**—The Audifren-Singron refrigerating machine is a new type of machine which is said to be the most efficient and reliable of any of the kind now in use. It is a simple machine, easy to operate, and gives a large output of cold.

**WATER WHEELS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**AIR COMPRESSORS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**TOOLS FOR CABLE WORK.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**GENERATORS AND MOTORS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**INDICATING INSTRUMENTS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**LAUNDRY MACHINES.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**INSULATING MATERIALS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

**TELEPHONE APPARATUS.**—The Fenbush Electric Manufacturing Company, Plainville, Conn., has issued a circular with a striking cover, bearing the title "Service Time Saved," which shows special products for all furnace purposes on heat exchangers.

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## Business Notes

THE PARAGON-SELLERS COMPANY has moved its Chicago headquarters from 150 North Fifth Avenue to 9 South Clinton Street.

THE STATES COMPANY has removed its office from 302 West Water Street, Syracuse, N. Y., to 19 New Park Avenue, Hartford, Conn.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., will move its Cincinnati office on May 1 to the twenty-third floor in the tower of the new Union Central Building, Fourth and Vine Streets.

THE ARMORDUCT MANUFACTURING COMPANY, London, Eng., has just received from one of the largest English railway companies a second order for approximately 100 miles of rubber-covered cable.

THE CARSTARPHEN ELECTRIC COMPANY, of Denver, Cal., is

now occupying its new building at 1252 Broadway. The company is going more extensively into manufacturing operations and among other products is developing a complete line of knife switches.

THE KENNICOTT COMPANY, Chicago Heights, Ill., has recently received from the city of Philadelphia, upon the recommendation of the Franklin Institute, the award of the John Scott legacy medal, for the Kennicott water weigher. The award was made in consideration of the novelty, simplicity of design and accuracy shown by the water-measuring device.

THE W. A. JACKSON COMPANY, electrical engineer and contractor, Chicago, has received the contracts for the electrical installation in the Ontario Paper Company's mill at Thorold, Ontario, Canada. The same company has also received a contract for the electrical equipment in the Grand Calumet River power station, which is situated at East Chicago, Ind.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 8, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,058,047. APPARATUS AND PROCESS FOR MAKING WIRE ELECTROLYTICALLY; W. E. Gibbs, Pittsburgh, Pa. App. filed Sept. 4, 1909. Copper is deposited upon an endless wire, which is passed through an electroplating vat.
- 1,058,048. METHOD OF AND APPARATUS FOR PRODUCING COPPER WIRE; W. E. Gibbs, New York, N. Y. App. filed Aug. 30, 1910. Copper wire is passed through depositing vat; has means for drawing and reeling resultant product and automatic means for maintaining speed of wire through vat and reeling speed in proper ratio.
- 1,058,051. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed June 20, 1912. Push-buttons operate a rocker arm.
- 1,058,057. ELECTRIC-FURNACE CARBON ELECTRODE; A. T. Hinckley, Niagara Falls, N. Y. App. filed Feb. 2, 1912. Has a longitudinal hole and a narrow slit extending from end to end of the electrode.
- 1,058,071. SWITCH; H. E. Leppert, New Britain, Conn. App. filed March 17, 1910. Push-buttons operate oscillating switch arm.
- 1,058,107. CONTROLLING MECHANISM; A. L. Ruthven, Topeka, Kan. App. filed April 22, 1912. For railway trains; operated by pressure from braking or throttle electric control.
- 1,058,113. METHOD OF TREATING WATER FOR STEAM-BOILER PURPOSES; W. C. Stuckel, Newark, N. J. App. filed May 10, 1912. Water is passed through mass of zinc and copper particles to agitate mass and set up galvanic action in water.
- 1,058,120. TELEPHONE MUFFLER; M. Weil, New York, N. Y. App. filed June 27, 1912. Has vacuum-jacketed walls which prevent the speech being heard by others in the room.
- 1,058,143. HIGH-TENSION CONNECTING INSULATOR; A. Bitter and E. Weissberg, Cassel, Germany. App. filed Sept. 4, 1912. Cart-ridge with fuse wire is removably seated in the connecting or leading-in insulator, with the fuse chamber connected at its inner end with the oil space of the apparatus.
- 1,058,176. SELECTIVE SIGNALING SYSTEM; W. E. Harkness, East Orange, N. J. App. filed Dec. 19, 1911. For railway train dispatching work; a selector in a closed bridge of the line at each station.
- 1,058,178. ELECTRICALLY OPERATED APPARATUS; G. W. Hart, West Hartford, Conn. App. filed Jan. 2, 1912. Solenoid operated device.
- 1,058,179. SWITCH; G. W. Hart, West Hartford, Conn. App. filed July 29, 1912. Combination of solenoid, switch arm, detent and actuating means.
- 1,058,184. ELECTRIC TYPE-METAL HEATER FOR LINOTYPE MACHINES; D. S. Kramer, Columbus, Ohio. App. filed April 9, 1912. Heat generated by current induced in secondary winding by passage of alternating-current through primary winding; has thermo cut-out.
- 1,058,200. ELECTRIC-SWITCH CONTROL; W. M. Scott, Berwyn, Pa. App. filed March 8, 1912. Circuit-breaker, electromagnet means controlling same and a control switch in the circuit of the electromagnetic means.
- 1,058,219. SIGNAL DISPLAY; P. J. Chase, Los Angeles, Cal. App. filed Oct. 10, 1911. For grade crossings; pair of cross-arms rotatably mounted on a standard.
- 1,058,243. PROCESS OF ELECTRIC WELDING; M. Lachman, New York, N. Y. App. filed Sept. 28, 1909. Consists in butting the two pieces together with the end of one piece against an edge of the other so that when current is on and pressure is applied one piece will be split by the other.
- 1,058,244. INDUCTION ALTERNATOR; L. J. Le Pontois, New Rochelle, N. Y. App. filed Jan. 13, 1909. Particularly for igniting circuits; field construction and windings.
- 1,058,261. SIGNALING MECHANISM; R. T. Reid, Seattle, Wash. App. filed April 24, 1912. Police call; electromagnetically operated step-by-step circuit-closing device.
- 1,058,270. SEAT; E. E. Stephens, Los Angeles, Cal. App. filed March 26, 1912. Closet seat warmed by inclosed resistance coil; thermo control.
- 1,058,296. COMBINED POTENTIAL AND OVERLOAD SWITCH; E. J. Gale, New York, N. Y. App. filed June 11, 1907. Electric responsive device controls switch, and a thermoelectric means controlled by current through switch controls operation of the electro-responsive device.
- 1,058,308. SAFETY SLOW-DOWN AND STOP MOTION FOR ELEVATOR ELEVATORS; D. L. Loran, New York, N. Y. App. filed July 5, 1910. A dynamic brake circuit for the elevator motor.

- 1,058,329. AUTOMATIC KEYBOARD PLAYER; C. W. Nystrom, Karistad, Sweden. App. filed April 27, 1910. Key-actuating devices have arc-shaped portions moved by electromagnetic means into engagement with cylinders rotating at different speeds.
- 1,058,380. ELECTRIC HEATER; J. F. Monnot, Paris, France. App. filed Dec. 10, 1910. Metallic envelope having hermetically sealed within it an electric resistance conductor embedded in pulverulent plaster of paris.
- 1,058,514. ELECTRIC-ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed July 8, 1909. Upper metallic electrode is dropped upon the lower metallic electrode successively to remove scorificaceous deposits and permit proper electrical contact.
- 1,058,515. ELECTRIC-ARC LAMP; T. E. Adams, Cleveland, Ohio. App. filed April 5, 1910. Additional weight is given upper electrode to cause it to strike the lower electrode with force sufficient to remove congealed slag from latter.
- 1,058,519. AUTOMATIC CONTROLLER; S. P. Armstrong, Fort Scott, Kan. App. filed Nov. 10, 1909. Means for operating a main controller and means governed by a master controller for actuating the said operating means.
- 1,058,533. AUTOMATIC RESISTANCE REGULATOR FOR TELEGRAPH LINES AND THE LIKE; E. Bclm, Paris, France. App. filed Dec. 20, 1911. Relays move a slider along a resistance; a galvanometer in series with the line controls the relays.
- 1,058,541. TELEGRAPHIC RELAY; S. G. Brown, London, England. App. filed Aug. 29, 1912. Thermoelectric couple, an independent heating element and mechanical means controlled by the cable circuit for varying heating effect of said element on the couple.
- 1,058,545. ANNUNCIATOR SYSTEM; H. Caldwell, Fort Michie, N. Y. App. filed Dec. 5, 1911. Circularly arranged magnets control an annunciator drum.
- 1,058,555. RECEIVING TRANSFORMER FOR WIRELESS-TELEGRAPH SYSTEMS; E. L. Colby, Auburn, N. Y. App. filed Feb. 6, 1911. Primary and secondary windings on common axis with adjacent ends separated by air space and an adjustable winding in series with one of the first windings and disposed within the same.
- 1,058,574. CABLE-REELING MECHANISM FOR ELECTRIC LOCOMOTIVES; D. T. Fisher, Columbus, Ohio. App. filed Feb. 15, 1909. Planetary gear transmission between motor armature and reel with a controlling brake.
- 1,058,587. CIRCUIT CONTROLLER; N. M. Hopkins, Washington, D. C. App. filed Aug. 25, 1911. For odometers, speedometers, etc. Battery is automatically cut out of circuit when the mechanism is not in operation.
- 1,058,589. ELECTRIC ANNUNCIATOR AND LIGHTING MECHANISM; P. A. Huddleston, Oklahoma, Okla. App. filed Oct. 2, 1912. For calling hotel guests; closing of switch, ring bell and lights lamp in guest's room; guest operates wall switch in room and thereby cuts out bell and sends full current into the lamp.
- 1,058,598. TELEGRAPHER'S KEY-BUTTON CUSHION; H. A. Kelly, New Castle, Pa. App. filed May 9, 1912. A cap covers and is yieldingly supported upon the key button.
- 1,058,631. TELEPHONE ATTACHMENT; A. Schlosser, Dodge, Neb. App. filed May 14, 1912. Unauthorized party listening to conversation on a party line causes a signal to be given the party using the line.
- 1,058,635. CABLE-REELING MECHANISM FOR ELECTRIC LOCOMOTIVES; F. L. Sessions, Columbus, Ohio. App. filed Feb. 16, 1909. The armature of the driving motor is mounted within the hollow drum.
- 1,058,653. PROCESS FOR CARRYING THROUGH CHEMICAL GAS REACTIONS BY MEANS OF AN ENLARGED ELECTRICAL DISCHARGE; H. Aueries, Munich, Germany. App. filed July 17, 1912. Arc is deformed by blowing a suitable medium against it and deformed arc is spread and extended linearly by subjecting it to force of a magnetic field.
- 1,058,670. HANGING SUSPENSION FOR ELECTRICAL TRANSMISSION LINES; T. Jervis, Brescia, Italy. App. filed Nov. 18, 1911. Pivotally supported hanger with rectangular arm extending on opposite sides thereof.
- 1,058,677. WATER-COLORED WELDING ELECTRODE FOR ELECTRIC SPOT-WELDING MACHINES; A. C. Taylor, Warren, Ohio. App. filed Nov. 1, 1912. Tubular electrode body with fluid connections.
- 1,058,687. ELECTRICAL RESISTANCE DEVICE; G. C. Marx, Elizabeth, N. J. App. filed Dec. 17, 1909. To render ventilating fans on subway cars interchangeable on lines using different current intensities, has support with insulated contact points and a sectional resistance and removably secured to the support.



# Electrical World

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## Fighting Water with Water

Resourcefulness of engineers in emergencies was much in evidence during the recent flood period in various sections of the country.

Many of the plans put into successful operation at that time were well worthy of note. Perhaps the most interesting solution found for the problem of keeping water out of a station and preventing the building from being carried away by the flood was that to which attention is called in this issue. A destructive agent was used against itself with telling effect, first as a barrier to hold back the rushing tide which threatened to engulf the electric-light station and then as ballast to thwart its attempt to lift the station bodily and hurl it to destruction. Windows and doors of ice were never before used as bulwarks against a flood, nor was a leak in the cellar ever considered desirable. The engineering plan employed to combat the forces of nature at Louisville was certainly unique and withal successful.

## The Institute as Defendant

Attention is called elsewhere in this issue to a suit to restrain the American Institute of Electrical Engineers from

transferring any person to the grade of Fellow or Member in accordance with a special section of the Institute constitution which has been in effect since June, 1912, and will expire on May 1, 1913. This suit has no bearing on the division of the membership into three grades or the establishment of the grade of Fellow. It would seem, in fact, that all parties to the suit agree that the division represents a proper change in the organization and that the qualifications to be required for admission to the upper grades after May 1, 1913, are satisfactory. The point under contention relates exclusively to the legality of the so-called special section of the constitution in accordance with which any person formerly belonging to the Institute can be transferred upon proper certification to a higher grade, provided he applies for transfer before May 1. The claim by the persons bringing the suit is that the special section is nullified by other parts of the constitution with which it is in conflict, and that transfers made under this section are illegal. The point under contention in the suit is a perfectly proper one for discussion by the membership and officers of the Institute, but should not have been aired in public. In the interest of the professional standing of both the Institute and its members this quarrel should be settled out of court, and that very quickly. It can safely be stated that any injury to the Institute which might be caused by admitting partially qualified persons to the higher grades would be negligible in comparison with the discredit brought about by the present legal conflict.

## Free Renewal of Tungsten Lamps

With the general tendency to reduce the price of tungsten lamps it is safe to predict that before the end of the year central stations in large cities will hold it as their advantage to place such lamps of the higher ratings on a free-renewal basis. While this is already true of the very large tungsten lamps designed to replace inclosed arc lamps, where maintenance of the latter is assumed by the lighting company, the time is fast approaching when those sizes of lamp in more general use should be included. To be sure, the energy consumption of the smaller sizes of tungsten lamp is such as to make it unwise, for the present at least, to include these in any free-renewal plan; but it has been demonstrated that where an 80-watt lamp, for instance, is offered at the same price as a 25-watt lamp, the natural desire to obtain the most for one's money prompts the choice of the larger lamp—much to the detriment of the larger lamp may be had for nothing. There is nothing new in this, and since from time immemorial it has been a trait of humanity to be very free with that which costs nothing, there should be but one result following the free-renewal of the larger sizes of lamp, while the smaller sizes must be paid for. More light, better illumination, increased consumption and greater satisfaction with the service are inevitable.

## The Electrified Gasoline Automobile

With perhaps thirty applications of electricity contributing to its operation and convenience, the gasoline motor car of the near future is likely to become an electrified vehicle which will earn more of the central-station man's professional sympathy than it now gets in competition with his favorite battery-driven car. For right here in the young and restless gasoline-car industry there is going on a development of electrical auxiliaries which will, as one authority estimates, shortly be consuming 50 percent of electrical products yearly. The use of electricity in ignition, lighting and self-starting has already become standard in the motor-car field. But many other refinements and conveniences are now making their appearance. An electrically heated carburetor, for example, assures for one make of an accurate mixture regardless of temperature. Electric heaters are a comfort in the limousine. Another inventor has produced an electricity-actuated alarm clock. Lamps arranged to turn on automatically and illuminate the step and sill when the door is opened will be appreciated by women motorists. An electric auxiliary controlled by the hand so that it can be turned to read wayside signboards is useful for night touring. Sign transparencies which flash automatically the car is being turned should help the critical pedestrian judge, while another device shows the car the driver means to steer.

### Economical Application of Turbo-Generators

In this issue appears the second and concluding part of an unusually thorough-going account of the recent improvements introduced in the Cambridge (Mass.) central station, where low-pressure turbines have been installed with excellent results both in increasing the available output of the plant and in improving the net economy of the generating system as a whole, after going through those various phases of technical history which have fallen to the lot of most central stations. The present plant was built nearly fifteen years ago, following the best steam practice of the day. The generating plant was operated by high-grade compound condensing vertical engines with an admirable boiler plant. The steam plant in its present development is, as our readers will appreciate on examining carefully the details, thoroughly good and represents a high development of the station with reciprocating engines.

As time has gone on, the need for increased equipment has called for radical action, and after a thorough study of the subject it was decided to install low-pressure steam turbines running on the engine's exhaust. The steps were not taken without careful preliminary tests, and it is these tests which lend particular interest to the installation.

The first fact which came to the surface as a result of the tests of the engine under back pressure was that with the reciprocating engine, designed for a normal output of 500 kw, the greatest available power obtained under considerable loss of economy by operating the machine at atmospheric exhaust was 673 kw, while the addition of a low-pressure turbo-generator of a little over 600-kw rating, receiving the steam which otherwise at maximum load would exhaust into the air, would enable the extreme load to be pushed up to nearly 1400 kw, with a very material gain of economy. Tests of the completed installation were highly gratifying, for they showed that while the steam consumption of the reciprocating engine set, including all its auxiliaries, was about 22 lb. per kw-hr., the combined unit with greatly increased output consumed only 17.3 lb. per kw-hr. The test results are in accord with the known fact that the last end of the steam expansion is much more valuable in a suitably proportioned low-pressure turbine than it is in an engine cylinder.

Since the first installation was made, a 1500-kw low-pressure turbine of similar character has been added. The result of the first winter's service with the renovated plant showed 10 per cent saving in coal consumption. Probably not all of this is to be credited to the low-pressure turbine since automatic stokers were introduced about the same time and more care was taken with the loading of the units. A test with the turbine out of service caused the coal consumption to jump 6 per cent, so that it is fair to say that in the neighborhood of two-thirds of the winter's saving should probably be credited to the turbines. The Cambridge plant has been in skilful hands of late and the recent improvements bear witness to the effect of good management on station costs. From the commercial standpoint the system has been well handled. Those of our readers who are interested in the problems of commercial development will find much worth

study in the description of the Cambridge system. A prominent feature to which attention might well be directed is the arrangement for off-the-peak service to be applied to battery charging, cooking and heating appliances, pumping and refrigeration plants. The specification is that from Oct. 20 to March 10 no service shall be used between 3 p. m. and 6:30 p. m., and the price begins at 5 cents per unit for the first 70 kw-hr. per month and drops down to 3 cents and even 2 cents for large consumption. Certain classes of work can be managed very comfortably off the peak, and the special rate for such cases is well deserved. This plan should prove profitable for both the station and the consumer.

### The Computation and Subdivision of Electric Conducting Networks

The computation of voltage and current distribution over electric mains or conducting networks is a special subject with a large literature, most of which has been published in the German language. A contribution to this literature, mainly from a historical standpoint, has recently been presented in *Elektrotechnik und Maschinenbau*, by Mr. Josef Herzog, who has taken for many years a notable share in the development of this important branch of electrotechnics. It is remarkable how closely analogies may be traced between the statical relations of masses suspended on strings and the electrical relations of loads carried on conductors. Many of these propositions are now currently known to electrical engineers; but the history of their development is by no means so generally understood.

### The Reactance of Stranded Conductors

Although the reactance of transmitting or distributing wires does not, in the ordinary sense, absorb energy, yet it may play a very disturbing part on the pressure-regulation of the circuit to which the wires belong. The inductance and the reactance of such wires is thus a matter of considerable practical importance. The ordinary formulas for determining the reactance of aerial conductors such as are used in transmission lines are based on the assumption that those conductors are solid wires. But many such conductors now in use are stranded. The question naturally arises, What effect will the stranding have upon the resistance, inductance and reactance of such conductors? The effect is always to increase the resistance slightly, because the conductor is virtually lengthened by the helical lay of its strands. In an article by Mr. H. B. Dwight on page 828 of our last issue the question of the reactance was considered. Assuming that the conductor is not large enough to introduce any serious amount of skin effect, it is shown how the inductance and reactance of stranded wires may be computed.

One effect of stranding a conductor is necessarily to increase its diameter by comparison with the solid or unstranded state. The effect of increasing the diameter of a wire, everything else remaining the same, is to diminish the inductance and reactance of the wire. In general, the article indicates that when the virtual diameter of a conductor is increased by stranding the reactance is diminished,

but not to the same extent as though the conductor were solid with the strand diameter. Stranding, therefore, slightly increases the resistance of a conductor, and slightly diminishes its reactance.

### Investigation of Diffusing Glassware

With feeble illuminants, such as candles and ordinary flames in air, their brightness is a matter of relatively little significance and the more numerous the illuminants the greater their total illumination effect as apparent to the eye. When, however, use is made of intense illuminants, such as arc-lamps, intensified flames and metallic-filament incandescent lamps, their brilliancy often detracts from their effectiveness.

The retina of the eye can support only a certain intensity of illumination, as measured, say, in lumens per square millimeter of retinal surface. If the intensity is raised beyond the critical value, the nervous mechanism of the eye is automatically invoked to stimulate the curtaining muscles of the eye—the muscles of the iris diaphragm or pupil—so as to contract the aperture and cut down the offending intensity. The curious fact comes into action that the brilliancy of the image thrown on the retina by any light source is constant at all ordinary distances in air from the source, for a given iris aperture. That is, if an eye is made to face any bright body, such as a flame, then when the iris aperture is kept constant, the size of the image thrown by the flame on the retina at the back of the eye will dwindle as the eye retreats from the flame, but the intensity of illumination in the image will remain constant at all distances. At a great distance the image may occupy, say, 1 sq. mm of retinal surface, with perhaps 1 microlumen per sq. mm and 1 microlumen total flux in the image. At a short distance the image may occupy 20 sq. mm of retinal surface, with 20 microlumens of total flux in the image, but yet with the same intensity of 1 microlumen per sq. mm. A similar phenomenon is presented in the photographic camera, where the image of a flame increases in area, on the ground glass plate, as we approach the flame, but the intensity of the image in lumens per square millimeter remains constant. Now, it appears that the stimulus to the iris muscle is determined more by the maximum intensity of illumination on the retina than by the total flux of incident light. Hence a brilliant light anywhere within the field of vision, even though a long way off, tends to shut down the iris diaphragm. But shutting down the pupil reduces the light entering the eye from all parts of the field. Consequently, an illuminated page or other object which might make a good, clear picture on the retina with the diaphragm open may make a poor and indistinct picture with the diaphragm cut down merely because a brilliant light source happens to strike the retina somewhere.

The economic moral of the story is that we may have powerful illumination on objects and yet very poor seeing, because a brilliant light source comes into the field of vision. Naked arcs or naked tungsten filaments may so limit the field of an observer's view that, even where he may, his pupil has to keep contracted and so keep all the rest of the

visual field dim. Half of the flux of light poured into the same room, from lamps in the same place but of reduced brilliancy, might give him possibly twice as good seeing, because his pupil would have a chance to dilate and let the light into the retina. Thus, to produce interior lighting from brilliant sources in the heart of a room may be very wasteful, optically and physiologically.

The only efficient way to convert a low brilliant light source into feeble, diffusing illumination is to do it in one of three ways. One is to hang the sources where they will not occupy the visual field. Brilliant lamps that find room may not be within the field of view under normal conditions. A second way is to conceal the lamps behind reflecting or diffusing screens, such as ceiling cornices, and thereby produce indirect lighting. The third way is to hang the lamps where one chooses but to reduce their brilliancy by increasing their active surfaces; this may be done by enclosing the lamps in diffusing bulbs, shades or globes. The eye can then rest on the enlarged secondary source without fixing the eye directly on the source. The practical advantage of diffusing globes is thus evident.

In an article in this issue Mr. M. Luckiesh discusses the diffusing and absorbing powers of certain types of glassware. What is desirable is a complete diffusion, together with negligible absorption. In other words, each little surface element of the enclosing globe receiving its share of light from within should send all of that light, scattering it in all directions, as though the element were an original source. In practice it absorbs an appreciable amount and does not scatter the remainder properly. Thin globes of a small diffusing material are usually less likely to absorb than are thick ones, other things being equal. The data reported are of much practical interest.

### Further Work on the X-Rays

As we have recently had occasion to note, the discoveries of the last few months on the reflection of X-rays from crystal surfaces and their transmission through crystal bodies have gone far toward clearing up the mystery of their character. All these investigations have pointed to the X-rays being similar in character to other electromagnetic radiations but of enormously shorter wavelength. Very lately some of the English investigators have gone a step further in the same direction and have found a certain tendency toward differentiation of the reflected beam into bundles, sending one along, also to a spectrum spectrum scattering in the line of the so-called "hard" and "soft" tubes. It is not well yet to become confident of this announcement beyond the ordinary report. Previous experiments have shown the reflected X-rays to be fairly homogeneous. If the present indication are borne out, that by suitable means the homogeneous condition of X-ray tubes can be secured, a long step will have been taken toward the formation of a spectrum using the extremely short rays, similar to the spectrum of visible light. More than this, it is not clear that the mystery of atomic and molecular structure will have been disclosed, a clue that may lead forward, there as now, through



# The News of the Week

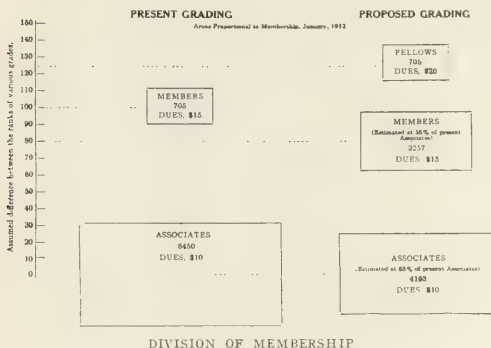
## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Lawsuit Against the A. I. E. E.

On Thursday of the present week in the Supreme Court of the State of New York a suit was brought against the American Institute of Electrical Engineers, its president and the board of directors, in the name of Dr. Louis Duncan, Prof. Francis B. Crocker and Prof. Michael I. Pupin, to restrain the defendants from "transferring or electing any person to the grade of Fellow or Member without fairly considering and deciding on merit whether such person has the qualifications required by the constitution." The plaintiffs claim that the transfer under the special section is "contrary to the provisions and requirements of the constitution and by-laws of the defendant American Institute of Electrical Engineers and is illegal."

In view of the attention to Institute affairs which this suit has attracted, an outline of the conditions leading to the amendment of the constitution and the introduction of the "special section" should prove of interest.

In this connection it is worthy of note that the amend-



ments referred to received the record vote of 45 per cent of the membership, of which 83 per cent voted in favor of the proposed changes.

The amendments, including the special section, were the result of the work of an Institute committee appointed in 1911 to propose a plan for an additional grade of membership. There had always been in the Institute only two grades, Associate and Member, the latter or full professional grade being jealously guarded and so exclusive as to include less than 10 per cent of the membership. The grade of Associate was composed of two classes—junior professional electrical engineers and a large number of friends of the profession, commercial or financial members, or laymen, who were, nevertheless, sufficiently interested in scientific and engineering matters, and in electrical engineering in particular, to desire to support the objects for which the American Institute of Electrical Engineers was established and to be interested in its transactions.

The desire for an additional grade of membership which would permit the separation of the professional and non-professional elements among the Associates had been so long expressed that for four years successive committees had been appointed to study how best this important constructive change could be made in the Institute's organiza-

tion. The present plan was first approved by a unanimous vote of the board of directors and then by the largest constitutional vote of the membership ever recorded in the history of the Institute, indicating that the plan proposed met, to an unusual degree, the desires of the membership. Approximately stated, this plan consisted, in brief, of increasing from five to ten years the experience required for the highest grade, calling that highest grade by the name of Fellow and transferring to it as the nucleus with which to start practically all of the members of the old highest grade. The name of Member, no longer used for the highest grade, was kept for the intermediate grade, and the standard was somewhat reduced. The grade of Associate remained unchanged. Transfers from one grade to another were provided for in the customary manner of application, examination by the board of examiners and vote of the board of directors, two negative votes excluding an applicant.

To get this new plan promptly started, it was recognized that some special provisions must be adopted for temporary application at the outset, and the special section, valid only until May 1, 1913, was enacted. This gave to members of record at the time the amendments were adopted the right to transfer on complying with certain special conditions. It was believed that the board of examiners could not discharge the duty of investigating the records of the several thousand members who would apply at the outset for transfer from Member to Fellow and from Associate to Member. Since it was decided, as a matter of policy, and in accordance with previous custom in the Institute and in other societies, that the increased standard of the highest grade should be accomplished gradually, because it was felt that it would be an injustice to old and distinguished members of the Institute to exclude them from the highest grade when the standard of the grade they were in was to be lowered, it was considered wise to arrange a plan that would not make too onerous the transfer of older members to the grade of Fellow.

If five Members or Fellows, upon inquiry, certified that a Member met the requirements for Fellow in the constitution, he had the right to be transferred and, correspondingly, if four Members or Fellows, upon inquiry, certified that an associate met the requirements for Member in the constitution, he had the right to be transferred to that grade.

The contention of the plaintiffs in the present suit is that the certification alone is not sufficient, and that in addition to it the applicant's name should go before the board of examiners for the investigation of his professional record, and that instead of the applicant having a right to transfer, he can be rejected by two negative votes in the board of directors, and that unless this interpretation be followed, the integrity of the two higher grades in the Institute cannot be preserved.

The contention of the defendants is that, since it was decided as a matter of procedure that the increase in standard of the highest grade should be gradual by applying the severer requirements only to new entrants, the transfer of practically all of the old grade of Member into the new grade of Fellow was the only just course to pursue, and if there were already in the grade of Member persons whom the mistakes of previous boards of examiners had wrongfully admitted there, their transfer to Fellow could

not be avoided. It was felt that, as their number was extremely small, a broad constructive addition to Institute organization should not be hampered by this consideration.

In respect to transfers from Associate to Member, the reduction of the standard of the grade of Member and the fact that the grade of Member was no longer the highest grade in the Institute made rigorous examination less necessary than it otherwise would have been, but, nevertheless, it was felt that those holding the rank of Member or Fellow in the Institute would be sufficiently honorable and conscientious and sufficiently jealous of the standards of those grades not to certify that an applicant from the grade of Associate met those standards unless he really did, especially when what was required of the four Members or Fellows who acted as certifiers or, in fact, as a board of examiners was not the mere giving of their opinion, but a "certification" of the facts of the applicant's career.

The defendants claim that when an applicant has been certified by the group of four or five Members or Fellows respectively, provided for by the constitution under the special section, he has complied with the requirements of the constitution, and the board of directors is then constitutionally obliged to transfer him, its only discretion being the making sure that he has in fact been duly certified by the requisite number of men who are in fact Members or Fellows in good standing.

In the accompanying illustration is reproduced a diagram which was sent to each member of the Institute at the time the proposed amendments were to be voted upon. At that time it was estimated that 705 members would be transferred to the grade of Fellow and that about 2007 would enter the grade of Member. Up to the present month there have been transferred under the special section 308 to the grade of Fellow and 389 to that of Member.

### Reduction in Tungsten-Lamp Prices Foreshadows Free Renewals

The manufacturers of tungsten incandescent lamps have decided on a further reduction in the price of lamps which will become effective about July 1. Although the exact prices cannot be ascertained as we go to press, there is every reason to believe that the cut will be at least 10 per cent. In view of the concerted movement among the large Edison companies to devise some plan whereby tungsten lamps can be placed on a free-renewal basis just as is the present graphitized-filament lamp, it is more than probable that following this reduction in the prices of lamps will be the announcement that the Edison companies have placed tungsten lamps of the larger candle-power ratings on a free-renewal basis. Certainly the lamp committees of the national associations are working hard toward that end.

### Operating Staff of Toronto's Municipal System Out

Most of the feature space in the six daily newspapers of Toronto, Ont., has been occupied during the past week with charges, counter-charges, rumors and statements affecting the turbulent situation brought to a head by the petition presented to the Mayor against Commissioner Ellis by Acting Manager W. R. Sweany of the Toronto Hydro-Electric System, which culminated in the dismissal of Mr. Sweany and the resignation of the chief engineer, general superintendent, engineer of distribution, engineer of operation, superintendent of meter department, chief inspector, manager of appliance department, sales manager, contract agent and the assistant to the acting general manager. The events leading up to the final break are in brief as follows:

Last summer Mr. H. L. Drayton, the commissioner representing the Ontario Hydro-Electric Commission on the

board of the Toronto Hydro-Electric System, was appointed to the chairmanship of the Dominion Railway Board. Mayor Geary, who, under the law, was an ex-officio member of the board of the Toronto Hydro-Electric System, and who was familiar with the work from the construction period, resigned the mayoralty and was succeeded by Corporation Counsel of Toronto. The new Mayor, Mr. H. C. Hocken, who became an ex-officio member of the Toronto board, was entirely unfamiliar with the situation so that the work of the commission was left practically in the hands of one commissioner, Mr. P. W. Ellis, who had been appointed by the City Council in Toronto on the original Toronto Hydro-Electric System board.

When the original members of the Toronto Hydro-Electric System, Mr. Kenneth L. Appleton resigned some time ago owing to illness last fall, his assistant, Mr. W. R. Sweany, was appointed acting manager and immediately took charge of the construction of a distributing system, including the street-lighting system, power and water, and organized the sales and recording departments.

A short time after active operations began, Mr. Sweany is said to have experienced difficulty in securing cost figures from the accounting department, which, it is claimed, had been manned by representatives of Commissioner Ellis. When attention was called to the matter, it is claimed that the manager was told in effect that the question of costs did not concern him. This was the beginning of friction between the various departments, and before long the situation grew to be such that there was a distinct lack of confidence between the commissioner and the operating staff. A little over a week ago Mr. Sweany petitioned the Mayor to use his influence with the City Council not to reappoint Commissioner Ellis, whose term as commissioner has just expired. Mayor Hocken gave Mr. Sweany's letter no heed to the daily press, and its publication created a sensation. Commissioner Ellis forthwith dismissed Mr. Sweany from his position as acting manager and thereupon ten heads of departments who had signed the petition handed in their resignations.

Upon Mr. Sweany's dismissal Mr. R. A. Ross, consulting engineer of the Ontario Hydro-Electric Commission, was called in as acting manager of the Toronto Hydro-Electric System, and Mr. R. G. Black, formerly superintendent of the Toronto Electric Light Company, Ltd., was named as his representative and assistant.

### Ice Protection Against Flood Water at Louisville

During the flood in Louisville, Ky., the water rose steadily above the water level of the latter a floating station, now under the control of men George H. Harwood of H. M. Byllesby & Company. Floods, however, are not uncommon in Louisville, although that of this year was unsurpassed as regards volume except by the flood of 1884. Hence the engineers of the power station were prepared to combat emergency of the kind and adopted an ingenious method of making the house and window water-tight and of preventing the power station from flooding because of its location, when surrounded by water. A part of the equipment at the power station is a dry main distributing plan, and as the water rose to the street level, connecting coils connected with the plan were run about the sides of the windows and doors, the cracks in which were filled with sawdust. After the water began to enter and flood water it was found to be better to the water level and thus the surface of water was attracted. To prevent the tendency of the water to enter the building, however, in the flood waters, some water was permitted to run into the basement on "sillars." During the flood, however, with dry land, was protected by a number of vertical supports to the floor.



### Competitive Conditions in Macon, Ga.

The granting of a franchise to the Georgia Public Service Corporation of Macon, Ga., to manufacture and distribute gas in that city will add zest to the fight between that company and the Macon Railway & Light Company. The latter company is one of the properties of A. B. Leach & Company, bankers, of New York, who purchased it, together with the Central Georgia Power Company, from Mr. W. J. Massee, at that time president of both companies. Shortly after the deal was consummated the Georgia Public Service Corporation was formed with the former president of the Macon Railway & Light Company at its head, and it obtained a franchise to generate and distribute electricity in Macon. The latter company has just placed in operation a steam-turbine station containing one 1500-kw and one 500-kw Allis-Chalmers unit. Coincident with the starting of the station came a cut in rates and a fight for business.

The city lighting contract for 400 4-amp magnetite-arc lamps was taken by the Macon Railway & Light Company at the rate of \$21.95 a lamp per annum on a five-year basis and the rate for commercial and residence service was cut in two. The net rate for commercial lighting is as low as 2 cents and for residence lighting 6 cents, the minimum charge in each case being \$1 and 50 cents per month respectively. The gas rate is \$1.25 per 1000 cu. ft., and it is this branch of the company's business which is now attacked.

The Railroad Commission of Georgia, which has supervision over the public utilities of the State, has never taken a definite stand on the matter of competition, its policy heretofore being rather to encourage than discourage it. By its ruling, however, companies are prevented from raising rates once lowered without its consent, as per the following extract from its general order No. 14, dated Dec. 23, 1909: "All rates now in effect, or which may hereafter become effective, which are not higher than the maximum rates prescribed by this commission, whether such rates are the result of voluntary action upon the part of any company, corporation or person, subject to the jurisdiction of this commission or otherwise, are hereby established as the rates of the Railroad Commission of Georgia, and no such rates shall be discontinued or raised without the consent of the Railroad Commission first being obtained, but all such rates shall continue in force without hindrance, the same as other rates prescribed by the commission."

The Macon Railway & Light Company, however, has not changed its base rate, the low rates being made possible by reason of discounts allowed. It is more than likely that an attempt will be made to end competitive conditions as quickly as possible, so that a further reduction may be made effective. It is considered improbable that the ruling of the commission can be enforced in the case under consideration, especially if the company can prove that consumers are being served at a loss.

### Plans of the Society for Electrical Development, Inc.

In order to further the work of the Society for Electrical Development, Inc., several of its committees are to hold meetings in May at the society's offices, Engineering Societies Building, New York.

On May 5 the slogan committee, which is composed of Messrs. J. Robert Crouse, Philip S. Dodd, J. M. Wakeman and George Williams, will hold a meeting. Over 500 suggestions have been received by the society as a result of the contest it announced a short time ago for a suitable trademark and "slogan" to be used by it in the various campaigns to extend the use of electricity. These suggestions will be considered by the slogan committee in order to select the one best adapted for the society's purpose.

A special committee on plans has been appointed to study the mass of suggestions and ideas produced at the conference of the society in New York on March 4 and 5. This committee, a list of whose members appears below, is composed of men especially qualified to pass upon the different phases of effort contemplated by the society. The specific purpose of this special committee is to prepare from the many plans and suggestions made at the conference a comprehensive plan to be submitted to the members of the society at their annual meeting, which will probably be held in Chicago just prior to the annual convention of the National Electric Light Association. The plans of the society will be presented to the industry at large in a booklet to be issued shortly after the meeting.

According to the by-laws, the first regular annual meeting of the society is scheduled to be held at its offices at 11:30 a. m. on May 13, but as the annual meeting of the National Electric Light Association is to be held in Chicago June 2-6, the board of directors of the Society for Electrical Development, Inc., states that no business will be conducted at the meeting held in New York on May 13, and that this meeting will be adjourned to reconvene in Chicago at 11:30 a. m. on May 31, in the special meeting room of the Hotel Sherman.

The members of the committee on plans are as follows:

From the central-station companies—Messrs. E. W. Lloyd, L. D. Gibbs, Arthur Williams, George Williams and M. E. Turner.

Contractors—Messrs. H. B. Woodhill, C. L. Eidlitz, C. R. Krieder and W. D. Carstophen.

Jobbers—Messrs. Gilbert Smith, C. C. Sibley and P. L. Thompson and Col. A. V. Carter.

Manufacturers—Messrs. F. H. Gale, J. C. McQuiston, H. I. Markham, Kern Dodge and J. Robert Crouse.

At Large—Messrs. F. B. Rae, Hugh M. Wilson, F. E. Watts and T. C. Martin.

### New York to Determine Economy of Isolated-Plant and Central-Station Service for Municipal Buildings

A test which is to run continuously for an entire year is being conducted upon the steam and electrical generating plants in the Hall of Records in New York City. The building in question is located directly opposite the new Municipal Building, which has central-station service, and just north of City Hall Park. It contains an electrical generating plant comprising four units, with an aggregate rating of 450 kw, and the boiler equipment comprises five water-tube boilers, with a combined rating of 1600 hp. A complete description of the installation is contained in the *Electrical World* for July 27, 1907. From the completion of the Hall of Records until the autumn of 1912 the electrical generating plant supplied the requirements of this building alone, and the installation was considerably in excess of the maximum demand to which the plant was subjected. Last fall the City Hall, the City Court and the County Court Buildings—all of which are located in City Hall Park—were connected with the Hall of Records by means of underground ducts and steam mains, and since that time the three buildings in City Hall Park have secured electricity for lighting and motor service and steam for heating from the plant in the Hall of Records.

While the Bureau of Municipal Research had collected data upon certain buildings in New York City, which purported to show the comparative cost of supplying these buildings with light, heat and motor service with electrical energy purchased from the central station and with electrical energy generated upon the premises, the bureau was unable to reach a decision as to whether any real economy would result from supplying the buildings in City Hall Park from the Hall of Records plant. It was decided that



the only way to settle this question would be to make a year's test, and such a test was sanctioned by the Borough President upon the advice of the Bureau of Municipal Research.

The test is being conducted by a board of supervising engineers, consisting of Mr. E. P. Goodrich, consulting engineer to the Commissioner of Public Works; Prof. George P. Sever, consulting engineer of the Department of Water Supply, Gas and Electricity; Prof. Charles L. Lucke, of Columbia University; Prof. R. C. Carpenter, of Cornell University; Mr. R. P. Bolton, of New York City, and Mr. E. F. Tweedy, of the New York Edison Company. Prof. Herman Diederichs, of Cornell University, is in direct charge of the test.

## Bond Issue for Los Angeles Municipal Distribution System Defeated

The bond election held in Los Angeles, Cal., on April 15 for the installation of a municipal electric distribution system costing approximately \$6,500,000 resulted in the defeat of the issue.

For the past six years the city of Los Angeles has been working upon an aqueduct to bring the waters from Owens River to the city, a distance of approximately 250 miles. The capacity of the aqueduct is 20,000 miners' inches, and the estimated cost of the enterprise is \$23,000,000. It is expected that the aqueduct construction will be completed during the latter part of the present year, and water drained from the high Sierras by the Owens River will be available for use in the city of Los Angeles within six months' time.

In connection with the aqueduct construction a considerable amount of electrical energy can be developed by the installation of plants at various favorable locations along the route. The maximum amount possible to generate is variously estimated from 60,000 hp to 65,000 hp with greater outputs over the peak by means of storage reservoirs. Three years ago a bond issue of \$3,500,000 was authorized by the citizens for the installation of the first generating plant at a site in the San Francisquito Canyon, relatively close to Los Angeles. This plant is constructed to develop an average of 17,500 hp and over the peak a maximum of 35,000 hp. The original estimated cost of \$3,500,000 will be exceeded by \$1,350,000.

### PROPOSITIONS MADE BY EXISTING UTILITIES

There are three generating and transmission companies doing business in Los Angeles—namely, the Pacific Light & Power Corporation, the Southern California Edison Company and the Los Angeles Gas & Electric Corporation. The two first-named companies distribute a large amount of energy outside Los Angeles as well as inside the city, and the last-named company confines its electrical operations entirely within the limits of the city of Los Angeles. Naturally there has been much anxiety among the city officials and the officers of the generating companies as to how the city's electrical energy, to be generated along the aqueduct, should be distributed. During the past two years frequent meetings and discussions have been held between the city's representatives and the representatives of the interested central-station companies, and at an early stage it developed that whereas the latter were willing to take the aqueduct energy from the city upon a fair basis and distribute it over their own lines, the city officials were mostly of the opinion that the city should purchase such portions of the existing distributing systems as it might desire and distribute the aqueduct energy itself. Finally the generating companies were asked to set prices on their distribution systems in Los Angeles. This, because of the restrictions in the first deeds securing the various bond issues on their properties,

the companies were unable to do so. This situation was explained to the city officials. The latter, however, would not accept the explanations of the companies.

It has been recommended by the members of the three companies in question that the aqueduct energy should be cheaply because it is practically a by-product and that the people of Los Angeles should have the full advantage of it. Many believed that in a proper agreement there must be between the city and the companies the city could get the electrical energy at wholesale, and the citizens could have it distributed to their homes at a price of no more than 10¢ per kw-hr. cost as the city could do itself, for the Mayor and Council could fix the price at which the people could be sold—by the city, the companies, and the Board of Public Utilities, appointed by the Council, would fix the schedules at which the energy would be distributed to the consumers in the city.

Finally, the companies made the following four definite and distinct proposals to the Los Angeles City Council: (1) To purchase the aqueduct energy at a fair price—from \$750,000 per year upward—according to the amount developed. (2) To become the distributing agency in the city, the price for this service to be determined upon the basis of the amount of energy distributed. The city would comply with the conditions in all matters pertaining to the same. (3) To lease the present distributing system to the city upon a satisfactory basis to be agreed upon. (4) To transfer the aqueduct energy on a partner ship basis.

The present city administration of Los Angeles, however, contended that the companies must sell their lines and get out of the city or the city would put in its own distributing system. The City Council would not submit the proposals made by the companies to the people but decided to call a bond election and submit to the citizens the question whether or not the city should bond itself for \$6,500,000 to put in an electrical distribution system which would parallel existing lines. After several postponements it was decided to hold the election April 15, and at the same time bonds, mostly for other aqueduct matters, were to be submitted, the total amount under consideration being \$17,600,000.

### MOVEMENT TO OPPOSE BOND ISSUE

The majority of the business men of Los Angeles were plainly against the issue of power bonds for \$6,500,000, believing that the administration had not presented at the present time, if at all. A voters' Educational Association was formed, with the idea of increasing the number of each of the eight bond issues to be considered for the five payers and to make the same difficult to pass. And meetings held Jan. 23, 1913, resulted in the adoption of issuing only two of the eight proposals.

With regard to the proposal for \$6,500,000 of bonds for an electric distributing system the Educational Association's recommendation was as follows: "While it seems to be the consensus of opinion that it will be wise to use the electrical energy generated along the line of the aqueduct to furnish light and power to the people, with the opportunities offered through the transfer of the generating companies to the city from the city at a small cost that will at once materially reduce the burden of taxation, and with the right vested in the Council to fix the rates which the companies are to charge, there is strong people prefer to the use of such a large amount of bonds for this purpose, a fair measure at this time and one that would be deferred." In the resolution which follows citizens were advised to vote against the \$6,500,000 because the prohibition of a lighting distributing system."

### EDUCATIONAL CAMPAIGN OF ELECTRIC COMPANIES

The electric companies did not commence a campaign of education until about three weeks before the date finally fixed for the election. In Los Angeles there are three morning papers and two evening papers. Two of the morning papers were opposed to the power bonds, but not actively; one morning paper was aggressively in favor of the bonds; both evening papers were in favor of the bonds and were somewhat bitter against the lighting companies. In the three morning papers and one evening paper daily electric talks were published, paid for by the companies, and these were of undoubted value from an educational standpoint. Other literature was published and mailed to voters, pointing out certain conditions surrounding the issue before the people. One of the companies mailed to each of its 45,000 customers in Los Angeles a letter containing a straightforward statement of the whole matter, in as few words as possible. Many consumers took the trouble to send replies to the effect that they agreed with the company's stand and that they would use their influence to oppose the approval of the bonds. The letter read as follows:

"To Our Consumers: A bond election is to be held in Los Angeles on Tuesday next, April 15, and one of the things to be considered is whether or not the city will expend the sum of \$6,500,000 for an electric distribution system.

"The Southern California Edison Company has always been frank and fair with its customers and has consistently endeavored to be worthy of their confidence. The company is not in politics and has no desire to enter that field. But this bond election is of great importance to the city, to the company and to you as taxpayers, and for this reason we now give you some undeniable facts, which you are asked to consider.

"1. The electric companies now supplying Los Angeles have a combined distribution system which amply takes care of all parts of the city. The proposed bond issue for a distributing system is not sufficient to supply more than two-thirds of the city's present needs.

"2. The electric companies have made four definite proposals to take all the energy generated on the aqueduct as soon as it is ready for delivery, viz: (a) To purchase the energy at a fair price; (b) to become the distributing agents of the city; (c) to lease the existing distributing system to the city; (d) to handle the aqueduct electricity on a partnership basis. The acceptance by the city of any one of the above proposals means that the city would immediately receive a large income, available for the reduction of expenses.

"3. You are aware that taxes are high in Los Angeles. The proportion of the tax levy at present applicable to interest on bonds and sinking fund is 64 cents on \$100. If the additional power bonds of \$6,500,000 are voted, the rate will be raised to 75 cents on \$100. But if these bonds are defeated and any one of the offers made by the electric companies is accepted, the large income made available from the sale of energy will be equivalent to a reduction of the present rate from 64 cents to 45 cents on \$100. In other words, the difference to you as taxpayers by defeating the power bonds will be 30 cents on \$100.

"An argument has been put forth that voting these bonds would place the city in position to reduce rates for electric service, granting two years for the installation of the system and development of the business. Owing to the continued growth of Los Angeles the city administration makes some reduction in rates almost every year, and these reductions seem likely to continue under present conditions.

"4. By defeating the power bonds you will prevent your streets from being encumbered with two lines of poles where one line is sufficient.

"Vote against the proposed power bond issue of \$6,500,000 and reduce your taxes. Then combine aqueduct energy

and the companies' distributing systems and make reduced rates a certainty. Remember the city is in a position to regulate the wholesale price it shall receive for the aqueduct energy and also the price at which it shall be resold to the consumers, and any arrangement along the lines we have suggested need not necessarily be permanent, but it is well worth trying for a few years."

The effectiveness of the campaign, which was conducted by the companies along frank and clean educational lines, may be judged by the result. Under the city charter a two-thirds vote is necessary to approve bond issues. A total vote of approximately 52,000 was cast in connection with the power bonds, and the movement was defeated by about 4000 votes.

### Commercial Section Features at the Chicago Convention

At the meeting of the executive committee of the Commercial Section of the National Electric Light Association held at the Hotel Sherman in Chicago last week several matters of importance were discussed and the program for the convention was finally passed on. In addition to reports from the standing committees on finance, publications and membership, printed reports will be made by the following committees: Electrical salesman handbook, Mr. E. L. Callahan, Chicago, chairman; electricity on the farm, Middle States, Mr. C. W. Pen Dell, Chicago, chairman; Eastern States, Mr. J. C. Parker, Rochester, chairman; wiring of existing buildings, Mr. R. S. Hale, Boston, chairman; ice and refrigeration, Mr. G. H. Jones, Chicago, chairman; electrical merchandising, Mr. T. I. Jones, Brooklyn, chair-



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man; steam heating, Mr. S. M. Bushnell, Chicago, chairman; advertising, Mr. J. R. Crouse, Cleveland, chairman; education of salesmen, Mr. George Williams, New York, chairman, and short cuts in executing customers' orders, Mr. G. C. Holberton, San Francisco, chairman. Additional features will be a lecture by Mr. M. Luckiesh, of Cleveland, on "Light and Art" and a talk by a prominent citizen of Chicago. Headquarters of the Commercial Section at the convention will be established in one of the exhibit spaces in the basement showroom of Medinah Temple.

A distinctive N. E. L. A. button has been designed for members of the Commercial Section as shown herewith, the ring shown in black in the engraving being blue, the lettering gold and the rest of the button white. There will probably be four sessions of the Commercial Section, and these will be held in a large tent with ground dimensions of 50 ft. by 85 ft. erected on the lawn west of the Temple building. This tent will seat approximately 700. It is expected that the attendance at the Commercial Section sessions will be so large that room can be provided only by this means. The general assembly room of the Temple will be in use for the general sessions of the convention, and there are no other quarters in the Temple considered large enough to accommodate the expected attendance.

### Activity of the Jovians

The present administration of the Jovian Order with Mr. Frank E. Watts, of New York, as Jupiter and Mr. Ell C. Bennett, of St. Louis, as Mercury, is a very active and energetic one. From Oct. 16, 1912, to April 1, 1913, 1590 new members were initiated into the order, which passed



the 10,000 mark on March 29. However, even this rate of progress does not satisfy the energetic officers, and they are urging the necessity for extra efforts during the month of May. Future rejuvenations now definitely set at this writing, with names of the statesmen in charge, are as follows: April 29, Pittsfield, Mass., Mr. E. F. Gehrke; May 8, Oklahoma City, Mr. W. J. Lantenburgh; May 9, Austin, Tex., Mr. A. E. Hancock; May 22, Galveston, Tex., Messrs. A. J. Binns, P. Loyd Lewis and Charles L. Martin; May 23, St. Louis, Mr. F. D. Beardslee; May 24, Erie, Pa., Mr. R. B. McClain; June 3, Chicago, Mr. George C. Richards; June 4, Louisville, Mr. C. A. Klemm; June 7, Pittsburgh, Mr. M. Frank Knapp; June 17, Cedar Point, Ohio, Messrs. A. F. Loch and M. H. Moten.

### Convention of Missouri Electric Association at Kansas City

Mr. J. E. Horsh, business manager of the City Light & Traction Company of Sedalia, Mo., and vice president of the Missouri Electric, Gas, Street Railway and Water Works Association, presided at the seventh annual convention of this association, held in the Coates House at Kansas City, Mo., on April 17, 18 and 19. In his address Mr. Horsh spoke in very complimentary terms of the services rendered the association by Mr. P. A. Bertrand, the past-president, who resigned previous to the meeting of the executive committee at St. Louis in January. Mr. Bertrand, it was stated, resigned because he felt that he had severed his connection with the association when he left the Jefferson City Light, Heat & Power Company, of which he was manager, to go to another State.

Thorough organization of the Missouri association was recommended in the vice-president's address, with a view toward developing every phase of industry represented by its name. Special efforts will be made to cover the subjects of gas and water-works, as many of the members are interested in combination properties. With this idea in view a committee consisting of Messrs. Herman Spoehrer of St. Louis, F. E. Murray of Louisiana, Mo., and R. J. Freine of Moberly, Mo., was appointed to prepare a program for the 1914 convention covering all subjects closely allied with the industries in which the members are interested. Interest in electrical subjects will not have to be fostered, as was evident from the program. More attention will be directed toward practical topics of interest to small stations at future conventions, and special stress will be laid on rates, policies and labor costs. Committees will be appointed to keep in close touch with all state and municipal matters concerning public utilities. The hope was expressed that this association would become closely affiliated with the National Electric Light Association.

Two papers, which were prepared by Mr. J. A. Gelzer, of the Wagner Electric Company, and Prof. L. J. Hildebrand, dean of engineering at the University of Missouri, respectively, were read at the afternoon session on the first day of the convention.

#### SINGLE-PHASE MOTORS

Mr. F. Johnson, of the Wagner Electric Manufacturing Company, read Mr. Gelzer's paper, which was entitled "Solving the Small Users' Problem." The paper was an exposition on the merits of single-phase motors, particularly as applied to smaller installations. Figures were given showing the saving on the original transformer and meter investment and on the transformer losses attributed to the use of single-phase instead of polyphase motors. The relative disturbing effect of single-phase versus polyphase motors on transmission lines was discussed, and the effect on the power factor was noted.

In the discussion of the paper inquiries as to the performance of the unity power factor motor manufactured

by the Wagner company were made by Messrs. E. J. Jones and J. O. Macfarlane. The advantage of the unity-power factor motor as a condenser on the line was questioned because of its reduced efficiency. In reply it was said that if the loss in efficiency in one case offset the gain in the other the saving in transformer investment installation and transformer losses would more than offset the loss in phase motors.

#### TRANSFORMER SUBSTATIONS

Prof. Hildebrand's paper on small transformer substations was read by Mr. R. K. McMasters. This paper outlined a number of different industrial and domestic uses. High tension transmission lines can be supplied with energy with profit to the central-station company. Accompanying the paper were curves plotted to show the annual investment and the operating expenses connected with the installation of step-down distributing substations for communities consuming different amounts of energy. Indoor and outdoor type substations designed for manual and remote control were represented by different curves. By the aid of these curves a method was shown which enables an equitable charge per kilowatt-hour to be determined for different communities.

From the figures given it appears that the smallest indoor step-down substation is entirely self-sufficient in installation for supplying energy to domestic consumers whose aggregate consumption is on the order of 100 to 200 kva outdoor substation can successfully compete with a 400 kva indoor station in producing returns to the central station.

Several representatives of companies supplying energy throughout rural districts in Missouri took part in the discussion. Mr. P. W. Marshall, superintendent of the Brookfield Electric Light Company, spoke of some very promising rural districts in Missouri which are rapidly being supplied with electricity from the company's lines.

Mr. Paige, of the General Electric Company, described the new portable step-down substation which are being used in connecting rural distribution lines with high-tension transmission lines in which the potential reaches many volts.

#### WHITE RIVER DEVELOPMENT

The morning session on April 18 was opened by an illustrated lecture on the "Hydroelectric Development on White River" by Mr. J. O. Kennedy, of the White River Construction Company. An abstract of the paper will be given in a subsequent issue.

#### MANUFACTURING OPERATIONS

Mr. E. B. Uring, of the Western Electric Company, gave an illustrated lecture on the conversion of the raw material to the finished product. Starting from the mines of silver ores through Utah and the copper mines at Bisbee, Ariz., together with extensive and diverse uses of the Western Electric Company's buildings at Chicago, accompanied the lecture. A few figures on the cost of mining copper and the expenses connected with the Western Electric plant at Chicago were given.

#### CONVENTION IN 1914

At the executive session held by the attention of a committee consisting of Messrs. S. Sandberg, H. Campbell and J. R. Wright. It is reported on the morning paper for the 1914 convention, it is held on May 10, from 10 a. m. to 6 p. m. at the Hotel Kew-Forest in New York City. The Missouri Electric, Gas, Street Railway and Water Works Association is to meet at that time. The trip will extend over three days, as both the society and the night in the morning of the trip will be covered by a lecture on the return. However, will be concerned on the last May 7, 8 and 9.

Subsequent to Chicago is more rather with more prominence. The session on May 10, it is reported that all of the time



bers attending might take advantage of the automobile trip around the scenic Cliff Drive and other boulevards of Kansas City.

#### BANQUET

In the evening a banquet was held at the Coates House, at which several members of the senatorial committee on conservation of water-powers and of the state utility commission were guests. Mr. William Hand was toastmaster. Mayor Jost of Kansas City expressed his views on municipal and corporate ownership of public utilities. Although he does not believe in municipal ownership of public utilities in general, he does believe that such utilities should be put in charge of the city when a corporation takes advantage of the citizens. Senator Bronson and Senator Hawkins each gave a short informal talk.

#### ELECTRICITY IN AGRICULTURE

Mr. E. P. Edwards, of the General Electric Company, gave an interesting talk on electricity as a factor in progressive agriculture. In speaking of the investment and expenses connected with the operation of various farm machines, he said that he believed it was the duty of agricultural schools and the United States Department of Agriculture to establish a bureau which would compile data on the cheapest methods of operating apparatus used on farms. Only in this way does he believe that farmers will promptly accept electricity as their motive power.

In the absence of such data, the General Electric Company has conducted tests on numerous farm machines, the results of which show the advantage of electricity over other motive powers. Comparative tests for determining the relative costs of manual labor, work done by horses and electric motors show that for manual labor the cost is 88 cents per hp-hr., for work done by horses 8 cents per hp-hr., and for electrical service 5 cents per hp-hr. It is estimated that an installation of 15 hp in motors will do the work on an average farm. A saving of from 3 to 5 cents can be realized per bushel of grain if electrically operated machinery is used.

In the interesting discussion which followed the presentation of this paper Messrs. Howard, Horsh, Lee, Henderson, Horan, Forest, Long and Woodhill took part. The prevailing opinion seemed to be that while it does not pay to install a single 15-hp motor on a transmission line, several such installations in a group would prove profitable. It was suggested that a demonstrating farm equipped throughout with electrical apparatus be established near the central station yet not too far to be out of visiting distance for prospective farmers. Electric lamps on farms are not found a profitable load to the central station unless accompanied by a motor load.

Mr. Lynton T. Block explained the relations of the Utilities Indemnity Exchange with public utilities in eliminating the profit made by old-line insurance companies. Several members of the convention commended the exchange as a result of the prompt settlements made on different occasions.

As a result of the talk by Mr. Block the following resolution was brought before the association and adopted: "Resolved, That this association recommend to its members that they join the Utilities Indemnity Exchange and thus obtain for themselves and afford to others the benefits of co-operation in the matter of liability protection."

#### NEW OFFICERS

Reports submitted by the committee on resolutions and nominations were accepted, and Messrs. J. E. Harsh of Sedalia, Mo.; C. L. Clary of Sikeston, Mo., and F. D. Beardslee of St. Louis were elected as president, first vice-president and secretary-treasurer respectively.

Mr. J. E. Horsh, president-elect of the Missouri Electric, Gas, Street Railway and Waterworks Association, displayed, when Mr. Bertrand resigned in January, his wide-awake attitude and ability to put the association on a par

with any similar association in the country. The substance of his address as presiding officer at the Kansas City convention is illustrative of his progressive qualities.

In 1904 Mr. Horsh was employed by the Denver Gas & Electric Company as meter man. He remained in the employ of this company for several years, being promoted to the business department. From 1908 until December, 1912, he occupied the position of contract agent with the Empire District Electric Company at Joplin, Mo. Since that time he has been employed as new-business manager of the City Light & Traction Company at Sedalia, Mo. During his career he has been connected with H. L. Doherty & Company, of New York City.

#### TROLLEY TRIP

The 1912 convention was brought to an enjoyable close by a trip over the 1200-volt direct-current interurban line from Kansas City to Excelsior Springs. A special car chartered for the occasion stopped at Liberty, Mo., where luncheon was served at the local hotel. After a short stop at the Springs the party returned to Kansas City.

### Pittsburgh Meeting A. I. E. E.

A meeting of the American Institute of Electrical Engineers was held under the auspices of the committee on electricity in mines, in co-operation with the Pittsburgh Section, at the Fort Pitt Hotel, Pittsburgh, April 18-19. About 300 members and visitors were present. On the evening of April 18 an informal dinner was held, at which local Chairman E. L. Farrar presided, and President Ralph D. Mershon made a few remarks advocating increased activity among the local sections. A series of moving pictures, entitled "From Mine to Molder," was also shown, accompanied by an explanatory lecture.

At the opening of the session on April 18 President Ralph D. Mershon called attention to the increasing activity of the Institute and the need for larger revenue. He outlined several plans which are under consideration for reducing the outlay incident to the publication of papers and proceedings. The present meeting, he said, was the first held under the auspices of the new committee, and each additional committee and new line of work taken up means greater expense. He suggested that it should be the special function of the sections, and not of the main body, to increase the membership, and thereby the revenue, of the Institute. President Mershon turned the conduct of the meeting over to Mr. George R. Wood, chairman of the committee on use of electricity in mines, who presided throughout the sessions.

The papers by Mr. H. C. Eddy on "Purchased Energy in Coal Mines" and by Mr. C. W. Beers on "Central Station Energy for Coal Mines" were then presented by the authors.

#### PURCHASED ENERGY IN COAL MINES

This paper, by Mr. H. C. Eddy, presents a comparison between relative costs of electric energy for coal-mining purposes, as between that purchased from the central station and that generated in an isolated plant at the mine. The conditions incidental to the industry are shown to be such as to produce an exceptionally poor load-factor. The demand varies greatly within a single day and the average working time per day is less than sixteen hours. The average number of working days per month is between fifteen and twenty, and the annual load-factor is very low. Altogether there is a considerable portion of the year when the equipment necessary to an isolated-plant power source would be idle, causing the actual output to carry a very high fixed charge per kilowatt-hour generated.

The advantages which are claimed to attend the purchase of energy are summed up as reduction of fixed charges on the investment, reduction of actual operating

costs, cutting down of distribution losses, increase in output of mining machines, increased flexibility of energy supply system, reduction of labor for attendance, elimination of high maintenance and repair expense on generating equipment, cost of superintendence reduced, liability decreased, insurance against constantly increasing energy costs obtained through term contracts at fixed rates, and finally additional coal made available for sale.

## CENTRAL-STATION ENERGY FOR COAL MINES

After devoting some space to a preliminary study of the conditions which make desirable the purchase of central station energy for coal mining operations, Mr. C. W. Boers outlines the points considered in negotiating for such a supply for the Lehigh Valley Coal Company. These points were, in the order given, basis on which energy would be paid for, territory covered by contract, location of energy consumption meters, delivery voltage, power and point of delivery, maximum-demand charges, methods of denoting and rating connected load, rating of intermittent apparatus, method of determining load-factor, pole-line charges, power-factor, explanation of terms, and defining what constitutes a substation.

A contract of this kind was eventually made, and the author closes his paper with a statement of some of the ways in which the service was found advantageous to the mining operators. Among others the following seemed to carry the most weight: Promptness and reliability of service; coal that would have been used in a boiler plant at the mine was rendered available for sale; the added worry of operating a power plant was saved; a cheap and ready means for operating isolated equipment was furnished; and, finally, additions to the power equipment were more readily approved, since increased power-plant costs did not appear in the estimate.

## Discussion

In the discussion of the papers Mr. George H. Morse referred to the recent law enacted in Ohio limiting the potential used in mines to 250 volts. He thought this was probably too high and that the potentials in general use throughout the mines possibly should not exceed 50 volts.

Mr. K. A. Jolly called attention to the steam and fuel consumption as brought out in the paper of Mr. Boers. Fuel is only one of the items entering into the cost of energy, and low-priced fuel is not necessarily the most economical. The steam equipment in a mine shows wear and depreciation, whereas the efficiency of an electric motor varies but slightly with age.

Mr. E. D. Dreyfus in a written communication called attention to the rapid growth of electrically equipped mines in a limited time. The author's personal observation had shown over 200 coal companies using central station energy, and he felt this to be but a small percentage of the whole.

Mr. Partridge thought that the figure of 8 mills given by Mr. Beers might represent the cost of energy in a 1000-kw station, but he believed the lowest average figure for which energy could be sold at any profit whatever was 1.5 cents per kw-hr.

Mr. H. C. Eddy stated that in his opinion the low rate of 8 mills was possible because of the diversity-factor of the load, and his company is willing to take contracts on that basis.

## SAFEGUARDING THE USE OF ELECTRICITY IN MINES

The dangers incidental to the use of electricity in mining work are given by Mr. H. H. Clark as accidents arising from shocks, fires and explosions. The conditions of limited working space, darkness and necessarily bare wires, quite commonly found, are such as to favor many accidents of the first-mentioned nature. Falls of roof, the blowing of fuses, sparks from trolley wheels and commutators, and even heat from incandescent lamps, may, any of them under the right conditions, lead to mine fires. Accidents

[illegible]

After the reading of this paper Dr. S. J. Kniffier, medical director of the Westminster Electric & Manufacturing Company, was asked to make some remarks on resuscitation. He explained and advocated the use of what is known as the "suction" or "pressure" method, stating that the same holds true in any type of medical resuscitation as required on apparatus whatever.

Mr. J. S. Parks, and by means of all his patients, more than three between operations in the Schaefer method of treatment. Each one of the results was a complete stopping of the dermics and instructions for their care. The latter, however, did not approve of the use of medicine, but of a physician. At the conclusion of the discussion the speaker gave a demonstration of the principles of first aid as exemplified by the Schaefer method, with a record of a supposed subject who was played in a film. Further discussion of Mr. Clark's report was participated in by Messrs. W. E. Dickinson, Graham Bright and L. R. Thomas.

ALTERNATING CURRENT MOTORS FOR DOMESTIC CONSUMPTION  
OF MINERAL OILS

Problems in connection with electric drive for mine fans are discussed in this paper by Mr. V. B. Gerasimov. The subject is divided into two main headings: constant-speed and adjustable-speed drives, of which the former is treated over rapidly as of only occasional importance. Adjustable-speed drives are treated under several basic headings: the nature of the practically arising requirements. The use of changeable pulleys in connection with a constant-speed motor is also considered, although it is not in line. Rheostatic control of a variable-speed motor is a possible method, but is not adopted and is unsuitable in present conditions. Speed-pulse control is inefficient. The use of motor-speed windings is shown to be good, where two, three, or four definite speeds must come out in different and thus different motors in connection with rheostatic control is desired. Where there are more than two speeds are required, operation is possible by "intermediate" speeds are used, and a few percent of the speed is kept in the single speed motor. One of the shortcomings of the general principle of use of a motor with a variable speed is the deficiencies are connected with the motor. These can be obtained from a speed and torque characteristic curve with a high percentage of the speed range, where adjustment of the speed is not required. The use of the speed and torque characteristics of the motor in shifting the pulleys of the motor is not required. This machine can be equipped with a constant-speed motor manipulation of the pulleys. The machine working in the operation of the motor is not required. The machine working in the operation of the motor is not required. The machine working in the operation of the motor is not required.



### Discussion

In the discussion, Mr. Beers said the title of the paper was misleading in that it dealt with motors. The speaker said a fan should be run at its maximum efficient peripheral speed, and that it is not a good idea to put change of speed under control of a man not directly under the superintendent. The displaced air, he maintained, should be the measure of the power to be expended. Constant-speed motors are proper for this work and the great advantages of simplicity and ruggedness possessed by the squirrel-cage motor should be capitalized. Mr. W. Sykes mentioned other schemes which he had suggested for this work and called attention to the fact that little supervision is given to a fan in the mine. The schemes proposed, he said, are of European origin and demand considerable attention. The speaker believed that two speeds will meet all conditions of mine fans, and these can be obtained by two-speed motors or by changing pulleys. Mine fans are generally belted on account of the low speed required so the latter method can be used easily. The practice of adding a three-phase commutating motor can only be justified by experience. Chairman Wood did not think the scheme was proposed as a panacea, but there are places where such an installation is justified. Messrs. G. Bright, Meyer-Delius, Oschman and Fast also joined in the discussion.

Owing to the pressure on our columns this week, the remaining papers of the afternoon session with those of the Saturday morning session and the discussions on each will appear in a subsequent issue.

### Discussion of Wisconsin Public Service

Eighty utility men and manufacturers' representatives attended a public hearing held by the Railroads Commission of Wisconsin in Milwaukee on April 22. There was a general discussion of the proposed revision of the standards for gas and electric service in Wisconsin which have been in force for five years. Mr. David Harlowe, commissioner, presided. Prof. Charles F. Burgess conducted the technical discussions. The testing of meters, intervals between tests, meter records, the providing of modern illuminants, fees to be charged for tests and similar subjects were brought up. A committee of the Wisconsin Electrical Association, through Mr. F. A. Vaughn, commented on the proposed rules and ample opportunity was afforded for free discussion. An account of the discussions will appear in a later issue.

### The New Missouri Commission Law

The recently enacted public service commission law adopted by Missouri, mentioned on page 819 of our issue of April 19, gives the commission jurisdiction over railroads, street railroads, common carriers, express and sleeping-car companies, and gas, electric-light, power, heating, water, telephone and telegraph companies operating or doing business within the State, and abolishes the Railroad and Warehouse Commission. Every gas, electrical and water corporation and every municipality is required to furnish safe, adequate and reasonable service and facilities at just and reasonable rates. Every unjust or unreasonable charge is forbidden, including undue preference or advantage to any person and discrimination in general. The quality of service will be investigated from time to time and standards of service will be established. Uniform accounts and annual reports to the commission are also among the requirements. Rate schedules must be displayed in public and changes in rates must be preceded by thirty days' notice to the commission. Sliding scales for the automatic adjustment of rates for service and dividends paid to stockholders will be permitted for fixed periods.

The provisions for inspecting and testing meters are already familiar owing to their general similarity to provisions in the laws of other states. Sales, leases, mergers, mortgages or transfers of property are subject to the commission's approval. No public-utility corporation may hereafter acquire stock in a similar utility, except that where a majority of stock is now lawfully held the remainder may be acquired upon consent of the commission. Security issues are also under the commission's jurisdiction; no franchise may be capitalized at more than its actual cost, and in mergers the amount of new stock issued shall not exceed the sum of the old stock and any cash actually paid in addition. Depreciation reserves, established under the direction of the commission, will be required and interest on the funds shall be added thereto. In rate making due regard shall be had for a reasonable average return upon capital actually expended and the necessity of making reservations out of income for surplus and contingencies. Provision is also included for valuation of property by the commission.

The provisions in regard to telephone and telegraph corporations are in general similar to those above. Physical connections between different systems when they can reasonably be made and are needed to serve the public will be required. No such corporation hereafter formed shall commence to build a plant without a certificate of public convenience and necessity. Stock, bond or scrip dividends are forbidden unless specially authorized. Review of the commission's decisions or orders by the Circuit Court of the county where the hearing was held or where the commission has its principal office, with right of appeal to the Supreme Court of the State, is among the provisions common to such public-utility laws. Appeals to the courts take precedence over all other civil cases except election contests. The health and safety of employees, passengers, customers and the public as affected by any railroad or public utility system are under the jurisdiction of the commission.

### Public-Utility Bills Before Illinois Legislature

Among the bills introduced in the present session of the Illinois Legislature to create public-utility commissions, the two which seem most important are the one recommended by a majority of Senator Dailey's joint legislative committee and the one favored by Governor Dunne, known as the administration bill.

The Dailey bill provides for one commission for the entire State. There are to be five members of the commission, each to receive a salary of \$10,000. Two of these are to be from the city of Chicago, one from northern Illinois, one from central Illinois and the remaining member from southern Illinois. The bill provides for uniform accounting, the supervision of stock and bond issues, power to investigate the affairs of utility companies, power to make physical valuations, to fix rates and to make rules and regulations necessary to conduct a just and equitable system of regulation. The bill does not affect the existence of the present Railroad and Warehouse Commission, although the committee recommends that ultimately this commission shall be abolished. The committee also contends that the cost of maintaining the commission should be paid by the utility companies themselves, and it is provided in the bill that a tax of \$100 for this purpose be made upon each utility company in the State, with an additional imposition of one-tenth of 1 per cent upon the gross earnings of such companies. It is said that the annual cost of maintaining the Wisconsin commission is about \$100,000, that of the commission for the Second District of New York about \$300,000, and that of the commission for the First District of New York about \$1,300,000. In the judgment of the Dailey committee a single commission for Illinois would require an expenditure of about \$400,000 a year.



The bill favored by Governor Dunne is modeled largely after the California law. It would create a state commission, but give to Chicago and all the other cities of the State having a population of more than 25,000 the option of regulating their own utilities or turning this power over to the state body. The Dunne bill abolishes the Railroad and Warehouse Commission. It also provides for five commissioners with salaries of \$10,000 each. The situation in the Illinois Legislature is such that observers familiar with political conditions are of the opinion that no public utility commission bill will be passed at this session.

### Massachusetts Commissions to Have Increased Powers

Governor Foss has signed a bill giving the Massachusetts Railroad Commission and the Gas and Electric Light Commission authority to examine the books, accounts, contracts, records and memoranda of the trustees of any voluntary association or express trust holding the capital stock of any public service corporation under their jurisdiction, and to require such trustees to furnish such reports and information as the board shall from time to time direct with respect to the relations and dealings between such trustees and any such corporation. Similar authority is granted each of the commissions to investigate and require reports from any voluntary association or holding company under the same ownership, control or management as a corporation subject to the supervision of either board. The act (Ch. 509) also contains a section stating that nothing in its terms is to be construed as requiring either board in making any recommendations, rulings or orders with respect to rates charged or the service furnished by any corporation subject to the supervision of either board to take into consideration in any respect whatsoever any certificates of participation or shares issued under a declaration of trust and representing the beneficial interest in the stock, bonds, notes or other securities of such a corporation or the investment in such certificates or shares.

### Public Service Commission News

#### NEW YORK COMMISSIONERS

The New York Railways Company has served upon the Public Service Commission, First District, a writ of certiorari, issued by the Supreme Court, to review the action of the commission in requiring the company to set aside 20 per cent of its gross earnings each month for maintenance and depreciation. This requirement was embodied in an order of the commission approving the mortgages issued by the New York Railways Company in the reorganization of the old Metropolitan Street Railway Company, which it succeeded. The company claims that the commission has no authority to make such an order and that by so doing it illegally substitutes the judgment of the commission for the judgment of the company's directors.

The Public Service Commission, Second District, has ordered the New York Telephone Company to make an addition to its line extending along or near the Buffalo-Batavia State Road from the end of its present line to connect with the eight subscribers located on or near this road, provided that one or more of the subscribers give a bond covering the taking by the eight subscribers of multi-party-line service connected with the company's Williams-ville exchange for a period of three years at a rate not less than \$18 per annum as a base rate plus \$2 per quarter mile as line mileage. The order is made following the complaint by a resident within 2 miles of where the company's line is now constructed and 4 miles east of Williams-ville on the Buffalo-Batavia State Road. The Pioneer Telephone Company's line now ends about 11½ miles to the

east of complainant's residence. The company refused to make the connection, except upon the building of 2 miles of line at a cost of \$670 and an annual rental of \$66. The commission is of the opinion that the company should make the extension upon the filing of a bond which was offered by complainant, and the New York Telephone Company may, if it wishes, work out an arrangement for the extension of the line by the Pioneer Telephone Company, which operates in the locality in question.

#### ILLINOIS COMMISSION

A special report was presented to the Public Service Commission last week by a committee named by that body to go into the regulations concerning electric wiring in Baltimore. The committee was brought up several months ago by a complaint that the Consolidated Gas, Electric Light & Power Company had required a larger wire than was specified by the Department of Public Safety and the Fire Underwriters. While the complaint was withdrawn the commission decided to take up the entire question. The committee named was composed of representatives of the inspector of buildings, the State Board of Electrical Engineers, the Electrical Contractors' Association, the Consolidated Gas, Electric Light & Power Company, and the Public Service Commission. The report, which is voluntary, comprises a set of standard wire rules which it recommended that the electric-light company be required to follow. These do not interfere with the existing rules set forth by the Department of Public Safety or the Fire Underwriters, but add to these requirements.

#### NEW JERSEY COMMISSIONERS

The New Jersey Board of Public Utility Commissioners has dismissed the application of the Consumers Gas Company, Millville, for approval of an ordinance granting it permission to operate in that city. The decision is based on findings that the supply of gas now furnished in the Millville Gas Company is fully adequate for present and future needs, that the price charged is practically as low as that in any other section of the State, and that the introduction of a competing company into the field would not be for the public interest. The board holds as previous opinion, that competition on the part of public-utility companies does not necessarily tend to the public's good.

## Current News Notes

LIGHTING OF THE THEATRE. A picture of how Dayton was restored, illustrated by moving pictures and lantern slides, was given on April 24 at the New York Edison Company's auditorium by Messrs. John W. Lieb, Jr., and S. G. Rhodes. Mr. Lieb and Mr. Rhodes, who were among the first engineers to arrive at the stricken city, devoted themselves chiefly to restoring the lighting service. With the assistance secured from the Edison stations in New York, Chicago, Cleveland and other cities, temporary service was restored in remarkably short time. Public personnel have reported a high opinion.

ST. LOUIS LAMPS AS LAMPS OF FUTURE. With the object of showing the strength of the Electrical Bureau in St. Louis, the St. Louis Lamp and Electrical Bureau of that city has issued a circular to the members of electrical industries, intended to show, among other things, the total number of installed lamps, the number of kinds of materials and the total number of lamps for each of the electrical companies. Matters of such the desired material may be ordered have been sent to the members of the Bureau by Mr. E. C. Bennett, secretary and treasurer. It is believed that this narrative and interesting information will be obtained in the future. The results will be furnished to the daily and technical press.

**CORRECTION IN NAME.**—In the "Digest of Current Electrical Literature" of the *Electrical World* of March 29, page 686, credit was erroneously given to Mr. C. S. Wall for the article on separation of leakage reactance and direct magnetizing effect which appeared in the *London Electrician* of Feb. 28, 1913. The writer of the article was Mr. T. F. Wall.

\* \* \*

**PUBLIC LIGHTING CONTRACTS IN ONTARIO HEREAFTER TO BE PASSED ON BY ELECTORATE.**—Hon. Adam Beck has introduced a bill in the Ontario Legislature which will have a far-reaching effect on municipalities which desire to make contracts with private companies for the supply of electricity for light and motor service. Under the present law it is necessary for a vote of the people to be taken before the municipality can enter into a contract with the Hydro-Electric Power Commission of Ontario, but if the council of any municipality desire to enter into a contract with a private company it can do so without consulting the electorate, provided the power obtained is distributed by the municipality. The bill introduced by Mr. Beck puts private power companies on the same footing as the Hydro-Electric Commission with regard to the making of contracts for furnishing of electrical energy.

\* \* \*

#### SOCIETY MEETINGS

**ANNUAL MEETING CHICAGO SECTION, ELECTRIC VEHICLE ASSOCIATION.**—At a meeting of the Chicago Section of the Electric Vehicle Association on April 22 plans were discussed for the annual session and banquet of the section, to be held May 6 at the Hotel Sherman, Chicago. Mr. John F. Gilchrist, Commonwealth Edison Company, will preside as toastmaster, and there will be addresses by Mr. Arthur Williams, of the New York Edison Company, president of the Electric Vehicle Association, and Mr. E. E. Witherby.

\* \* \*

**CONVENTION OF THE CALIFORNIA ELECTRICAL CONTRACTORS.**—The fourth annual convention of the California State Electrical Contractors' Association will be held at Santa Barbara from Aug. 13 to 16, with headquarters at the Hotel Potter. An exceptionally good program of practical papers is being arranged, as well as entertainment features that will greatly add to the pleasure of the occasion. The committee of arrangements includes Mr. J. C. Rendler, chairman, and Messrs. C. Loveday, J. S. Reynolds, W. S. Hanbridge and F. Neilson.

\* \* \*

**ILLUMINATING ENGINEERING SOCIETY MEETING.**—On Thursday evening, May 8, at 8:15 o'clock, the Illuminating Engineering Society will hold a meeting at the Clymer Street Theater, 162 Clymer Street, Brooklyn, N. Y., at which Mr. Bassett Jones, with the co-operation of the Hewell-Basing Studios, will deliver a lecture on stage lighting. The lecture will be demonstrated with scenery, modern stage-lighting devices and living models. It is proposed to meet for dinner at the Café Boulevard at 6 p. m., from which place special buses will be provided to convey members and guests to the theater and return. The secretary of the section is Mr. Clarence L. Law, 124 West Forty-second Street, New York.

\* \* \*

**ELECTRIC-VEHICLE EDUCATIONAL WORK OF TRADE UNION.**—In a paper entitled "The Power-Wagon Driver," prepared by Mr. Daniel J. Tobin, general president of the International Brotherhood of Teamsters and Chaffeurs of America, and presented by Mr. William H. Ashton, general organizer of the same brotherhood, before the Electric Vehicle Association of America in New York on April 22, it was pointed out that the trade union of which these truckmen and drivers are members is doing much to educate the teamster of to-day to become the power-vehicle operator of to-morrow. The statement that the teamsters'

union is opposing the introduction of electric and gasoline vehicles in place of those drawn by horses was refuted. In voicing the sentiments of the teamsters of America in his paper Mr. Tobin said that the teamsters and carriage drivers of to-day believe in the necessity of the motor vehicle.

\* \* \*

**CHICAGO ELECTRIC CLUB LISTENS TO DR. MILLIKAN.**—Dr. R. A. Millikan, professor of physics in the University of Chicago, was the speaker at the luncheon of the Electric Club of Chicago on April 17. He gave a scientific discourse on "Theories of Electromagnetic Radiation." Among other things he spoke of the work of the research laboratories of the General Electric Company and predicted that electric-lighting systems would be entirely changed in the next ten years, because of discoveries which will be made through research in relation to the conductivity of gases. The club adopted resolutions of condolence on the death of Mr. Francis B. Badt. A report was presented by the committee appointed to co-operate with the general entertainment committees of the National Electric Light Association in providing entertainment for visiting electrical men at the time of the N.E.L.A. convention during the first week in June. On recommendation of the committee the Electric Club decided to give a vaudeville entertainment during the convention and authorized the expenditure of \$500 for that purpose.

\* \* \*

**JOVIANS' ACTIVITIES IN DISTRICT OF COLUMBIA.**—The monthly meeting of the District of Columbia Section of the Jovian Order was held on April 21 in the office building of the Potomac Electric Power Company. Statesman E. S. Marlow, manager of the commercial department of this company, presided. Mr. Arthur Dunlop, of the National Electrical Supply Company, spoke of the necessity of co-operation with the statesman in his administration. Mr. T. L. Townsend, vice-president of the National Electrical Supply Company, past-statesman, talked on the value of regular attendance and encouraged the members to take an active part in the proceedings. Elections to fill the offices of secretary and treasurer of the District of Columbia Section were held. Mr. C. B. Mirick was elected secretary and Mr. H. R. Carroll treasurer. During the early part of the evening a talk on the history of electric service in Washington and the various uses of electricity in connection with the home was given by Mr. G. P. Mangan, of the Potomac Electric Power Company. This talk was illustrated by motion pictures and lantern slides under the direction of Mr. H. A. Brooks, also of the Potomac Electric Power Company.

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**OFFICERS OF NEW YORK COMPANIES SECTION, N. E. L. A.**—At the monthly meeting of the New York Companies Section, N. E. L. A., held April 21, the following officials were elected for the ensuing year: Chairman, Mr. H. M. Edwards, of the New York Edison Company; vice-chairman, Mr. H. L. Snyder, of the New York & Queens Electric Light & Power Company; treasurer, Mr. W. L. Bruce, of the Westchester Lighting Company; executive secretary, Mr. F. C. Henderschott, of the New York Edison Company; recording secretary, Mr. J. A. Burke, of the United Electric Light & Power Company; executive committee, Messrs. H. M. Edwards, chairman; F. W. Smith, United Electric Light & Power Company; Stewart Wilder, Northern Westchester Lighting Company; I. M. Beatty, Peekskill Lighting & Railroad Company; Jesse Richards, New York & Queens Electric Light & Power Company; J. P. Radcliff, Jr., Yonkers Electric Light & Power Company; J. M. Butler, Bronx Gas & Electric Company; W. J. Clarke, Westchester Lighting Company; W. I. Donahue, the New York Edison Company; J. E. Phillips, Richmond Lighting & Railroad Company; Carleton Macy, the Queensboro Gas & Electric Company.



## Central-Station Practice at Cambridge, Mass.—II

Commercial methods and service data of the company—Street-lighting and electric-vehicle service—  
Methods used in testing meters Facts and factors

**I**N a previous article an account was given of the recent developments in the generating station of the Cambridge (Mass.) Electric Light Company, with details of the application of low-pressure turbo generators to the existing steam-engine plant, the tests made upon the first low-pressure unit installed, and various operating data pertaining to the generating equipment. Reference was made to the highly diversified character of the load carried by the system, and its interest from the commercial side was implied. The present and concluding article deals chiefly with the commercial phases of the company's work, including certain features of interest in connection with the distribution system and statistical data of interest from the analytical standpoint.

Apart from the diversified character of the service rendered, one of the most striking features of the company's work is the development attained along commercial lines with an unusually small organization. The population of Cambridge increased from 61,886 in 1900 to 104,830 in 1910, and with this gain came also a large increase in the manufacturing interests of the city. But the rapid growth in the earnings of the company must be attributed mainly to progressive management, to the maintenance of good service at rates in many respects lower than those in force in many larger cities, and to the solicitation of new business along the most favorable lines, although by a small force.

The company's gross earnings increased from \$297,230 for the fiscal year ended June 30, 1908, to \$430,495 in the corresponding fiscal year of 1912, while the gross receipts for the calendar year 1912 were \$453,063. The gross sales

for the month of January, 1913, were \$24,224, compared with \$45,453 in the previous year, important reductions in rates having been put in effect during the period which elapsed between these two dates.

### Business Accommodations

The main offices of the company, shown in an accompanying illustration, are located in an ill-placed, street property adjacent to the power house and occupy the central quarters for the executives and heads of departments, clerical force and telephone exchange of the commercial and engineering service. A city warehouse, a machine shop and a generating room are also located in the building, and in the yard beside a garage for electric and gas-line cars is conveniently located.

The Cambridge company maintains no appliance exhibit, but carries a small stock of induction motors ranging in size from 1/2-hp. to 2-hp. and several for emergency service. Two motors of each of the 1-hp., 2-hp and 3-hp sizes are carried, which are always available for emergency service or for immediate installation. The company acts as agent for a prominent motor manufacturer and sells the motors through its retail outlet in emergency service.

At the entrance of the office building is installed a company sign in the shape of the emblem which is used on its stationery of various kinds, company publications, etc., and owned by the organization, badges carried by employees and at pay stations located throughout the city. A typical sign of this type is shown in an accompanying illustration. It is illuminated by forty-four 8-cp., 10-watt, 25-watt tungsten lamps installed horizontally on a side and supplied



FIG. 1—ORNAMENTAL LIGHTING OF MASSACHUSETTS AVENUE, CAMBRIDGE, MASS.



with energy from a separate transformer connected with the lighting mains.

At the cashier's window in the main office seats are provided for the public. A lamp exhibit has been installed in an unused window space at the rear. Two rows of seven lamps each are wired to the office-supply circuit, the sizes ranging from 10 watts to 250 watts. The bases are at-

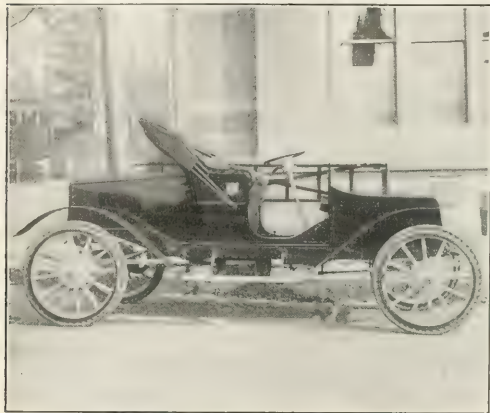


FIG. 2—ELECTRIC RUNABOUT OF CAMBRIDGE ELECTRIC LIGHT PLANT

tached to shelves 1 in. thick extending across the window space and 12 in. apart.

#### RATES FOR SERVICE

The company's charges for service as defined include general lighting, yearly lighting, power, contract power and miscellaneous energy rates. A price of 11 cents per kw-hr. is charged for all electricity used under the lighting rate up to and including 667 kw-hr. per month, with a discount of 1 cent per kw-hr. for payment within fifteen days of the bill's rendering. Between 667 kw-hr. and 1934 kw-hr. per month a 7-cent rate is charged without discount, and the price decreases in several steps to a minimum of 5.5 cents net per kw-hr. for all consumption equal to or over 4949 kw-hr. No minimum charge is made under this rate.

In case a customer whose lighting consumption equals 1934 kw-hr. per month elects to supply his own lamp renewals, the company deducts  $\frac{1}{2}$  cent per kw-hr. for all electricity used under this rate. The company also sells electricity for any purpose under yearly lighting rates to customers who have signed contracts for yearly electric service in addition to the regular application embodying the company's terms and conditions. A service charge is made of \$48 per year per kilowatt contracted for and is payable in regular monthly instalments. In no case, however, is such a contract closed for less than  $\frac{1}{4}$  kw. The service charge itself includes the supply of no energy, an operating charge of 6 cents per kw-hr. consumed being made for all energy furnished under the yearly lighting rate.

Electricity for power use is defined by the company as that used in general motor service, cooking, heating, electroplating and the charging of storage batteries, but it does not include the operation of dynamos for electric-lighting service.

The "power" rates are 5.6 cents per kw-hr. for the first 660 kw-hr. used per month; 4 cents each for the next 2130 kw-hr.; 3 cents each for the next 930 kw-hr., and for the next 1280 kw-hr. and above, 2.5 cents per unit, with a 10 per cent discount for fifteen-day payment. A minimum charge of \$1 per horse-power of demand is made. In deal-

ing with elevator service the company assumes the demand as equal to the rated horse-power of the motor. When a customer signs a contract for three years or longer to pay for 5000 kw-hr. per month minimum consumption, electricity for motor service only is sold under a schedule with an initial charge of \$163.58 for the first 5000 kw-hr., a charge of 1.85 cents per unit for the next 10,000 kw-hr., decreasing to a charge of 1.75 cents for the maximum consumption. When the meter readings of a contract customer show a use of his installation of 340 or more hours per month, his service is charged under a schedule which begins with \$163.58 for the first 5000 kw-hr. and drops to a price of 0.75 cent for a consumption above 780,000 kw-hr. per month.

#### OFF-PEAK RATES

Under its miscellaneous energy rates the company now sells electricity for battery charging, cooking, heating, refrigeration, water supply and pumping, provided the customer agrees to use no service between 3 p. m. and 6.30 p. m. from Oct. 20 to March 10. The off-peak schedule is 5 cents net per kw-hr. (when paid promptly) for the first 70 kw-hr. used per month, 3 cents net for the next 1930 kw-hr., and 2 cents per unit for over 2000 kw-hr. A minimum charge of \$1 per kilowatt of demand is made.

To insure the company against the use of energy during the hours exempt, the customer is required to provide a time clock at his own expense. If the customer is using energy for lighting, he is, however, allowed to charge batteries during the hours exempt, at a 10-cent rate. A customer who desires to use electric service as an auxiliary to another source of power or light may do so by paying a minimum charge of \$2 per kilowatt per month for as many kilowatts as it is possible for him to use on the service

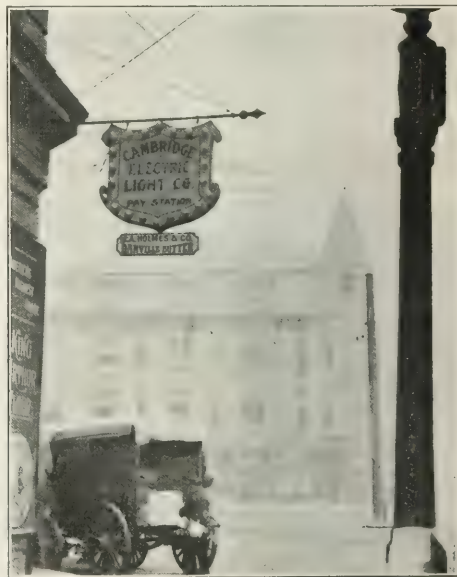


FIG. 3—ELECTRIC SIGN AT PAY STATION

at any one time. No lamps or renewals are supplied for such service.

The company reserves the right to install on any of its services a circuit-breaker arranged to disconnect the supply, if the demand arranged for that point is exceeded. In the supply of temporary service the customer pays the cost of installing and removing all equipment in addition to the





The company does not allow single-phase motors above  $\frac{1}{2}$  hp in rating installed on lighting services. When motors not above this size are wired for metering separately from the lighting service, the company grants them a "power" rate but in all other respects considers them a part of the lighting service. Mercury arc rectifiers are treated as single-phase motors, except that a larger capacity than



FIG. 6—ATTENDANTLESS SWITCHING AND METERING STATION FOR TOWN OF BELMONT

$\frac{1}{2}$  hp is permitted. The company requires that all motors larger than  $\frac{1}{2}$  hp in rating shall be wound for 550-volt, three-phase service, and when they are over 5 hp in rating it requires the provision of a starting box in order to prevent disturbances of the company's other devices. When a motor larger than 15 hp is to be installed the company advises consultation in order to secure the most acceptable type of installation.

These distribution and service requirements have been worked out with unusual care, and prospective consumers are provided with a booklet of about thirty pages which gives in detail the steps necessary to be taken before service can be had, the limitations upon the various installations and the burdens which can and which cannot be assumed by the company in its relations with its customers.

#### RENTALS AND FREE TRIALS

In emergencies the company is prepared to rent motors to meet conditions resulting from breakdowns of apparatus. It makes a regular practice of installing motors for a

TABLE I—CONNECTED LOAD DATA

	Kw
Municipal arc lamps .....	301
Commercial arc lamps .....	72
Municipal incandescents .....	55
73,785 carbon lamps, 50-watt equivalents .....	3,689
14,966 tungsten lamps, 40-watt equivalents .....	599
129 Nernst lamps .....	11
Total connected lighting load, about .....	4,727
Electric motors, 1135 in service .....	6,045
Total connected load of system .....	10,772

free trial of one week, including free energy for that period, and has secured much business in this way. It does all the wiring in such cases, and if the consumer decides on electric service the cost of wiring is later paid by him in cash or instalments. The free trial is extended for a month beyond the first week if the customer pays for energy consumed after the initial period. Demand indicators are not used, but the company tests individual installations as required. Electric flatirons are installed on a two weeks' free trial, the company selling 3-lb. and 4-lb. irons for \$3.60 each and 5-lb. irons for \$3.90. About 70 per cent of the irons thus put out are retained. A card index of all appliances placed by the company is maintained.

#### ELECTRIC-VEHICLE PRACTICE

The company has taken an active interest in the electric-vehicle campaign of the Greater Boston central-station interests and has operated six machines for some time. Two 5-ton General Motors trucks were purchased very recently, making a total of eight. In service at present there are four commercial cars, of 750-lb. to 1000-lb. capacity, and two small runabouts. The equipment includes one Bailey car, capable of making 28 miles per hour, which is equipped with a ladder for the use of troublemen and with tool boxes fore and aft. This car is used in the daytime by the installation department and at night by patrolmen on the street-lighting system. The machine runs between 8 a. m. and 10 p. m. and makes about 40 miles per day. It is provided with broad steps and easily carries four men.

Another equipment is the 1000-lb. Walker car shown in the illustration. This car is provided with an Edison battery and solid tires and makes about 25 miles per day. It is used by the meter department about eight hours per day and is employed as a traveling office by the company, carrying contract blanks and lamps for renewals. Orders for service are taken by the employees who man the vehicle, and a considerable amount of new business has been secured at the sidewalk curb with the use of this machine. It is employed mainly in the downtown district of the city. Other electric vehicles include a 750-lb. Waverley chassis which the company has supplied with a body used by the installation and lamp-delivery service. This machine carries an 8-ft. ladder concealed in a 6-ft. x 16-ft. side box and used mainly in store work. It operates eighteen hours daily and averages about 1000 miles per month. A Rauch & Lang runabout, used in about the same service as the last-named machine, carries a step-ladder on its side and is a valuable asset in the work of the company. The other two machines are used mainly by employees of the sales department.

The two large trucks just purchased are to be used in hauling coal from the company wharf on Broad Canal to the power plant, eliminating the present extensive storage of coal on the border of the Parkway. There are few hills in the territory and the distances are comparatively short on account of the density of population in Cambridge.

All company electric automobiles are equipped with Sengamo ampere-hour meters, and the greater part of the charging is done at night in the company garage adjoining the power house. Eight machines can be charged simul-



FIG. 7—2-HP MOTOR DRIVING SEWING MACHINES

taneously. Each charging circuit is equipped with a watt-hour meter and a separate rheostat. There is also a special charging circuit for large trucks which cannot enter the building. This line is run to the doorway of the garage, so that a maximum of 120 amp at 110 volts can be delivered as required at this point.

The individual charging circuits vary in capacity from



An interesting special water installation was made last year for the electrical use of the Harvard College yard. Formerly some fairly irregularly located faucets for washing and motor service were at one to the machine building and the college yard group. An ingenious arrangement of the water valve is served through a three-phase power cable installation in the basement of the Harvard Union, a master meter being located in each dormitory and building around the yard. The collection of the meters in the yard, while

the wires, cables and pole lines in the territory belong to the company.

The company pulls in the cables, and after the term is over at the beginning of the summer season all secondaries are open-circuited and the primary meter is read for several hours to determine the line and core losses. A special deduction is then made from the bills. The company reads

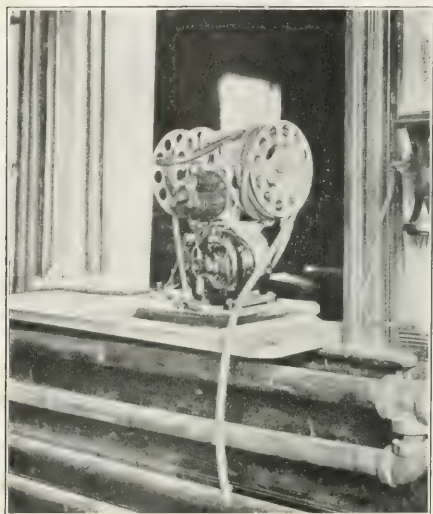


FIG. 10—MOTOR-DRIVEN TIRE PUMP IN COMPANY'S GARAGE

every student's meter and sends the owner of the dormitory, whether on the yard or elsewhere, a memorandum of the consumption. In most cases the owner deals with the student directly and his bill for electric lighting usually in-

TABLE III—CENTRAL-STATION FACTS AND FACTORS, CAMBRIDGE, 1912

Population served (excluding Belmont municipal distribution)	104,839
Number of consumers	2,732
Gross income (including about \$5,000 miscellaneous)	\$435,901
Kw-hours delivered at station buses	11,029,427
Kw-hours sold, total	10,083,962
Kw-hours sold for motor service	6,132,177
Kw-hours sold for street lighting	1,332,024
Kw-hours sold for all lighting	3,681,785
Earnings from street lighting service	\$72,032
Earnings from commercial lighting	\$195,957
Total operating expenses and taxes	\$236,566
Total liabilities, capital and loans	\$850,000
Cost of plant (entire system) above capital and loans	\$356,029
Excess of system cost over assessed valuation	\$6,029
Total cost of system	\$1,206,029
Total cost of steam plant	\$341,504
Total cost of electric generating plant	\$137,335
Plant rating, June 30, 1912, in kw	5,425
Cost of manufacture, net, at station only	\$101,004
Total number of employees	81

cludes a charge for corridor and lavatory illumination. In the Harvard Square district the company has a connected load of about 250 hp in motors and 526 kw in lighting installations, the latter all being metered through the Harvard Union board, thus effecting a saving in bookkeeping.

#### ATTENDANTLESS METERING AND SWITCHING SUBSTATION

In connection with the sale of energy to the town of Belmont an attendantless metering and switching station has been built at the town line. The installation is housed in a small frame building lined with corrugated iron. From it two 2300-volt, single-phase lighting feeders and two street-

lighting circuits are run through the residential suburb of Belmont. The potential is regulated on the lighting feeders by a General Electric feeder regulator of 17.5-kw rating placed within the switch house. Both the services are metered within the house, but the special interest of the installation is the arrangement provided for automatic switching of the street-lighting circuits through the operation of a remote control in the hands of the local lighting superintendent 2.5 miles distant. Two oil switches with mechanical trips operated by a solenoid plunger are installed in series with each street-lighting circuit, the solenoid coils being in series with one side of the Belmont line.

The lamps are lighted by closing a push-button switch at the Belmont police headquarters or at the lighting superintendent's home. When the push-button is operated and held in for about five seconds a 0.1-hp, 220-volt single-phase motor in the switch house revolves a set of short-circuiting cams a half revolution, closing the oil switches between the Cambridge supply and the local lighting installation. To cut off the lamps, the push-button is again pressed, rotating the short-circuiting cams another half turn and short-circuiting the Belmont lines. This de-energizes the solenoids and the falling plungers trip the oil switches. The switch nearest the Cambridge supply in each circuit is of the Holmes short-circuiting type, so that when it is tripped the Cambridge circuit connected to it is short-circuited. By this means the local lighting service on the streets of Belmont can be cut in or out without interrupting the service on the Cambridge streets served by the same street-lighting feeders. In case of a short-circuit or heavy ground on the Cambridge side the withdrawal of current from the solenoids trips the oil switches. To guard against a total interruption of any length an extra constant-current transformer is installed in the switch house with its primary connected through an oil switch with the company's three-phase, 2300-volt mains, the secondary being plugged into the

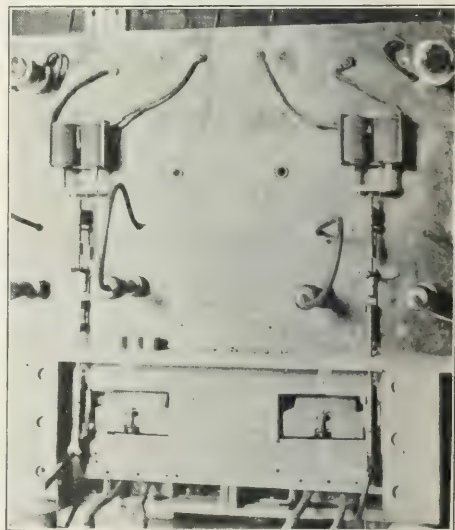


FIG. 11—AUTOMATIC SOLENOID TRIPS FOR STREET LIGHTING

street-lighting system on the Cambridge side of the meter to be available in case there should be trouble on the regular feeders.

#### DISPLAY LIGHTING ON MASSACHUSETTS AVENUE

The company has made an installation of display lighting within the last few months on Massachusetts Avenue, the



principal thoroughfare of Cambridge, between the City Hall and Lafayette Square, erecting thirty-eight two-lamp posts in a distance of about 2560 ft. The posts are of the Lundin type, and carry the lamps 18 ft. above the sidewalk by iron brackets supporting Wheeler radial reflectors immediately above the bulbs. Each lamp is a 200-cp, 6.8-amp

in the former globes. About 25 lamps have been replaced in this way and 175 have already replaced with clusters of three 80-cp tungstens each. On June 30 last the company operated about 675 incandescent arc lamps of the C-5 series, 45-watt size, but since that time the substitution of incandescent has been very rapid in fact, within a month from the present time it is probable that not an arc

TABLE IV—UNIT DATA

Station rating in kw per station employee	100
Station rating in watt per capita	1.0
Connected load in watt per capita	100
Ratio in per cent of station rating to connected load	100
Average load for year in kw	1,360
Load factor for fiscal year in percentage	29.2
Investment per kw station rating, 1912	\$225
Total liabilities per kw station capacity	\$500
Gross income per kw station rating	\$80
Gross income per capita	\$4.1
Gross income per \$100 investment	\$16
Gross income in cents per kw hour sold	1.0
Gross income in cents per kw hour generated	1.0
Investment in system per capita	\$11.0
Ratio of operating expenses and taxes to gross income, per cent	14.0
Net earnings per \$100 invested	\$16.0
Gross yearly operating expense per \$100 liability	\$2.80
Total cost of system per hp of steam equipment	\$148
Earnings from all lighting business per kw hour sold, cents	1.0
Earnings from street lighting output per kw hour consumed	1.0
Ratio in per cent of motor energy consumption to consumption of power installations on continuous full load rating	11.7
Ratio of energy consumption of lighting installation in per cent of consumption at continuous full load rating	11.7
Total connected load of system in kw per kw station rating	100
Number of customers per 100 population	100

series tungsten, the average distance between lamps on the same side of the street being 135 ft. The posts are staggered and the street is about 103 ft. in width at the points shown in the accompanying day and night views of the in-



FIG. 13—SEWING MACHINES DRIVEN BY 2200 MOTORS



FIG. 12—MOTOR-DRIVEN SKIVING MACHINES AND TURNING

stallation. These lamps are to burn 3010 hours per year at a price of \$82.44 per post, one lamp of each pair being cut off at midnight. The circuits are arranged for future underground supply.

There is also a movement on foot to eliminate the existing installation of 6.8-amp inclosed alternating-current arc lamps in all parts of the city, substituting 200-cp tungstens

lamp will be in use on the streets. The company is now replacing gasoline Weibach lamps on the Charles River Parkway by about 200 arc series incandescent lamps giving all night service, placed about 100 ft. apart and 18 ft. above the roadway. The cost of the electrical service is about 70 per cent of that of the gasoline lighting.

The connected load of the company on June 30, 1912, is given in Table I. Averaging this connected power load for June 30, 1912, with the connected motor load for June 30, 1911, gives the mean connected power load during the year as indicated in the accompanying analysis of industrial service earnings (Table II).

TYPE OF OTHER INDUSTRIES

The customers of the company using manufacturing are the largest parking house in the city, the largest retail shops. Among the large users of electricity for power service are the John F. Sperry Printing Company, with a connected load of 2200 hp, a maximum demand of 1000 hp and a monthly average consumption of about 400,000 kw-hr. This alone has about 100 motors in action, ranging in size from 1/2 hp to 100 hp, its connection with the load furnished by this house, the Cambridge trustees, has suggested the installation of a gas-hp hydroelectric plant which would be run 100 or 200 hours during the month of November to January, thereby saving about 1000 kw per day, to improve the motor power factor. In the summer season this factor could be used by means of condensing machinery.

Another large customer is the Boston Water Pipe & Rubber Company, with about 100 motors of from 1/2 to 100 hp rating and a monthly consumption of about 100,000 kw-hr. The motor rating in rating time is to be 200 hp. The Blake-Kearney Steam Pump Company also purchases power from the Cambridge system, about thirty motors



of 463 hp combined rating being in service and consuming about 51,000 kw-hr. monthly.

Other concerns taken almost at random from the company's large list are the Riverside Press of Houghton, Mifflin & Company, 100 hp, largely in individual motor drives; the University Press, with about 185 hp and 60 motors; Elliott Addressograph Machine Company, with 75-hp connected load; Commonwealth Glue Company, with 130 hp in motors and a monthly use of about 23,000 kw-hr.; the Barbour-Stockwell Company, maker of railway track fittings, 8000 kw-hr. monthly; Harvard College Observatory, the Davis Ice Cream Company, the Library Bureau, John H. Cross Company (shoes), Alberti Box Company, Simplex Electrical and Simplex Electric Heating companies, etc.

#### A MODEL ELECTRICALLY DRIVEN SHOE FACTORY

The John H. Cross installation, recently completed, is one of the most modern electrically driven shoe factories in the country and has a total equipment of about 180 hp in General Electric motors in service throughout four floors and a basement. This concern consumes about 15,000 kw-hr. per month and can manufacture 2400 pairs of shoes per day. It occupies a reinforced-concrete building in the new industrial section of the city, the

trial motor of 20-hp rating, with a 3-hp motor on the ice crusher. The plant now has a capacity of freezing 3500 gal. in ten hours.

The auxiliary service of the Cambridge company includes an emergency electric-lighting connection of 90-kw rating with the Cambridge subway of the Boston Elevated Railway Company at a price of \$2 per kilowatt per month. The service rendered Harvard University includes the operation of book lifts, lighting, the driving of ventilating fans in scattered buildings, laboratory machinery, a small printing plant and auxiliary connections with the principal dining establishments.

#### PUBLICITY

The company is a firm believer in the benefits of newspaper advertising on the basis of a legitimate news interest in its work. Electrical energy was supplied by the company in the building of the Cambridge subway, as described in the *Electrical World* for July 28, 1910. The completion of this work in half the allotted time, and the testimonial of one of the best-known contractors in New England as to the superiority and greater economy of electricity over steam, were featured effectively in the press. The company has also taken advantage of the rigorously enforced Boston smoke law in advertising its service.

*Extract from Sunday Herald of Jan. 29, 1911*

#### HOW HARRY NAWN RUSHED SUBWAY

**Contractor Was Always on the Cambridge Job, Which Was Done in Half Time**

#### WON A HAT FROM BANCROFT

**Good Workmen and Electric Power of Great Aid in Hustling Work**

"Well, it was something of a job, but you had better ask somebody else about it," said Harry F. Nawn, President of the Hugh Nawn Construction Company, when asked what methods he used in constructing the Cambridge main subway in 18 of the 36 months it was thought the work would require. "We were assisted in hustling the work on the subway along by the use of **Electric Power Exclusively** for hoisting and other applications of power. We were thus able to do away altogether with the portable engines that used to have such a prominent place in such work, and this innovation proved a benefit to the community as well as to ourselves because it created no smoke nuisance and was much cleaner generally. This use of electricity was **less expensive than steam**. It was the first time, I think, that electric power was used on a similar work of construction in this country."

**WE FURNISHED THIS POWER AT OUR REGULAR POWER RATES**

**CAMBRIDGE ELECTRIC LIGHT CO.**

**FIG. 16—ADVERTISEMENT OF THE  
CAMBRIDGE ELECTRIC LIGHT  
COMPANY**



## ON TRIAL

To any responsible party in need of power, and near our line in Cambridge, we will furnish, install and operate, **FREE FOR ONE WEEK**, an Electric Motor of not over 20 Horse Power. If at the end of the week the party is not willing to keep the motor and service on the **VERY LIBERAL TERMS OFFERED**, we will remove same and the party has been put to no expense whatever for the trial.

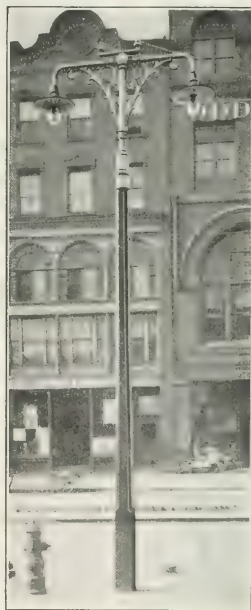
**Ask to have our Agent call**

### CAMBRIDGE ELECTRIC LIGHT CO.

NOTE:  
The Frank H. Davis Co.  
Paper Mill Machinery  
75 Crescent Ave.

Tried this last month and bought a 10 Horse Power Motor. Offer Still Open.  
**CAMBRIDGE ELECTRIC LIGHT CO.**

**FIG. 14—FREE TRIAL PROPOSED TO  
PROSPECTIVE MOTOR  
CUSTOMERS**



**FIG. 15—ORNAMENTAL STANDARD,  
MASSACHUSETTS AVENUE,  
CAMBRIDGE**

motors ranging in rating from  $\frac{1}{2}$  hp to 15 hp. The group drive is largely used on account of the multiplication of duplicate machines in the 150 operations necessary in making a shoe. Electric heating equipment with rheostatic adjustment is a feature of this factory. A typical motor application is illustrated, with the method of attaching the motor to a bracket on a reinforced-concrete column. A view is also shown of the typical service entrance in the factory.

The Alberti Box Company utilizes about a dozen motors, with several individual drives and a total connected motor load of about 40 hp. The Davis Ice Cream Company, with 113 hp in motors, operates either of two 20-ton ammonia compressors, an ice crusher, brine pump, fans and ice carriers, with a consumption varying from about 9000 kw-hr. per month in winter to nearly 20,000 kw-hr. in each summer month. This plant, displacing a gas engine, was inaugurated on central-station service by a free

The influence of the power load is illustrated by the fact that the peaks on the generating station during the months of 1912 occurred in the forenoon in March, April, June and August, and before 5 p. m. seven months of the year. The average daily output per month at the plant varied from 29,260 kw-hr. in July to 38,741 kw-hr. in December, the average for the year being 33,383 kw-hr. per day.

The peak load of the year was 4670 kw, occurring at 5 p. m. on Dec. 16, and the minimum peak load in any month, 2700 kw, occurred in April. The average load on the station in April was 1252 kw, giving a monthly load-factor of 46.5 per cent, the corresponding figures for December being 1614 kw and 34.5 per cent. For the calendar year 1912 the average station load was 1392 kw and the load-factor practically 30 per cent.

The officers of the company are: President, Mr. J. Q. Bennett, vice-president, Mr. J. Henry Russell; treasurer and general manager, Mr. Welles E. Holmes.

## Investigation of Diffusing Glassware

By M. LUCKIESH

In the *Electrical World* for Nov. 16, 1912, the writer gave an account of a method for determining the light diffusion curves of glassware together with the results

retain its great diffusing property with a resulting higher coefficient of transmission.

The transmission is obtained by considering the shape of the diffusion curve together with the relative normal brightness given in column three of the table by the same method. In the first paper the transmission of a perfect diffuser is given as 100 per cent. But the fact that this is for a flat plate be lost sight of, attention will be called to the fact that this is in reality one per cent of one-half the light incident upon the glass (considering no specular reflection.) The transmission coefficients have been calculated for the second lot of samples, but because of the confusion arising from the fact that only flat plates are considered here the transmission of the ideal diffuser is taken as 50 per cent. However, the prime object of the investigation was to determine the diffusing properties of various kinds of commercial glassware. The transmission coefficients given here are of interest chiefly when diffusing glass in flat sheets is desired. The samples in Table examined here were cut from commercial reflectors. Those considered in the former paper were especially made in flat pieces. Thus, no doubt accounts for the great difference in the two lots of samples. This difference is quite noticeable to the eye.

Three general types of diffuse transmission are found in this lot of specimens as in the former lot. It will be noted that there are samples which are practically perfectly diffusing. Other samples might be termed as showing a spread transmission. Etched or roughed surfaces tend to produce spread transmission. Some samples show a tendency to diffuse some of the light perfectly and to transmit directly (sometimes with a little scattering) the remainder which is not absorbed or otherwise lost. Most samples of this type transmit a fair range of the light more nearly defined.

In order to illustrate the great difference in the resultant

obtained on various samples procurable at that time at the physical laboratory of the National Electric Lamp Association. Other specimens have since been examined so that now the various types are well represented. For details of the method the reader is referred to the article just mentioned.

A circular orifice 1 in. in diameter was illuminated by means of parallel light incident normally to the surface. The specimens of diffusing glassware were placed in contact with this opening and the brightness was determined at various angles, the normal being taken as zero degrees. The brightness at various angles is plotted in Fig. 1 for the samples examined since the last paper was published. The brightness values multiplied by the cosine of the angle between the normal and the direction in which the glass was viewed give the candle-power distribution curves. These values are shown in Fig. 2. Nearly all the specimens are what would be termed satisfactory diffusing media, but notable differences in the character of the diffusion are very evident.

In Table I other data are to be found.

In order to make these data comparable with the data presented in the former paper, check measurements were made on flashed-opal glass. The original sample was not at hand so several determinations were made with other specimens. It was found that the opal coating is sufficiently uneven to cause wide variations in the brightness of different samples. The ratio of the brightness at 60 deg. from the normal to the glass is taken empirically as the diffusion coefficient, as in the former paper. In general these specimens were more desirable than the former ones from the standpoint of the diffusion of light. It is interesting to note that flashed opal, *I/K* and *P/veo* are practically perfectly diffusing.

The sample of *I/K* examined in these experiments was about 1/16 in. thick, but it can be made thinner and yet

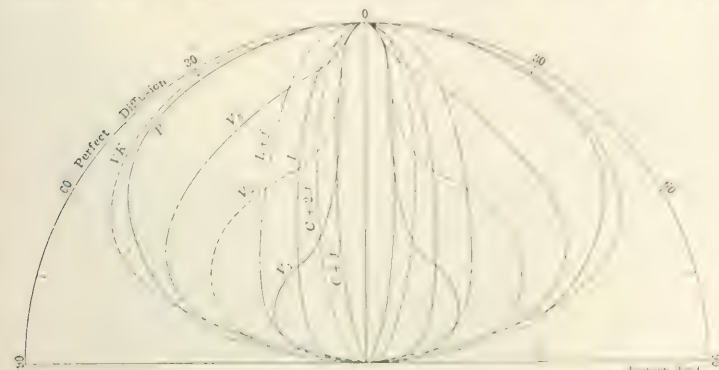


FIG. 1—BRIGHTNESS DISTRIBUTION CURVES

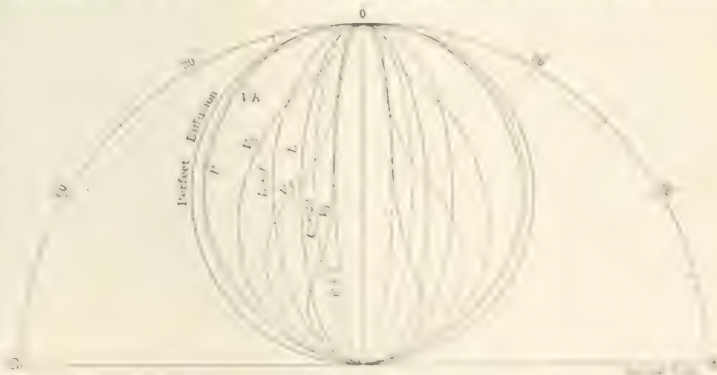


FIG. 2—CANDLE POWER DISTRIBUTION CURVES

transmission of really diffusing glass plates and the specimens of diffusing glass now here obtained by Mr. H. C. Merriam, of the engineering department are presented in Table II.

Nothing but the most general comparison can be made between the data given in the two tables because of the

unknown thicknesses of the glass in the spheres. Of course the "efficiency" of the spheres varies somewhat with their size under practical conditions, but the figures show very closely what degree of transmission can be expected.

TABLE I—DIFFUSION AND TRANSMISSION OF VARIOUS TYPES OF GLASSWARE

Curve	Kind of Glass	Relative Normal Brightness for Constant Illumination of Specimen	Diffusion Coefficient (Empirical), per Cent	Transmission (Flat Specimen), per Cent
	Perfect diffusion	Ideal diffuser	1.00	100.0
O	Flashed opal			88.0
VK	No. 505 Welsbach shade, 1-16 in. thick		0.74	86.0
P	Pyro, 1-16 in. thick		0.41	78.4
L	Lucida, 1 in. thick		2.80	19.9
L+P	Lucida, one side frosted, 1/4 in. thick		1.71	34.0
V <sub>1</sub>	Veluria, 1/2 in. thick		1.65	31.0
V <sub>2</sub>	Veluria, 3/16 in. thick		0.79	52.0
V <sub>3</sub>	Veluria, roughed inside, 1/4 in. thick		0.66	67.8
C+f	Crystal, one side frosted		18.3	
C+2f	Crystal, two sides frosted		3.9	10.3

Among other experiments made is that of showing how a roughed surface changed the properties of a reflector. Instead of permitting the glass to change its angle with the line joining its center with the photometer, it was kept

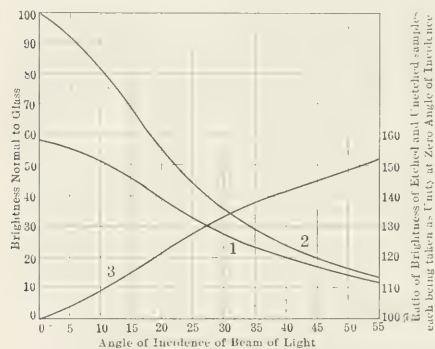


FIG. 3—CURVES SHOWING RELATIVE NORMAL BRIGHTNESS

perpendicular to this line while the angle of the incident light was varied. Measurements of the normal brightness were made while the angle of incidence of the beam of light was varied from zero to 55 deg. This procedure was

TABLE III—TRANSMISSION OF VARIOUS TYPES OF GLASSWARE

Glassware	Transmission, per Cent
Alabaster	86.8
Alba plain smooth	85.8
Melite (polycase)	77.6
Gleason Tiebout (polycase)	76.9
Opalescent	86.4
Opal...	75.2
Verra Krasna (VK)	85.7
Veluria	88.0

carried out with an unetched sample of Lucida glass and with a sample roughed inside. The data are shown plotted in Fig. 3. Curve 1 represents the results with the roughed inside sample, while curve 2 shows the relative results ob-

tained for the unetched sample. These curves are reproduced for the purpose of emphasizing the fact that the character of the inside surface greatly affects the ability of the reflector to direct the light. In curve 3 is shown the ratio of the brightness of the sample with roughed inside to that of the unetched sample, their brightness at zero angle of incidence being taken as unity. As would be expected, the normal brightness of the roughed sample does not decrease as rapidly as that of the other sample with increasing angle of incidence of the beam of light. The curves show how an etched inner surface reduces the ability of the reflector to direct light, making it a better diffusing unit.

Representative glassware of all types readily obtainable has been examined. The writer acknowledges his indebtedness to those who kindly furnished the samples, and to Mr. Leonard Krill for assistance which was rendered by him in the experimental work.

## Water-Power Plant with 300-Ft. Head at Longmont, Col.

The recently completed municipal electric-lighting plant for the city of Longmont, Col., utilizes a 300-ft. head for developing the power of its allowance of 10 cu. ft. per second from the north fork of the St. Vrain River. Two Leffel waterwheels are directly connected to a pair of 250-kw Fort Wayne alternators producing 2300-volt, three-phase energy. For transmission to Longmont, which is 12 miles distant from the water-power development, the emf is stepped up to 23,000 volts. Trussed-steel poles and pin-type insulators have been used for the transmission line. The substation at Longmont, transforming back to 2300 volts for local distribution, is unattended. Leading north from the station three-phase main primary circuits are carried, from which branch off single-phase laterals. Secondaries are to be grounded to avoid danger to life and property resulting from possible crosses with high-voltage wires.

## Oil-Engine Set for Ship's Emergency Lighting

The *Titanic* disaster has called attention to the need for auxiliary sources of electrical supply for deck lighting and wireless-telegraph operation in case of the flooding of the main electrical generating equipment of a vessel that has become disabled.

In a large steamship now under construction at Dumbarton, England, trial is being made of a gasoline-engine set mounted on the bridge deck far from the possibility of immersion. The lightness of the unit has made feasible its positioning at this height without adding to the top hamper of the ship. By means of a throw-over switch energy for the deck lamps and wireless set can be taken either from the main generators or from the emergency set as may be more convenient.

The 28-hp Brooke engine is direct-connected to a 20-kw, 110-volt Siemens generator. The motor is of the standard vertical four-cylindrical type, with Bosch ignition and alternative accumulator starting. The whole is mounted on a single bedplate, and the crank shaft, passing through the base of the radiator, which is situated between the engine and the dynamo, is direct-coupled to the dynamo shaft. The radiator is of the tubular type, with ample surface. Thermosiphon cooling is used, and a powerful fan, driven by belt from the cam-shaft end of the engine through a shaft passing along the tops of the cylinders, induces a current of air sufficient to keep the radiator cool. Large movable inspection plates are provided to enable the crank pit to be examined, and the crank itself can easily be taken out should occasion require.



# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Convincing the Directors

Some time ago the electric-light plant in a small Middle Western town was, in the words of its manager, "hobbling along, paying an ignominious dividend in return for an exorbitant amount of hard work and close management." The manager was not satisfied with the small dividend which the plant had been earning and at a directors' meeting suggested a combination ice-electric plant. A few figures and a little argument convinced the directors that the operating expenses would not be increased by the combination plant. The addition of a 10-ton refrigerating auxiliary was agreed upon. "And from that moment," continues this enterprising manager, "the stock of this company has been something worth owning. We are now paying a good dividend, have installed two 100-hp boilers and added to the generating equipment and ice-plant machinery. There is outstanding at present only \$11,000 in stock and \$16,000 in bonds on our property, which is certainly worth more than \$200,000, if the returns may be taken as any indication of the value of an investment. To say that we are enthusiastic over our combination plant would indeed be mild. I do not hesitate to add that the only way to make an electric-light plant in a small town pay a life-sized dividend is to make by-product ice."

## Closing Ornamental Street-Lighting Contracts

In the smaller towns of its territory, particularly those varying from 300 to 10,000 population, the Illinois Northern Utilities Company has been very successful in closing street-lighting contracts for both standard and ornamental street illumination as follows:

When renewing its regular contracts the company has found that usually a few of the local merchants want ornamental posts. These it has advised to take up the matter of ornamental lighting with the city while a new contract was going through and the municipality might be willing to undertake the installation. Such a plan of having the city defray the cost is in any case, according to Mr. C. B. Yonts, general contract agent at Dixon, Ill., much more desirable than the method sometimes followed of dividing the expense among the merchants.

The interested merchants then agitated the question and made up parties to visit installations of ornamental lighting in nearby cities at their own expense. The company got them to call a meeting with the city officials, at which plans were submitted showing the total cost of the installation and the maintenance of the posts, the merchants to pay the cost of the installation and the city that of lighting and maintenance. The figures that were submitted were made in conjunction with the regular street lighting, which is taken for a ten-year period, thus placing the ornamental lighting on a permanent basis.

At Forreston, a town of 900, where the company installed twenty-three lamp posts, the city paid for the total installation and the lighting of the lamps. In Ansoy, a city of 2500, the merchants paid for the posts and the city for the lighting. In other small towns the municipality paid half the cost and the other half was raised by means of public subscription.

One lesson learned from the experience at this town was that it is always best to get the merchants to meet on the talking. Indeed, many contracts have been made in this way with less effort than for any other class of business. In one town the president of the village board secured every donation himself. In another town a newspaper man, with one of the largest merchants, raised the entire amount necessary for the installation.

## The Approach of Electric-Ironing Days

In attractive advertisements in the local newspapers the Union Electric Light & Power Company of St. Louis, Mo., is carrying on a campaign of reminders to its customers.



**Summer Time**  
will soon be here

There is more ironing done in a week in summer than in a month in winter

Remember this about the  
**Electric Iron**

It is efficient, economical and convenient. Saves time, saves steps, saves fuel and

**nothing gets hot but the iron**

You can order one on thirty days free trial

**at our Show Rooms**

1015 and 1017 Broadway  
4012 Drexler Avenue  
1015 N. Grand Avenue  
1525 N. Grand Avenue

**ELECTRIC**

CENTRAL STATION, CHICAGO'S FIRST POWER PLANT

and progressive system, but they must not let the glorious days of summer will pass by. Remember the summer will be in the hands of the sun. Many women are doing a good deal of ironing in a week in summer, but in a month in winter, notwithstanding the fact that women are doing the best of their electrical ironing, usually go out of season with the approach of the hot days.

The electric ironing machine is the latest in appliance for use. It is efficient, economical and convenient. It saves time, steps and fuel, and is the best of the St. Louis company's advertisement. "Nothing gets hot but the iron." The Union Electric company offers to furnish these irons on thirty days free trial of service.

### Six-Ton Ice Plant a Valuable Auxiliary

That even a 6-ton by-product ice plant may be a valuable addition to a small central station is shown in the figures presented by the general manager of an ice-electric plant in Georgia. During the ice man's busy season this industrious manager has succeeded in marketing 1500 tons of ice, which is quite a remarkable record for a town of 1000 inhabitants.

Steam compression apparatus is used for handling the ammonia. The total investment, including the buildings and refrigeration plant, is given as about \$10,000. A statement of the yearly operating expense is made as follows:

Fuel .....	\$750 00
Labor, including office .....	400.00
Miscellaneous .....	50 00
Delivery .....	280.00
Total .....	\$1,480.00

It is estimated that the price of producing 1 ton of ice at the platform is \$3.60. The ice which was sold from the platform in wholesale lots was disposed of at \$4.30 a ton. Deliveries were made to small customers at \$8 a ton. One wagon was found adequate to supply the retail trade.

The statement of this firm's annual receipts and disbursements from its ice business follows:

Yearly gross income for ice business .....	\$2,250.00
Yearly expenses (including depreciation, interest, etc.) ..	1,730.00
Net income .....	\$520.00

These figures show that the ice plant has earned in excess of 5 per cent per annum, a showing of an entirely satisfactory nature.

### Handbook of Central-Station Service

The revised or 1913 edition of the "Handbook for Users of Central Station Lighting and Power Service," issued by the Commonwealth Edison Company of Chicago, contains much useful information for customers. The user is told how to obtain electric service, what the rates are, how to read the meters and how bills are figured and receives other information in relation to incandescent lamps, repair service and the company's display rooms. At the end are a few questions and answers explaining in a simple manner the most common terms relating to the business, such as "kilowatt-hour," "alternating current," "cycle," "load-factor" and the like. One excellent feature is an explanation showing why it is not practicable to charge for electricity at a uniform rate regardless of how or when it is used. The pamphlet is of convenient size to slip into a coat pocket and contains thirty-two pages bound in a cover.

### Moving-Picture Publicity at Brattleboro, Vt.

Popular interest in central-station service at Brattleboro, Vt., was recently stimulated by the "electrical matinees" given at a local moving-picture house by the Twin State Gas & Electric Company. Advertisements announcing the performance had been run in advance in the local papers, and on the day preceding the exhibition printed invitations were sent out with admission tickets.

The program opened with a brief address by Mr. C. M. Addis, manager of the company, who spoke in popular language concerning electricity and its applications in the home, office and factory. He then exhibited four semi-humorous moving-picture films loaned by electrical manufacturers, interspersing them with the regular entertainment films obtained from a motion-picture agency. These were followed with lantern slides especially prepared for this matinee, including charts showing night and day service hours, etc.

On the stage was placed a display of electric cooking and heating appliances, where their use could be actually demonstrated. Mr. Addis had a loaf of bread ready to bake and put this into an oven and baked it before the audience. He also made coffee, cooked eggs and browned toast, meanwhile quoting rates and prices.

Mr. Addis had expected an attendance of about 300 householders, as he held the matinee on Tuesday when children were in school and servants normally at home. The moving-picture theater seats 560 people. But when 750 tickets had been turned in at the door the town policeman refused to allow any more to enter, and some fifty to sixty people were turned away. The rental of the theater cost \$15 for the performance.

Officials of the Twin State company are confident that this electrical matinee will be helpful and influencing for three to five months, at which time it may be advisable to repeat the performance. The interest manifested on the part of the public, as shown by the questions asked, was quite amazing and shows how far the electrical industry has yet to go before reaching the saturation point.

### The Electric Sign as an Advance Agent

The prospective user of an electric sign should not lose any time waiting until his new building or quarters are completed before installing and operating his display. If he does thus postpone putting up the sign after there is



ELECTRIC SIGN OPERATING AS BUILDING IS UNDER CONSTRUCTION

enough of the structure completed to carry the weight, he will be losing a valuable advertising potentiality. In the weeks preceding the completion of a new building an electric sign will impress on the minds of the public the nature and identity of the future business, doing this at a time when the natural curiosity and interest of the public will be appealed to.

At all events, the sign display should be got into place at the first possible opportunity, and then, when the structure is later finished and opened for business, there will already have been fixed in the public mind a full understanding of the new undertaking. The start obtained in this way may prove valuable in establishing the new business during the trying initial period of getting under headway, thus reducing what utility appraisers call "the cost-of-going value." In the accompanying illustration is shown the display of a new Times Square theater in New York City, whose electric-lighted sign has been up, and burning nightly, for weeks in advance of the actual opening of the playhouse.

### Electric Pole Truck

The distribution of wooden poles has always been one of the most troublesome problems confronting the transportation department of the Philadelphia Electric Company. This has become more serious in the last few years, owing to the rapid increase in the use of excessively high poles due to the extension of high-tension transmission lines, which necessitates the placing of such wires over the wires of all other companies and over railroad crossings at a clearance not less than 30 ft. above the rails. It has been the practice of the Philadelphia Electric Company to distribute such poles by the use of horse-drawn trucks the rear wheels of which are rigid, and for this reason turns of large radius have been necessary.

Some of the poles used in the work are 90 ft. long and are very difficult to handle in congested sections of the city. In making turns consideration must be given not only to the length of the poles but also to the space occupied by two or more horses in tandem—sometimes the length of street occupied by the loaded vehicle and horses is as much as 130 ft.

For a number of years the construction of an electric truck has been under consideration which would embody the following advantages: the space occupied by the loaded truck to be limited to the length of the poles, this to be accomplished by allowing the poles to overhang at both the front and rear ends; ability to turn in a comparatively small circle; ability to cover more ground at a greater speed than a horse-drawn vehicle; construction such as to permit

steering mechanism, the rear steer being used only when short turns are necessary.

On account of the greater weight on the front wheels when the truck is running empty the brakes were made to operate on the front wheels, as well as on the rear wheels, in order to eliminate any tendency to skid.

The loading and unloading of poles is accomplished by an electric winch in the center of the truck. This winch is wired so that it can be controlled from switches under the seat or from either side of the truck at the motor, and when in operation the control of the truck itself is cut out. By this winch it is possible to place poles in any position on the truck, and even when the truck is partially loaded additional poles can be placed at the top of the pole. This is particularly advantageous inasmuch as it is only necessary to detail two men (a driver and a helper) with the truck when loading or unloading poles, which can be done much more rapidly than has been practicable with team men heretofore.

The truck itself is of 6-ton capacity and weighs, when unloaded, about 12,000 lb. The division of the unloaded weight is 60 per cent on the front wheels and 40 per cent on the rear wheels. Consideration has been given showing the positions to be occupied by the various lengths of poles on the truck, in order that the load may be equally distributed between the front and rear wheels.

The truck is fitted with four-motor drive, which is necessary in order to provide proper traction for such a long wheelbase. The batteries (forty-two-cell, twenty-one-plate



ELECTRIC POLE TRUCK WITH FOUR-MOTOR DRIVE

of the loading and unloading of poles by electricity. All of these advantages are embodied in the new truck shown herewith and built by the Commercial Truck Company at the suggestion of Mr. A. H. Manwaring, head of the arc-lighting department of the Philadelphia Electric Company.

The devising of a satisfactory method of steering such a long vehicle proved to be quite a problem. It would be a simple matter to control all the wheels from the driver's position, but under such conditions the front and rear wheels would turn in opposite directions. This would not be satisfactory in a pole truck, because of the fact that poles are unloaded at the curb line, and in getting away from the curb, while the front wheels would leave, the rear wheels would run into the curb. The control of the rear wheels by an upright standard and an additional steering wheel was also impracticable, for the reason that this arrangement would prohibit the loading and unloading of the poles from either side of the truck. All these difficulties have been overcome in the present design, which provides for the steering of the rear wheels from the side of the truck by an apparatus so arranged that it can be locked when the wheels are in a neutral position. This enables the truck to be controlled entirely by the front

"M.V. Exch." are placed in a compartment under the bed of the truck in front of the center. A compartment to the rear of the center is utilized for carrying tools, such as cant hooks, jacks, short chain rope, etc.

A number of interesting features of the truck are as follows: The weight of the steel used in its construction is 5750 lb.; the weight of the rubber in the tires is 1750 lb.; the length over all is 30 ft. 6 in.; the wheelbase is 20 ft. With the rear wheels locked in the neutral position the truck will turn in a radius of 20 ft. By engaging both front and rear steering wheels the truck will turn in a radius of 18 ft. The truck can meet approximately 20,000 lb. of full load. Its speed on the level is approximately 7 miles per hour at full load. The four-motor drive will enable the truck to travel in any direction across any condition of roadway, and on trial it successfully carried a full load up a 6 per cent grade.

The new truck has four double steering wheels. The name of the company is prominently displayed on either the company's name, "If it isn't electric, it isn't modern!" Improvements have been made regarding the operation of the truck and it has been a great deal to attract the general public to the use of electric vehicles.



# Illumination and Wiring

## Testing Shadow Effects of Various Systems of Lighting

In a paper read before the Illuminating Engineering Society of London by Messrs. J. G. Clark and V. H. Mac-

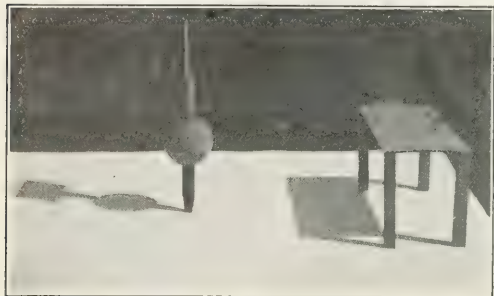


FIG. 1—SHADOWS CAST BY OBJECTS LIGHTED BY SINGLE DIRECT UNIT

kinney an attempt was made to define the main functions of a shade or reflector. One quality which is sometimes forgotten is the softening of shadows. A so-called "harsh" or "hard" system of lighting is usually one in which abrupt shadows are cast by a lamp owing to the light not being spread over a sufficient area. It is well known that very soft shadows are cast by indirect systems of lighting, although it would be incorrect to term the illumination shadowless. Although a great deal of discussion has raged around the shadow effects of direct and indirect systems of lighting, very little effort seems to have been made to define shadows and to represent by models and experiments what the effects of various systems of lighting in this respect will be.

In the paper by Messrs. Clark and Mackinney an interesting method of exhibiting shadow effects was described. A standard object, consisting of a rod having on it a sphere and a flat disk, was mounted on a piece of white paper and photographs of the shadows with various systems of lighting were taken. Figs. 1 and 2 show the nature

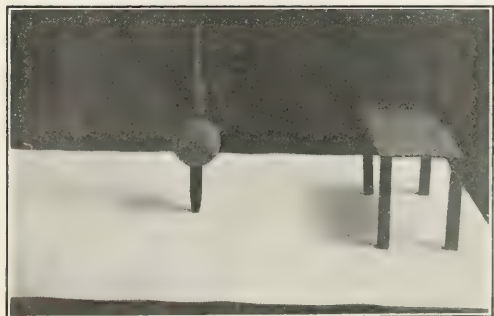


FIG. 2—OBJECTS LIGHTED BY SINGLE INDIRECT UNIT

of the shadows cast respectively by a single direct and a single indirect unit placed in the center of the room.

By taking an object of standard dimensions and subjecting it in turn to each system of lighting to be studied, and subsequently taking photographs of the shadow produced, much useful information about various systems of lighting might be obtained.

## Indirect Lighting on Limited Trains Between New York and Boston

One of the most striking features of the Merchants' Limited five-hour trains between New York and Boston on the New York, New Haven & Hartford Railroad is the use of indirect electric lighting on new rolling stock recently purchased and installed for this service. The cars are of steel construction and represent in finish and appointments the perfection of the car builder's art, consisting in the case of each train of four parlor cars, a combination parlor and baggage car and an observation smoker, with the usual dining-car equipment. The lighting is provided by an axle generator and auxiliary storage-battery installation on each car, with automatic voltage regulation standardized for 32 volts operation.

The accompanying photographs illustrate the interior of the observation car and of one of the standard parlor cars. The length of the observation car inside sills is 71.5 ft., and it contains seating accommodations for fifty-four passengers, the main aisle being flanked by two rows of twenty seats each. Seven indirect lighting fixtures are provided in the observation section, each containing three 50-watt tungsten lamps suspended vertically above a white porcelain reflecting bowl 16 in. in diameter and carried in a solid bronze lacquered dome hung 7.5 ft. above the floor. Three



FIG. 1—LIGHTING UNITS IN OBSERVATION CAR

additional fixtures are provided, one for the drawing-room or rathskeller section of the car and one at each entrance into the car from the vestibule. The monitor is about 5 ft. wide and is finished in a light cream color. The fixture is hung so that the reflecting bowl is about 12 in. below the monitor ceiling, the fixtures being spaced 6.5 ft. apart on centers and installed in a single row. No side lighting is required. The interior finish is in cocoa-wood and a buffet in which water can be heated electrically is attached to this car.

The parlor cars are of the same length as the observation smoker, each having thirty-six chairs upholstered in a rich rose-colored tapestry. The seats are installed on centers 42 in. apart and are about 17 in. above the floor, the aisle width being 28 in. The inside length of the parlor car between bulkheads is about 62 ft., and in this distance ten indirect lighting fixtures are provided, each containing a 100-watt tungsten lamp mounted vertically above the inverted reflecting bowl. The latter is carried in a bronze receptacle as in the observation car, and the general dimensions are approximately the same in each case. Outside the bulkheads at each end an additional fixture is installed to illuminate the approach and exit between the car interior and the vestibule. The fixtures are about 9 in. deep.

The dining cars on these trains are 73.5 ft. long over sills and are each fitted with twelve tables seating four passengers each, the tables being on centers 6.5 ft. apart and

being 2 ft. 9 in. x 41 in. in size, carried 24 in. above the floor. Six fixtures, each with a 100-watt tungsten lamp, are provided, the fixture spacing being 6 ft. 5 in. and the height of the bottom 7 ft. 4 in. above the aisle. The fixture dimensions are about the same as in the other cars, and there is a monitor 5 ft. wide at the top, with light cream-colored finish to reflect the light downward from the fixture. The side walls of the dining cars and the parlor



FIG. 2—PARLOR CAR ON LIMITED TRAIN

cars are finished in Mexican mahogany, with a cream-colored border above the window spaces. The cost of each dining car was about \$30,000 and of each parlor car about \$20,000. The lighting of the combination parlor car with baggage compartment is similar to that of the other parlor cars, but a smaller total number of fixtures is required. The lighting effect throughout the train is soft and pleasing, without the slightest glare, and the finest print can be read with ease. Preliminary observation indicates, however, that the 150-watt fixtures are giving better satisfaction than the 100-watt outfits, and it is probable that the former will take the place of the latter, as the substitution can easily be made without altering the fixture itself. The plans for the installation provide for approximately 4 to 4.5 ft. candles on a working plane 33 in. above the floor. These trains are believed to be the first in the world to be equipped with indirect lighting.

The new Denver station code is stated from conferences between Messrs. John Malm, city electrician, of Denver, C. B. Ford, assistant city commission, W. J. Canada, engineer of the Daily Morning Free Press-Telegraphers' Association, and a committee of the local electrical contractors.

## Recent Telephone Patents

### Automatic Devices

A patent has been granted to Mr. William Kellogg of Chicago, an automatic answering system, and a second patent has been granted to him for a dial and indicator adapted to include this sender. This sender mechanism is included in the base of the dial unit. Projections are provided for the various digits, each being connected individually to a relay in a relay circuit upon the receiving end. Each relay is connected to a spring which is held up by a spring and is arranged along an arc whose center is opposite the center of the dial itself. The angular movement of this arc in response to a pull corresponds to the digit associated with that finger-hold. The movement is limited by the contact of the arc with a stop and this engagement is only released by spring pressure on the finger hold. When the pressure is released, the arc returns to its normal position, the limiting mechanism continuing to send out the required current of response. Other patents are assigned to the Kellogg Switchboard & Manufacturing Company.

Mr. C. R. Austin of Los Angeles, has also patented a device in which the sender is returned to its original position by electrical impulses rather than by spring. The numbers are arranged upon a perforated dial over which the sender lever travels. The lever is set in the desired position, a pin in its extremity engaging the pin set in the dial. The mechanism is released by depressing an auxiliary key, which transmits a closing relay sets up a series of impulses which operate simultaneously upon the central office switch of the sender, returning the same forward and the other back. It is, however, recommended, a lamp is lighted to denote this. If a lamp has not been connected, ringing takes place automatically.

## Letters to the Editors

### Recodification of Denver Electrical Ordinances

The city of Denver, Col., has just recodified its electrical ordinances, including in the new measures much that is helpful to the workman.

Conduit is required for all new work in all classes of buildings, except that metal molding can be used in exposed work, while for fished wires in rewiring jobs flexible steel armored construction may be employed.

Motors with commutators and brushes must either be of the enclosed type or have the openings in their frames tightly covered with metal, unless they are installed in separate motor rooms not in garages, dry cleaning or similar establishments having cement floors. The Minneapolis rules for size of motor leads and fusing have been embodied in the new Denver code.

Neutrals must be grounded at each service. Vapor-proof globes must be used on all lamps in dry-cleaning establishments and paint and varnish works. The standard conduit and wire table published by the National Electrical Contractors' Association has been adopted as the requirement of the city.

The use of standard symbols for wiring plans, as published by the above-named association, is required on all wiring plans submitted to the city electrician.

### High-Frequency Alternator

*To the Editors of the Electrical World.*

Since my article in the *Electrical World* dated April 5, entitled "Electromagnetic Research Laboratory at Columbia University," by Prof. J. H. Murray, reference is made to a "General Electric high-frequency alternator."

Allow me to give a brief history of the development of this machine. The first high-frequency alternating current at a frequency above 10,000 cycles per second was designed by Prof. H. A. Rowland, the machine being built in 1901 at a cost of \$10,000 and giving a frequency of 75,000 cycles per second. Professor Rowland applied to the construction of this machine in the shop of the National Electric Sounding Laboratory. The machine was directly connected to a generator of the Cape May type. Finally, after much work in all ways connected with the machine and the very old and inefficient system of the disk, a new machine was built, in which a new and efficient method of the generation was employed. It is plain to see that, after being used for some ten years on various forms, which time and a large number of experiments have now been exhausted with it.

It was found necessary to build a new machine, somewhat after the same type as the one before mentioned, and—

order to get the required speed—in this case 20,000 r.p.m.—it was decided to use De Laval gears. These gears are the same as are used to reduce the speed from the De Laval turbine to the generator it drives. We decided to use them to increase the speed of the generator above that of the motor.

The facilities in the shop of the National Electric Signaling Company not being adequate for manufacturing the machines commercially, the work was given to an outside shop, in this case that of the General Electric Company. The General Electric Company proceeded to build the machines along the lines of the former Fessenden generators.

The above is a brief history of the machines now referred to as the "General Electric high-frequency alternators."

D. R. PRICE,

Pittsburgh, Pa.

Formerly Chief Engineer National  
Electric Signaling Company.

#### To the Editors of the Electrical World:

SIRS:—Quotations on the high-frequency alternator in the laboratory at Columbia University were received from the General Electric Company, and after the bid was accepted that company furnished an alternator built at Schenectady and bearing a General Electric Company name-plate. From any possible standpoint, the machine is as much a General Electric alternator as is any other alternator built by the company.

J. H. MORECROFT,

New York, N. Y.

Department of Electrical Engineering,  
Columbia University.

[The history of the development of the high-frequency alternator was outlined by Mr. E. F. W. Alexanderson, in a paper entitled "Alternator for 100,000 Cycles," presented before the American Institute of Electrical Engineers on June 28, 1909. In this paper the author stated that his work of development had been undertaken for Professor Fessenden in 1904. Several publications by Mr. Alexanderson and Professor Fessenden show that they have co-operated in the development work since that time. In an A. I. E. E. paper presented on Nov. 10, 1911, Mr. Alexanderson described an alternator giving 200,000 cycles per second, probably the highest frequency ever obtained directly from a generator.—Eds.]

### Magnetization and Weight

#### To the Editors of the Electrical World:

SIRS:—Many puzzling physical phenomena can be defined in simple terms by the electronic theory, although sometimes it is hard to reconcile some of these varied explanations with each other. Two interesting cases, for example, are the electronic explanations of gravitation and of magnetism, to which recent reference has been made in the *Electrical World*.

In magnetized materials, we are told, the spinning solar systems of electrons are more or less polarized in direction so that the charges, moving in parallel-plane orbits, set up perceptible magnetic effects in the mass—just as would similarly circulating currents to which the moving charges can be compared.

Turning to the pleasing electronic theory of gravitation as presented by Dr. Crehore in your pages several months ago, we are there given to understand that any negative electron, sweeping in planetary fashion around its positively charged principal, exerts its electromagnetic-gravitational pull chiefly on such other atoms as are near the plane of its orbit, the effect decreasing to zero as the line of the axis of rotation is approached. Since, however, the hundreds of electronic planets in a given atom probably revolve in as many

different planes, and since the atoms themselves are very likely disposed higgledy-piggledy in ordinary matter, we find gravitation occurring in identical degree in all directions about a given mass.

Now, if this gravitational hypothesis be true with respect to the individual electron, and if it were possible with a powerful magnetic field to polarize some of these electronic solar systems, we ought to get increased gravitational attraction along the common plane of rotation, while at the axis this force should be correspondingly enfeebled. We should then have the anomaly of a body which weighed more on one side than on another.

But, from the magnetic explanation already cited, do we not, in magnetized iron or other material, have exactly such a polarized condition of the electronic systems? Putting a bar of magnetized steel to a practical test, will careful measurements show a minimum gravitational pull along its magnetic axis? And at right angles to its length will the mass attraction be greater than that of an unmagnetized piece?

If, despite the obvious observational difficulties, evidence could be found of such a diminution of gravitational pull in the region of greatest magnetic activity, certainly both of the present interesting electronic explanations of gravitation and of magnetism would receive very direct substantiation—of which, by the way, they are still in some need.

New York, N. Y.

F. RUSSELL WEED.

### Prevention of Accidents

#### To the Editors of the Electrical World:

SIRS:—The article in your issue for March 22, referring to a paper by Mr. D. D. Lescohier before the Minnesota Electrical Association on March 11, is of much interest to me. I agree with the author that "linemen appear to be the greatest sufferers." It is quite true that most of the accidents are due to contact with wires in close proximity to the lineman while his mind is intent on "making up" joints on which he is working. The cure for this kind of accidents, however, is not by holding the foreman "rigidly accountable for use of protective devices," nor is it true that he "holds the key to the situation and on him should the responsibility be concentrated." The gang foremen are placed in a peculiar position in that they rarely have opportunity to choose the safety appliances they are to use, to dictate the standard of construction to be employed, the pin spacings with relation to pole or the weather conditions they are to work under; nor can they "kill" a line to make repairs, or direct what position dangerous dead-grounded lead cables or telephone wires are to occupy with relation to the live primary wires or what relation the local primary distribution system main is to occupy with relation to the secondary distribution mains.

Many companies insist on putting primary and secondary wires on the same cross-arm, thereby compelling the men to work in dangerous positions 90 per cent of the time because of the extra expense of separate cross-arms. The engineer who determines the standard of construction and holds the job of the foreman in the palm of his hand is the man to be "rigidly accountable for the use of protective devices," and this plan would result in proper safety in standard of position and operation methods. One should provide safe rules under which a man can work, not rules for legal protection. One should sectionalize the branch mains so that sections can be cut out as suggested by Mr. H. J. Gille, of St. Paul. The lineman should be called into the "family group" and a few experience meetings should be held. If safety is put above the dollar, accidents will be reduced and the volume of work increased, with a consequent reduction in the labor cost.

St. Louis, Mo.

JOHN L. FAY.

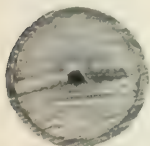


# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Pipe Choked with Scale and Foreign Matter

The importance of inspecting boilers periodically and thoroughly is well illustrated by the feed pipe shown in section from a photograph taken by one of the well-known accident insurance companies. This pipe was neglected and became choked with stony scale until the area opening through it was only  $5/32$  in. in diameter. The necessity of frequent inspection of pipes is keenly appreciated along the seacoast cities, where it not unfrequently happens that the circulating water intakes for the condensers are found choked with seaweed and barnacles, even in cases where screens have been provided with them.

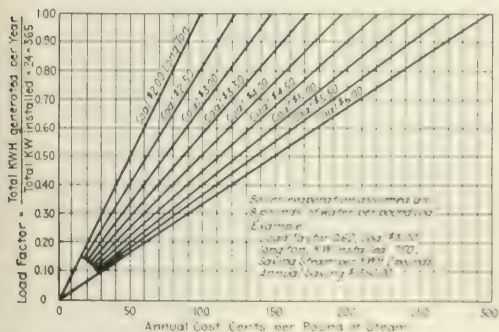


CROSS SECTION OF  
PIPE

## Steam Economy Versus Dollars

Frequently the purchaser of a steam engine or turbine is not alive to the enormity of the loss which may be occasioned from poor steam economy in the prime mover. In order to demonstrate more clearly the advisability of securing the lowest steam consumption possible and to enable the prospective customer to associate a real money value with each pound of steam saved, an enterprising salesman has prepared the accompanying set of curves.

With the aid of this chart and a knowledge of the load-factor and the cost of coal at the plant in question, only a simple arithmetical calculation is necessary to arrive at the annual plant saving with any condition of decreased steam consumption. For example, the load-factor at a certain 750-kw plant has been found to be 62 per cent, and coal



CURVES FOR CALCULATING SAVING FROM INCREASED STEAM ECONOMY

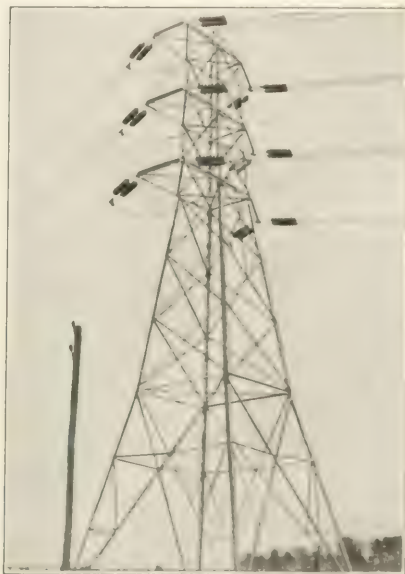
may be bought at \$3 a long ton. Tracing a horizontal line through the point marking 62 per cent load-factor to intersect the curve bearing the legend "coal \$3," and reading the ordinate of this point, it is found that the annual cost per kilowatt of generating 1 lb. of steam is 18 cents.

If the proposed installation is to save 2 lb. of steam per hour per kilowatt installed, it is readily seen that the total

annual saving will be  $750 \times 2 \times \$0.90 = \$1,350.00$ . To the man who is contemplating the installation of new apparatus such a graphic and forcible presentation of facts as this cannot fail to carry home its point.

## Construction Methods on Keokuk-St. Louis Transmission Line

The 110,000-volt transmission line which will convey to St. Louis the output of the great Keokuk water power plant 144 miles distant is made up of six symmetrical, self-supporting



KEOKUK TRANSMISSION TOWER, SHOWING FOUNDATION AND TOWER ARMS

cables, each 18 in. in diameter. Sixteen 25-ton conductors, each consisting of seven steel strands, carry the enormous weight of this conductor when it is hung in place of 50 ft. each. The cable has an ultimate strength of 1,000 lb. and its strung line between towers, even when coated with ice, is that of 125,000 pounds. Each cable has 16,000 lbs. of steel in the 25-ft. span between towers and is galvanized symmetrical, symmetrical cable used on a ground wire.

Owing to the very great weight of the symmetrical conductors, the method of securing the tower and cables are of interest. The towers were constructed complete on the ground and raised with a derrick crane, balanced by two of the foundation arms, by means of a steel cable and a tower of heavy. The symmetrical steel cable from one angle derrick to the top of the structure. This was accomplished by hauling cable from the towers at points

where the insulators would ultimately be placed, threading the cable through these and pulling it up for the entire distance between anchor towers. It was brought to the proper tension by means of a dynamometer or heavy spring scale and then fastened to the dead-end insulators at each end. A stirrup support was next attached at each tower, the conductor raised from the pulley by it, the pulley removed and the insulator hung and bolted to the cable.

The insulators which support the high-tension conductors are of exceptional interest. They consist of seven corrugated porcelain disks, each 10 in. in diameter, mounted in a string by means of malleable-iron fittings which are cemented to them. These insulators were selected after a large number of tests of various types at the highest voltages that had been used for that purpose, and an insulator was finally devised which affords a safety factor greater than that employed on any other transmission system of like voltage. The completed insulator unit, 3 ft. in length, withstands a pressure test of 440,000 volts under ordinary conditions, and even in a driving rain this is reduced by only 25 per cent.

The insulator is held to the tower and the conductor to the insulator by fittings of open-hearth steel. The fitting for the latter purpose, called the wire clamp, consists of two plates into each of which a wavy groove, flaring at the ends, has been pressed. These are bolted together around the wire and the waves serve to produce the necessary friction for holding it. A large cable of this kind must be held so that none of the small individual wires will be mashed in the clamp or over-strained by sharp bends at the ends of the clamp, and much careful investigation was necessary before this type of clamp, which holds the wire firmly and yet does not injure it, was devised.

### Operation of a Turbo-Electric Ice Factory

A turbo-alternator will be used to generate electricity for operating the motor-driven compressors and other machines of a new ice and cold-storage plant now being erected for the American Refrigerating Company at Los Angeles, Cal., the condensate reclaimed from the turbine being used as the source of distilled water for ice making. Heretofore there have been installed in various parts of the country a number of electrically driven ice plants, but in most of these instances the central-station electric drive employed has generally been used for making only "raw-water" ice, no steam machinery being installed.

To make distilled-water ice, the standard practice has been to connect a Corliss engine directly to the ammonia compressor and to use steam-driven auxiliaries for miscellaneous purposes about the plant. Steam condensed from all these sources, usually in a condenser open to the air, is then re-boiled to drive off the air, being skimmed at the same time to remove oil and grease. To make distilled water ice by the ordinary process requires therefore a waste of distilled water, in skimming, of from 10 per cent up and involves the use of inefficient steam auxiliaries.

In the Los Angeles plant referred to, now under construction by Hoxie & Goodloe, of New York and Los Angeles, all power used is to be furnished by a turbo-generator, the ammonia compressor as well as all auxiliaries being motor-driven. Even the power required to move the ice wagons will be made to yield its quota of distilled water, since ice delivery is to be entirely by electric trucks, charged with energy furnished by the turbo-generator. The reasons that led the engineers to such a radical departure from existing practice were, in addition to those already enumerated, the desire to produce ice of unapproached purity by keeping oil out of the steam to begin with, to produce a plant requiring a minimum amount of labor for its operation, to get the same efficiency from the auxiliaries as from

the main units, and to keep this efficiency high for the entire plant.

Following through the course of the water, the supply, coming from an artesian well, is passed through a purifying system and goes through an open type of feed-water heater, in which the water is not only heated to boiling but is actually boiled for some minutes in order to drive off the dissolved gases that otherwise would interfere with the transparency of the ice, unless otherwise removed.

From the feed-water heater the feed water is delivered by an electrically driven triplex pump to the oil-fired Stirling boilers, operated at 160 lb. pressure. As steam then passes to the turbine which drives a 60-cycle, three-phase, 440-volt General Electric turbo-generator. The exhaust steam from this unit rises to a special type of surface condenser located in a room directly overhead, in which also are placed the ammonia condensers, distilled-water tank, pre-coolers, etc. After being condensed, the condensate is led through a specially designed re-boiler, in which any remaining gases are driven off. These gases and the vapors of re-boiling are carried back to the condenser and the gases removed by an electrically driven dry vacuum pump. The water from the re-boiler drops down through a barometric column and is pumped through the pre-coolers and filters to the storage tank and to the freezing cans.

The ammonia compressor is driven by a two-speed induction motor which can be changed from full speed to half speed, or vice versa, by a double-throw switch mounted on the motor. The rotor is wound six-phase, with six slip-rings, and the same controller is used to start the motor at either full speed or half speed. The main mechanical equipment may therefore be run at half output, but at very nearly the same efficiency during the winter months when the demand for ice is light, or, if desired, during the night time.

A flexible coupling connects the compressor motor to a pinion shaft running in three bearings rigidly fastened to the frame of the compressor. The compressor flywheel is made of semi-steel and has Wuest herringbone helical gear teeth cut in its face, which mesh with a pinion carried by the pinion shaft. Pinion and gears were made by the Falk company, Milwaukee, and the compressor by the Frick company, Waynesboro, Pa. The transmission losses between the motor and the compressor are believed to be materially less than between the cylinder of a Corliss engine and a similar compressor.

Electric motors are used for driving the circulating pumps, well pump, boiler-feed pump, dry-vacuum pump, brine tank agitators, ice hoist, etc., and a motor-generator set is provided for charging the batteries of the electric trucks which deliver the ice. The ice delivery trucks were purchased from the Baker Electric Company and are of 2 tons and 3.5 tons capacity. Exide batteries are used.

The performance of this plant will be watched with much interest, not only by electrical engineers, but by ice manufacturers generally, for if the plant fulfils its promise a new field will be opened for the steam turbine and the electric motor in ice-factory operation.

### Lead Burning

Kindly inform me whether lead burning is done with a blowtorch or a charcoal fire and what kind of flux is used.

H. M. G.

In lead burning as generally done use is made of neither a blowtorch nor a charcoal fire, but a needle-point hydrogen flame. As a rule the hydrogen generated is mixed with air and fed through a rubber hose to the burning tip. Under the action of this flame the lead surfaces to be joined flow together, and as lead is added from a stick in the hands of the operator the seam is filled by the process of amalgamation.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Commutation and Interpoles.**—LUDWIG BINDER. The emfs which according to the usual view are produced by the armature conductors cutting the so-called armature cross-flux are in reality produced by the transformer action of the linear short-circuit currents. The effect of the self-induction and the mutual induction of the armature conductors in the slots due to the linear short-circuit currents can be replaced in an exact manner by a field stationary in space which is cut by the rotating armature conductors. The form of this field can be found in a simple way from the number of conductors per slot and the time of commutation. This field is co-axial with the armature cross-field, but it runs across through the slots. The annihilation of the reaction voltage is, according to this view, due to the production of a flux-free zone in the slots (not on the armature surface), since the commutation field overcomes the slot cross-field which is also stationary. According to this view, therefore, it is not the emfs which compensate each other, but the fluxes.—*Elek. und Masch.* (Vienna), March 2 and 9, 1913.

**Alternator Emf.**—L. KLEIN.—G. Kapp gives the following formula for effective emf of the general alternating current machine:  $E = k\Phi nS \times 10^8$ , where  $n$  is the frequency,  $\Phi$  the maximum number of the lines of flux from a pole and  $S$  the number of active armature conductors (rods) in series. The coefficient  $k$  is called by Pichelmayer the "Kapp factor," and Pichelmayer has given tables from which the Kapp factor for rectangular fields, for trapezoidal fields and for sinusoidal fields can be easily found. The present author elaborates the formulas for sinusoidal fields still further with some references to the effect of higher harmonics in the case of turbo-generators.—*Elek. und Masch.* (Vienna), March 9, 1913.

**Single-Phase Repulsion Motor.**—A note on a recent British patent (No. 11,434, 1912) of the Oerlikon company. The motor has a shunt characteristic, and the direction of rotation is changed by shifting the magnetic axis. The stator winding is divided into groups connected in series, and part is reversible. Auxiliary brushes displaced 90 deg. from the short-circuited brushes are connected to the reversible stator winding. Arrangements are made so that the current in the working brushes is not reversed during the change-over. If a transformer is used to feed the auxiliary brushes, it is provided with a supplementary winding, through which the working brushes are constantly short-circuited.—*London Elec. Engng.*, April 3, 1913.

**Starting Cascade Converters.**—R. JOHS. JENSEN.—An article illustrated by diagrams giving the theory of the phenomena during the starting of cascade converters. The author shows that on account of the armature reaction in the converter synchronizing becomes difficult. By using starting induction coils synchronizing may be greatly facilitated.—*Elek. Zeit.*, April 3, 1913.

### Lamps and Lighting

**German Illuminating Engineering Society.**—The official report of the first general meeting of the German Illuminating Society (Deutsche Beleuchtungstechnische Gesellschaft), held in the physical laboratory of the University of Berlin on Feb. 24, 1913. The meeting was opened by an address by Dr. Warburg, of the Reichsanstalt. Professor

Pichelmayer reported that some 100 guests, meeting at the thirty-eight (thirty) members of the society of members, has increased to 212. Dr. Warburg was elected president. The board of directors consisted of twenty-four members, of whom six were to be the members of the German Association of Electrical Engineers, and the others also members of the German Association of Opticians. Dr. Pichelmayer presented his paper on "The Arc and Illuminating Engineering." In the first part he discussed the physical aspect of the illuminating engineering problem and said that there are two ways of progress, one being to use light without heat and the other being an increase in the temperature of the body which gives out light. The second part of the paper dealt with the physiology of the human eye. Three committees were appointed, namely a committee on the light unit, a committee on color factors and a committee on measuring methods.—*Elek. Zeit.*, March 27, 1913.

**Metallic-Filament Lamps versus Arc Lamps.**—A discussion.—A review of an extensive discussion between representatives respectively of the arc-lamp industry and the incandescent-lamp industry as to whether high-candle-power metallic-filament lamps can replace arc lamps. The brilliancy of the arc lamp was given as a particular advantage, but from a hygienic point of view it is rather a disadvantage. Twenty-nine trolley-car motormen were asked to compare the lighting of two streets of equal lengths, one of which was lighted with 10-amp arc lamps and the other with 500-cp metallic-filament lamps. One of the twenty-nine motormen twenty-five were in favor of the metallic-filament lamps. This is chiefly due to the irritation of the eyes of the motormen by the arc lamps and incandescent-lamp lighting is said to reduce the number of accidents. The cost of operation was especially discussed. If the high-candle-power arc lamp consumes 0.8 watt per burner candle and has a life of 1,000 hours, the metallic-filament lamp is superior to a series of arc-lamp types. The superiority of the high-candle-power metallic-filament lamp is especially evident with alternating current. In the comparison of the two kinds of lamps the greater subdivision of the light in the case of the metallic-filament lamps is also to be taken into account so that the same illumination is obtained with a smaller candle-power with metallic-filament lamps.—*Schweiz. Elek. Zeit.*, Vol. 36, 1913, No. 3, abstracted in *Elek. Zeit.*, March 27, 1913.

**Electric Lighting.**—A. STEINHAUS.—A review of the electric-lighting industry in Germany in 1912. He outlines the great progress of the metallic-filament lamp and states that although 200,000 arc lamps and 100,000 200-volt metallic-filament lamps are in the market, yet the 100-volt lamp should become the standard lamp for all purposes. The metallic-filament lamp has also been developed directly for advertising purposes. The first lamp used was one only for physical purposes and as a standard lamp. The problem of the illumination of the street appears to have been solved. Arc lamps in which pure carbon electrodes are used are continually being improved because of the advantages of improved arc electrodes. Mercury and sodium arc lamps are being used in the United States, but have not been able to find a foothold in Germany. In connection with the incandescent lamp the use of fluorescent substances which is taken chiefly in the use of



rhodamin, is not yet out of the experimental stage.—*Elek. Zeit.*, March 27, 1913.

### Generation, Transmission and Distribution

**Large Gas and Oil Engines.**—SCHOENBURG.—The article points out that for electric-power plants the gas engine operated with producer gas is very satisfactory in large units. Very recently the large Diesel engine operated with tar oil has assumed a steadily increasing importance; for instance, in the new plant of Mannstadt & Company in Friedrich-Wilhelms-Hütte on the Sieg two Diesel engines, each of 2000 hp, will be installed which will operate in parallel with 440-volt direct-current gas units operated with blast-furnace gas.—*Elek. Zeit.*, April 3, 1913.

### Installations, Systems and Appliances

**Equalizing Voltage Fluctuations.**—E. BECKMANN.—The testing machines in the Institute of Technology at Hanover are being driven by direct-current motors supplied with energy from the network of the tramway system. Although shunt motors with lightly saturated fields are used, the voltage variations, which are between 420 and 520, are sometimes so large that the speed fluctuations may reach 11 per cent. In the course of a few seconds there are occasionally voltage fluctuations of 30 volts or more. For this reason it became necessary to install an automatic device for equalizing the voltage fluctuations. The arrangement is shown in Fig. 1. The direct-current supply from the tram-

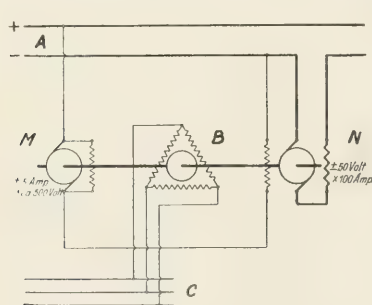


FIG. 1.—CIRCUIT DIAGRAM OF AUTOMATIC VOLTAGE REGULATOR

way network is shown at *A*, fluctuating between 420 volts and 520 volts. *B* shows a 10-hp, three-phase synchronous motor operated from the lighting network *C*. This motor *B*, running at constant speed, drives the auxiliary machine *M* and the booster *N*. The booster *N* produces the additional or correction voltage which at any instant must equal exactly the difference between the normal voltage and the instantaneous value of the fluctuating voltage at *A*, so that at the point *X* the constant normal voltage is obtained. In order to let the booster *N* (which has a straight-line characteristic) always produce the voltage difference between normal voltage and instantaneous voltage at *A*, it is necessary that the magnetizing current in the field coils of *N* be proportional to the difference between normal voltage and voltage at *A*. For this purpose this voltage difference is impressed on the terminals of the excitation winding *W<sub>e</sub>* of the machine *N*. This voltage difference is produced by opposing the constant normal voltage generated by the auxiliary machine *M* by the fluctuating voltage at *A*. A graphical method is given to show the most favorable value of the resistance of the winding *W<sub>e</sub>*. The results of tests are given in diagrams.—*Elek. Zeit.*, April 3, 1913.

**Main Switch Gear.**—B. MITTELL.—An illustrated article in which the author deals with the importance of constructing main switch gear so that the chance of failure of supply is reduced to a minimum. The points discussed include the elimination of apparatus liable to breakdown and unsuitable material, the support of conductors, flame and arc-proof

construction, ready isolation, and minimum interruption of healthy circuits.—*London Electrician*, April 4, 1913.

**Warships.**—A. P. PYNE.—A paper in abstract read before the New Castle section of the (British) Institution of Electrical Engineers on some special applications of electricity on warships.—*London Electrician*, April 4, 1913.

**German Electrical Industries.**—A continuation of the reviews of the status of the different fields of electrical engineering in Germany in 1912. C. Michenfelder discusses electric hoisting and transportation machinery, W. Philipp the uses of electric energy in mining and metallurgy, Usbeck electric traction, V. Engelhardt electro-metallurgy, and K. Arndt electrochemistry. This series of reviews is to be concluded.—*Elek. Zeit.*, April 3, 1913.

### Wires, Wiring and Conduits

**Calculating Networks.**—JOSEF HERZOG.—An article illustrated by numerous diagrams discussing several general superposition and subdivision principles for the calculation of complicated networks with many branches.—*Elek. und Masch.* (Vienna), March 16 and 23.

**High-Tension Cables.**—L. LICHTENSTEIN.—An English translation in abstract of his German paper recently noted in the *Digest* on high-tension cables for the Dessau-Bitterfeld railway.—*London Electrician*, April 4, 1913.

**Suspended Insulators.**—E. E. SEEFEHLNER.—An article pointing out that suspended insulators permit obtaining a high electrical and mechanical degree of safety with simple technical means. Comparative notes are given on the properties of several different types.—*Elek. und Masch.* (Vienna), March 23, 1913.

### Electrophysics and Magnetism

**Theory of Roentgen Rays.**—W. F. G. SWANN.—When a beam of X-rays or ultra-violet rays falls upon a thin sheet of metal, the values for the number and velocity of the beta rays produced are greater for the emergence beta rays than for the incidence ones. The explanation of this fact on the wave theory is generally considered to be attended by difficulties so serious as to necessitate the abandonment of the pulse theory in favor of a corpuscular hypothesis. Practically the same arguments which support the corpuscular theory for X-rays also support it for ultra-violet light, so that if the wave theory is abandoned for one, it is necessary to abandon it for the other. The author endeavors to show to what extent the want of symmetry in the expulsion of beta rays may be reconciled with the pulse theory, and also to discuss certain other points concerned with the properties of X-rays, etc.—*Philos. Mag.*, April, 1913.

**Electrification Associated with Dust Clouds.**—W. A. DOUGLAS RUDGE.—Nearly all kinds of finely divided material when blown into a cloud of dust by a current of air give rise to electrical charges upon the dust and upon the air. The nature of the charge resident upon the dust particles depends upon the chemical characteristics of the material. In general, the charge obtained upon the dust is opposite to that associated with the "ion" of the same substance when in solution, that is, strongly basic bodies give negatively charged dusts and strongly acidic bodies give positively charged dusts. In the case of salts the charge apparently depends on the relative strengths of the acidic and basic ions. Similarly constituted bodies give similar charges.—*Philos. Mag.*, April, 1913.

**Brush Discharge in Water.**—HAROLD SMITH.—An account of a spectroscopic study of the electric brush discharge in water and salt solutions. The series spectrum of hydrogen in both the capillary and brush discharge increases with increase of current density, while the secondary spectrum decreases in relative intensity to the series lines. The series lines broaden considerably with the condensed discharges, and the relative intensity of the lines falls off toward the violet. The series spectrum of oxygen appears only with the higher-current density discharges, being

brighter with higher current density. The elementary-line spectrum appears in the brush with the feeble discharges only, its brightness also depending on the nature of the solution. It appears in the spectrum of the capillary in the capillary discharge, only very faintly, if at all, but in the discharge in dilute sulphuric acid it is the most important part of the spectrum of the bubble which forms at each end of the capillary. The lines of the metal of the dissolved salt appear in the brush. In the case of lithium their relative intensity varies with the salt used and also with the current. In weak solutions the metal lines are destroyed by the heavier condensed discharges. The metal lines appear very feebly in a capillary, and they are produced strongly only in the immediate neighborhood of a metal electrode. The spark lines of platinum appear with the condensed discharges when a spark-gap is used.—*Philos. Mag.*, April, 1913.

**Geissler Tube.**—B. HODGSON.—An illustrated account of an experimental investigation of the temperature of the cathode and anode in a Geissler tube. There exists a linear relationship between the current through a vacuum tube and the heat energy communicated to the cathode both for normal and abnormal cathode glow. There exists a pressure at which this effect is a minimum. The ratio between the positive and negative carriers at the cathode is approximately ten to one. A linear relationship between current and heat energy exists at the anode, though for the same pressure and current the heat communicated is much less than in the case of the cathode. The anode fall alone is not able to account for the heat energy communicated to the anode.—*Philos. Mag.*, April, 1913.

#### Electrochemistry and Batteries

**Conductivity and Fluidity of Strong Solutions.**—W. S. TUCKER.—An illustrated (British) Physical Society paper in abstract. The author describes experiments made to find whether there is any relation between conductivity and fluidity. The feature of the method described is the simultaneous observation of temperature, viscosity and resistance. The electrolytic cell and viscometer are immersed in the solution for which they are employed, and both are bound to the bulb of a platinum thermometer, which serves also as a stirrer. The electrolytic cell *C* (Fig. 2) is a flattened tube drawn out into a flat jet. It contains a platinized-platinum electrode *P*, the dimensions of which are 25 mm by 5 mm. The second electrode, also of platinized platinum, forms a cylindrical sheath *Q* around the bulb of the thermometer *T*. The thermometer is mounted on a frame to which a vertical oscillatory motion is imparted. This motion is caused by a connecting rod attached to a large pulley driven by a motor. As the thermometer oscillates it draws through the liquid a platinum scoop, which acts as an efficient stirring arrangement. The resistance was measured by that modification of Kohlrausch's method described by Fitzpatrick in which a high speed double commutator and a moving-coil galvanometer replace the coil and telephone. An accuracy of one part in two thousand could be thus obtained, which was greater than that possible with the viscosity apparatus. The results of tests of solutions of different concentrations are given. The



FIG. 2.—APPARATUS FOR DETERMINING VISCOSITY AND CONDUCTIVITY.

viscosity is measured by a modification of Poiseuille's method. The tube through which the flow occurs is a uniform jet about 2 mm long, drawn out from a point at right angles to the direction of flow by means of the side tube *S* with an aspirator or with a compressed air reservoir. When the tube is immersed in the solution the latter can be drawn in or driven out at will. The movement is measured into the solution by a side tube, and the time of passage is measured and compared with that of water under the same conditions. During the experiments the viscometer is visible, hence the levels of the liquids when flowing into the tube are indicated by electrical means. Two fine platinum wires, *A* and *B*, serve as electrodes and are insulated from one another. As the liquid rises within the tube it makes circuit with *Q* and *A* through the liquid and the output of a galvanometer is noted. A second reading is produced when contact with *T* is made. Thus the change of the levels can be seen directly read. The assumption is made that the rate of influx of the solution is proportional to the hydrostatic pressure and inversely proportional to the viscosity. *London Electrician*, April 4, 1913.

#### Units, Measurements and Instruments

**Indicator of Heat Meter.**—S. ONO, in *Sci. Mus.*—An illustrated mathematical paper on the characteristics of the induction-type alternating current watt-hour meter. The author gives the approximate equations of the watt-hour meter and discusses the meter and load characteristics, the power-factor characteristic, meter testing and superposed error, and the effect of frequency.—*Electrotechnical Laboratory, Dept. of Communications, Tokio, Japan*, March 4, 1912, reprinted from the report of the first section of the Electrotechnical Laboratory, Tokio, Japan.

**Demonstration of Oscillation Phenomena by Means of Resonance Curves.**—F. KESK.—A description of an arrangement by which resonance curves, as used for the investigation of oscillation phenomena, may be projected on a screen or a directly sighted scale. The arrangement consists of a bolometer bridge in connection with a moving-coil galvanometer of high sensibility and small period of oscillation and a rotating commutator which drives an oscillating magnet.—*Verh. d. Physik. Vers. Berliner*, 1912, S. 701 (abstracted in *Elek. Zeit.*, March 27, 1913).

**Röntgen Photography.**—F. DESSAER.—A review of recent progress in Röntgen ray photography. It is now possible to take a Röntgen ray photograph in an exceedingly short time, so that photographs can be taken, presenting the different phases of an occurring action in the human body, for instance, of the action of the heart, and can be assembled into the form of a moving picture.—*Arch. f. physik. Mediz. u. med. Physik*, Vol. 7, 1912, abstracted in *Elek. Zeit.*, March 27, 1913.

**Insulation Tester.**—This continuation of the reviewed serial on dielectric testing of electrical apparatus deals with the determination of insulation resistance and dielectric strength.—*Elek. Zeit.*, March 27, 1913.

**Testing Lighting.**—By ALFRED E. L. CHRISTENSEN.—The author shows that there is loss in lighting circuits due to inductance. It is of an inductive character should be presented. He relates some facts that have been hitherto inapparently applied to lighting circuits and explains some of the reasons why they are wrong.—*Elek. Zeit.*, March 27, 1913.

**Testing of Insulation.**—By ALFRED E. L. CHRISTENSEN.—An English translation of a paper of the German paper recently issued in the *Elek. Zeit.* on the use of direct current in testing insulation resistance. *March 14, 1913.*

**Power Factor Indicator.**—By ALFRED E. L. CHRISTENSEN.—An article describing the principle of action of power factor indicators and describing in detail the method of constructing such indicators and giving the construction details.—*Elek. Zeit.*, March 27, 1913.



## Miscellaneous

*Jubilee of the Electrical Society of Vienna.*—The thirtieth anniversary of the foundation of the electrical society of Vienna (which is the national electrical engineering society of Austria) was celebrated on March 14 and 15. A full account of the various functions, including the principal festival meeting, a banquet and excursions, with reports of the speeches made, is given in *Elektrotechnik und Maschinenbau*, April 6, 1913. This journal, which is the official organ of the society, issued on this occasion a large and profusely illustrated festival number, in which after an introduction by the editor, J. Seidener, a review is given of the development of electrical engineering with special reference to Austria. F. Ross gives reminiscences of the early days of electrical engineering, E. von Rziha discusses the development of the electric-power plant, L. Kliment the development of heat engines, A. Budau the development of water-power plants, K. Pichelmayer the development of the design of electric machines, F. Patzelt the development of switches and circuit-breakers, F. Natalis the development of starting and regulating apparatus, A. Schwaiger the problem of regulating mechanisms in electrical engineering, E. Orlich the development of electrical measuring instruments and methods, J. Herzog the evolution of electric wiring calculations, J. Sahulka the situation of electric lighting, F. Niethammer the evolution of the electric drive of machines, P. Poschenrieder the development of electric railways, E. Wikander the domestic applications of electricity, H. Paweck the present status of the electrochemical industry, R. Franke telegraphy, telephony and signals, M. Reithoffer the evolution of wireless telegraphy, S. Jellinek electro-medicine and electro-pathology, F. von Gunesch the general situation of the electrical industries in Austria, J. Kareis the training of electrical engineers in Austria, and E. Adler the patent situation.—*Elek. und Masch.* (Vienna), Festsnummer, March, 1913.

## Book Reviews

**DESIGN OF ELECTRICAL MACHINERY.** Vol. II. Alternating-Current Transformers. By William T. Ryan, E.E. New York: John Wiley & Sons. 120 pages, illus. Price, \$1.50.

This is a useful volume to be recommended to students who wish to obtain a general working knowledge of the design of alternating-current transformers. The methods employed are simple and rather general. The examples cited are typical, and they will help the student to acquire a working idea of the principles of transformer design.

**DESIGN OF ELECTRICAL MACHINERY.** Vol. III. Alternators, Synchronous Motors, Rotary Converters. By William T. Ryan, E.E. New York: John Wiley & Sons. 130 pages, illus. Price, \$1.50.

The author treats the design of alternating-current generators, synchronous motors and rotary converters in a very elementary manner without particular emphasis upon general principles or fundamental ideas. His book is undoubtedly a useful one, adapted to the college courses, but it is a work in which one misses a broad scientific spirit. The examples of electrical machines are almost exclusively the product of one manufacturing concern, which fact, though it may not show much fault, is certainly apt to inculcate a certain narrowness of vision, however good the examples cited may be. The book may be heartily recommended to students at college, provided they accompany it with the study of a treatise emphasizing more strongly fundamental problems and their application to electrical design.

**METHODS OF MEASURING ELECTRICAL RESISTANCE.** By Edwin F. Northrup, Ph.D. New York: McGraw-Hill Book Company. 390 pages, illus. Price, \$4.

A good treatise on the principles, methods and apparatus of measuring electrical resistances from the standpoint of electrical engineering. No other book with which we are acquainted covers just this field. The chapters relate to the following subjects: Electrical measurements, deflection methods, null methods, Wheatstone bridge methods, low resistances, conductivity, high resistances, insulation resistance, alternating-current measurements, resistances including electromotive force, fault location, temperature measurement, instruments, galvanometers. The plan of the book is eminently practical and adapted to the needs of the practitioner. Numerous practical examples are presented and worked out. The book will be useful to all who are interested in the principles and practice of electrical measurements.

**A MANUAL OF PHYSICAL MEASUREMENTS.** By Anthony Zeleny, Ph.D., and Henry A. Erikson, Ph.D. Third edition. New York: McGraw-Hill Book Company. 248 pages, illus. Price, \$1.50.

An experimental laboratory textbook intended for college students in elementary physics. It is divided into six sections besides the introductory chapter, appendices and tables. The sections relate to the following subjects: Mechanics, fluids, heat, electricity and magnetism, sound, and light. The section on electricity and magnetism is much the longest. The work is divided under each section into experiments, for each of which the apparatus to be used is described and the procedure is outlined. The principal formulas are presented. The mathematics is all elementary. The descriptions are clear and the diagrams simple. A brief appendix outlines the simplest method of determining the probable error of observations. The book will be useful to teachers and students of elementary physics.

**DESIGN OF POLYPHASE GENERATORS AND MOTORS.** By Henry M. Hobart. New York: McGraw-Hill Book Company. 265 pages, illus. Price, \$3.

Mr. Hobart has given us a very interesting book. In a lucid and comprehensive manner he enters upon his subject by discussing such simple though fundamental matters as the number of poles, the output coefficient and the ampere-conductors per pole, per phase and per centimeter of periphery, which he calls the "peripheral loading." The slot insulation and distribution of windings are then discussed, and the magnetic circuit is plainly and sensibly described. The armature reaction and the saturation and regulation curves are then explained, as well as the use of the short-circuit characteristic. Everywhere common-sense methods and common-sense modes of looking at the problem are used, and practical data, so largely at the disposal of an engineer of such vast experience as Mr. Hobart, are not omitted from the text. After the subject of alternating-current generators has been dealt with thus carefully, Mr. Hobart treats of induction motors in the same manner. It goes without saying that he utilizes the circle diagram extensively, giving also a useful bibliography of this important subject. In the discussion of slip-ring induction motors many interesting points will be found. The discussion of synchronous motors versus induction motors is also most instructive. A separate chapter deals with the induction generator, and examples for practice in designing conclude this useful treatise. The book will be found of assistance to both the student and the engineer, and for reference will be most helpful to those consulting engineers and station operators who wish to gain some authoritative information on the data which enter into the design of the machinery they are using.



# New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed  
Manufactured Products of Interest to Electrical Readers

## 19,000-Hp Water Turbine for Rio de Janeiro

In the Pirahy power station of the Rio de Janeiro Tramway, Light & Power Company, which was described in the *Electrical World* May 13, 1909, there have recently been installed two 19,000-hp water turbines and generators.

The power station, which has been in operation since 1907, is situated on the River Lages about 50 miles from Rio. Three-phase energy is generated at 6000 volts and 50 cycles, the emf being stepped up to 80,000 volts for transmission. The equipment in operation prior to the installation of the two 19,000-hp units consisted of six 8700-hp impulse wheel units and three 200-kw exciter sets, two of the latter being operated by Pelton wheels and one being motor-driven.

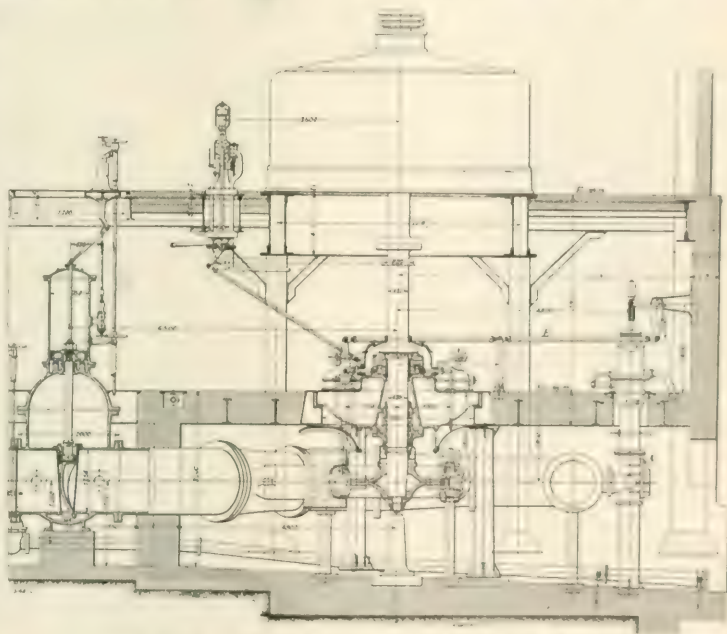
The River Lages has a drainage area of 193 sq. miles with an average rainfall of 59 in. a year. The river descends in a series of rapids and falls nearly 1000 ft. in a distance of only a few kilometers. A dam at the top of the falls forms a reservoir, with an average level of 1323 ft. above the sea. The power station is built 308 ft. above the sea level, so that the gross head available for the turbines is 1015 ft.

Water was conveyed from the dam to the power house by pipe lines in two sections, consisting of two upper low-pressure lines, one receiver pipe and six lower high-pressure lines. At the time the new units were installed two high-pressure pipe lines were added. The diameter of the low-pressure pipes is 8 ft. and that of the high-pressure pipes 3 ft. The lines are fitted with relief pipes. The high-pressure pipes for the new turbines are divided into three sections having diameters of 56 in., 54 in. and 52 in. respectively. Relief pipes 400 ft. long are installed. The gross head available at the turbines is 1015 ft., which is reduced by pipe friction losses to an equivalent of 925 ft.

The arrangement of the new 19,000-hp units is shown in the illustration. The machinery room is constructed with two floors, the upper of which forms the station floor proper and carries the governors and control handles. The lower floor carries the thrust bearing of the vertical shaft of the machine and also the oil pumps which serve for lubrication and for the operation of the nozzle valves. The space below the thrust-bearing floor serves as the wheel pit, which has communication with the tailrace through the opening shown at the right-hand side of the cut. The station is built close to the bank of the river which takes the discharge, so that only a very short tailrace is necessitated.

The runner to which the buckets are secured is keved to

the bottom of the vertical shaft, the shaft having two main bearings, one directly above the turbine runner and the other on the base of the alternator frame. The shaft has also a thrust bearing just above the thrust-bearing floor. The turbine wheel is surrounded by a casing carrying four needle valves arranged symmetrically in a horizontal plane. The pipe distributing the water to the nozzles below is arranged in the form of a spiral without sharp turns or angles, so that a smooth flow is obtained. The nozzles are entirely independent of each other and are governed directly by a motor operating with oil in such a way that the nozzle discharge corresponds with the load. The main



19,000-HP WATER TURBINE WITH GOVERNOR, OIL PUMPS, AND CONTROL HANDLES

water valve, which can be seen at the left-hand side of the illustration, is operated by means of pressure water taken from the incoming pipe line acting in the operating cylinder, which is fixed above the valve. The actual control connections to this cylinder are taken from the four 2400-psi. passages.

Each pipe line is fitted with a pair of relief valves at its tailrace end in order to limit the pressure and make sudden changes of load. The valves, which are of sufficient capacity to allow the total quantity of water to pass if necessary, are operated in connection with the throttle regulating gear. This gear is mounted on two frames mounted on the base and which carries the thrust bearing and one of the main bearings. The cross-shafts of the governors are connected up, by means of cranks, to short rocking shafts which are mounted in frames on the top plate

The rocking shafts operate the needle valves through double links.

As there are but two motors and four rocking shafts and needle valves, arrangements were made to interconnect the rocking shafts in pairs. This was done by means of bell-crank levers lying in a horizontal plane. One arm of each bell-crank lever is connected by short links to the head of the rocking-shaft crank which lies opposite the front end of the motor, while the other arm of the bell-crank lever is connected to an oscillating link. This link connects up to the crank of the rocking shaft which lies at the opposite side of the turbine from the motor which is driving it and at the back end of the second motor. The result of the arrangement is that the second rocking shaft lies at right angles to the first, which gives the best position for connecting up to the second needle valve, owing to the position of the incoming pressure pipe.

The interconnecting links *E* between the valve mechanism and the operating gear of the relief valves are shown in the illustration. The link is carried at the end of a crank secured to one of the rocking shafts, and thus operates the relief valves after the needle valves have closed to a predetermined amount. The relief valves are fitted with tandem cylinders, the lower of which are supplied with water from the main pressure pipe, and tend to open the valve. The upper cylinders are supplied with oil from the pump, and oppose the lower cylinders. The oil pumps are fitted in duplicate and each pump is driven by a Pelton wheel. The pumps work in conjunction with a common oil accumulator. Each pump is large enough to supply the whole of the oil required for the operation of its turbine, so that the other is available as a stand-by. The oil supply to the governor and motor is at a pressure of 350 lb. per square inch, but the pressure is reduced to 120 lb. per square inch for the bearings.

The turbines and governors were built by the Escher, Wyss Company, Zurich, Switzerland, and the installations of the machinery as well as the pipe lines were made by the same concern.

The generators were furnished by and are of the standard design of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

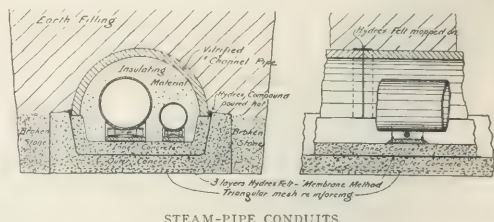
### Steam-Pipe Conduits

Central stations engaged in steam-heating practice are constantly brought face to face with the problems of economical and flexible distribution by underground piping systems. To meet the demands of watertight construction, durability and efficiency in this class of work, and also to provide a reliable method of transmitting steam underground in high-pressure service, a new type of conduit illustrated in the accompanying diagram has been developed with patent pending under the control of Mr. Percy N. Kenway, 79 Milk Street, Boston, Mass. The illustrations show typical transverse and longitudinal sections through the so-called "W.E.D." conduit.

The lower portion of the conduit is composed of three separate elements—an outer trough-shaped monolithic shell of concrete reinforced with triangular metal mesh, a waterproofing course of three layers of "Hydrex" felt mopped on with hot "Hydrex" compound, according to the so-called "membrane method," and an inner monolithic shell of concrete. The upper portion consists of vitrified channel pipe with water-tight "Hydrex" joints sufficiently elastic to permit slight movements due to expansion or contraction. At each side of the channel pipe, and between it and the outer concrete shell, a longitudinal groove is formed as shown in the cut. This groove is filled with "Hydrex" compound, poured hot, making an elastic and water-tight joint. As there are no joints in the lower portion of the conduit and as the outer shell is reinforced, the danger of

uneven settlement and leaky joints is eliminated. With the double shell and the waterproofing course, expansion cracks in either the outer or the inner shell are of no real importance.

The pipe supports rest on a flat surface and may consist simply of plates and rolls, the concrete lower portion forming a solid base upon which to install the pipes. Another



advantage claimed is that the longitudinal joint does not depend for its tightness upon the matching and careful cementing of the upper and lower sections of a split tile pipe. All joints below the center are eliminated, and if leaks develop in the steam pipes or if alterations are required at any time, this conduit can be broken into and repaired at a minimum expense.

### Water Sterilizing by Means of Ozone

By J. P. SCHROETER

It is claimed that the sterilizer invented by Mr. Siegfried Held sterilizes water perfectly and instantaneously. The device consists of an ozonizer which can be attached to any faucet in a house where electricity is available. In case alternating current is present a transformer steps up the voltage, and in case of direct current a small rotary converter or vibrator according to the size of the outfit changes the supply into alternating current. In larger installations a fan with attached motor is provided for driving air through the ozonizer.

The latter consists of a tubular electrode placed in a vacuum tube and of another tubular electrode surrounding the vacuum tube. By means of returned lips a space for the passage of air between the outer electrode and the tube is provided. The discharges take place between the electrodes with an output of fifty-eight parts of ozone in 10,000 parts of air. This ozonized air is conducted to an especially constructed faucet, where it is mixed with the water. The effluent leaves the faucet completely sterilized. Filters are introduced for the purpose of eliminating coarser suspended particles.

The absence of any nitrites is worth mentioning. The discolored water carries with it some of the peculiar odor

#### RESULTS SHOWN WITH USE OF OZONIZER

Unfiltered Lake Water Inoculated with	Number of Bacteria per Cubic Centimeter Before Ozonization	Number of Bacteria After Ozonization
Colon bacilli.....	2100	0
Typhoid bacilli.....	6800	1
Typhoid bacilli (second test) ....	5600	0
Dysentery bacilli.....	4100	0

of ozone, which, however, vanishes in the time required to bring the glass to the mouth, so that the result is a clear, odorless water. A push-button on the faucet brings the apparatus into action, the water pouring out instantly, as from any other faucet.

Tests made in leading laboratories have shown perfect sterilization. The Laboratory of Hygiene, Pathology and Bacteriology, Chicago, made tests with somewhat turbid, unfiltered lake water (turbidity 30) and with clear sparkling distilled water. A definite portion was artificially contaminated with a large number of colon, typhoid and dysentery bacilli, all three of which types are intestinal and often present in water supplies. After a definite quantity of the bacterial emulsion was added to the water, the ozone was generated and samples were collected for examination of the untreated and the ozonized water. The result is given in the accompanying table.

The single typhoid bacillus remaining after the ozonation in the first test probably dropped into the sterile bottle from the mouth of the nozzle without having undergone treatment.

The tests with distilled water inoculated with pathogenic bacteria showed the same results; that is, perfect sterilization.

Mr. H. McCormack, of the Armour Institute, found that

an apartment building. The ozonized air and water mix in the sterilizer tank, whence the sterilized water is conducted into the storage tank from which it is forced into the house service.

These sterilizers are made in the Hall Company, Chicago.

### Electric Combination Fireless Cooker

The Caloric Company, Janesville, Wis., manufacturers of fireless cookers, and the Higgins Electric Heating Company, Chicago, have united their efforts in producing an electric combination fireless cooker which eliminates the preliminary heating of the food as is required in the use of a separate device.

Several sizes of the "fireless electric cookers" are manufactured having 8, 10 and 12 quart compartments, each having a capacity of 8 or 12 quarts as desired. The cooking compartment is lined with seamless aluminum and the radiation of heat is prevented by filling the space be-

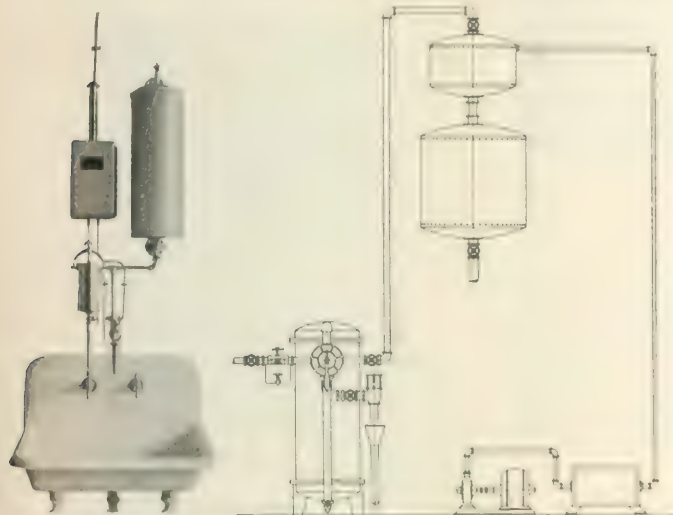


FIG. 1—OZONIZER ATTACHED TO KITCHEN FAUCET

FIG. 2—WATER STERILIZER PLANT FOR APARTMENTS

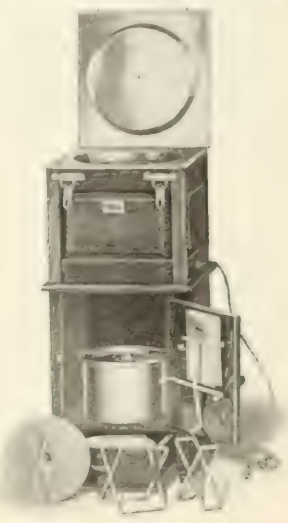


FIG. 3—FIRELESS COOKER

water with from 150 to 270 bacteria per cubic centimeter present was rendered perfectly sterile. Further tests with pathogenic bacteria, such as colon and typhoid, which were in some instances present to the extent of more than 1,000,000, produced the same results of perfect sterilization.

Mr. C. H. Higgins, of the Gulick-Henderson Company, chemists, assayers and metallurgists, Chicago, made tests for nitrites and found negative results. A series of tests were made to ascertain if any nitrites were formed when ozone was generated for purifying water for drinking and domestic purposes. The tests were made on Lake Michigan water, both filtered and unfiltered, but tests showed that no nitrites were formed by the machine, although several operating tests were made varying in length of time from an instant up to fifteen minutes, which, particularly in cases of long operation, necessitated the generation of a large amount of ozone.

From these results, together with the fact that a sample of highly ozonized water was kept tightly sealed for two days and that still no nitrites were found, it seems positive that no nitrites are formed by the ozonizer.

Fig. 1 shows a photograph of an ozonizer attached to a kitchen faucet. Fig. 2 is an ozone water sterilizer plant for

tween the aluminum box and the casing with kieselguhr, a natural non-heat-conducting mineral which is mined in the western part of the United States. A 500-watt electric heating unit is secured to the bottom of each compartment in such a manner that it can be readily removed in 1000 repairs are necessary.

Conductivity can be made with no electrical unit by means of a cord and plug. When electricity is not available the electric radiators which are furnished with the cookstove can be used and a flame and placed in the compartment to furnish the preliminary heat which is necessary in a fireless cooker.

The cookstove shown in the illustration is of the open type, has one cooking compartment, and is set on a cabinet in which cooking utensils, heated water and other accessories used in conjunction with the cooker may conveniently be stored.

A model for two people consisting of one box and three kinds of vegetables, including potatoes, was prepared in one of these cookers in a recent demonstration. The electricity was turned on at the proper instant, when added the food was allowed to cook for ten hours. The energy consumed in preparing the food was 1.07 kwhr.



### Illumination at the Baltimore Automobile Show

The artificial illumination used in connection with the Baltimore Automobile Show recently held in the Fifth Regiment Armory Building was one of the attractive features of this exhibit. The floor area of this spacious armory is approximately 325 ft. by 225 ft. and afforded favorable



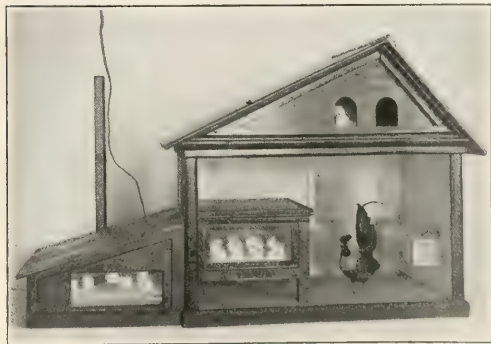
ILLUMINATION OF AUTO SHOW ROOM

opportunities for the production of spectacular and decorative lighting effects.

The fixtures were suspended uniformly from the ceiling. The installation consisted of 1100 100-watt, 1300 25-watt, 250 40-watt and 100 60-watt Sterling tungsten lamps. An idea of the splendid illumination provided by these units can be gained by referring to the accompanying illustration.

### Electric-Incubator Display

At the recent St. Paul convention of the Minnesota Electrical Association an exhibit made by the Northwestern Electric Equipment Company, of St. Paul, attracted considerable attention. It consisted of an electric in-



ELECTRICAL INCUBATOR EXHIBIT

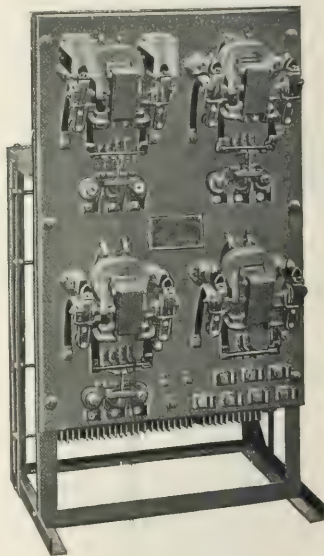
cubator and brooder specially arranged as a show-window attraction and included a number of imitation baby chicks made of translucent glass and electrically lighted from within. A large stuffed rooster was also prominent in the display. Electricity was used for both lighting and heating this attractive exhibit, which originated with Mr.

F. G. Klein, Jr., of the company named. The exhibit has attracted so much attention from various electrical dealers that the company has made it a part of its traveling dealers' exhibit, and it is now sending the exhibit out to dealers for general advertising purposes.

### Self-Starters for Polyphase Motor

A new line of self-starters for polyphase slip-ring motors has been placed on the market by The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. One is designed for use with motors driving reciprocating pumps, air compressors and similar machines that must be started under full load requiring a starting torque equal to or in excess of the normal full-load torque of the motor. The other class is designed for use with motors driving centrifugal pumps or other machines having similar load characteristics.

These new types of self-starters are of the multiple-



SELF-STARTER FOR POLYPHASE SLIP-RING INDUCTION MOTOR

solenoid type and are entirely self-contained. Where used in connection with motors operating on the-compression or open-tank system, the motors can be started and stopped automatically by means of pressure regulators or float-type switches.

The acceleration of the motor is controlled by resistors in each of the three phases of the rotor circuit, which is cut out of the circuit step by step by two-pole solenoid switches under the control of the secondary current relays. The resistance is balanced on all steps. The rate of acceleration is controlled by three-phase current relays in the rotor circuit, each arranged so as to prevent the following step of resistance from being cut out of circuit until the secondary current has dropped to a safe value and the motor has accelerated properly, when it will permit the next step of resistance to be cut out. The starting current is limited to a predetermined and adjustable value by the current relays and the motor is accelerated in the shortest time consistent with this starting current. The current relays have three coils connected in the secondary circuit with the starting resistance and carrying the starting current. The relay plungers are thus controlled directly by the starting

current, and the rate at which the motor is accelerated can be adjusted by varying the spring tension on the relay plungers.

### Electrical Laboratory for High School

On page 846 of the issue of April 19 a description was given of the electrical laboratory of the West Philadelphia High School, Philadelphia. The equipment in this laboratory is so arranged that by bridging from right to left to a central board by means of cable and attachment plugs either direct current or alternating current can be obtained at any location in the laboratory. The electrical equipment of this installation was furnished by the Diehl Manufacturing Company, Elizabeth, N. J.

### Portable Wheatstone Bridge

A portable testing set, weighing 8 lb. and measuring when closed only 7 $\frac{3}{4}$  in. by 8 $\frac{3}{4}$  in. by 4 $\frac{1}{2}$  in., is being placed upon the market by the Leeds & Northrup Company, Philadelphia. The set, which is shown in the illustration, is adapted for resistance measurements within the range of the Wheatstone bridge. By means of two small double-throw switches the internal connections are changed for the Murray or Varley loop tests used in locating grounds, crosses, etc., on lines and cables. The set may also be used for locating broken wires. The ratio and rheostat resistors are controlled by dial switches, the contacts being entirely inclosed and thus protected against dust and dirt. The contacts are readily accessible, however, for inspection.

The ratio resistors are controlled by a single dial switch, thus eliminating the possibility of confusion due to uncertainty as to whether the ratio value to be used is to be taken as the "A" arm value divided by the "B" arm value or the reverse.



PORTABLE WHEATSTONE BRIDGE

All resistors are wound upon metal spools, which makes them more stable in their adjustment than those wound upon wooden spools. Moreover metal-spool resistors will carry more current than wooden-spool resistors and therefore the coils in this set are less liable to be burned out because of excessive currents than are those in sets using

wooden spools. The rheostat coils are claimed to be accurate to 0.1 per cent and the ratio coils to 0.05 per cent. The galvanometer is of a new type having a specified sensitivity of 1 megohm. The moving system is contained in a separate unit which may be readily removed if it should become damaged. A battery of four cells is contained in the instrument. Provision is made for using both an external battery and a galvanometer, should this be desirable. All necessary switches and binding posts are provided.

### Electric Automobile-Steering Signals

The device illustrated is designed to eliminate automobile accidents at street crossings by warning foot passengers which way the car is about to turn. It also prevents rear-end collisions by flashing similar signals from the rear of the car. Each of the four electric signs is lettered in black on white glass with the words "left" and "right." Ordinarily the signs are concealed by metal covers, but a press-



ELECTRIC SIGN INDICATING DRIVER'S INTENTION

sure of a switch on the steering wheel throws up the cover and at the same time lights a small incandescent lamp behind the sign. A storage battery supplies the energy. The parts of the sign are quite incompressible except when in use. The device is made by the Electric Automobile Signal Company, 525 Broadway Building, Los Angeles, Cal.

### Rough Usage of Storage Battery

Some interesting tests were recently made by Mr. F. W. Jackson, of the Ames Electric and Machine Co., Ames, Cal., on the so-called Karrydry storage battery, manufactured by the Gen. Storage Battery Company, Boston, U.S.A., and described in our issue of Jan. 4, 1913.

A 2-volt, 20-amp. hr. and a 6-volt, 20-amp. hr. battery received a number of charges and discharges, and upon these these batteries showed a discharge considerably over their normal rating. Afterward they were subjected to a test from their normal rate the load being left on them for twenty-four hours after they were completely discharged. Then they were charged at one-tenth their normal charging rate, discharged again at a third rate and left on the constant for thirty days. At the end of thirty days they were charged at their normal charging rate, they recharged well and were again discharged at more than their normal rate.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Start Construction of Canada's Largest Power Station.**—Fraser, Brace & Company, 1328 Broadway, New York, to whom, as noted last week, the contract has been awarded for erecting the power station of the Ceda Rapids Manufacturing & Power Company, Montreal, Que., have started work on this hydroelectric station, which, when completed, will be the largest in the Dominion of Canada. Its initial rating will be about 100,000 hp, and later on this will be increased to 160,000 hp. The site is at Cedar Rapids, in the St. Lawrence River, about 30 miles above Montreal. The plant will be 663 ft. long and 130 ft. wide and will be built as a part of the dam. The intakes will be of the scroll or involute type. Orders have been placed by the Cedar Rapids company for the generating equipment. This includes twelve 10,800-hp waterwheels, which are to operate at 56 r.p.m. under a head of 30 ft, and will be the largest ever built. There will also be three 1500-hp exciter units which will operate under the same head at 150 r.p.m. The Canadian General Electric Company will furnish the twelve generators to be connected to the waterwheels. The contract for the latter was divided between the I. P. Morris Company, Philadelphia, and the Wellman-Seaver-Morgan Company, Cleveland. The contract awarded to the first-named company includes the design, construction and installation of nine of the main units, the three exciter units and the governors and pump auxiliaries for all the units. The Wellman-Seaver-Morgan Company is to construct three of the main units from the same design as the others. The design of the turbines will be very much the same as that of the wheels for the plant of the Mississippi River Power Company, at Keokuk, Ia. The chief difference will be in arranging for carrying the weight of the generator rotor and the moving parts of the turbine on a thrust bearing above the generator instead of below, as is done with the Keokuk turbines. The waterwheel contract includes the turbine complete, the shaft running through the turbine and generator, the thrust-bearing support or truss to be located above the generator, also the thrust bearing complete. The weight of the generator will be taken through cast-iron supporting barrels through the turbine to the foundation below. The main units will be of the single-runner vertical-shaft type and will be installed in wheel chambers of spiral shape formed in the concrete foundations of the power house. The exciters will be of the same type but smaller in size. The runners for these wheels will be an enlargement of a model runner which under test at Holyoke gave an efficiency of 90 per cent. About 100,000 yd. of concrete work and 2,000,000 yd. of rock and earth excavating is to be done by Fraser, Brace & Company. Contracts for 80,000 hp of the output of this station have already been closed. Of this, the Aluminum Company of America will take 60,000 hp and the Montreal Light, Heat & Power Company will take 20,000 hp. It is expected that the plant will be finished in October, 1914.

**National Conduit & Cable on the Copper Situation.**—The National Conduit & Cable Company, 41 Park Row, New York, makes the following comment upon the copper market: "Conditions have improved sufficiently in the copper situation apparently to warrant higher prices, and the market has had a good recovery from the recent low range touched more than a month ago. Sales during the last few weeks were heavier than for a long time previous, and both domestic and foreign manufacturers bought on a liberal scale. Market activity developed the last part of March and transactions of importance were closed at 15 cents. Substantial sales were made later at advancing prices, and with Europe an active buyer further market advances were recorded without meeting serious resistance. It transpired that a good deal of copper was needed for prompt ship-

ment, and as domestic and foreign demand increased, prices soon reached the 15½-cent level. With the decided improvement in the local statistical position of copper there is nothing apparently in the present situation to suggest any material falling off in prices. On the contrary, if manufacturers continue as busy as they have been lately and the rate of copper production is not increased over that for the month of March, it is expected that the market will be able to maintain a healthy degree of firmness for some time to come."

**Changes in United States Light & Heating Company.**—At a special meeting of the directors of the United States Light & Heating Company, Niagara Falls, N. Y., J. Allen Smith, formerly general manager, was elected president, to succeed D. W. Pye, who resigned some time ago. Charles A. Starbuck, president of the New York Air Brake Company, was elected chairman of the board. F. P. Frazier was elected a vice-president, to succeed Mr. Starbuck, and W. P. Hawley was also made a vice-president. A. H. Ackerman was made general manager, succeeding Mr. Smith. W. S. Crandell was re-elected secretary and treasurer. Business with the company is very good, according to one of its representatives, who said: "Our total sales for last month amounted to \$446,945, as compared with \$370,352 in February. We are now employing about 1600 hands at our plant at Niagara Falls and have contracted to supply the Edwards-Knight, Rambler, Moyer, Willys-Overland and several other well-known types of automobile with our electric starters. Business at present is good and the outlook for the spring and summer months is very bright."

**Large Turbine Unit for German Lighting Plant.**—Brown, Boveri & Company, of Baden, Switzerland, are building a 40,000-hp steam turbine for the electric power station at Hagen, Westphalia, Germany. This will be the largest turbine unit ever manufactured in Europe. The largest units now in operation are two 30,000-hp steam turbines built by the same company. These are installed in the works of the Rhine-Westphalia Electric Power Company, Düsseldorf, and have been in service since the middle of 1912. Each is connected to a 21,500-kva generator.

**Norfolk & Western Electrification Plans.**—The Norfolk & Western Railway Company, Roanoke, Va., is arranging to electrify its line from Eckman to Bluefield, Va., a distance of 27 miles. The preliminary work is now under way, but as the plans are not very far advanced, no details are yet available. Negotiations are in progress with the Appalachian Power Company, Bluefield, Va., relative to a supply of electrical energy, but it has not been decided yet whether the railway company will purchase the necessary energy.

**New President for Manhattan Electrical Supply Company.**—On April 19 the directors of the Manhattan Electrical Supply Company, 17 Park Place, New York, held a special meeting to fill the vacancy in the office of president of the company caused by the recent death of H. T. Johnson. At this meeting J. J. Gorman was elected president, B. H. Ellis, treasurer of the company, was also elected vice-president. Messrs. Whitmore, Pierce and Manger will continue in the offices held by them.

**Contracts for Street Lighting Line Material.**—The Line Material Company, South Milwaukee, Wis., maker of the Kyle line material, has secured contracts from the Sanitary District of Chicago for supplying two-pin, four-pin and six-pin malleable-iron cross-arms and also for supplying malleable-iron lamp brackets of the type used in connection with overhead-construction street lighting. These two contracts involve an expenditure of approximately \$30,000.



**Highland Power Company to Operate in Colorado.**—The Highland Power Company has been formed by Philadelphia, New York and Colorado interests to erect a power station on Middle Boulder Creek, near Hesser, B. & D. County, Col. The new concern will enter into a contract with the Colorado Power Company for the supply of lighting Central City and Black Hawk, Col., and for ma-

**Defeat Bond Issue for Los Angeles Municipal Distribution System:**—At the election held in Los Angeles on April 15, the voters defeated a \$10,000,000 bond issue for the distribution of water to the city and county of Los Angeles. The bond issue was for the purpose of financing the construction of a new distribution system for the city and county of Los Angeles. The bond issue was defeated by a vote of 5,000 to 1,000.

**Progress of Toledo (Ohio) Railways & Light Controversy.**—In a note in these columns on April 12 it was stated that at a meeting of the directors of the Toledo Railways & Light Company on April 3 Morris Allen was elected president and L. E. Beilstein was made general manager of the company and that these men replaced F. R. Coates, who had held both offices. It was also stated that Mr. Allen is a son-in-law of Barton Smith, counsel for the company and for the stockholders' reorganization committee. Following these changes the Doherty interests applied for an injunction restraining the Barton Smith interests from operating the property. On April 17 Federal Judge Killets, sitting at Toledo, granted to the representatives of Henry L. Doherty & Company a temporary injunction ousting the Barton Smith faction from the management of the company. This gave possession of the property to the Doherty interests, who, it is understood, control 83 per cent of the outstanding stock. The bill of complaint filed by the Doherty interests alleges that Barton Smith conspired with others to keep the majority stockholders and lawful owners out of control of the property after they had refused to pay his bill for \$49,000 for professional services as attorney for the stockholders' protective committee. Upon the issuance of Judge Killets' order, F. R. Coates was at once installed as president, M. R. Bump, of New York, as auditor, and F. J. Derge as operating manager. A ruling on motions to make the injunction permanent has not been given. The hearing on the permanent injunction case was begun before Judge Killets on April 18. The defendants on the same day denied that they are attempting to aid Barton Smith to collect any sum of money and claimed that the United States court did not have jurisdiction in the case. They also denied that the plaintiff is the owner of 117,447 shares of stock of the Toledo Railways & Light Company or any shares whatever in the company, and that there was any arrangement made through which Maurice Allen was elected president and L. E. Beilstein general manager.

**Pennsylvania Properties Consolidated.**—The Edison Light & Power Company, of York, Pa., has been organized by interests affiliated with the York Railways Company for the purpose of consolidating various lighting subsidiaries of the latter and to acquire other electric-service properties. The properties merged into the new company are the Edison Electric Light Company, the West York Electric Light Company, the Mount Wolf Electric Light Company, the Dover Electric Light Company, the Hallman Electric Light Company and several other electric-service and steam-heating concerns operating near York. In nearly every case the foregoing companies were organized originally for the purpose of distributing energy generated by the Edison Electric Light Company in communities near York, since, under the laws of the State of Pennsylvania, it is necessary to organize a separate company for each township in which a lighting franchise is obtained. All the franchises having been acquired, the several companies have been brought under one holding corporation for the purpose of facilitating economical operation.

**New Subsidiary for Utah Power & Light Company.**—The Western Colorado Power Company, which was formed recently, is to be a subsidiary of the Utah Power & Light Company, Salt Lake City, and will hold and operate the Colorado properties of that company. Besides taking over the Colorado properties, the Western Colorado Power Company has also taken over the Durango (Col.) Gas & Electric Company and the San Juan Water & Power Company of Durango. J. T. Clay, manager of the Colorado properties of the Utah Power & Light Company, is to be general manager of the Western Colorado Power Company. The headquarters of the latter company will be in Durango.

**Increasing Sales of Electrical Equipment to Automobile Trade.**—One feature of the business of the General Electric Company at this time is the large increase in the sale of electrical equipment to the automobile trade. One automobile accessory manufacturer, who has been in business only two years, is now buying electrical apparatus at the rate of \$3,000,000 a year from the General Electric Company. As was stated last week, the latter is doing a record business and is taking orders 40 per cent in excess of its productive capacity.

**Great Western Power's Showing.**—The Great Western Power Company, San Francisco, has issued its annual report for the year ended Dec. 31, 1912. On that date, according to the report, the company had 11,382 consumers of electrical energy on its books, a gain of 7152 for the year. The connected load was 102,935 kw, which represents an increase of 20,835 kw during the year. In addition to this connected load, the company also made contracts from which an estimated revenue of \$155,000 will be obtained.

**Pacific Electric to Make Improvements.**—The California Railroad Commission has authorized the Pacific Electric Railway Company to issue \$6,839,000 5 per cent first-mortgage bonds. The proceeds of these will be used in extensions and additions to the properties of the company. Of the proceeds \$3,428,000 will be used for extensions and branches, \$1,554,000 for rolling stock, and the balance for various improvements, including additions to power stations.

**Pacific Telephone & Telegraph Company Plans Improvements.**—Officials of the Pacific Telephone & Telegraph Company, San Francisco, which has over 5,000,000 subscribers in California, Oregon and Washington, are contemplating an expenditure of \$111,600 for improvements and extensions to the company's system.

**Electrical Energy for Utah Copper Company.**—The plants of the Utah Copper Company are to be operated by electricity from the mains of the Utah Power & Light Company, Salt Lake City, about Jan. 1, 1914.

**Detroit Independent Telephone Company Absorbed.**—The Bell Telephone Company has taken over the Home Telephone Company of Detroit, Mich.

**Allis-Chalmers Stock Assessments.**—The fourth assessment on the stock of the Allis-Chalmers Company was payable on April 24.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	April 16	April 23
Allis-Chalmers, t.r., 3d pd..	\$17,196,600	.....	.....	3	3
Allis-Chal., pf., t.r., 3d pd..	14,165,500	.....	.....	63	71
Amalgamated Copper.....	133,887,900	1 1/2	O	70 1/2	77
American Tel. & Tel.....	344,465,900	2	O	131 1/2	129 1/2
Electric Storage Battery, c.	16,074,425	1	O	50	49 1/2
General Electric.....	101,301,200	2	O	139 1/2	140 1/2
Mackay Cos., c.....	41,380,400	1 1/2	O	83 1/2	83 1/2
Mackay Cos., pf.....	500,000,000	1	O	69 1/2	67 1/2
Western Union Tel.....	99,747,200	1 1/2	O	60 1/2	66 1/2
Westinghouse, E. & M., c.....	34,076,350	1	O	63 1/2	64 1/2
Westinghouse, E. & M., pf..	3,998,700	1 1/2	O	116 1/2	118 1/2

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

	April 15		April 22	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot .....	15.12 1/2	to 15.50	.....	to 15.50
London, standard, spot .....	69	1 3/4	67	18 9
Prime Lake .....	15.60	to 15.70	15.65	to 15.70
Electrolytic .....	15.55	to 15.65	15.55	to 15.65
Casting .....	15.40	to 15.50	15.40	to 15.50
Copper wire, base .....	16.50		16.75	
Lead .....	4.35		4.50	
Nickel .....	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter .....	8.00		7.75	
Spelter, spot .....	5.75	to 5.87 1/2	5.60	
Tin, spot .....	49.40		49.40	
Aluminum:				
Prompt delivery .....	26.75	to 27.00	26.50	to 27.00
Future .....	26.75	to 27.00	26.50	to 27.00

## OLD METALS

Heavy copper and wire.....	14.75	14.50
Brass, heavy .....	9.37 1/2	9.37 1/2
Brass, light .....	8.25	8.25
Lead, heavy .....	4.25	4.25
Zinc, scrap .....	4.87 1/2	4.87 1/2

## COPPER EXPORTS IN APRIL

Total tons to April 23 .....

22,976



## Personal

**Mr. G. Devlin** has been appointed sales manager of the Toronto (Ont.) Hydro-Electric System, vice Mr. Harry Jacobs.

**Mr. E. C. Johns**, formerly of Jersey City, has become associated with the Huron Light & Power Company, Huron, S. D.

**Mr. D. R. Blaicher** has resigned as purchasing agent of the Toronto (Ont.) Electric Light Company, Ltd., and has moved to Minneapolis, Minn.

**Mr. H. F. See**, formerly at the Lumberton (N. C.) office of the Yadkin River Power Company, is now at Wadesboro, with the same company.

**Mr. H. H. Beasley**, purchasing agent for the Toronto Railway Company, has also been appointed purchasing agent for the Toronto (Ont.) Electric Light Company.

**Mr. George Schwanger** has been promoted to the position of engineer of distribution with the Toronto (Ont.) Hydro-Electric System, succeeding Mr. A. Lang, resigned.

**Prof. Robert Andrews Millikan**, of the department of physics of the University of Chicago, has had awarded to him by the National Academy of Sciences the Comstock prize for research in electricity.

**Mr. S. B. Hammond**, who has been with the Porto Rico Railway Company, Porto Rico, for the past two years, has returned to Montreal, Que., as secretary of the Montreal Engineering Company, Ltd.

**Mr. Percy E. Hart**, formerly connected with the Canadian General Electric Company, has been appointed electrical engineer of the Toronto (Ont.) Hydro-Electric System, succeeding Mr. J. D. Jackson, resigned.

**Mr. H. A. Horner**, electrical engineer for the New York Shipbuilding Company, delivered a lecture recently before the Franklin Institute of Philadelphia, describing the electrical equipment of the modern battleship.

**Mr. Thomas Newell, Jr.**, has succeeded Mr. Arthur Perman as superintendent of the municipal electric lighting plant at Adrian, Minn., Mr. Perman having taken charge of the municipal plant at Appleton, Minn.

**Mr. J. L. Mishler** has severed his connection with the Kelly Foundry & Machine Company, of Goshen, Ind., and has become associated as secretary with the Goshen Novelty & Brush Company, manufacturer of wood and metal lighting fixtures.

**Mr. H. Reyss**, chief engineer of the export department of the Siemens-Schuckertwerke, Berlin, Germany, is at present visiting this country for business purposes. Mr. Reyss was previously connected with the Japanese home of the same concern at Tokio. He will return to Germany on May 13.

**Mr. H. H. Couzens**, formerly general manager and electrical engineer of the Corporation of Hampstead, London, England, has been appointed general manager of the Toronto (Ont.) Hydro-Electric System, succeeding Mr. W. R. Sweany. Mr. Couzens has held positions with the Corporations of Taunton, Bristol, West Ham and Hampstead.

**Mr. Henry Floy** is expected to arrive in New York on the *Kaiserin Augusta Victoria* April 26, on his return from a combined pleasure and business trip to Europe. Mr. Floy visited Italy, inspecting electric railway operation and the effect of fire zones, and made observations on construction in most of the principal cities. He inspected the underground trolley system in Vienna, the Prussian government's single-phase, 10,000-volt railway at Bitterfeld, and the 60,000-volt underground cable transmission system.

**Mr. R. F. Morkhill** has been appointed signaling engineer of the Grand Trunk Railway Company, with offices at Montreal, Que., succeeding Mr. C. A. Dunham, who recently resigned. Mr. Morkhill was until six years ago in charge of the signaling on the Central South Africa Railway, or organizing the signal department of that road after the war. He became an assistant engineer in the construction of the Pennsylvania's New York terminals, later joining the Railway Signal Company of Canada, Ltd., which he served as sales manager and as assistant general manager.

**Mr. David Daly** has been appointed manager of the Galveston-Houston Electric Railway, Galveston, Tex., besides acting in his present capacity as manager of the Houston Electric Company. Mr. Daly was born in Boston, Mass., Oct. 16, 1878, and was educated in the public schools of that city and at Harvard. He entered the employ of the Stone & Webster Engineering Corporation, and after serving with the company in Boston in various capacities was sent by Stone & Webster to Ponce, P. R., as local manager there of the Ponce Railway & Light Company. Returning to the United States in 1905, he was appointed manager of the Houston Electric Company.

**Mr. Howard W. Leitch**, the newly appointed electrical superintendent of the United Electric Light & Power Company, which supplies alternating-current service in New York City, was graduated from the Brooklyn Polytechnic Institute in 1895. Following graduation, he was employed at the Twenty-sixth Street station of the New York Edison Company as brushman and remained as repairman and operator until 1902. He then entered the employ of the Interborough Rapid Transit Company, but after a few months with it he returned to the New York Edison Company, being assigned to the Waterside station. He was made chief operator in 1906, assistant electrical superintendent in 1907 and assistant superintendent in 1909, retaining the last position until his appointment with the United company. Mr. Leitch is a member of the American Institute of Electrical Engineers.

**Mr. Frank E. Watts**, reigning Jupiter of the Jovian Order, will join the advertising staff of the *Electrical World* on May 1. Mr. Watts was born in Sunbury, Ohio, in 1878, and



received his education in the public schools of Delaware County, Ohio. He attended Western University and Ohio Northern University. Following eight years of teaching and two years' experience in mill and machinery Mr. Watts entered the mercantile lamp business in August, 1907, and at the same time he has been manager of the Sunbeam lamp department of the Western Electric Company. Mr. Watts served as statesman at the Jovian Order for New York and was largely responsible for the success of the Jovian Order Club in that city. He was elected

Jupiter at Pittsburgh in October of last year. Mr. Watts lives at West Orange, N. J., and is a member of the Ohio Society of New York and the Essex County Country Club.

## Obituary

**George P. Brophy**, one of the founders of the Ontario Electric Railway and the Ontario Power Company, chief superintendent engineer of the Ottawa street car line and one of the most prominent figures in the capital and its suburbs, died at his residence in Ottawa on Friday, April 26, at about 60 years of age, on his sixty-fifth year.

**Victor Dwelshauwers Dery**, the distinguished Belgian scientist whose painstaking and systematic procedure have been far-reaching in their effects on the development of this important April-March 1913 issue of *Electrical World*, died at his residence in Brussels on Friday, April 26, at about 70 years of age. He made valuable contributions to the study of the possibilities of using hydroelectric and of underground steam and organizing the operation of the steam. Mr. Dery had a long and successful career, studied in Brussels and had received the degree of doctor of science from the University of Liège, which he received in 1890. He was a member of the Académie des Sciences et des Lettres of Belgium and the Académie des Sciences et des Lettres of the Netherlands. He was a member of the Académie des Sciences et des Lettres of the Netherlands. He was a member of the Académie des Sciences et des Lettres of the Netherlands.



## Construction

### New England

**BIDDEFORD, MAINE.**—A. B. Leach & Co., of New York, N. Y., acting for the Cumberland County Pwr. & Lt. Co., of Portland, Maine, has purchased the property of the York County Pwr. & Lt. Co., including the York County Lt. & Ht. Co. and other corporations of a similar nature, doing business in the counties of York and Cumberland and in the towns of Fryeburg, Porter and Hiram in the county of Oxford.

**LACONIA, N. H.**—The Laconia Gas & El. Co. has petitioned the Public Service Commission for permission to extend its transmission lines into the town of Sanbornton.

**CLINTON, MASS.**—The Clinton Gas Lt. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue \$100,000 in capital stock. The company is planning to make repairs and extensions to its system.

**EASTHAMPTON, MASS.**—The Easthampton Gas Co. has petitioned the State Board of Gas and Electric Light Commissioners for permission to increase its capital stock by \$100,000, making a total of \$450,000.

**PROVIDENCE, R. I.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14, for a conduit and wiring system, lighting fixtures, etc., in the United States post office, court house and custom house at Providence, R. I., in accordance with specifications and drawings, copies of which may be obtained at the above office or at the office of the custodian, Providence, O. Wenderoth is supervising architect.

**PROVIDENCE, R. I.**—The contract for the erection of the addition to the power plant of the Rhode Island Co. on Manchester Street has been awarded to William H. Hamlyn & Son. An addition will be erected on the north side, 35 ft. wide and 160 ft. long, to provide room for new electrical equipment, and an addition to the west end, 72 ft. wide and 150 ft. long, will be erected, where a battery of boilers and two new turbines will be installed. The cost of the improvements is estimated at \$750,000.

**DANIELSON, CONN.**—The Burgesses are considering the question of replacing the present arc-lamp lighting system throughout the borough with Mazda tungsten lamps. Arc lamps on Main Street have been replaced by tungsten lamps. The People's Lt. & Pwr. Co., of Danielson, furnishes the street-lighting service.

**DERBY, CONN.**—Plans are being considered for improvements to the street-lighting system which require an additional expenditure of \$600 per year.

### Middle Atlantic

**CICERO, N. Y.**—The Public Service Commission has authorized Fred J. Auburn, of Cicero, to exercise a franchise for furnishing electricity in the town of Cicero and the village of Brewerton.

**FREDONIA, N. Y.**—The Niagara & Erie Pwr. Co. has submitted another proposition to the Board of Trustees to furnish energy to operate the municipal electric-light plant. Earlier in the year the company offered to take over the plant and furnish the street-lighting service at a specified price per lamp. Under the new proposition the village would retain control of the plant and street-lighting system.

**GLEN COVE, N. Y.**—The Glen Cove Lt. & Pwr. Co. has applied to the Public Service Commission for permission to erect a transmission line in Sea Cliff to supply electricity there.

**ITHACA, N. Y.**—The Ithaca El. Lt. & Pwr. Co. and the Ithaca Gas Lt. Co. have petitioned the Public Service Commission for permission to consolidate. The companies also ask for authority to execute a mortgage for \$1,500,000 and to issue \$429,000 in bonds thereunder to retire outstanding securities of the two companies and for new construction; also to issue \$600,000 in capital stock. The J. G. White Co., of New York, N. Y., controls both plants.

**MEXICO, N. Y.**—The Public Service Commission has authorized the Mexico El. Co., of Mexico, to exercise franchises for furnishing electricity in the village of Mexico, the town of Mexico and the town of Palermo.

**ALTOONA, PA.**—The Penn Central El. Co., of Altoona, has entered into a contract to furnish electricity for lamps and motors for the Cambria Mines, located near Barnesboro. A branch will be erected to the mines from the Patton division of the transmission line from this city. About 200 hp will be furnished to the mines.

**HARRISBURG, PA.**—Charters were granted on April 12 for electric companies that will take in 31 boroughs and townships in Allegheny County. Each company will be capitalized at \$5,000 and will take its name from the respective district in which it will operate. The incorporators are: H. C. Seidle, C. E. Theobald and G. R. Speer, of Pittsburgh.

**HILLSVILLE, PA.**—The Carbon Limestone Co., which operates extensive quarries near Hillsville, has decided to equip its entire plant for electrical operation. Electricity for operating the plant will be secured from the new power station of the Mahoning & Shenando Valley Ry. & Lt. Co.

**INDIANA, PA.**—Bids will be received by the Richard D. Kimball Co., 15 West Thirty-eighth Street, New York, N. Y., engineers, until April 28

for construction of a central heating and lighting plant, including power house construction, heating and electric work, generators, engines and boilers, for the State Normal School at Indiana, Pa. Plans and specifications can be seen at the office of the engineers, also at the office of J. Wood Clark, secretary of the Board of Trustees, Indiana, and at the office of Rutan & Russell, Pittsburgh, Pa.

**LEBANON, PA.**—The Lackawanna Iron & Steel Co. will equip two blast furnaces, located at Colebrook, for electrical operation, work on which will begin in the near future. The ore, coke, coal and stone handling devices will be equipped for electric-motor drive. Changes will be made in the electrical equipment in connection with the conveyors and coke ovens.

**PHILADELPHIA, PA.**—Estimates are being made for the construction of a power house, to be erected at Nineteenth Street and Allegheny Avenue, for the Electric Storage Battery Co.

**PHILADELPHIA, PA.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14 for two engines and generators in the United States post office and court house, Philadelphia, Pa., in accordance with specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

**PITTSBURGH, PA.**—The Duquesne Lt. Co., successor to the Allegheny County Lt. Co., has taken over nearly all the lighting companies in the boroughs and townships in Allegheny County. Embraced in the merger with the Duquesne Lt. Co. are the following separate electric-light companies: The Pittsburgh City Lt. & Pwr. Co., the St. Clair El. Co., Mount Oliver El. Lt. Co., Carrick Lt. Co., Baldwin Township and Mount Lebanon Township El. Lt. Co. The Pittsburgh City Lt. & Pwr. Co. recently acquired franchises in the various South Hills boroughs and townships and separate light companies were organized.

**ROYALTON, PA.**—Bids will be received by the Borough Council until May 15 for the installation of a new street-lighting system. Electricity for maintaining the system will be obtained from the York Haven Wtr. & Pwr. Co., of York Haven.

**VERSAILES, PA.**—The Borough Council has awarded the Duquesne Lt. Co. a contract for lighting the streets of the borough. Under the new contract many of the arc lamps now in use will be replaced with tungsten lamps.

**LAKEWOOD, N. J.**—The Commonwealth Wtr. & Lt. Co., of Summit, N. J., has been granted authority by the Board of Public Utility Commissioners to issue \$20,000 in bonds, the proceeds to be used for extensions to the plant of the Lakewood Wtr., Lt. & Pwr. Co., a subsidiary corporation.

**PENNS GROVE, N. J.**—The Board of Public Utility Commissioners has granted the Penns Grove El. Lt., Ht. & Pwr. Co. permission to erect transmission lines and distributing systems in Upper Penns Neck and Oldmans Townships.

**PERTH AMBOY, N. J.**—The Board of Education will receive bids until May 1 for electric-lighting fixtures for the addition to the Grammar School, Manual Training Building and heating plant. Specifications are on file at the office of Jesse Colyer, secretary of the board.

**ABINGDON, VA.**—The capital stock of the Abingdon Wtr. & Lt. Co. has been increased from \$25,000 to \$50,000.

**CHARLOTTESVILLE, VA.**—The Charlottesville & Albemarle Ry. Co. is planning to build a new power plant near Charlottesville. Contracts have been placed for the equipment of the plant with the exception of three 400-hp high-pressure boilers. The old plant will be abandoned when the new station is completed. The company will also purchase six new semi-converter cars. Contracts for construction of plant will be awarded at once. Neff & Thompson, of Norfolk, are engineers in charge. John L. Livers is manager.

**WASHINGTON, D. C.**—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until May 5 for furnishing one 25-hp fuel engine with generator directly connected for use in the Water Department. Specifications and form of proposal may be obtained from the purchasing officer, room 320, District Building, Washington, D. C.

**WASHINGTON, D. C.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for two high-pressure water-tube boilers at the Bureau of Engraving and Printing, Washington, D. C., in accordance with specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

**WASHINGTON, D. C.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for furnishing special lighting fixtures for the new United States post office at Washington, D. C., in accordance with the specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

**WASHINGTON, D. C.**—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 13, for furnishing at the various navy yards the following supplies: Brooklyn, N. Y., Schedule 5580—1500 ft. interior-communication cable; Washington, D. C., Schedule 5365—One electric conveyor; Newport, R. I., Schedule 5364—One motor-driven planer. Applications for proposals should designate the schedules desired by number. T. J. Cowie is procurement general U. S. N.

## North Central

**DETROIT, MICH.**—The Trojan Laundry Co. is planning to rebuild its plant, which was recently destroyed by fire. The company, it is said, will rebuild on a large scale and expects to purchase a generator for its power plant.

**GRAND RAPIDS, MICH.**—A complete lighting plant will be erected at the West Michigan State Fair grounds and a new lighting system installed. Incandescent lamps hung in arches will illuminate the streets of the ground.

**HARBOR SPRINGS, MICH.**—The Township Board has granted the Chelogyran E. L. & Pwr. Co. a franchise to construct and operate an interurban electric railway in Harbor Springs. The franchise must be approved by the voters at the spring election.

**MOUNT CLEMENS, MICH.**—Contractors were awarded the spring the county infirmary. The Eastern Michigan Electric Co. will erect a transmission line to the institution to supply electricity there.

**MOUNT CLEMENS, MICH.**—The Eastern Michigan Electric Co., of Detroit, is putting in foundations for a power station at Cheltenham Station. The station is being built to furnish electricity to the Cheltenham Creamery, which has abandoned its steam plant. Incandescent lamps within a radius of half a mile will be supplied with electricity for homes and motors.

**PONTIAC, MICH.**—A movement has been started by property owners on Huron Street for the installation of an ornamental street lighting system on that thoroughfare.

**FORT HIRON, MICH.**—A movement is on foot among the businessmen to install ornamental street lamps for Marine, Water and Huron Streets, provided the city will furnish electricity to maintain the lamps.

**READING, MICH.**—Arrangements have been made for an extension to the municipal electric light plant, including the installation of two 100-hp. high-pressure turbine engines, one of two 1,000-hp. engines, a 2,000-volt generator and engine directly connected, and auxiliary equipment for two units. Bids will be received until May 15 next for the advice plans for the boilers and piping for the electric plant and power works plant. Specifications may be obtained from a statement by W. J. Goodman, chief engineer of the municipal electric light and power works plant.

**CLEVELAND, OHIO.**—Bids will be received at the office of the secretary of the director of public service, 164 City Hall, Cleveland, until May 5 for furnishing gas and electric light fixtures for the Lakeside Fire Service Station, Water Department, specifications for which may be obtained at the office of the superintendent of the water department, W. J. Spornsborn, director of public service, and W. D. K. K.

**CLEVELAND, OHIO.**—At a meeting of the stockholders of the Cuyahoga Power Co. to be held May 1, a vote will be taken on the proposition to increase the capital stock from \$250,000 to \$1,000,000. The company contemplates developing the water power of the Cuyahoga River to generate electricity to be transmitted to Cleveland, Akron, Youngstown, Kent and other cities in this section of the State. W. R. K. Lee, of New York, N. Y., is president of the company.

**COLUMBUS, OHIO.**—Bids will be received at the office of the Board of Trustees, Ohio State University, Columbus, Ohio, until May 15, for insulating material and labor for the construction of the following work: (1) For an underground tunnel, approximately 0.3 in. long; (2) For two automatic underfoot stokers in the power plant of the Ohio State University; (3) for heating, ventilating and air conditioning in the new biology and zoology building; (4) for insectary and greenhouse (this to be an enclosed unit). Plans and specifications for the above improvements are on file at the office of the auditor of state and also on file at the office of Joseph N. Bradford, university architect, the chief engineer and the secretary of the Board of Trustees. Carl L. Stearns is clerk.

**DELIANCE, OHIO.**—The American Power Co., of Chicago, is planning to build an extension 322 ft. long to its dam across the American River to take the place of the 1,000-ft. section, which was destroyed by the recent flood. The extension will be built of concrete and will situate at the west end.

**DELWOOD, OHIO.**—Bids will be received by the Mayor until June 10, until April 30 for furnishing and installing an electric lighting system and maintaining same for the village of Delwood for a period of ten years. The plans provide for the construction of a new electric plant. Specifications are on file at the office of the village engineer, Edward J. Burt, office, E. A. Burr is clerk.

**LISBON, OHIO.**—The power house of the Columbus Edison Co., at Lisbon, located 5 miles east of Lisbon, was destroyed by fire.

**LOUDONVILLE, OHIO.**—Bids will be solicited until May 1 for improvements to the municipal electric light and power plant, with the exception of Specification E, which covers the installation of a centrifugal pump. Specifications covering pump and valve service will be furnished. Bids were advertised to be received until April 15, but no bids were received. The recent high waters this date was postponed. The Central Engineering Co., Union National Bank Building, Columbus, has charge of the engineering work.

**MARIETTA, OHIO.**—The Buckeye Electric Manufacturing Co. is now furnishing electricity for lighting the streets of the city. The municipal electric light plant is a total wreck. The city desires to purchase

the plant and install a new one. The city is now using a temporary system of lighting.

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system on Douglas Avenue to North Street, Chicago Street to Geneva, Villa Court, and Du Page Street to Villa Street.

**FIATT, ILL.**—The Farmington Lt. & Pwr. Co., of Farmington, has secured contracts for furnishing electricity for lamps for residences and business houses in Fiatt, and also to furnish energy to operate the machinery in the Fiatt Mine, and for the local elevator. Extension will be made from the line that runs from Cuba to Fairview.

**HILLSBORO, ILL.**—The Southern Illinois Lt. & Pwr. Co., successor to the Hillsboro El. Lt. & Pwr. Co., is contemplating further development to its system, involving an outlay of about \$500,000, most of which will be expended during the coming summer in extensions to its transmission and railway lines. The transmission lines will be extended from Morrisville to Palmer and from Coffeen to Fillmore, and the electric railway will be extended from Hillsboro to Nokomis. The company also proposes to install a gas system in Hillsboro, if granted a franchise, to cost from \$60,000 to \$75,000. The officers of the company are: J. J. Frey, president; W. A. White, vice-president; B. H. Walcher, secretary, and Charles A. Ramsey, treasurer.

**HOOPESTON, ILL.**—The Hoopeston Gas & El. Co. is contemplating extending its transmission line from Hoopeston to Ambia, Ind.

**JACKSONVILLE, ILL.**—At an election held recently the proposition to issue \$50,000 in bonds for improvements to the municipal electric-light plant was defeated.

**LEXINGTON, ILL.**—The property of the Lexington El. Lt. Co. has been purchased by Cash M. Harlan from the receiver. Mr. Harlan will not take over the plant until June 1. It is understood that improvements will be made to the plant. J. W. Van Dolah is manager.

**SILVIS, ILL.**—The Village Board has awarded the People's Pwr. Co., of Moline, a five-year contract for lighting the streets of the village and for pumping the water supply. The contract calls for three arc lamps and 51 tungsten lamps. Tungsten lamps will be substituted for the arc lamps in the residential districts.

**SPRINGFIELD, ILL.**—The Springfield Lt., Ht. & Pwr. Co. and the Springfield Gas Lt. Co. have been consolidated under the name of the Springfield Gas & El. Co. The capital stock will be increased to \$3,000,000. B. C. Cobb, of New York, N. Y., is president, and Harry T. Willett, of Springfield, secretary of the new company.

**URBANA, ILL.**—The Urbana Park Commissioners are contemplating the installation of an electric-light plant to furnish electricity for lighting Crystal Lake, Leal and Carl Parks. Should the plant be installed it will be located at Crystal Lake Park, where the waste steam could be used for furnishing heat for the pavilion.

**WARSAW, ILL.**—The Stone & Webster Corp., of Boston, Mass., which recently purchased the local electric-light plant, it is reported, will expend about \$20,000 in improvements to the plant. A new brick substation, to cost \$5,500, will be erected and an ornamental street-lighting system will be installed on Main Street.

**EDGERTON, WIS.**—The residents of Albion have petitioned the Edgerton El. Lt. Co. to extend its electric light and power service to that village.

**GREEN LAKE, WIS.**—J. R. Stewart, of Ripon, Wis., who was recently granted a franchise to install an electric-light plant in Green Lake, is reported to be asking for bids for construction of the proposed plant. William L. Walker is president.

**LONE ROCK, WIS.**—At an election held recently the proposition to issue \$5,000 in bonds for the construction of an electric-light plant was carried.

**MILWAUKEE, WIS.**—The National Avenue Advancement Association is contemplating the installation of an ornamental street-lighting system on National Avenue.

**NEKOOSA, WIS.**—The Nekoosa-Edwards Lt. & Pwr. Co. has applied for a franchise to supply electricity for lamps and motors in Nekoosa.

**HARDWICK, MINN.**—The Village Council has decided to install an electric-light plant and establish a 24-hour service. The proposed plant will be of the storage-battery system. Bids have been asked for the plant and equipment.

**RENVILLE, MINN.**—The City Council has granted the Lethert El. Co., of St. Paul, a 20-year franchise to install and operate an electric-light plant in Renville. The company agrees to furnish a 24-hour service.

**ST. PAUL, MINN.**—Bids will be received at the office of the Ramsay County Board of Control, St. Paul, Minn., until May 1 for plumbing, heating, electric work and electric elevator for the tuberculosis pavilion at the City and County Hospital, in accordance with plans and specifications prepared by Clarence H. Johnson, architect, now on file in the office of the Board of Control. Oliver J. Tong is secretary of board.

**TWIN LAKES, MINN.**—Plans are being considered for the installation of an electric-light plant and a co-operative laundry. It is proposed to operate the electric-light plant and the laundry in conjunction with the creamery. The Twin Lake Creamery Co. is interested in the project.

**BLANCHARD, IA.**—The Lee El. Lt. Co., of Clarinda, is planning to install an electric-light system in Blanchard. The company will extend its transmission line from Clarinda through College Springs to Blanchard.

**BLOOMFIELD, IA.**—We are informed that the city of Bloomfield does not contemplate the construction of a new electric-light plant, as reported in these columns in the issue of April 12. A. B. Welch is city clerk.

**CEDAR FALLS, IA.**—The City Council has instructed the city engineer to prepare plans for the construction of a municipal electric-light plant, for which bonds to the amount of \$50,000 have been voted.

**CRESTON, IA.**—The Creston Mutual El. Lt., Ht. & Pwr. Co. has decided to install new machinery, which will double the output of the plant. The new equipment will consist of a 750-hp engine, boiler, generator, switchboard, etc., to cost about \$28,000. Contracts will probably be awarded within 30 days. The company recently entered into a contract to furnish electricity to operate the municipal electric-light system in Afton.

**CUMBERLAND, IA.**—The installation of an electric-lighting system in Cumberland is under consideration.

**DE SOTO, IA.**—The installation of an electric-lighting system in De Soto is under consideration.

**FORT MADISON, IA.**—A new company has been organized by the Stone & Webster interests to be known as the Fort Madison El. Co. The company is capitalized at \$150,000 and will take over the property of the Fort Madison El. Lt. & Pwr. Co., recently purchased by J. A. Trawick. The directors are: J. A. Trawick, A. S. Nichols, J. O. Boyd, S. W. Trawick, R. W. Child, W. G. Ross and George B. Stewart.

**HUMBOLDT, IA.**—Plans are being considered for lighting the business district in Humboldt with electroliers.

**LORIMER, IA.**—N. W. Lovegrove, of Des Moines, has been granted a franchise to furnish electricity for lamps and motors in Lorimer.

**VAN METER, IA.**—The question of issuing bonds for the installation of an electric-light plant in Van Meter is under consideration.

**VINTON, IA.**—The Cedar Rapids & Iowa Ry. & Lt. Co., of Cedar Rapids, has submitted a proposition to the city of Vinton offering to furnish electricity to operate the municipal electric-light system at 3.2 cents per kw for the first 25,000 kw and all in excess of that amount at 2.7 cents.

**ALBANY, MO.**—At an election to be held April 29 the proposition to issue \$19,000 in bonds for the construction of an electric-light plant will be submitted to a vote.

**ST. LOUIS, MO.**—The Electric Co. of Missouri, successor to the Suburban El. Lt. & Pwr. Co., has purchased the electric-light plants in Pacific, Union and Washington and will supply energy from the Keokuk dam. The new company has taken over the property of the Mississippi River Pwr. Distributing Co., which owns the equipment in St. Louis County for delivering current from Keokuk, including the large substation on Page Avenue, near the St. Louis limits. S. H. Wallace, of Webster Groves, is secretary of the new company.

**FARGO, N. D.**—Samuel F. Crabbe, of Fargo, architect, has been engaged to prepare plans for a heating and power plant for the State.

**FARGO, N. D.**—The Village Board of Dilworth has entered into a contract with the Union Lt., Ht. & Pwr. Co., of Fargo, for the installation of a street-lighting system in that village. The contract is for a period of three years and calls for 12 lamps of 32 cp.

**LISBON, N. D.**—The City Council has granted I. J. Bennett, of Sioux Falls, a franchise to install and operate an electric-light plant in Lisbon. M. E. Moore is city auditor.

**ARMOUR, S. D.**—Bonds to the amount of \$15,000, it is reported, have been voted for the installation of an electric-light system.

**FRANKFORT, S. D.**—Plans are being considered for the installation of an electric-lighting system in Frankfort.

**INTERIOR, S. D.**—John Farnham is installing an electric-light plant in Interior.

**TRIPP, S. D.**—The local electric-light system has been purchased by Richard and Christopher Vetter. It is understood that the new owners will improve and extend the system.

**WHITE, S. D.**—At an election held April 15 the proposition to issue \$18,000 in bonds for the construction of an electric-light plant and waterworks system was carried. R. E. Cameron is auditor.

**GENOA, NEB.**—The Nebraska Pwr. Co. has completed the first unit of its hydroelectric power plant on the Loup River and is furnishing energy to operate the local electric-light plant. Plans are being prepared for additional units which will develop 16,000 hp. The third plant will develop 40,000 hp. H. E. Babcock, of Columbus, is interested in the company.

**OXFORD, NEB.**—Bids will be received by the chairman and Board of Trustees of the village of Oxford until May 9 for the construction of a municipal lighting plant as follows: One 50-hp fuel oil engine, one 30-kw, direct-current, three-wire, 125-250-volt slow-speed generator, one three-panel switchboard (slate), one 240-amp-hr. storage battery, one 10-in. double leather belt and brick power station; also one 20-hp, 220-volt, direct-current motor and one 10,000-gal. fuel-oil tank, 7½ ft. by 30 ft., and miscellaneous line material. The cost of the plant, not including the fuel-oil tank and direct-current motor, is estimated at \$8,950, and the cost of the tank and motor is estimated at \$1,100. Plans and specifications are on file at the office of W. T. Pettygrove, village clerk, and Charles F. Sturtevant, of Holdrege, consulting engineer.

**ST. PAUL, NEB.**—S. B. Knudson is reported to be interested in a project to develop a power canal at St. Paul. The project includes the erection of a power house. It is expected to have the plant in operation by June 1.

**STEINHAUER, NEB.**—Bonds to the amount of \$7,000 have been voted for the installation of a municipal electric-light plant in Steinhauer.



**WESTERN, NEB.**—The installation of an electric-light plant in Western is under consideration by the Commercial Club.

**AUGUSTA, KAN.**—At an election held recently the proposition to issue \$5,000 in bonds for the municipal electric-light plant was carried. This will be added to the \$36,000 the city already has on hand.

**BEATTIE, KAN.**—The local electric-light plant, which was recently burned, is to be rebuilt. New machinery has been purchased and work will soon begin on construction of the plant. A larger generator will be installed. Electrical service was also furnished by the plant in Home City, 6 miles west of the town. Prior to the burning of the plant plans had been perfected for extending the service to Summerfield, 12 miles northeast of Beattie. Harry D. Hickman is proprietor.

**CEDAR POINT, KAN.**—Bonds have been voted for the installation of a municipal electric-light plant in Cedar Point.

**GARDEN CITY, KAN.**—The City Council has passed an ordinance authorizing the sale of \$40,000 in bonds for the installation of a municipal light plant.

**KANSAS CITY, KAN.**—The city commissioners have decided to submit the proposition to issue \$150,000 in bonds for the extension of the municipal electric-light plant. It is proposed to purchase a steam turbine and to extend the system into the Seventh Ward, formerly Argentine.

**MADISON, KAN.**—Bonds to the amount of \$40,000 have been voted for the installation of an electric-light plant and water-works system. The electric plant will have a generating capacity of about 75 kw and will be driven by an oil engine. The street-lighting system will consist of about 50 incandescent lamps of 100 cp. R. Hink & Westover, Merchant Building, Kansas City, Mo., are consulting engineers. Bids for construction of plant will be asked for about May 15.

**SCOTT, KAN.**—The City Council is considering the construction of an electric-light plant and water-works system, plans for which were prepared by the Alamo Engine & Supply Co., of Omaha, Neb. Charles A. Kison is Mayor.

## Southern States

**CHERRYVILLE, N. C.**—The proposition to issue \$5,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters on May 5.

**VADE MECUM, N. C.**—Preparations are being made for the construction of a large dam and electric-light plant at Vade Mecum Springs to supply electricity for the hotels there. J. C. Tise, of Winston-Salem, is owner of the property.

**WILSON, N. C.**—At an election held recently the proposition to issue \$80,000 in bonds for improvements to the municipal electric-light plant was carried. It is proposed to increase output of plant to 750 kw. The plant is operated by steam power. Bids for the proposed work will be called for in about 60 days. R. J. Grantham, of Wilson, has charge of the engineering work.

**ATLANTA, GA.**—The Water Board and finance committee of the Council have recommended to the City Council the acceptance of the bid of the Georgia Ry. & Pwr. Co. for furnishing electricity to operate the new centrifugal pump at the river station. The company offers to furnish the service at 6 mills per kw up to 5,000,000 kw per year, the city to guarantee consumption to an amount not less than \$9,000 per year.

**GUYTON, GA.**—At an election held April 18 the proposition to issue \$15,000 in bonds, the proceeds of \$10,000 to be used for the installation of a water works system and \$5,000 for an electric-light plant, was carried. Bids for construction of plant will be called as soon as possible. The J. B. McGary Co. of Atlanta, Ga., has charge of the engineering work. George T. Haywood is Mayor.

**MACON, GA.**—Work will soon begin on extensive improvements to the large power plant of the Central Georgia Pwr. Co. on the Ocmulgee River, 8 miles from Jackson. Two new generators will be installed, increasing the generating capacity of the plant from 15,000 to 25,000 hp.

**ROCHFELT, GA.**—At an election held recently the proposition to issue bonds for the installation of an electric-light plant and water-works system was carried. The contract will be awarded to the J. B. McGary Co., of Atlanta.

**CHIPLEY, FLA.**—Bids will be received by N. A. May, Jr., president of the Chipley Lk. & Pwr. Co., Chipley, until May 15 for the furnishing of material and equipment for the construction of an electric-light plant in Chipley. The equipment will consist of one two-cylinder horizontal automatic engine with a rating of 115 hp, direct connected to a three-phase, 60 cycle, 2300 volt alternating-current generator. The company reserves the right to furnish the poles. Proposals will be received as follows: (1) For furnishing material and constructing the system, including the furnishing labor and constructing system; the company to supply the material and equipment for the whole work or any part thereof as indicated under the bidding sheet. Plans and specifications can be seen in the office of the company at Chipley, also in the office of Solomon N. Jones Co., engineers, Candler Building, Atlanta, Ga.

**JACKSONVILLE, FLA.**—The Public Pier & Light Co., recently incorporated with a capital stock of \$500,000, is contemplating the installation of an electric-light plant in Jacksonville. Marcus Conner is president.

**MIAMI, FLA.**—The Forbes Pioneer Boat Dock Co. is contemplating

the construction of a pier and dock at Miami, Fla., for the use of the United States Fish Commission. The pier will be 1,000 ft. long and 100 ft. wide, and will be built of concrete. The pier will be built on Ball's Creek, and will be a part of the pier which the United States Fish Commission is now building at Miami.

**MOBILE, ALA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system. The city council has also decided to issue \$100,000 in bonds for the construction of a street-car system. The city council has also decided to issue \$100,000 in bonds for the construction of a public building.

**SHREVEPORT, LA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**MONTEVALLO, ALA.**—The Montevallo Ice & Lt. Co. is planning to erect an electric-light plant at Montevallo, Ala. The company has been organized by J. B. McGary, of Atlanta, Ga., and J. B. McGary, of Montevallo, Ala.

**CORWY, ALA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**ARIZONA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**HOOT SPRINGS, ARK.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**MARVELL, ARK.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**DE RIDGER, LA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**LAKEVILLE, LA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**CHESLANT, ORIA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**SHILOH, W. VA.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**ATHENS, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**GRAND SPRING, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**CAMEROON, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**DALLAS, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**EL PASO, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**LA PORTE, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**SAN ANTONIO, TEN.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

## Pacific States

**SEASIDE, CALIF.**—The city council has decided to issue \$100,000 in bonds for the construction of a municipal electric-light plant. The city council has also decided to issue \$100,000 in bonds for the construction of a water-works system.

**VANCOUVER, WASH.**—Application has been made to the City Council by Dr. I. Sedgwick Putnam, of Vancouver, for a franchise to construct and operate an electric railway on various streets of the city. The parties interested in the project, it is said, propose to build interurban lines out of the city.

**REDMOND, ORE.**—The city lighting committee is planning the installation of cluster lamps in the business section and other lamps in the residence section.

**ST. JOHNS, ORE.**—The City Council has accepted the proposition submitted by the Washington Wtr. Pwr. Co., of Spokane, for a franchise and contract for lighting the city, subject to the approval of the city attorney.

**YONCALLA, ORE.**—Plans are being prepared by E. S. Benefiel, of Paisley, for the construction of a power plant, near Drain, for the purpose of supplying electricity for lamps and ultimately for motors. Work will soon begin on construction of the proposed plant.

**CLOVERDALE, CAL.**—The Cloverdale Lt. & Pwr. Co., of Cloverdale, and the California Tel. & Lt. Co., of Santa Rosa, have applied to the State Railroad Commission for an order empowering the former to sell its property to the latter. The California Tel. & Lt. Co. also asked for permission to issue \$5,000,000 in bonds and to sell at this time bonds to the amount of \$350,000. Of the proceeds it is proposed to use \$228,000 to discharge existing obligations, \$75,000 to purchase the property of the Cloverdale Lt. & Pwr. Co. and \$17,000 for improvements.

**LOS ANGELES, CAL.**—The City Council has voted to install a new lighting system in South Park.

**LOS ANGELES, CAL.**—At the election held April 16 the proposition to issue \$6,500,000 in bonds for the installation of a distribution system for aqueduct power was defeated.

**LOS ANGELES, CAL.**—The contract for furnishing lamp standards for the new lighting system on Sixth, Eighth and Ninth Streets has been awarded to the Liwellyn Iron Works, of Los Angeles, for \$14,725. The conduit to feed the system will be laid in the near future.

**LOS ANGELES, CAL.**—Plans are being prepared for the construction of a pipe storage house, 95 ft. by 286 ft., to be erected on Macy Street, Los Angeles, for the H. R. Boynton Co. The building will be equipped with a complete electrically operated loading and conveying system. The United Engineering Co., M. Ray Costerian, manager, American Bank Building, Los Angeles, is consulting engineer.

**MARYSVILLE, CAL.**—The Great Western Pwr. Co., of San Francisco, has been granted a franchise by the Board of County Supervisors to erect transmission lines for the distribution of electricity over the highways of Yuba County.

**REDDING, CAL.**—The franchise for the erection of transmission lines in Redding, bids for which were opened April 7, was purchased by Albert C. Agnew, of Oakland, for \$100. Mr. Agnew also purchased the franchise for the erection of transmission lines on the roads and highways in Shasta County for \$125, bids for which were opened April 7. It is understood that Mr. Agnew represents the Sierra Pwr. Co.

**REDLANDS, CAL.**—Bids will be received by the Board of Trustees for furnishing materials for the municipal water plant, including pumps, pipe, motors, wire and controlling equipment. The city of Redlands recently contracted with the Southern Sierras Pwr. Co., of San Bernardino, to furnish electricity to operate the pumps of the new water system. R. Warner is city clerk.

**RIVERSIDE, CAL.**—Important extensions to the municipal electric light system have been provided for by the Board of Public Utilities, which include the erection of a new substation at Arlington to handle the power to be delivered to the city by the Southern Sierras Pwr. Co., an ornamental lighting system for Market Street, between Seventh Street and Whittier Place, and the installation of an ornamental lighting system in Brentwood Place. Among the extensions provided for is the erection of a transmission line from the proposed Arlington substation to Mockingbird Canyon to supply power to all the pumping plants along the Gage Canal.

**SAN BERNARDINO, CAL.**—The Empire Water Co., of San Bernardino, has applied to the State Railroad Commission for permission to issue \$200,000 in bonds, the proceeds to be used for the construction of a hydroelectric power plant in the San Jacinto Mountains, near Coyote Creek.

**SAN FRANCISCO, CAL.**—The stockholders of the Pacific Gas & El. Co. have voted to issue \$5,000,000 in bonds to provide funds for its extensive plans for construction and improvement in Northern California.

**SANTA MONICA, CAL.**—Plans are being prepared for the installation of an ornamental street-lighting system on San Vicente Boulevard, to cost about \$5,000. Concrete standards may be used. J. A. Campbell and others are interested.

**EMMETT, IDAHO.**—The Beaver River Pwr. Co., of Bliss, contemplates extending its transmission lines into the Payette Valley to furnish electricity in this section. The company will apply for a franchise in Emmett.

**POCATELLO, IDAHO.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States post office and court house at Pocatello, Idaho. Draw

ings and specifications may be obtained from the custodian of site at Pocatello or at the above office. O. Wenderoth is supervising architect.

**MOUNT PLEASANT, UTAH.**—The contract for the construction of the municipal electric-light plant has been awarded to Lyman & Samuels, of Salt Lake City, for \$25,312. The work includes the construction of a power plant in Pleasant Creek Canyon, the erection of 4 miles of transmission lines and remodeling the present distributing system.

**COLUMBUS, N. M.**—The village trustees have granted to C. E. Cooke, of El Paso, Tex., a franchise to install and operate an electric-light plant and water-works system in Columbus. The equipment of the electric plant will include a 25-hp Fairbanks, Morse & Co. engine and a 15-kw generator; a No. 2 Layne & Bowler two-stage pump will be installed to pump the water. The cost of both plants, including piping and wiring, is estimated at about \$10,000.

**LAS CRUCES, N. M.**—The Las Cruces El. Lt. & Ice Co. is planning to install a 15-ton ice machine in its plant.

## Canada

**ALERT BAY, B. C.**—The provincial government will build a telephone line from Campbell River to Alert Bay, a distance of 120 miles.

**KAMLOOPS, B. C.**—By-laws have been approved by the ratepayers authorizing an expenditure of \$250,000 for construction of a hydroelectric power plant and \$65,000 for improvements and extensions to the electric-lighting system. J. A. Wilson is city engineer.

**SOUTH VANCOUVER, B. C.**—The British Columbia El. Ry. Co. is planning to erect a new substation in South Vancouver to cost \$90,000. The building will be of reinforced concrete, one story high, with gallery for switching apparatus. The equipment will consist of three motor-generator sets with a rating of 1000 kw each and transforming equipment for 7000 kw. The company has agreed to extend the electric railway from Earls Road, Westminster, to Joyce Road, Collingwood, immediately, and eventually to Boundary Road, Central Park, provided the municipality will agree to the conditions of the company.

**VANCOUVER, B. C.**—Requests are being made by the property owners on several streets for the installation of ornamental brackets for luminous are lamps instead of the tungsten lamp standards. The cost of the proposed lamps is estimated at about \$218 each. City Electrician Fletcher has charge of the work.

**BARRIE, ONT.**—Anticipating the advent of hydroelectric power from the Severin River, it is proposed to discard the present arc-lamp lighting system on the principal streets and substitute about 500 incandescent lamps. These would probably be attached from arms on the poles already erected.

**HANOVER, ONT.**—The Hanover El. Lt. & Pwr. Co. contemplates installing meters in the near future. The flat-rate system now in use will be discarded.

**MERLIN, ONT.**—Estimates are being secured for the installation of an electric-light plant in Merlin.

**STAYNER, ONT.**—The town has purchased the local electric-light plant. Electricity for operating the system will be purchased from the Hydro-Electric Power Commission of Ontario.

**AYLMER, QUE.**—The town of Aylmer is contemplating the installation of a complete electric-lighting system, to cost approximately \$30,000.

**MEGANTIC, QUE.**—The corporation of Megantic has engaged Edward A. Evans, of Quebec, to prepare plans for a hydroelectric power plant to furnish electricity for lamps and motors for the town. The proposed dam will probably be about 65 ft. high. Megantic has not a post office.

**MONTREAL, QUE.**—The Cedar Rapids Mfg. & Pwr. Co., of Montreal, has awarded the contract for the construction of the hydroelectric development at Cedars, to cost over \$3,000,000, to Fraser, Brace & Co., of New York, N. Y. The work will include the completion of the canal and building the power-house substructure. The initial installation under the contract provides for 100,000 hp, the work to be completed by October, 1914. This contract does not include machinery, for which negotiations are under way. The hydraulic work will be done under the supervision of Julian C. Smith, chief engineer of the Shawinigan Wtr. & Pwr. Co. R. M. Wilson, chief engineer of the Montreal Lt., Ht. & Pwr. Co., will have charge of the installation of the electrical machinery.

## New Industrial Companies

**THE BORG & BECK COMPANY**, of Moline, Ill., has been incorporated by Charles W. and George W. Borg and Marshall Beck. The company is capitalized at \$80,000 to manufacture machinery and motors.

**THE CLARK ENGINEERING COMPANY**, of Brooklyn, N. Y., has been incorporated with a capital stock of \$40,000 to do a general electrical contracting business. The incorporators are: Royal S. Clark, Luford S. S. and Wallace A. Jack, 359 St. John's Place, Brooklyn, N. Y.

**THE INLAND ELECTRIC COMPANY**, of Indianapolis, Ind., has been incorporated with a capital stock of \$35,000 to deal in electrical supplies.



The incorporators are James H. Drew, Charles P. Greenawald and B. G. Drew.

**THE JANDONS ELECTRIC EQUIPMENT COMPANY**, of New York, N. Y., has been incorporated with a capital stock of \$100,000 by Louis Freed, B. Freed and Gustav Seegerman, 444 East One Hundred and Seventy-ninth Street, New York. The company proposes to be a general electrical contracting firm.

**THE METAL TREATING & EQUIPMENT COMPANY**, New York, N. Y., has been incorporated with a capital stock of \$100,000 for the purpose of exploiting the patented processes and methods for electrolytic galvanizing, both in the form of installing and operating plants and of installing special plants. The officers are Louis M. Jandons, president; Lewis E. De Noogard, vice president, and Louis A. Freedman, secretary and treasurer. The offices of the company are located at 100 Broadway, New York, N. Y.

**THE PUBLIC UTILITIES CONTRACTING COMPANY**, of New York, N. Y., has been chartered with a capital stock of \$25,000 by C. F. Miller, J. E. Hughes and R. E. Conner, 200 West Second hundred Street, New York, N. Y.

**THE WOLFRAM WIRE COMPANY**, of Wilkes-Barre, Pa., has been incorporated with a capital stock of \$250,000 by Otto E. Ayers, 10 Third Avenue, New York, N. Y. The company proposes to deal in metallic tungsten and tungsten acid, etc.

## New Incorporations

**MONTEVALLO, ALA.**—The Montevallo L. & Ice Co. has been organized by the Brown Brothers Lumber Co. to install an ice and cold storage plant.

**TEXARKANA, ARK.**—The Hardin El. Co. has been incorporated with a capital stock of \$10,000 by James W. Morris, William J. Morris, Arthur S. Herrington and others.

**SAN FRANCISCO, CAL.**—The Aero Pwr. Co. has been incorporated with a capital stock of \$75,000 by O. E. Still, H. F. White and W. H. Buttner. The headquarters of the company will be located in San Francisco.

**STOCKTON, ILL.**—The Stockton El. Co. has been incorporated with a capital stock of \$25,000 by John W. Sayer, Harrison A. Smith and C. H. Kinderbach. The company proposes to operate a heat, light and power plant.

**UNION CITY, IND.**—The Union City El. Co. has been incorporated with a capital stock of \$100,000 to operate public utilities. The incorporators are: J. S. Dales, Robert Cass, T. S. Monks and G. H. Fisher.

**OWENSBORO, KY.**—The Daviess County Telephone Co. has been incorporated with a capital stock of \$50,000 by William W. Crawford and William T. Hale and J. J. Hettenger.

**IDAHO, OKLA.**—The Bettis Pwr. Co. has been incorporated with a capital stock of \$500,000. The company proposes to establish a hydro-electric power plant on Mountain Fork River, in Monticello County, for the purpose of supplying Texas, Arkansas and Oklahoma with electricity for lamps and motors. A dam 150 ft. high and 100 ft. long will be built. The incorporators are: J. M. Bettis, of Muskogee; R. S. Bettis, of Paris, Tex.; George A. Gorden, of Dallas, Tex., and F. R. Clark, of San Antonio.

**HARRISBURG, PA.**—Six charters for companies to operate in Berks County have been granted by the State Department of Public Safety. Cantco, Chocoma, Fairview, Oakland and Parker. Each company is capitalized at \$5,000 and takes the name of the district it is to operate in. The incorporators are: H. C. Carpenter, R. E. Sprengle and C. R. Bartley, of Bartley.

**PHILADELPHIA, PA.**—Charters have been granted by the State Department to six electric companies to operate in the following ways: the Philadelphia & Western R. Co., on the Schuylkill and Market Streets, Philadelphia, and Bridgeport, Pa., on the Delaware River; the Millbourne El. & Pwr. Co., of Upper Merion, Pa., on the Schuylkill River; the El. & Pwr. Co., of Upper Merion, Pa., on the Schuylkill River; the El. & Pwr. Co., of Bridgeport, Pa., on the Schuylkill River; the El. & Pwr. Co., of Bridgeport, Pa., on the Schuylkill River; the El. & Pwr. Co., of Bridgeport, Pa., on the Schuylkill River. It is understood that a large amount of money will be expended in energy for operating the several plants. The companies are: The El. & Pwr. Co., of Philadelphia, Adams, of Norristown, and Gerald H. Jones, of Philadelphia.

**ROGERSVILLE, TENN.**—The Rogersville El. & Pwr. Co. has been chartered with a capital stock of \$50,000 to operate a hydro-electric power plant on Big Creek, 3 miles from Rogersville. The incorporators are: J. E. Miller, George D. Hale, J. E. Cline and J. E. Cline.

**CHARLOTTESVILLE, VA.**—The Red Land Park Co. has been incorporated with a capital stock of \$50,000. The incorporators are: C. G. Todd, president, W. Allen Wilson, secretary and treasurer, both of Charlottesville.

**FAIRMONT, W. VA.**—The Fairmont Land & Ice Co. has been incorporated with a capital stock of \$50,000 by John W. Fleming, J. M. Brownfield, M. A. Lefebvre and others.

## Trade Publications

**STEAM SHIP**, for the construction of steamships, has been issued by John A. Smith, 111 East 10th Street, Brooklyn, N. Y., and is illustrated with plans, sections and elevation drawings. Each drawing is accompanied by diagrams.

**THE ELECTRICAL ENGINEER**, published by the Electrical Engineering Society, 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**GRAB**, published by the Grab Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**WATER**, published by the Water Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

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**BOILER**, published by the Boiler Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**FIGHTING**, published by the Fighting Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**THE SHIP**, published by the Ship Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**REINFORCING**, published by the Reinforcing Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**VACUUM**, published by the Vacuum Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

**MODERN**, published by the Modern Co., 111 East 10th Street, Brooklyn, N. Y., is a monthly publication. It contains articles, news, and briefs.

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## Business Notes

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# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 15, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,058,724. SUPERVISORY SIGNAL SYSTEM; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Combination of an auxiliary fire alarm with a watchman's supervisory signal system.
- 1,058,725. COMBINED AUXILIARY AND AUTOMATIC FIRE-ALARM SYSTEM; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Automatic signaling devices operated by thermostats and a code-signal transmitting means operated by automatic signaling devices.
- 1,058,728. ELECTRIC SIGNAL-TRANSMITTING APPARATUS; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Multiple signal-transmitting device adapted to send a number of different signals.
- 1,058,730. REVERSIBLE BRUSH HOLDER FOR USE WITH DYNAMOS; J. L. Creveling, New York, N. Y. App. filed Aug. 25, 1911. Direction of current supplied is maintained uniform throughout reversals in direction of armature rotation.
- 1,058,731. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Sept. 16, 1910. Constant voltage on a translation circuit is maintained through changes in the voltage at the source; use is made of carbon pile and electromagnetic means exerting pressure thereupon.
- 1,058,761. TROLLEY FINDER; A. Klein and J. Poss, Chicago, Ill. App. filed July 1, 1912. Finder arms rise on opposite sides of trolley wire when pressure on the trolley wheel is released.
- 1,058,778. STORAGE BATTERY; W. Morrison, Des Moines, Ia. App. filed Aug. 31, 1912. Uses a compound of titanium for a binder.
- 1,058,779. SEPARATOR FOR STORAGE-BATTERY PLATES; W. Morrison, Des Moines, Ia. App. filed Sept. 7, 1912. Wood separator plate heated in melted wax to drive off volatile ingredients and then the residual bath material is dissolved from the wood.
- 1,058,800. SILICON-CARBIDE ARTICLE AND METHOD OF MAKING THE SAME; E. S. Smith and F. J. Tone, Niagara Falls, N. Y. App. filed April 16, 1912. Porous silicon-carbide which is non-crystalline under naked vision and is characterized by extreme fineness of particle and pore.
- 1,058,825. ELECTRIC HEATING PAD, BLANKET, ROBE AND THE LIKE; F. R. Whittlesey, Oakland, Cal. App. filed April 1, 1912. Current-carrying wire is arranged in tortuous course and secured to foundation sheet by narrow tape.
- 1,058,832. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Nov. 10, 1909. Motor is responsive to departures from predetermined condition of battery circuit and acts to control regulating apparatus to vary the load on the generators.
- 1,058,851. SELF-ADJUSTING OUTLET BOX; O. F. Dubruiel, Duluth, Minn. App. filed Jan. 4, 1912. Made in two relatively movable parts so that box may adjust itself to settling of house without breaking joints.
- 1,058,872. SIGNALING SYSTEM; O. T. Lademan, Milwaukee, Wis. App. filed July 29, 1910. Impulse mechanism at each station with signal-sending devices at central station arranged so central station can selectively call any substation.
- 1,058,899. MOTOR VEHICLE; H. Pieper, Liege, Belgium. App. filed March 29, 1907. Power developed by engine controlled by means depending on the equilibrium, setting of the controller and speed of the dynamotor shaft.
- 1,058,902. PLAYING APPARATUS FOR MUSICAL INSTRUMENTS; W. C. Reed, Dalton, Mass. App. filed May 26, 1910. Special electric circuit for varying strength of current to playing magnets with music sheet having special perforations.
- 1,058,903. TELEPHONE-EXCHANGE SYSTEM; J. N. Reynolds, Greenwich, Conn. App. filed July 8, 1911. Controlling circuit for reversing control power-driven automatic switches used in automatic or semi-automatic exchange systems.
- 1,058,916. BATTERY INSTALLATION; L. Y. Spear and G. E. Edgar, Quincy, Mass. App. filed March 13, 1911. For boats, autos, etc.; tank for the battery cells with ventilating pipes and automatic sealing valves to prevent entrance of water.
- 1,058,986. APPARATUS FOR CONTROLLING ELECTRIC-LIGHT SYSTEMS; A. W. Knutson, Galesburg, Ill. App. filed March 21, 1910. Particularly for "boulevard systems"; cuts out a predetermined portion of the lamps in a circuit simultaneously and from a single point.
- 1,058,991. PROCESS FOR THE PRODUCTION OF MALLEABLE IRON DIRECT FROM ORE; A. R. Lindblad, Ludvika, Sweden. App. filed July 16, 1910. Mixture of ore and reducing material is treated in shaft furnace and after being fully or partially reduced is passed without cooling or contact of air into an electric melting furnace.
- 1,059,002. RECTIFIER; C. C. Ruprecht, Cleveland, Ohio. App. filed Nov. 18, 1907. Cell containing electrolyte and electrodes, one of which surrounds the other and has a closed chamber at the top thereof to collect gases liberated by decomposition of electrolyte.
- 1,059,003. METHOD OF AND APPARATUS FOR RECTIFYING ELECTRIC CURRENTS; C. C. Ruprecht, Cleveland, Ohio. App. filed April 20, 1908. Pressure is maintained upon the electrolyte by obstructing the discharge of gases from the cell.
- 1,059,004. ELECTRIC MEASURING INSTRUMENT; M. C. Rypinski, New York, N. Y. App. filed May 4, 1908. Single instrument indicates voltage of circuit connecting electric motor to storage battery, the charging current applied to the battery, or the current supplied from the battery to the motor.
- 1,059,007. ELECTRICAL BURGLAR ALARM; B. F. Sharp, Ambler, Pa. App. filed May 21, 1912. Alarm clearable with plurality of circuits and circuit-opening and circuit-closing devices.
- 1,059,011. TROLLEY; E. Swinarski, Buffalo, N. Y. App. filed May 3, 1912. Retaining arms at opposite sides of trolley remain upright regardless of inclination of the trolley pole.
- 1,059,013. REGULATED-CONTACT PUSH-BUTTON; B. Urquhart, Plainfield, N. J. App. filed Oct. 5, 1909. Primary and secondary pistons regulate duration of contact regardless of duration of pressure thereon.
- 1,059,014. OZONIZER; C. F. Wallace, New Brighton, N. Y. App. filed Aug. 21, 1911. Spaced concentric glass tubes with an electrode on the outside of the outer tube and an electrode on the inside of the inner tube.
- 1,059,048. FRAME OF DYNAMO-ELECTRIC MACHINES; F. C. Hall, Wilkensburg, Pa. App. filed June 9, 1910. Segments of the frame have adjacent tapered projections and a cap is clamped over these projections.
- 1,059,056. ELECTRIC SWITCH; L. F. Lindstrom, Bridgeport, Conn. App. filed Nov. 20, 1912. Pawl and ratchet circuit-breaker with segmental latch plate having slanted portions at its edge bent to form a channel for the chain.
- 1,059,071. ELECTRIC WASHING MACHINE; R. D. Robinson, New York, N. Y. App. filed June 20, 1912. Electrodes are cleaned while in assembled condition in the machine by reversing flow of current; amperage is controlled by lamps.
- 1,059,073. ANTISEPTIC TELEPHONE MOUTHPIECE; I. S. Rosenbalt, San Francisco, Cal. App. filed May 25, 1911. Rigid body of disinfectant material is inclosed in an air-tight casing which supports the mouthpiece.
- 1,059,076. ELECTRIC PLANT; O. Schaller, Steglitz, Berlin, Germany. App. filed Aug. 7, 1907. Car-lighting system; double-direct-current generator driven by car axle and a motor booster.
- 1,059,086. IGNITING DEVICE FOR GAS STOVES; B. D. Stevenson, Harvard, Ill. App. filed May 22, 1911. Induction coil and selective push-button control.
- 1,059,090. ELECTRIC MESSAGE ROLL; D. Tibbals, St. Louis, Mo. App. filed Sept. 24, 1909. Induction coil within the handle which carries the roll, variable connections inside the handle and controller on outside of handle.
- 1,059,095. HIGH-VOLTAGE-MEASURING INSTRUMENT; J. B. Whitehead, Baltimore, Md. App. filed April 5, 1912. Two concentric conductors, one of which has a diameter corresponding to a given circuit intensity.
- 1,059,096. SYSTEM OF CHARGING SECONDARY BATTERIES; J. A. Wotton, Atlanta, Ga. App. filed May 6, 1909. Mercury-vapor rectifier, voltmeter influenced by battery current and electrical means actuated by voltmeter for discontinuing one leg only of the alternating-current circuit.
- 1,059,120. SPARK COIL; W. H. Cotton, Chicago, Ill. App. filed Jan. 25, 1912. A pair of insulated magnet blocks are apertured to receive the coil and each is connected to one end of the coil.
- 1,059,131. TROLLEY SWITCH; L. E. Elwell, Los Angeles, Cal. App. filed July 29, 1911. Special construction for holding and clamping the trolley wires at a switch point.
- 1,059,134. COMMUTATOR MOTOR; C. W. Fornander, Wilkensburg, Pa. App. filed Aug. 26, 1911. Single-phase commutator-motor brush is made up of plurality of conducting laminae bearing a definite spaced relation to spacing of commutator bars.
- 1,059,172. MEDICAL CABINET; I. H. Lewin, New York, N. Y. App. filed Dec. 10, 1912. Hand-and-foot operating mechanism located in a cabinet with insulated contacts mounted on said mechanism.
- 1,059,233. ELECTRODEPOSITION AND REFINING OF ZINC; U. C. Tainton and J. N. Pring, Manchester and Sandbach, Eng. App. filed March 16, 1912. Electrolyte consisting of zinc salt solution, a large proportion of an acid and a small proportion of gum tragacanth.
- 1,059,255. SYSTEM FOR CHARGING SECONDARY BATTERIES; J. A. Wotton, Montclair, N. J. App. filed May 6, 1909. Battery-charging circuit including circuit-breaker and controlling means therefor, electromagnet for short-circuiting the controlling means, and battery-voltage-actuated means for energizing the magnet.
- 1,059,304. MERCURY DROPPER; E. C. Ketchum, Boston, Mass. App. filed March 18, 1912. An amalgam containing sodium is intermittently fed to the armature at the point of contact of the brush.
- 1,059,314. BATHING APPARATUS; A. J. Petter, Los Angeles, Cal. App. filed June 12, 1912. Electric-light cabinet containing tub and a support for the patient.
- 1,059,322. ELECTROLYTIC APPARATUS FOR THE PREPARATION OF PAPER PULP; F. F. Strong, St. Petersburg, Fla. App. filed June 10, 1910. Porous tube for the flow of subdivided plant material, electrode within the tube, and a tank supporting an electrolyte around the tube.
- 1,059,326. PROTECTED TERMINAL CLAMPING DEVICE; A. H. Ackermann, Brooklyn, N. Y. App. filed May 2, 1910. A conducting stud is clamped between adjacent cells of storage battery and acid-proof caps inclose the clamping nuts and the ends of the conducting stud.
- 1,059,328. ELECTRICAL INDICATING OR RECORDING APPARATUS; W. H. Bristol, Waterbury, Conn. App. filed March 30, 1912. The mounting for the movable members of the instrument is located so that it will not be affected by the heat generated in the coils or by eddy currents.

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## Reorganization and Debt Evasion

"Alarming" is the word applied by one of the justices of the Supreme Court in dissenting from the presiding opinion handed down this week in the case of John H. Boyd versus the Northern Pacific Railroad Company. And from the viewpoint of those who by a "reorganization" have sought to escape from an unprofitable contract or to evade their debts the word is not too strong. The court, the opinion of which was approved by a narrow vote of five to four, after remarking that "corporations insolvent or financially embarrassed often find it necessary to scale their debts and readjust stock issues, with an agreement to conduct the same business with the same property under a reorganization," holds that "of course such transfer by stockholders from themselves to themselves cannot defeat the claim of a non-assenting creditor. As against him, the sale is void in equity, regardless of the motive with which it was made." What makes this decision so striking and of such wide application is that the plaintiff, Boyd, was the creditor of a corporation bought by the Northern Pacific Railroad Company and later transferred to its successor, the Northern Pacific Railway Company. In upholding Boyd's judgment against the corporation acquired by the railroad company the Supreme Court has, it appears, gone far toward making "reorganization" useless and unprofitable as a method of escaping creditors of the second as well as the first generation of a corporation's existence.

## Delays in Patent Cases

As an example of the delays possible under the workings of our patent system and the attendant abuses, we commend to all interested in patent reform, and especially to the patent committees of Congress, the history of the Thomson patent for a system of electrical distribution recently held invalid by the United States District Court in Pittsburgh, as mentioned elsewhere in our columns this week. The date of invention, as claimed, was 1879, but the patent application was not filed until six years later, or in 1885. Complicated interference proceedings ensued, the matter being before the Patent Office for some eighteen years. Litigation in the courts against an alleged infringer consumed ten years more, with the final result that the inventor or his assigns were held to have no exclusive rights whatever. Leaving aside the inventor's delay of six years in filing application, which naturally prejudiced his case, seventeen years elapsed before issue, and twenty-seven years elapsed from the date of application to the adjudication by the court. Had the patentee's claims been sustained, his monopoly would have been extended to a total period of thirty-four years, or double the life of the patent.

Another phase of this remarkable case is the fact that if the patent had been sustained, practically every constant-potential distribution system in the country and a very large portion of the industry would be monopolized by the plaintiffs for a further period of seven years, or until 1920. On this point the court said with great force that so useful and valuable is the system described and claimed by the patentee that he ought to give some satisfactory reason for the delay of twenty-seven years from the date of his application to the time of testing the validity of the patent on final hearing. But the end of this litigation has not necessarily been reached, since appeal in such a case, involving as it does the federal law, may finally be taken to the highest court in the land.

## Monopoly in Energy Supply

Ever since central-station generating plants began to be established a vital engineering interest has surrounded the problem of the relative advantage of consolidating the generating stations of a community into one or a few plants as compared to the operation of a number of smaller plants each supplying energy throughout its limited area or to a single industry. The trend of development for thirty years has been very much in the direction of a more centralized supply and away from the establishment and maintenance of smaller plants, but the economic battle between the two methods has always been active and is no less active to-day than before. Recently interest in this problem has been added by the activities of Illinois and elsewhere in the direction of erecting networks of transmission lines supplying energy over large areas for all purposes. The determination of the extent one should go in the direction of centralizing generation into a few plants for a given territory involves the balancing of the fixed charges on transmission-line equipment (transmission) with the large plant, on the one hand, against the higher operating cost and higher fixed charges on the first cost of many small generating plants, on the other. The large generating plant nearly always has a decided advantage in terms of efficiency. Its first cost per kilowatt of peak load is lower than that for the smaller plants, and in addition the large station can take advantage of the fixed-charge factor—that the large station does not need to be of as large a load rating as the aggregate of the smaller stations it would replace. The transmission-line investment, which is indeed the key to the whole situation, has been rather lightly touched upon in some recent discussions of the subject. It is here assumed that the transmission lines erected would be of sufficient substantial character to make possible a reliable service from a centralized plant as well as when to be replaced by smaller scattered plants. The reason that

centralized service has not been adopted to a greater extent heretofore has been that the cost of transmission lines is so great that comparatively few centralizing movements could economically be carried out on a small scale with the rather uneconomical existing plants and with the load actually connected to the small central stations operating in the territory. The success of such movements as are going on in Illinois will depend on something more than a mere tying together of the existing central-station loads. It will depend upon operating on a much larger scale than heretofore, on the building up of motor business not before obtained or obtainable by smaller central stations, and on obtaining lighting and motor business from farms and intermediate towns along the transmission lines where there has been no electric service heretofore. It is a movement requiring centralized ownership and a large amount of capital, a combination of essentials which until recently seems to have been lacking for the development of small town and farm business.

### Spot-Testing Incandescent Filaments

In the early days of the carbon-filament incandescent lamp it was found very difficult to produce filaments of a sufficiently high degree of uniformity to give satisfactory life service. If a filament had a length of say 150 mm and there happened to be one thin spot or place where the cross-section was a little short, the current density at this spot would be above that in the rest of the filament and the working temperature at this spot would exceed the temperature elsewhere. Consequently, when the filament, judged as a whole, was operated at normal working temperature, the thin spot would be at an excessive temperature. The life of the filament would probably be much reduced owing to the presence of this hot spot.

It was not easy to perceive a hot spot in a carbon-filament lamp at full candle-power. The filament as a whole was so bright that an extra element of brightness had to be very marked to be detected in this way. By bringing the filament electrically to dull red heat during the later stages of evacuation on the pump it was fairly easy to see either hot or cold spots. It was subsequently discovered that if this process was conducted at a time when a suitable hydrocarbon vapor was introduced within the lamp chamber a glowing temperature would serve to decompose the vapor and deposit carbon. In this way, the thin glowing hot spots were forced to gather accretions of deposited carbon, and after such treatment hot spots could be made to disappear, although the filament after the "flashing process" gained somewhat in diameter throughout.

A delicate method of detecting spots or inequalities in the brightness of a filament is described by Mr. C. F. Lorenz on page 932. It consists essentially in providing a luminous color background for the filament in such a manner that when viewed against this background differences in brightness are thrown into effective contrast. In this sense the filament is subjected to optical pyrometry in successive portions.

It might be possible to carry the process described to a further degree of refinement, and to measure, at least ap-

proximately, by optical pyrometer methods, the differences of temperature at different portions of a filament. It has been demonstrated that an appreciable lowering of temperature occurs close to the ends of the filament where they terminate in the clamps, and also near to the anchoring clips, if any are used to support the filament. Such an effect must be looked for, in view of the conditions of heat conduction. Such reductions of temperature, while they lower the efficiency of the lamp, do not ordinarily lead to the troubles accompanying hot spots. It would be advantageous, however, in the case of standard lamps used in photometry to know the degree of non-uniformity in different portions of the filament. Even aside from special or standard lamps, it would be advantageous to be able to measure or specify the range of temperature variation along a filament at normal voltage.

### Electricity in Mines

A group of papers at the recent Pittsburgh meeting of the American Institute of Electrical Engineers dealt with various phases of the supply of electrical energy for mining operations. As our readers well know from many articles published in these columns, the increase of electrical service in mines during the last ten years has been very marked, and many plants have been established, both for local service and for supplying energy to groups of mines. A most important phase of the Pittsburgh discussion was the emphasis laid on the use of central-station service for mines in preference to steam service produced even by the cheapest of local fuel. The time has gone by when any scattered industrial plant can afford to use locally generated steam power for its various classes of service, and coal mines, despite the fact that fuel is almost waste produce, generally use this fuel under such extraordinarily uneconomical conditions that there is positive gain in taking up electrical service where it can be obtained at any reasonable price. One of the authors pointed out that it is a conservative statement to say that from 25 lb. to 30 lb. of fuel is burned in a steam-operated coal mine for every effective hp-hour used. This figure would be almost unbelievable were it not cited in cold blood in the course of analysis of economic conditions. The cause of such frightful lack of economy is that the boilers are usually small, overloaded and improperly handled by poorly paid and inefficient firemen. The steam lines are often preposterously long, with consequent enormous waste of heat, and the whole steam plant has usually grown up piecemeal, with the usual unhappy results.

In passing to electrical drive with a single centralized generating equipment for the mine there is evidently large opportunity for gain, but the plants are not usually large enough to be economically worked and the load-factor seldom exceeds 50 per cent, on which basis the fixed charges and operating expenses on a plant of from 500 hp to 1000 hp rise to a somewhat serious figure—in the vicinity of 1 cent per kw-hr., even with fuel at 75 cents per ton. On the other hand, as has been many times proved, a large distributing plant, with the advantage of cheap fuel and such a diversity-factor as would be incident on the service



of many mine customers, is able easily to furnish energy in large blocks at a lower figure than that named. A large amount of service of this kind has now been built up with satisfactory results from the standpoints of all concerned. The central station furnishes, on the whole, not only cheaper energy than the isolated plant, but more reliable service and is particularly convenient in the matter of isolated motor units such as are required for pumping and temporary work, which is peculiarly expensive and troublesome to manage without a centralized energy supply.

For a long time in the early days of the application of electricity to mining there was a hue and cry about the danger of electrical operation. That accidents from shocks, fire and explosions have occurred from electrical causes is not to be denied, but as a matter of fact accidents of any kind due to electrical causes are so insignificant compared with the accidents due to other causes in mining operation that they have turned out to be of comparatively little account. No cause of accidents can fairly be called negligible, but there seems to be a strong probability that the introduction of electric service on the whole produces improved working conditions that lessen the aggregate number of accidents of all kinds. A mine fairly well lighted, provided with electrical tramways and coal-cutting machines, with electrical pumps and hoists, can unquestionably turn out more tons of coal per accident than a mine operated in the old-fashioned way, and this condition means a great gain in safety in conducting mining operations. Now and then a miner may receive a shock from a trolley wire or some charged part of a machine, but, on the other hand, with the old-fashioned equipment, he stands a far greater chance of getting hit by a pick, kicked by a mule or killed outright by an explosion due to a mishandled fuse which would not have occurred had electric ignition been employed. Mining at best is not a safe business, yet we believe it can readily be shown that a first-class electrical equipment on the whole materially diminishes the number of accidents in proportion to the output delivered. Altogether the coal mines are steadily increasing in importance as consumers of central-station energy.

### The Cadmium-Amalgam Vapor Lamp

Ever since the development of the mercury-arc lamp persistent efforts have been made to remedy the deficit of red in the light produced so as to give more nearly normal color values to the objects illuminated. Efforts in this direction have been principally along three quite separate lines—the addition of red through independent light sources, as in the familiar combinations of mercury-arc and incandescent lamps; the transformation of part of the radiation into longer wave-lengths through fluorescence, as in Dr. Peter Cooper Hewitt's light transformer, and, finally, through the addition of light-producing vapors giving a larger proportion of red radiations than does mercury. As is well known, the mercury-arc lamp in glass gives practically no red rays. Worked intensively in quartz tubes the red radiations rise in intensity faster than do the green and blue radiations, so that the quartz-tube lamp, while yet far from giving a red

component of about one eighth of normal intensity, still is much better in color than is the ordinary mercury-arc lamp. For example, it appears brilliantly red when observed through a red glass, although obviously lacking in red rays when used for the observation of minute objects of various colors.

A recent paper by Dr. Wollastin gives the results of some interesting experiments carried out in conjunction with Mr. Ritzman and the famous chemist Carl Zeiss directed toward the production of quartz-tube or sealable vapor lamp. This plan has frequently been tried, sealable tubes being used instead of wire mercury, but the trouble has been that most of the elements from which red radiations—for example, the alkali metals and those of the alkaline earths—attack the tube and render it impervious within a very short time. Most other available metals have such high melting points as to render the lamp slow and somewhat troublesome in starting, if it does not give trouble in other respects.

Dr. Wollastin's researches have proceeded along the line of the fusible alloys, beginning with Wood's metal and running through the considerable range of similar compounds containing bismuth, zinc, cadmium, lead, thallium and mercury. It very soon appeared as might reasonably have been expected, that low melting points are only an accident to the successful prosecution of the search for better material. Of far more importance is the production of homogeneous vapor at a reasonable working temperature. Finally, the experimenters settled on cadmium as the most suitable material. The melting point of this in vacuum is about 150 deg. C., its boiling point in air being 320 deg. The spectrum of cadmium contains one strong deep-red line, much stronger relatively than the red mercury line. With intensive working this line increases in brilliancy, as does also the red mercury line, so that in working with pure cadmium under these circumstances the tube appears red. This tendency is corrected by a very slight addition of mercury, which is stated to bring the color again into balance.

Some interesting data are given with respect to the performance of this lamp. The specific consumption is stated to run as low as 0.16 watt per candle in a lamp taking 600 watts and giving 3500 cp. As in the case of the ordinary quartz-tube lamp, the efficiency rises rapidly as the tube is worked more extensively. In the best referred to both poles are of the cadmium-mercury alloy. Experiments made with a graphite seal show most favorable results in efficiency. The relative balance between working and efficiency seems to be about the same as in the quartz-tube mercury lamp. How far the practical details of the lamp, particularly with respect to starting, have been worked out does not appear, certainly, although several means of starting are described as feasible. Obviously, there has been considerable consideration given to the starting of the lamp, but the results are not definite, although it is stated that a definite position of the lamp is required for starting, and that at least the recommended quantity of sealable vapor lamps and sealable vapor lamps are required for a satisfactory energy output.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Electrification of the Norfolk & Western Railway

As mentioned in last week's issue, the Norfolk & Western Railway has authorized the electrification of a portion of its mountain division. This will include the most congested section of the main line, and upon it will be handled a freight traffic that is one of the heaviest in the country. The electrified zone will extend from Bluefield, W. Va., across the summit of the Alleghenies to the town of Vivian, W. Va., which lies on the western slope of the mountains.

The problems involved by the local conditions are unusual. The use of a third-rail is said to be impracticable because the line runs through a number of mining towns at street level and because there is in addition a large and extremely busy yard where coal trains are made up. It will, therefore, be necessary for an overhead conductor to be used whether the system adopted is single-phase, three-phase or direct-current.

The service will naturally be of the heaviest class yet considered in connection with electrification, as 3250-ton trains are contemplated and these, on the 2 per cent grades, will require a total drawbar pull per train of approximately 150,000 lb. To handle the traffic twenty-five electric locomotives of exceptionally high power are to be purchased, the design to depend to some extent upon the electrical system installed. These will be used for both switching and main-line service as the 30 miles of route to be electrified contains enough yard trackage and sidings to bring the total single-track mileage up to 75. The service is, however, to be designed exclusively for freight trains as the coal shipments are far in excess of the passenger traffic on this section of the railroad.

### Preliminary Program for the N. E. L. A. Convention

Although the actual program for the convention of the National Electric Light Association at Chicago, June 3, 4, 5 and 6, has not been definitely settled so far as the arrangement of subjects by days and sessions is concerned, it is certain that there will be between sixty and seventy separate matters taken up and disposed of. As has been customary for years, the exhibition of apparatus will be opened on the night before the convention proper and followed by the reception to the president. There will be two sessions daily with two and three sections meeting in parallel as a general rule. The annual ball game is planned for the afternoon of June 4, and it is proposed to hold the second session of that day in the evening.

The following is a list of the regular reports, addresses and papers to be presented: President's address, by Mr. Frank M. Tait; secretary's report and progress report, by Mr. T. C. Martin; treasurer's report, by Mr. W. W. Freeman; insurance expert's report, by Mr. William H. Blood, Jr.; public policy committee's report and library committee's report, by Mr. Arthur Williams; constitution and by-laws committee's report, by Mr. Frank W. Frueauff; rate research committee's report, by Mr. E. W. Lloyd; membership committee's report, by Mr. Holton H. Scott; question box editor's report, by Mr. S. A. Sewall; accounting committee's report, by Mr. E. J. Bowers; prime movers committee's report, by Mr. I. E. Moultrap; lamp committee's report, by Mr. Frank W. Smith; meter committee's report,

by Mr. W. H. Fellows; report on the grounding of secondaries, by Mr. W. H. Blood, Jr.; report on electrical measurements and values, by Dr. A. E. Kennelly; overhead-line construction committee's report, by Mr. Farley Osgood; report of committee on electrical apparatus, by Mr. L. E. Elden; report of committee on terminology, by Mr. W. H. Gardiner; report of committee on underground construction, by Mr. W. L. Abbott; report of committee on street lighting, by Mr. John W. Lieb, Jr., and report of committee on memorials, by Mr. T. C. Martin.

### COMMERCIAL SECTION

The work of the Commercial Section will include an address by its chairman, Mr. E. W. Lloyd, and a special address on the education and training of salesmen, as well as the following reports of committees: Finance, by Mr. T. I. Jones; publication, by Mr. Douglass Burnett; membership, by Mr. J. F. Becker; electrical salesman's handbook, by Mr. E. L. Calahan; electricity on the farm, by Mr. John C. Parker; wiring of existing buildings, by Mr. R. S. Hale; ice and refrigeration, by Mr. G. H. Jones; electrical merchandising, by Mr. T. I. Jones; short cuts in executing customers' orders, by Mr. G. C. Holberton; steam heating, by Mr. S. M. Bushnell; advertising, by Mr. J. R. Crouse, and education of salesmen, by Mr. George Williams.

### HYDROELECTRIC AND POWER-TRANSMISSION SECTION

The work of this section will include an address by the chairman, Mr. W. N. Ryerson, and a special discussion before the section by an engineer from the Bureau of Standards of the subject of life hazard in connection with the transmission and distribution of power, which the bureau is to study next July with an appropriation of \$15,000 from Congress. The committee reports to be taken up are as follows: Receiving apparatus, by Mr. M. R. Bump; distributing lines, by Mr. P. M. Downing; operation of water-power systems, by Mr. D. B. Rushmore; membership, by Mr. R. J. McClellan; power-transmission progress, by Mr. T. C. Martin.

It is also proposed to discuss in this section the part of the report of the committee on prime movers relating to a special investigation of water-power plants and apparatus made by a sub-committee with Mr. J. F. Vaughan as chairman. The following papers have also been prepared: "Factors Producing Reliability in the Suspension Insulator," by Mr. A. O. Austin; "Transmission Lines," by Mr. R. D. Coombs; "The Mississippi River Power Company's System" (illustrated), by Mr. H. L. Cooper; "Lightning Arresters," by Mr. E. E. Freighton, and "The New Type of Thrust Bearing," by Mr. Albert Kingsbury. Some attention will be given to conservation, but the specifically political aspects of this will be reserved for the report of the committee on public policy.

### ACCOUNTING SECTION

The work of the Accounting Section will include an address by the chairman of the accounting committee, Mr. E. J. Bowers, and the following papers and reports: "Handling of Freight Bills," by Mr. A. S. Scott; "Handling of Bond Coupons," by Mr. C. S. Mitchell; "Accounting for Replacement of Plant Retired from Service," by







were doing and did not amount to invention by him. The mere fact that he may have made connections which produced beneficial results, without there being novelty in the arrangement of the parts, must not be deemed to be invention." The opinion held the patent invalid by reason of prior publications, prior uses, lack of novelty or invention, and furthermore because of the patentee's delays and laches.

The suit against the Butler Light, Heat & Motor Company was defended by the Pittsburgh Transformer Company of Pittsburgh.

### Convention of the Southwestern Electrical and Gas Association

The tentative program for the convention of the Southwestern Electrical and Gas Association to be held at Galveston, Tex., on May 21, 22, 23 and 24 has been announced. There will be parallel morning and afternoon sessions on May 21, the papers being devoted exclusively to railway and gas topics. At the morning and afternoon sessions of May 22 the following papers treating of electrical matters will be presented: "Erection and Protection of High-Tension Lines and Apparatus," "Oil Engines for Light and Power Plants in Small Towns and Cities," "Economical Operating of Light and Power Plants in the Small Town," and "The Proper Basing of Rates by Light, Power, Gas and Water Public Utilities in Texas."

A general session will be held on the morning of May 23, with a parallel session at the same time for accountants. At the general session the following papers are scheduled for presentation: "Fire Prevention as Fire Protection," "The Purification of Feed-Water for Steam Boilers," and the report of the secretary on the work accomplished and the future value of the secretary's office. The paper to be presented at the accountants' session will deal with the necessity of a standard system of accounting for the small and medium-sized public utilities of Texas. In the afternoon of May 23 the supply men's session and entertainment will be held. On the closing day of the convention reports of standing committees and temporary committees will be read and the election of officers and standing committees for 1913-14 will take place. The secretary of the association is Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

### Convention of the Oklahoma Gas, Electric and Street Railway Association

At the annual convention of the Oklahoma Gas, Electric and Street Railway Association, to be held at Oklahoma City on May 6, 7 and 8, the following papers will be presented: "Compensation of Gas Companies," by Mr. W. J. Dibbens, Guthrie; "Lightning Arresters," by Mr. W. B. Clayton, General Electric Company; "The 'Safety First' Movement," by Mr. George W. Knox, general manager Oklahoma Railway Company; "Relation of the Incandescent Lamp to Lighting Service," by Mr. J. W. Tabb, National Quality Lamp Division of the General Electric Company, Cleveland; "Solving the Small Power User's Problem," by Mr. J. W. Johnson, Wagner Electric Manufacturing Company, St. Louis; "Electric Oil Engines," by Mr. J. W. Dawley, treasurer and manager Hugo Ice & Light Company; "Electricity and Irrigation for Oklahoma Farms," by Prof. H. B. Dwight, University of Oklahoma; "Uniform Accounting," by Mr. Henry Wilmerding, Oklahoma Gas & Electric Company; "Liability Insurance," by Mr. F. H. Ellis, Kansas City, Mo.; "Legislation Affecting Public Utilities," by Prof. H. V. Bozell, University of Oklahoma, Norman, and "Gas Plant Operation," by Mr. W. H. Bagely, Tulsa. The Jovian Order of Oklahoma,

of which Mr. A. V. Hancock is alternate statesman, will hold its rejuvenation during the convention. The headquarters of the Oklahoma association and also of the Jovians will be the Skirvin Hotel.

### Meeting of Arkansas Public Utility Operators

At the annual meeting of the Arkansas Association of Public Utility Operators, which will be held at Little Rock May 5, 6 and 7, the following papers will be presented: "Operation of Small Central Stations," by Mr. W. H. Walkup, superintendent and chief electrician of the Batesville Electric Light & Power Company; "Relation of Public Utility Companies with the Public," by Mr. J. Walter Gillette, general manager of the Fort Smith Light & Traction Company; "Operation of Small Water Plants," by Mr. W. C. Maguire, manager of the Arkadelphia Electric Lighting Company, and Mr. E. T. Reynolds, superintendent of the Camden Power Company; "Benefits to Be Derived from the Association," by Mrs. La Salle Stoops, manager of the Stuttgart Water & Electric Company; "Modern Practice on Feeder and Voltage Regulation," by Mr. V. A. Hain, district regulator specialist General Electric Company, Chicago; "Effect of Tungsten Lighting on Revenue," by Mr. A. E. Main, superintendent electrical department Hot Springs Railway Company, and "Electric-Light Accounting Applied to Small Companies," by Mr. R. B. Fowles, auditor Pine Bluff Company.

### Annual Report of General Electric Company

The twenty-first annual report of the General Electric Company, covering operations for the year ended Dec. 31, 1912, and including for the first time the business formerly conducted by the Fort Wayne Electric Works, the Sprague Electric Company and the National Electric Lamp Company, shows that the value of the orders received during the year was \$102,934,788, while the amount of sales billed for the year was \$89,182,185.80. Competition in the several lines of business has continued to increase with the result that the percentage of profit realized from the sales of apparatus has materially diminished.

There was a steady and nearly uniform increase in the number of orders taken during the year, which, exclusive of the Fort Wayne, Sprague and National Electric departments, numbered 466,895. To provide for the increasing volume of business, the manufacturing facilities of the company have been substantially enlarged—the factory floor area being now 12,160,000 sq. ft. Over 60,000 persons are in the employ of the company. An expenditure of \$539,956.93 made during the year for the purchase of patents, for applications and licenses under patents and for miscellaneous patent expense has been charged to profit and loss, and the patent account remains at \$1.

The stocks and bonds owned by the company have a par value of \$23,013,764.54 and are carried at a book value of \$23,325,070.38 at Dec. 31, 1912. The principal change from last year is the transfer into the various asset accounts of the General Electric Company of its investment in the National Electric Lamp Company. The book value of current accounts and notes receivable was \$26,950,244.90 on Dec. 31 after making ample provision for possible losses. Of the accounts receivable only \$558,224.92 represents the face value of unsettled accounts originating earlier than Jan. 1, 1912. From affiliated manufacturing and selling companies there was due \$4,099,062.64, making a total book value of all accounts and notes receivable of \$31,049,307.54. The book value of all the manufacturing plants of the company at Dec. 31, 1912, was \$24,556,110.59. Of this \$1 represents the value of furniture and fixtures, \$1 the value of

patterns, \$9,176,985.86 the value of machinery, and the rest is represented by real estate and buildings.

On July 25 the issue of \$60,000,000 forty-year debenture bonds was authorized, and of these \$10,000,000 bearing interest at the rate of 5 per cent per annum have been sold. The capital stock of the company has been increased by the conversion of \$510,000 of the gold debenture bonds of 1907 and also by the issue of \$2,500 of capital stock in exchange for \$3,000 of the debentures of 1892. A stock dividend of 30 per cent out of surplus was declared on Oct. 11 for the purpose, it is stated, of recouping the stockholders in part for dividends passed or relaxed during the

## PROFIT AND LOSS ACCOUNT, GENERAL ELECTRIC COMPANY

Sales billed .....	\$89,182,185.80
Cost of sales .....	\$1,074,192.25
	\$88,107,993.55
Interest and discount, royalties and sundry profits .....	\$1,222,204.20
Income from securities owned .....	1,031,954.72
From increase in value of securities of companies owned, due to the increase in the surplus of those companies for the year, and profit on securities sold .....	1,466,348.97
	\$5,002,829.89
Interest and discount—deferred bonds .....	532,087.18
	\$ 5,534,917.07
Dividends paid .....	\$12,578,736.26
	6,213,173.92
Net surplus for the year .....	\$6,365,562.34
Surplus, Jan. 1, 1942 .....	29,019,892.52
	\$35,385,454.86
Less: stock dividend .....	23,354,310.00
Surplus, Dec. 31, 1942 .....	\$ 12,031,144.86

years 1893 to 1902. The capital stock of the company on Jan. 1, 1912, was \$77,335,200, and during the year there was issued in exchange for debentures \$512,500, beside a stock dividend of \$23,354,300, making the total capital stock issued \$101,202,000. The reserve against debentures is \$240,166.67 and the amount of stock unissued and unappropriated is \$3,557,833.33, making the total authorized stock of the company \$105,000,000. Quarterly dividends at the rate of 8 per cent per annum have been paid during the year. A condensed profit and loss account is given herewith.

# Theories of Electromagnetic Radiation

Addressing the Electric Club of Chicago on April 17, Dr. R. A. Millikan, professor of physics in the University of Chicago, commented upon the rapidity with which during the last three years the results of the most advanced researches in the field of the conduction of electricity through gases have been utilized in electric lighting and other electrical industries. He prophesied increased co-operation during the next decade between the research man and the engineer. He traced the great advances which have been made within the last ten years in our knowledge of the nature of the electric charge and of the electric current, but declared that the nature of electromagnetic radiation is as yet but little understood.

Recent work has well-nigh demonstrated the essential identity, in all respects save that of wave-length, of X-ray radiation and light or heat radiation, but at the same time it has brought to light effects which seem to be quite irreconcilable with any theory of ether waves where the radiated energy is distributed uniformly over the wave front. Such a spreading-pulse theory finds itself completely powerless to explain the now well established facts that though both X-rays and ultra-violet light eject electrons

them are a straight, parallel, function on the graph, the slope through which decreases as the energy level is increased. As compared to the common soft-ray spectra expected in practice, independent of the intensity of the X-rays or of the light, and is directly proportional to the hardness of the X-rays or to the frequency of the light.

While these and other newly discovered effects which were discussed do not seem to Dr. Millikan to point to a return to the abandoned corpuscular theory of electromagnetic radiation, he himself thinks that we should indicate that some way must be found to reconcile the long familiar properties of ether waves, such as the properties of interference, refraction, etc. with the property of transmitting energy in discrete units while retaining the same intensity along the line of propagation no matter what the distance from the source may be. A great deal of the recent work of the physicist seems to indicate that we are on the verge of learning more than we have hitherto known about the nature of that mysterious stuff which is now called the ether, which transmits electromagnetic waves through space. So far as we are talking we have not to save that it is the carrier of electromagnetic energy.

## Annual Banquet of Engineers at Boston

The fourth annual banquet of the Boston section of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Boston Society of Civil Engineers, was held at the Boston City Club on April 29, the guest of honor being Prof. Ira N. Hopper, of Harvard University, president of the Western Polytechnic Institute. The speakers, all of whom emphasized the growing importance of technical education and the rising standard of the engineering profession, were President Lowell of Harvard University, President MacLaurin of the Massachusetts Institute of Technology, Dr. Hollis, Hon. Charles G. Washburn, Acting President W. L. Hooper of Tufts College, Councilman William C. Bowles and Mr. Matthew C. Brush, second vice-president of the Boston Elevated Railway Company. The toastmaster was Mr. James W. Rollins, Jr.

## Convention of Mississippi Electric Association

The fifth annual convention of the Mississippi Electric Association was held at Natchez, Miss., April 20 and 21 and 22. Delegates to the convention met at 9 o'clock on April 21 and embarked on a river steamer for Natchez. The opening session was held on the steamer. The address of the president, Mr. S. H. Clappin, of Greenville, was followed by reports of committees on electric heating and power testing. An address of welcome was made by the Mayor of Natchez, who also suggested as a subject for that city in April next, January, a paper entitled "Large Power Plants" by Mr. S. H. Parker, son of Mr. W. C. Parker. The afternoon session was given over to reports of committees on the construction and the generation of electricity. The heart of the convention dinner was attended at 6 o'clock. A number of committees on membership, insurance and public relations were organized in the evening. The first of the evening and the following morning were given to "Singing Time" by Mrs. J. C. Jones, "Entertaining Time" by Mr. W. C. McWaters, and "Oratorical Time" by Mr. J. C. Smith. On the morning of April 22 the National Electric Board Association met in the forenoon. The session was presided over by Mr. W. C. Jones, president; Mr. S. H. Jones, secretary; treasurer, Mr. F. J. Duffy, Natchez. The convention closed with a banquet at the Natchez Hotel.



## Convention of Iowa Electrical Association

Meeting as a section of the National Electric Light Association for the first time, the Iowa Electrical Association held its thirteenth annual convention at Waterloo, Iowa, on April 23 and 24. The sessions were held in the new building of the Citizens' Gas & Electric Company, the main floor of which was given over to exhibits. Mr. W. H. Thomson, Jr., general manager of the Des Moines Electric Company and president of the association, opened the convention with his address, in which he enumerated several advantages to be derived from being affiliated with the N. E. L. A. He said also that the public and the corporation can best be protected by a utilities commission consisting of men of the same caliber as supreme court judges. Instead of five men each of whom draws a salary of \$3,000 a year, Mr. Thomson believes that better results would be obtained with three men drawing a salary of \$5,000 a year. The smaller electrical companies, not being considered as octopuses, and being thereby better fitted to mold public opinion than the larger corporations, were considered to be very desirable members of the association by Mr. Thomson.

Mr. H. E. Kiester, president of the Town Criers' Club of Waterloo, delivered an address of welcome to which Mr. H. C. Blackwell, of Davenport, responded. The remainder of the morning session was taken up with routine business.

As is customary each year, the Iowa Electrical Association selects the next year's meeting place and awaits an indorsement by the Iowa Street & Interurban Railway Association in order that the two conventions may be held at the same place and overlap. On the invitation of the Commercial Club of Cedar Rapids, both associations will meet in that city next year.

The reports of several committees were submitted at the afternoon session. Mr. T. A. Fish, chairman of the committee on grounded secondaries, said that the N. E. L. A. report on that subject could hardly be improved. A driven pipe not having more than 12 ohms resistance to ground is considered the best medium except where connections can be made with a water main.

### MOTOR LOAD

"Off-Peak Possibilities" was the title of the paper delivered by Mr. C. W. Drake, of the Westinghouse Electric & Manufacturing Company. Several interesting figures comparing the motor load of a manufacturing state with that of Iowa, an agricultural state, were given. The population per horse-power in Iowa is fourteen, while in Rhode Island it is two. On a basis of 1 hp per sq. mile these same states have 3 and 212. Iowa compares with the average state, however, in having 12 per cent of the total primary horse-power connected to central stations.

### Discussion

A short discussion followed in which Messrs. W. J. Young, R. E. Lee, W. H. Thomson and H. C. Blackwell took part. The main topic discussed was how to keep certain consumers off the peak.

### WELFARE WORK

Mr. E. M. Walker, of Dubuque, read a paper on welfare work for employees, in which he said that the movement cannot help but result in mutual benefit. Maximum efficiency can result only when there is a humane bond between master and worker. Different forms of welfare work, such as club rooms, mutual benefit funds and pension lists, have been successfully practised. Investment clubs offering opportunities to employees for obtaining increased profits on their savings have met with success in several instances. Co-operative buying of all necessities of life has lowered the living expense of employees in large cities.

### Discussion

In the discussion which followed Mr. Thomson told of

a practice instituted in Des Moines recently whereby any grievance or question which an employee wished to take up with the general manager is handled through a question box. The need of such a system is evident as the growth in population in many of the cities has prevented the intimate contact of employer with employee. Mr. Blackwell said that the People's Light Company, of Davenport, has conducted bi-weekly meetings for department heads and monthly meetings for employees, the purpose of which is to familiarize those present with the manner in which business is conducted. Messrs. Austin Burt and H. W. Garner also took part in the discussion.

### FACTS AND FACTORS

Mr. Austin Burt's report on facts and factors was read at the morning session on April 24 by Mr. I. L. Craig. It consisted of tabulated data compiled from reports sent in by central-station companies from thirty-eight towns in Iowa having from 750 to 90,000 population.

This coming year advantage will be taken of the offers made by Professor Fish, of the Iowa State College at Ames, to send representatives to central stations in Iowa to obtain data for the committee on facts and factors. It is hoped that by personal interviews some of the erratic figures hitherto obtained by mail will be eliminated.

### FEEDER AND VOLTAGE REGULATION

Mr. V. A. Hain, of the General Electric Company, read a paper on modern practice on feeder and voltage regulation, which was accompanied by pictures and curves. The effect of change of voltage on the candle-power and energy consumption of carbon and tungsten lamps was shown in figures and graphically. Poor regulation causes dissatisfaction on the part of the consumer and means a loss in revenue to the system. While a motor will ordinarily adjust itself to changes in voltage and carry the load, yet it means a higher  $I^2R$  loss through the whole system. Views and wiring diagrams showing connections of switch-type, induction-type and outdoor-type voltage regulators accompanied the lecture. Figures on the saving in feeder conductors when regulators are used were given.

### Discussion

Mr. Austin Burt, general manager of the Citizens' Gas & Electric Company, of Waterloo, gave a description of the company's power plant and substations, in which remarkable results are being obtained with regulators in the primary circuit of a four-wire, delta-connected, grounded-secondary distribution system.

### LINE EXTENSIONS IN RURAL DISTRICTS

A paper on factors determining rural line extensions was read by Mr. J. M. Drabell, of Cedar Rapids, who said that the development of rural transmission lines will progress much more rapidly when reliable and cheaper high-tension apparatus is put on the market. On account of the high initial investment required for high voltages, Mr. Drabell believes that 6600 volts is the limiting tension for any rural distribution line. He gave the cost of constructing pole lines and stringing wires for 2300-volt to 6600-volt systems as being from \$325 to \$425 per mile. The density of population being a major factor in line extensions, at least one customer per half mile should be obtained. For strictly rural service he advised having farmers construct their own lines. Where electricity is to be transmitted to a distant point, he felt it best to build the line first and canvass the farmers along the route later. A form of contract used by the Cedar Rapids & Iowa City Railway & Light Company for this service was read.

### HIGH-TENSION TRANSMISSION LINES

The paper read by Mr. H. W. Garner, general manager of the Oskaloosa Traction & Light Company, of Oskaloosa, was on the detail and design of high-tension transmission lines. The paper consisted of a résumé of the present types



of line construction in Iowa, some details of transmission line construction and the actual cost of a 11,000-volt steel pole line being given. The style and cost of construction of small lines should to a certain extent depend on the probable amount of revenue obtainable from the localities supplied. For lines radiating from one small locality to other small towns, Mr. Garner advised the use of wooden-pole, single-phase lines at prices ranging from \$200 to \$1,200 per mile complete. For lines radiating from large central stations to various localities with prospective extensions, he advised the most sturdy type of construction protected by every device which will aid in giving reliable service.

An 11,000-volt, three-phase line running from Oskaloosa to New Sharon on steel tripartite poles a distance of 16 miles was constructed by Mr. Garner in 1912. The average cost of construction was \$982 per mile.

Mr. Rufus E. Lee, general manager of the Lee Electric Light Company, of Clarinda, spoke on the details of operation and maintenance of high-tension transmission lines. To prevent short circuits on lines, he said that all trees which are close enough to the line to cause trouble should be cut down. When this is not possible the line should be run above them. Grading should be done where practicable to prevent strain on the wires. Where extra safeguard is desired, as over highways and railroads, the spans should be made short and of extra-heavy wire double-tied to insulators. In order to locate trouble along transmission lines in a better way than when it is reported by farmers, he advised having blueprints made showing the relation of the line to the adjoining farms. On a 13,200-volt transmission line built by him 23,000 volt insulators are used as an additional precaution against lightning, and in tying line wires on insulators two sets of Buffalo grips are used to avoid breaks due to nicks in hard-drawn copper conductor. Where there are several fairly well populated rural districts close together alongside of a high-tension transmission line, Mr. Lee suggested running a 2300-volt line parallel to the main line and feeding it from the center each way with standard transformers. Each rural district can then be supplied with electricity from the 2300-volt line through standard instead of special transformers. Data were given on the cost of constructing a line starting east from Clarinda on steel tripartite poles set in concrete. An average of \$600 per mile was expended on the first 12 miles of the line and \$800 per mile on the last 12 miles. Long haulage of poles and construction supplies is said to account for the increased cost on the latter.

#### Discussion

The extent of the liability on companies transmitting high-voltage electricity as regards telephonic disturbance was the subject of the discussion which followed. It was held that telephone companies must show complete line construction before the transmission company is liable for any disturbance. Mr. Lee said that his company instead of moving a telephone line half a mile away to avoid disturbance, Mr. Drabell believed it sufficient to have telegraph and telephone lines on opposite sides of the same right-of-way.

Mr. Lee claimed that it is profitable to extend a line 7 or 8 miles to supply 500 people with electricity in such a ten-year contract for street lighting in the district as

passes the extension. He also believed that the Iowa association should suggest the voltage above which insulation should not be required on high-tension lines.

#### Equipment of Oskaloosa Central Switchboard

Prof. A. H. Ford's paper on the arrangement of switchboards for parallel operation of alternators was accompanied by vector diagrams showing the effect of changes in field excitation on the power-factor. A diagram of a switchboard for parallel operation was shown, which Professor Ford recommended for both large and small stations.

#### Discussion

In the discussion Mr. McMillen spoke of replacing the power factor meter by a lamp which would indicate either the power leading or the power lagging on the power. Mr. Drabell suggested using the ammeter which could be thrown into any phase desired.

#### Business of Oskaloosa

At the executive meeting which followed this discussion Messrs. A. L. Dodd, of Charles City, and Rufus E. Lee,

of Clarinda, were announced as being elected to the office of president and vice-president respectively. Mr. Dodd is secretary and treasurer of the Charles City Light & Heat Company and is one of the largest stockholders. Previous to the eight years which he has been in the service of that company he was connected with the Illinois Central Railroad. Messrs. H. B. Maynard, of Waterloo, and W. A. Mah, of Belle Plaine, were re-elected secretary and treasurer respectively. Two changes were made in the executive committee. Messrs. A. D. Ayres, of Keosauqua, and F. C. Jones, of Carroll, were appointed.

#### Important Features

Directly following the afternoon session on April 23 those attending the convention were taken for an automobile ride around the grounds and business districts of Waterloo.

In the evening the members of the association were the guests of the Oskaloosa Gas & Electric Company at a dinner party. After the dinner practically everyone attended a smoker held in the new building, which the local utility company has just constructed.

On April 24 (SATURDAY) late in the morning, Canon Falls & Northern Illinois companies were gathered and all attending the convention were taken on to the Oskaloosa Gas & Electric Company grounds where Mr. Barry presented a tour of inspection.

Mr. J. W. E. Smith, of the Oskaloosa Gas & Electric Company, gave an interesting lecture on power on railroad lines, before a large audience consisting of members of the association and the public. The lecture was held in the new building on the Oskaloosa grounds on Monday night, April 22, 1913. The program was as follows:

On the evening session preceding the convention a party consisting of about 500 members of the Oskaloosa Gas & Electric Company, headed out near Northwestern for a gathering at the hotel where the convention session and other business of the association is being held.



A. L. DODD

## Pittsburgh Meeting A. I. E. E.

The account published last week of the Pittsburgh meeting of the American Institute of Electrical Engineers gave a summary of the proceedings up to the afternoon session on April 18. The remaining papers and discussions of the meeting are given in abstract below.

### CENTRAL-STATION ENERGY FOR MINES

According to the author, Mr. J. S. Jenks, central-station service has been very greatly handicapped for use in mines by the prejudice of mine inspectors and by engineers who maintain it is not reliable and is more dangerous and more costly than other forms of energy. It requires a period of years to demonstrate the reliability of central-station service to them, and even after the operators are convinced the inspectors often prohibit its use for one reason or another.

After describing his company's early installations, Mr. Jenks said the West Penn system has now seventy-six coal mines on its lines with an aggregate load of 14,831 hp and is at present connecting ten installations with a total of 5701 hp, making a total of 20,532 hp. Mr. Jenks hopes soon to have 30,000 hp of coal-mining load on the company's lines.

### CHARACTERISTICS OF SUBSTATION LOADS AT THE ANTHRACITE COLLIERIES OF THE LACKAWANNA RAILROAD

A series of tests were made by Messrs. H. M. Warren and A. S. Beisecker on the substations which supply energy to the direct-current machinery in the mines of the Lackawanna Railroad, and the details appear in their paper. Fifteen of the substations, varying in size from 150 kw to 700 kw, were covered. Following a short description of the substation equipment and of the various classes of machinery operated with it, there is given an explanation of the method and scope of the tests. The variations in diversity and load factors were studied particularly, and the results of the tests along these lines are summed up in three sets of curves, showing relative variations for fixed periods. The economic significance of the tests is brought out. From their observations the authors advise in general against the installation for this class of work of a converter smaller than 200 kw and state further that, in case there is a probability of the load growing rapidly, a 300-kw unit will be cheaper eventually. They also say that, even though the initial cost may be greater, the installation of a motor-generator set instead of a converter will often work out advantageously in the long run, owing to improvement of the power-factor and of both the alternating-current and direct-current voltage regulation.

### Discussion

In the discussion of the last paper Mr. Bright stated that the integrated peak and not the block peak was the proper one for determining the fixed charge.

Mr. Thomas thought there should be a common basis of understanding of the proper definition of load-factor, thus eliminating the trouble of changing from one definition to another.

Mr. Clayton said, in referring to Mr. Beers' paper, that a mine with a load-factor of 50 per cent secured energy at a cost of 0.008 per kw-hr., whereas had the load-factor been 20 per cent the cost would have been 1.8 cents, and if the load-factor had been 15 per cent the cost would have been 2.4 cents per kw-hr., assuming in these figures 43,800 kw-hr. A load-factor even of 20 per cent would hardly be secured in an average installation in Illinois, and he believed that the publication of such costs was likely to create a wrong impression unless the load-factor was given at the same time.

Mr. Pen Dell said load-factor is the ratio of the average load for twenty-four hours to the maximum demand, which later may extend over a period of five minutes or an hour.

A load-factor of 40 per cent on a five-minute peak would become 85 per cent on a thirty-minute peak. Some contracts are based on a peak of one duration and some on a peak of another, but the formula remains the same and has nothing whatever to do with the size of the installation. The integrated peak is the only proper one for determining maximum demand. Peaks of five, fifteen, thirty and sixty minutes are all in common use, each one for a specific service, the last one being used for large interurban railways and similar service.

Chairman Wood said he was not surprised that the coal operator was often dubious about the rates and would not blame him if he insisted on a rate based on a ton of coal mined.

Mr. Lincoln called attention to the one-minute peak, in addition to those mentioned, used by the Niagara, Lockport & Ontario Power Company. He believed load-factor is a function of the load and equals the average kilowatt-hours divided by the kilowatts integrated over any given time and not restricted to any period of time.

Mr. Pen Dell did not agree with the chairman on the proposition to base price of energy on the tonnage of coal, as it placed all the risk for inefficient operation of the mine on the central station. The company with which he is connected (the Public Service Company of Northern Illinois) takes customers on a basis of 75 per cent power-factor. The operating department had suggested the use of synchronous machines for mine customers to boost the power-factor, but the commercial department had objected, owing to complications, and claimed that if the company wanted to correct power-factor it could put machines in its own plants. He described an instrument for measuring the peak which makes use of a clock set to indicate the time and which automatically stamps the value of the peak through a typewriter ribbon. He formerly used graphic meters but took them out on account of the too close reading necessary where large values are involved.

### ELECTRICITY AS APPLIED TO MINES FROM A PRACTICAL STANDPOINT

Judging from the applause it received and the laughter it created, perhaps the most interesting paper, in many ways, of the meeting was that presented at the opening of the Saturday session by its author, Mr. J. W. Hopwood.

The author said that the location of the mine had a great influence on the quality of labor employed. It was generally in an out-of-the-way place, possessing no community benefits, and consequently men were averse to living there. He was of the opinion that central-station service would tend to improve this. He has seen power houses at mines in all conditions. The generating equipment is usually placed near the mine on account of cheap coal transportation, and the engine equipment is nearly always single-cylinder, non-condensing, a compound or condensing engine being a rarity. Future growth is provided for occasionally by leaving room for another engine. Further than this nothing is done. All temporary work done around a mine generally becomes permanent; no reports are kept, no indicators are owned or used, and a graphic record of the load on is an unknown quantity. It is no uncommon sight to find an engine running along with a piston ring broken into three or four pieces. A mine boiler house is usually synonymous with trouble, worry and insomnia. The feed-water heaters are usually too small, insufficient draft is provided and no tests are ever made. In fact, as long as the fires burn fairly well, water is forced in, some steam is got out and the walls stand up it is considered all right. Repairs are made only when necessary to keep things going. The transmission of energy is the most important item, Mr. Hopwood said, and many troubles are due to an inefficient transmission, particularly to excessive drop. Equipments designed for 250 volts often are working on 75 volts. Armature repairs are consequently excessive, the author having seen as



many as fifteen armatures taken from a mine at one time. This inefficiency in electrical operation reacts on all other forms of energy around the mine. It produces slow speed of haulage which reduces tonnage, causes breakdowns, delays operation of the mine, and the men operate at about 30 per cent efficiency. Central-station energy, while not by any means a panacea for these ills, will greatly alleviate them because of its many advantages. He suggested that, as pumps usually run only at night, an alternating-current motor might be used to drive them and to drive a direct-current generator in the daytime. The author objected to the inaccessibility of mine locomotives for purposes of repair.

#### Discussion

Mr. Bright in discussing Mr. Hopwood's paper, said that the small mine often could not afford to pay for expert engineering service.

Mr. N. W. Stover suggested that the mines committee secure the adoption of standards for mines, especially regarding gages and heights of trolleys. Further discussion brought out the fact that central-station engineering service to be of real service must be based on actual knowledge of mine work. Many good engineers fail because they are not aware of the actual conditions for which they make recommendations. All apparatus used should be standard so as to facilitate repairs. Comparing a rotary and a motor-generator set, the former is more efficient by 10 per cent, but this should be based on 50 per cent load. If the former drops its voltage owing to drop in speed, etc., it loses that 10 per cent advantage. The motor-generator compounded from 250 volts to 275 volts has proved quite successful. Mr. Biesecker stated that the Delaware, Lackawanna & Western plant had 30,000 hp connected and twenty-five substations. Troubles there with low voltage were due mostly to a drop between substation and locomotive caused by poor bonding. To correct this the company has paralleled the track with steel rope, discarded from haulage use, and cross-bonded to the track with it. The company's experience with two three-wire stations had been very unsatisfactory. Wire in conduit is to be avoided in mine work, he said, as sulphur water attacks the pipe and honeycombs it. Likewise his experience with rotaries in the mines has not been good. The place for substations, in his estimation, is not in the mine. His company uses flat compounded machines.

Chairman Wood believes all mine people agree that substations should not be placed in the mine. He is also in favor of limiting the potential of circuits in mines to 300 volts.

#### MINING LOADS FOR CENTRAL STATIONS

MESSES. W. Sykes and G. Bright give in this paper a comprehensive outline both of the various applications of electricity in mine operation and the proper basis for fixing rates for such service. In general, the energy supply to a mine is used in haulage, hoisting, ventilation, cable cutting, pumping, tippie or breaker operation, machine and blacksmith shop drive, and lighting. As a rule, the haulage load is very ragged, as to both power-factor and load-factor, a great deal depending on the character of the conveying apparatus used. A hoisting load is also apt to be very unsteady, the amount of variation depending on the nature and extent of the hoisting done. The ventilating load is such as to improve the load factor and regulation but not the power-factor. While the load-factor of a single cable-cutting machine is low, where there are a number supplied the combined load-factor is fairly high. The pumping load greatly increases the total load factor for the same volume of its even and continuous character. The load factor is fair and the power-factor poor on tippie or breaker service. Both the machines and blacksmith shop drive and the lighting take so little of the total energy that they do not materially affect the combined load-factor or power-factor

for the mine as a whole. A comparison is then drawn between the "flat rate," "maximum demand" and "combined flat rate and fixed charge" systems of determining rates and the advantages and disadvantages of each are explained. The methods of measurement for use with these different systems are touched upon and the effects of power-factor, load factor and diversity-factor on the rates considered. The paper closes with suggestions as to the items to be included in a contract for central-station power for mining operations.

#### Conclusions

Mr. Lincoln said the ideal rate should take into account load-factor, power-factor, quantity and time of peak, should be easily measured and, furthermore, easily explained to the customer. However, the best that can be done is to effect a compromise on the points over which differences occur. The rate should depend on the maximum demand plus kilowatt-hours consumed, and should also take into consideration the power-factor of the load.

Mr. Seaton, who is connected with a plant having a rating of 40,000 kw, the output of which is used chiefly in mines, said he tried to secure an ideal rate but failed. For loads running from 10 to 150 kw, the peak-load limitation is five minutes and the circuit-breaker is set at 100 per cent overload, time per hour to make the peak-load limitation is ten minutes and the circuit-breaker is set at 75 per cent overload, but loads over 150 kw the peak limitation is ten minutes and the circuit-breaker is set at 50 per cent overload. In this manner practically all classes of service are covered. The speaker quoted several rates based on maximum charges with the resulting diversity-factor. He does not approve of underground substations, but advocates their relocation, which has been the policy of his company in securing mine business. Two locomotives, he said, with proper voltage, can do more work than three at ordinary mine voltage. The company uses one form of standard contract in which the rate is \$12 per kw, plus 15¢ per kw-hr. subject to discounts in steps of 40¢ per kw. This is equivalent to from 1.35 cents to 0.006 cent per kw-hr. on a consumption of from 10,000 kw-hr. to 30,000 kw-hr. His company is endeavoring to sell service, knowing the operators want reliable service and not cheap energy. The system is operating at 440 v. which will no doubt have been made to correct the power-factor as yet.

Mr. Swann believed a standard to be an interesting current proposition, even though the mine be equipped with direct current. Mr. Bright said that where the name-plate rating is used to determine the fixed charge it places a burden on the mine owner to make the maximum load stand up to its full rating.

Mr. S. P. Sever, of Syracuse, N. Y., who has made a particular study of the question, stated that he regarded central station rates getting down to a service plus a kilowatt-hour charge. The number consumed is determined at night and the only fair way to determine a peak is by an ammeter on the generator of the prime mover. The objection with some has been that the former being life is very hard to handle than the latter. The speaker advocated applying a proportional rate with the following proposition, which he had considered fully several times. The central station company offers to set up an agreement for one year and to make a load of 100 kw. at that time the company is to be paid 1¢ per kw. and with the agreement the second station takes back the half-year percentage to the first station the amount is paid for it at first.

There were two questions the question time was opened and several pertinent questions pertaining to the operation of load stations were asked. The speaker said that he would be glad to answer them and would be pleased to refer to them in some number of articles in the future.



## Interest of Minority Stockholders in Public Utilities to Be Established

A suit recently filed in the Superior Court of Cook County, Illinois, is of unusual interest because it strikes at the fundamental relationships between the parent Bell Telephone Company and its subsidiaries which our readers will recall have been the subject of recent investigations by the federal Department of Justice. This department turned over its findings to the Interstate Commerce Commission, which, it is understood, will conduct a complete investigation on its own account. The present suit is one in equity against the Central Union Telephone Company, the Chicago Telephone Company, the American Telephone & Telegraph Company and certain individuals, William A. Read, Charles J. Spencer and Charles G. Foster, as complainants, the latter being stockholders of the Central Union Telephone Company and holding a minority interest therein. The bill of complaint asked for an injunction against the Central Union Telephone Company and the appointment of a receiver, on the basis of certain allegations set forth in much detail in the complaint. The immediate cause of this action on the part of the complainants was the alleged intention of the board of directors and the officers of the Central Union Telephone Company to dismember the property of that company, which is situated in the States of Ohio, Indiana and Illinois, and dispose of the plant in return for certain outstanding 6 per cent demand notes held by the American Telephone & Telegraph Company and the Central Union Company, amounting to \$32,000,000.

It is set forth in the complaint that the Central Union Company was one of the original subsidiaries of the Bell system and was organized in 1883 to do business in Ohio, Indiana and Illinois, with the exception of certain counties, which included among other places the cities of Chicago, Cleveland and Cincinnati. The parent company, it is alleged, also withheld the right to transact the toll and long-distance business between points within the territory situated more than 100 miles apart. The total outstanding capital stock of the Central Union Company is now \$5,450,927, and it is charged that with the exception of about 2000 shares the entire capital stock is owned or controlled by the parent or American Telephone & Telegraph Company. The three individual complainants set forth that they collectively own 829 shares of the stock, which represented an original investment on their part of about \$91,000. The bill of complaint took up at considerable length the contractual relations between the parent Bell company and its subsidiaries, including the agreement of 1902, under which the Central Union Company paid to the American Telephone & Telegraph Company  $4\frac{1}{2}$  per cent of its gross revenues to cover the rental of transmitters and receivers and the general right to do business under the patents owned or controlled by the parent company.

Since about 1896 the Central Union Company has paid no dividends on its capital stock, and the outstanding amount of the latter has not been increased. Subsequently bonds were issued to the amount of \$6,000,000, and other financing was effected from time to time by loans from the parent Bell company, in return for which the Central Union Company gave its 6 per cent demand notes, and which now amount to some \$32,000,000, about \$10,000,000 of which is held by the Chicago Telephone Company, with the balance in the hands of the parent company. The bond issues were recently re-funded although they had not reached maturity.

The complainants charged that it was the purpose of the officers of the Central Union Company early during the present year to sell the tangible assets of the company in the State of Illinois, including franchise rights and good will, to the Chicago Telephone Company for the sum of about \$8,900,000, or substantially the amount at which the physical plant in Illinois is carried on the company's books.

This procedure, the complainants argue, would defraud them of any returns on their stock, and they charge in general that the management of the Central Union Company has at all times been under the complete domination and influence of the parent Bell company and that the result has prevented the minority stockholders from participating in their just share of the company's profits. It is also charged that the commissions allowed the Central Union Company on originating long-distance business and the arrangements for prorating long-distance tolls on messages handled over joint lines have been inadequate and unfair to the Central Union Company. Furthermore, it is alleged that because of the control exercised by the parent Bell company the Central Union Company has been prevented from handling much of the long-distance business which originates and terminates within its own territory and has been unable to make contracts with the parent company on terms as advantageous as would be the case if such control had not been exercised. The individual defendants named in the bill include Mr. B. E. Sunny, president of the Central group of Bell subsidiary companies and a vice-president of the American Telephone & Telegraph Company; Mr. T. N. Vail, president of the American Telephone & Telegraph Company; Mr. U. N. Bethell, vice-president of the American Telephone & Telegraph Company, and Messrs. L. C. Richardson, A. Burt, C. E. Mosley, B. S. Garvey, H. F. Hill, J. Sherwin, C. H. Brownell, E. E. Jackson, L. N. Whitney and W. I. Mizner, directors or officers of the Central group of Bell companies.

The defendants in their answer denied that the parent Bell company had ever exercised any improper control or influence over the Central Union Company and alleged that the contractual relations between the two companies were in all cases fair and equitable. They also stated that during the early period of development, when the Central Union Company was embarking in the exchange business, it was necessary for the parent company to retain the right to handle long-distance messages and to build and operate the plant therefor, because the local company was unskilled in the long-distance art and, generally speaking, incompetent to engage in that branch of the business, which was regarded as presenting great difficulties and obstacles. The answer also specifies that the parent company renders various engineering, legal and other services to the subsidiary companies, which much more than compensate for the  $4\frac{1}{2}$  per cent of the gross revenues of the subsidiary companies which is exacted as royalty.

## Public Service Commission News

### INDIANA COMMISSION

Governor Ralston of Indiana has named three members of the Public Service Commission of Indiana, which began its duties on May 1. Mr. Thomas Duncan, Princeton, and Mr. James L. Clark, Danville, have been appointed to serve four years, and Mr. Charles J. Murphy, Brookston, has been appointed to serve for two years. Messrs. John F. McClure, Anderson, and Frank E. Payne, Jeffersonville, the two members of the Railroad Commission of Indiana whose terms have not expired, are continued in office under the utility commission act. Mr. Burt New will be the general counsel of the commission and will serve as legal adviser of both the Governor and the commission. Mr. Duncan will be the chairman of the commission.

### MISSOURI COMMISSION

Governor Major of Missouri has announced the appointment of Mr. John M. Atkinson, former assistant attorney general; Mr. John Kennish, former Supreme Court judge; Mr. H. B. Shaw, dean of the engineering department of the Missouri State University, and Mr. Frank A. Wight-

man, of the Missouri Railroad Commission, as members of the Public Service Commission created by the recent Assembly. Mr. Wightman's term will expire on April 15, 1915. Mr. Shaw and Mr. Kennish are to serve four years. Mr. Atkinson is to serve for six years. This leaves one member still to be appointed. Mr. Atkinson has been elected chairman of the commission. A question having arisen in regard to the present status of the Public Service Commission of St. Louis, City Counselor William E. Baird of that city reported to the Municipal Assembly in part as follows: "The local body may continue to make investigation concerning matters connected with franchises of public utilities and violations of them in order that the best interests of the city may be protected by the proper authorities; to investigate methods of operation, facilities furnished and quality of service given, in order that the Assembly may, if it sees fit, cause the matter to be brought before the State Commission, or in order to afford the results of its investigation to the public who may desire to take such action, and to furnish information to the Municipal Assembly concerning the granting of its consent for the operation of a street railroad or the execution of contracts between the city and the public utilities companies. I am of the opinion that the city has the power to continue the commission for these purposes."

#### NEW YORK COMMISSIONS

The New York Public Service Commission for the First District has issued an order requiring all public-service corporations to adopt certain safety appliances and to take certain precautionary measures to protect their employees against injury by contact with conductors charged with electricity. The order covers twenty-eight different points.

The Public Service Commissions have assumed jurisdiction of baggage and transfer companies. The new law places under the jurisdiction of the commissions all baggage and transfer companies which are operated wholly or in part upon or in connection with a railroad or a street railroad. It gives to the commissions jurisdiction over such companies to the same extent as is now had over railroad corporations and street-railroad corporations in matters pertaining to rates, service and capitalization. The same provision made in relation to the liability for loss, damage or injury to property in transit which has existed in relation to railroads is now applicable to baggage and transfer companies.

#### MARYLAND COMMISSION

The Maryland Public Service Commission has decided that the Consolidated Gas, Electric Light & Power Company of Baltimore cannot be compelled to furnish alternating-current or direct-current service at the option of the consumer. A manufacturing concern sought to have the commission compel the electric-light company to supply alternating current which it desires to use in an electrical welding process. The Consolidated company refused on the ground that the factory is in the territory supplied with direct current and that it would prove too expensive to run a special line from its power station. It asserted that the direct current could be converted into alternating current by the use of a motor-generator which the consumer could supply. The cost of running a special wire to the factory would be \$604 and the line rental would be \$48 a year, while the return to the company would be about \$37 a month.

#### WASHINGTON COMMISSION

The Public Service Commission of Washington recently decided against the contention of Puget Sound Traction Light & Power Company of Seattle that it be permitted to put into effect without the usual thirty days' notice a rate intended to touch only those who would guarantee a minimum of business amounting to \$10,000 and sign a ten-year contract.

#### MASSACHUSETTS COMMISSION

An appeal has been presented to the Gas and Electric Light Commission by the Ludlow Manufacturing Company, of Ludlow, against a franchise granted by the Selectmen of the town to the Warren Power Company authorizing the latter to erect lines for the transmission of electrical energy within the municipality at pressures not exceeding 11,000 volts and to install distributing lines, provided that by Nov. 25, 1914, the company is ready to deliver 1000 hp for sale within the town. By Chapter 200, Acts of 1899, the Ludlow company was authorized to manufacture and sell electricity for lighting and other purposes in the municipality, and it has engaged in this service since 1899.

#### NEW JERSEY COMMISSION

Governor Fielder has signed the House bill giving the Board of Public Utility Commissioners authority to direct street railways to place tracks, wires and appurtenances on certain public bridges when there is a dispute as to the right-of-way between the railway company and the municipalities. He has also signed the bill increasing the annual appropriation of the Board of Public Utility Commissioners from \$100,000 to \$200,000, and has signed the bill giving the Board of Public Utility Commissioners power to authorize electric railways to operate freight cars through municipalities which object to the operation of such cars.

## Current News Notes

WARSHIP ORDER TO COLLEGE WARSHIPS. SECRETARY of the Navy Josephus Daniels has withdrawn the offer of warships for the use of college students during the summer months (which was reported in the *Electrical World* on page 562 in the March 15 issue). Sending the fleet through the Mediterranean will make it necessary to lay most of the ships now in reserve for various details. Consequently none will be left available for the use of college boys.

\* \* \*

CHICAGO PAPERS FOR PRIZE COMPETITION. A COMMITTEE of the Commonwealth Edison Company, Secretary of the National Electric Light Association, of which Mr. C. B. Smith, past-chairman, was president, has reported on the papers read before the section since the Southwestern convention to be entered for the competition for the Doherty and Harriet Billings medals. The papers selected are by Mr. W. L. Abbott, on the Northwest Station of the Commonwealth Edison Company, Chicago; Mr. W. J. Norton, on electric rate making; and Mr. A. D. Bailey, on human engineering.

\* \* \*

EDUCATIONAL ENTERTAINERS OF THE BALTIMORE SECTION. N. E. L. A.—In order to maintain a steady interest in the section work and to secure a full attendance throughout the winter, the Baltimore Section of the N. E. L. A. has devoted much time during the past few months to educational department group meetings. The monthly program has been as follows: On the first Tuesday of each month the entire membership has been addressed by Dr. T. B. Wheeland, professor of applied electricity, Johns Hopkins University, who has presented the subject in all elementary way. On the second Tuesday evening of the month meetings have been held in the Baltimore Laboratory of the company for the purpose of facilitating the membership to have the benefit of experimental work in connection with the subject presented by Professor Wheeland on the previous meeting night. On the third Tuesday of each month a discussion group meeting schedule has been arranged, adhered to, consisting of groups of men of the various departments. On the fourth Tuesday of each month the general meeting of the company's section is held.



**MAYOR HARRISON ON CHICAGO TRACTION.**—In his annual message to the City Council of Chicago, presented on April 28, Mayor Harrison criticised existing local transportation systems and urged a referendum on two traction plans—one authorizing a comprehensive system of independent subways and the other a merger of existing elevated and surface lines.

\* \* \*

**LOCAL CONTROL OF UTILITIES IN CHICAGO.**—One of the pending measures relating to public-service commissions in Illinois is known as the Glackin bill. It directs that the Mayor of Chicago appoint a commission to control public utilities in that city. The City Council of Chicago, however, has decided by a vote of 28 to 23 to oppose any bill which would decrease its powers. Mayor Harrison in his annual message spoke approvingly of the Glackin bill.

\* \* \*

**ADVANCED TELEPHONE ENGINEERING COURSE AT LEWIS INSTITUTE.**—Mr. Arthur Bessey Smith, formerly professor of telephone engineering at Purdue University, will give a course of lectures on advanced telephone engineering at Lewis Institute, Chicago, beginning June 6, 1913. A laboratory course will be given in parallel with the lectures, which will be delivered on Monday and Wednesday evenings. The course includes twenty lectures, the title of the first one being "The Problems of the Telephone." The principal features of telephone engineering will be discussed in this course of lectures.

\* \* \*

**"NICKEL-FIRST" TELEPHONE SERVICE PREFERRED TO "NICKEL-LAST."**—Following instructions from an aldermanic committee investigating telephone rates, City Electrician Palmer's assistants asked 521 subscribers to the nickel-first service of the Chicago Telephone Company if they were satisfied with that service. Of this number 347 were satisfied and 174 preferred the "nickel-last" method. By the former system it is necessary to drop a nickel or slug into the coin box before establishing communication with "Central" unless some push-button or other method of calling is provided to be used in emergency.

\* \* \*

**EXAMINATION FOR HYDROELECTRICAL ENGINEER.**—An open competitive examination for hydroelectrical engineer will be held soon by the United States Civil Service Commission to fill vacancies in the Forest Service, Department of Agriculture, and the Reclamation Service, Department of the Interior. Applicants must be between twenty-five and forty-five years of age and should be qualified to conduct expert examinations of water-power sites, possess theoretical and practical knowledge of hydrology and river hydraulics and also be thoroughly familiar with the design and operation of hydroelectric plants and have had special experience in testing, installing and operating them for supplying energy and for industrial service and irrigation pumping. The salaries range from \$1,800 to \$2,400 per annum. Full information regarding this examination may be had by applying for Form 304 of the United States Civil Service Commission, Washington, D. C., prior to May 19, 1913.

\* \* \*

#### SOCIETY MEETINGS

**REJUVENATION IN WATERLOO.**—A dignified rejuvenation of the Jovian Order was held in the Knights of Pythias Building, Waterloo, Ia., on the evening of April 24, during the convention of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association. Forty candidates were initiated into the order, including a number of well-known public-utility operators. Mr. N. W. Lovegrove, of Des Moines, statesman for Iowa, was in charge of the initiation. He was assisted by a number of Chicago Jovians, including Mr. Sam A. Hobson, past-Jupiter, who presided. A buffet supper was served after the ceremony.

**RAILWAY ELECTRICAL ENGINEERS' CONVENTION.**—The Association of Railway Electrical Engineers will hold its annual convention in the Hotel La Salle, Chicago, from Oct. 20 to Oct. 24, 1913. Mr. W. J. Cartwright, of the Lehigh Valley Railroad Company, is president of the association, and Mr. J. A. Andreucetti, of the Chicago & Northwestern Railway Company, Chicago, is secretary. During the convention the Railway Electric Supply Manufacturers' Association, will give its annual exhibition. Mr. G. H. Atkins, of the Electric Storage Battery Company, is president of this association, and Mr. J. Scribner, of the General Electric Company, Chicago, is secretary.

\* \* \*

**FREIGHT HANDLING AT BOSTON TERMINALS.**—At a joint meeting of the Boston Society of Civil Engineers and the Boston branches of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers on April 25 a paper on the delivery and handling of freight at the Boston terminals was presented by Messrs. Harold Pender, H. F. Thomson and C. P. Eldred, of the Massachusetts Institute of Technology. The paper, which will shortly be published by the Massachusetts Institute, contains an exhaustive account of the methods of analyzing terminal operating conditions at Boston, with load curves, diagrams and data indicating the best methods of eliminating delays, recent improvements and the detailed distribution of time in the various steps between the arrival of freight and the racking of the bills.

\* \* \*

**JOINT MEETING OF ENGINEERS IN CHICAGO.**—A joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers was held in Chicago on April 28. Officers for the Chicago Section of the Institute were elected as follows: Chairman, Mr. D. W. Roper; secretary, Mr. E. W. Allen; member of executive committee, Mr. R. H. Rice. The old members of the executive committee are Messrs. J. G. Wray and W. B. Jackson. Dr. W. F. M. Goss, of the University of Illinois, president of the American Society of Mechanical Engineers, presided at the meeting. The principal speaker was Mr. R. D. Mershon, president of the American Institute of Electrical Engineers. Mr. Mershon spoke of the desirability of close co-operation between national engineering societies and mentioned the proposed licensing of engineers in New York State as a subject considered by a committee representing several of the societies. He said that the engineer has not taken that part in civic affairs which he should, and he urged reform in the United States patent system and the appointment of a non-political patent commission to study the subject. Mr. A. Reichmann, president of the Western Society of Engineers; Mr. Paul M. Chamberlain, chairman of the new Chicago Section of the American Society of Mechanical Engineers; Mr. Albert Scheible, Mr. Stafford Montgomery, Mr. P. Junkersfeld, Prof. W. C. Bauer of Northwestern University, Messrs. D. W. Roper, R. F. Schuchardt, A. Bement, W. B. Jackson and Prof. P. B. Woodworth of Lewis Institute took part in the discussion. Mr. Scheible remarked that the Electric Club of Chicago had appointed a committee to work toward securing quarters as a common Chicago center for engineering and electrical societies. He also said a good word for the American patent system. Mr. Junkersfeld made the interesting statement that 49 per cent of the people of Illinois get their living from industries connected with engineering, and Mr. Roper cited the work of the electrolysis committee of the utilities in Chicago as an example of engineering co-operation. The next joint meeting will be held on May 26, at which time it is expected that Mr. H. E. Chubbuck, vice-president executive of the Illinois Traction System, will speak.



# Electrical Equipment of a Modern Hotel

**Artistic and efficient lighting scheme in the McAlpin Hotel, New York—System of control of electric circuits to insure continuity of service**

THE McAlpin Hotel, at Thirty-fourth Street and Broadway, New York, which was recently opened to the public, represents in an excellent way the most modern developments in all the details of equipment which contribute toward the increased comfort and pleasure of hotel patrons. Skill and foresight on the part of the architects and engineers resulted in the extensive use of electricity throughout this new hostelry. From a private plant energy is furnished for lighting, for the operation of a forced ventilating system, for laundry and refrigerating purposes, for escalators and dumb-waiters and for numerous other purposes, particularly in the kitchens where no fewer than twenty-five motors are installed for various uses.

The building is of fireproof construction, rising twenty-four stories above the ground, with four stories below the sidewalk level. The sub-basements contain the boiler, engine, refrigerating, pump and fan rooms, laundries, engineers' and electricians' offices, general storage, etc. The rathskeller, barber shop, general toilets, kitchens, florist shop, etc., are located in the basement. On the first floor are stores along the Broadway, Thirty-third and Thirty-fourth Street sides, the main lobby, general offices, cigar, news and telegraph stands and public telephone station. The first mezzanine floor contains the main dining room, banquet hall, ladies' café, parlors and writing room. On the second mezzanine floor are the gentlemen's lounge, private dining rooms and executive offices. The floors from the third to the twenty-second inclusive are arranged with sleeping rooms, baths and suites. The twenty-third floor contains the main telephone switchboard room, roof garden kitchen, valets' department, silver-plating department, upholstery shop and servants' quarters. The ball room, Turkish bath and roof garden are on the twenty-fourth floor.

## BOILER AND ENGINE ROOMS

There are installed six 30-hp. Babcock & Wilcox wrought-steel vertical-header longitudinal-drum boilers constructed for a working pressure of 200 lb. per sq. in. The heating surface of each boiler consists of two steam and water drums 42 in. in diameter and 20 ft. 4 in. long, placed above and connected to a set of sixteen sections of tubes, each section consisting of twelve tubes 4 in. in diameter and 18 ft. long. The lower ends of the sections are

connected to a main drain. Each boiler is equipped with a Webster throttle and pressure cut-off device. All piping and fittings are of polished brass. Each boiler is set singly, the front of the setting being faced with white enamel brick and set with copper water doors. A system of narrow-gauge tracks is provided for the loading of coal and ashes. A coal-weighing machine dumping 300 lb. of No. 1 bucket coal is also installed. For the fuel of the boilers there are three burning lines, by 8-in. by 12-in. American outside-pipe steam pumps, and in connection with the return pipe and blow-off tank there are two American 6-in. by 4-in. by 12-in. pumps. For the purpose of consuming the garbage a special destructor was designed by the Morris-Kauler Company, New York, having a capacity for disposing of 4 tons of garbage per day.

The engines are of the Wetherill turbine type. Three units are rated at 300 kw and one at 200 kw. They are directly connected to 240-volt compound-wound, three-wire Crocker-Wheeler generators. These are so placed that one is at right angles to the other two.

## SWITCHBOARDS

Owing to the comparatively cramped space conditions caused by the use of hydraulic elevators instead of electric ones, an original method of arrangement was devised to arrange the main switchboard in three sections. The generator panels are in the engine-room directly behind the main feeder distribution switchboard on a balcony and the feeder switchboard for the house lighting is on the third mezzanine floor. All the boards are built of gray iron, are marble and are of metal art. There is a complete rowing of switches or components on the front of the boards and on the rear there is plenty of clearance for hand work. Each generator is connected through a generator control panel and one of the set of main breakers in the main selector switchboard on the second mezzanine floor. These switches are connected through the main breakers to the circuit-breakers and distribution switches. The four generator panels are set in a progression and are geared in pairs so as to be turned through in line with the wheels of the engine. In the center of each board is a panel containing two main bus bars. All the wiring and one of each generator panel are provided with a double bus-bar over and a recessed conduit containing a main breaker with auxiliary contacts for connecting the busbars from the switchboard. The generator terminals are set



FIG. 1. LOBBY OF THE McALPIN HOTEL

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nected to the top studs of these breakers that the current passes through the breakers to the bottom studs and through busbars to the hinge studs of a five-pole double-throw fuseless switch mounted on the bottom section of this panel. By closing this switch to the right the connection is made to the No. 1 set of main busbars, and by

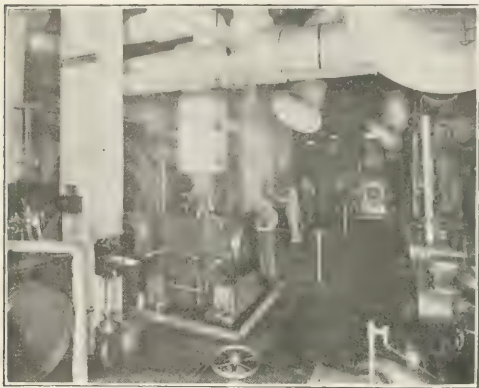


FIG. 2—VIEW OF ENGINE ROOM

closing it to the left the No. 2 set of main busbars is thrown in. Use is made of auxiliary switches for operating lamp signals on the benchboard to show to which busbars the switches are connected.

The generator rheostats are mounted under the switchboard gallery and are furnished with motors so that they can also be electrically operated from the benchboard. While each generator can be connected or disconnected manually, by walking from one generator panel to another, past the engine flywheels or around the engines and generators, the operator can also control all of the generators from the benchboard. This board is constructed in the form of a tilted table with the sides inclosed. All control instruments are mounted on the top so that the operator can see all parts of the engine room and at the same time



FIG. 3—MAIN DINING ROOM

see the voltmeters, ammeters and signals of all generators. With this benchboard there is perfect remote control of the entire plant.

In the engineer's office there is an instrument board which contains the following Esterline graphic instruments: One three-wire ammeter, connected to shunts on the main

lighting buses on the main distribution board, which records the total lighting current used; one graphic time-service instrument, connected back to the generator side of the circuit-breakers, showing how long each generator is connected in on the main busbars; one two-wire graphic ammeter connected to give the total motor load on the main distribution board; one two-wire graphic voltmeter to give the voltage on the motor-service busbars; two two-wire 110-volt graphic voltmeters to give the voltage on either side of the neutral on the three-wire 110-220-volt lighting bus. This gives the operating engineer a check on the variations in voltage, the loads carried at various times of the day and the hour each generator is in service. It also affords a method of studying the load conditions imposed on the plant.

The main distributing board is mounted on the gallery near the benchboard. All circuit-breakers and switches have extension studs extending back to guide or fuse panels and extension copper buses from this point to lugs at the top of the board, within a short distance of the pull box over the entire top of the board, in this way doing away with the necessity of exposing the cables.

The house distribution board contains twenty-four 200-amp three-pole, double-throw feeder switches for the lighting of the upper floors. The double-throw switch is so



FIG. 4—ELECTRICALLY EQUIPPED LAUNDRY

arranged that by having the blades in one position current passes directly to the feeder, while by throwing the blades in the opposite direction the current passes through an Esterline three-wire graphic ammeter for testing load conditions in any one of the twenty-four sections of the house. For the proper control of the lighting, independent feeders have been extended from the switchboard to the various specially detailed rooms, such as the main dining room, rathskeller, ladies' café, etc. For the upper, or sleeping, portions of the house each feeder system is arranged for the control of not more than five panels, the building being divided into wiring zones so as to reduce the number of circuits on the panel to a minimum.

#### LIGHTING EQUIPMENT

In the lower portions of the house—that is, in the kitchen, wine bins, laundries, etc.—the fixtures are of either the single pendant or the wireless-cluster type, and in all cases shades of the enameled-steel type have been provided, in order to minimize the cost of maintenance. In the barber shop use is made of ceiling fixtures, each consisting of a specially designed indirect fixture, with brackets of simple design, over the mirrors, the light in this room being unusually soft and effective. The same scheme of lighting is carried out in the washroom, toilets and bootblacking



department. The lighting for the special rooms in most cases has been treated to conform with the architectural character of the room. The rathskeller presented a difficult problem in illumination, owing to the peculiar feature of the material used in its construction and the bright colors used to carry out the effect. The original plan of this room contemplated the use of hanging lanterns, but after some study reflectors behind glass panels in niches were adopted. The brackets were, however, built into the new scheme of lighting was adopted, and the architect had this part of the equipment a total loss, and was obliged to install the brackets also. In the ladies' café hand-painted porcelain has been used to add to the effectiveness of the ceiling fixtures and brackets, and reflectors have been installed in the cornice around the room to provide general illumination for the panels near the ceiling.

All floors above the second up to and including the twenty-second floor are used exclusively for sleeping quarters. The lamps used for corridor lighting are so arranged as to provide an alternate system of lighting, thus enabling the house staff to put either half or all of the lamps in the corridors in service. Exit fixtures have been installed over the doors leading to all stairs, and these are equipped with ruby-colored globes. For the stair lighting these are of the lines of bracket fixtures, the wiring for which has been

hatten detachable flush push-button type are used throughout the building, the electric heating apparatus of the portable type, the electric heating apparatus of the portable type, the electric heating apparatus of the portable type of the bathrooms are of the portable type.

[illegible]

condemnation being and complete responsibility by the Manhattan Electric Company.

The base or illuminant of the lighting is provided by a forty square foot grid of lights in the ceiling, as the Broadway side front stage is situated in the middle of one of the Broadway aisles. The second lighting system is a thirty third and Thru-rod Street lamp. The lighting scheme of these surprising features is provided by the use of special glassware fabricated by the Jefferson Glass Company.

## Mitsuru Iizuka, Toshiyuki Furukawa, Shinya Aoyama

For refrigeration purposes, there are attached two 22.5



FIG. 5—MEN'S LOUNGE

so arranged as to make it almost impossible to be without light in the event of the blowing of a fuse. The bedrooms are equipped with specially designed ceiling light systems alongside the bureaus, portable desk lamp and portable lamp on the somnoe stand and a lantern in the entrance vestibule to each room. Each bathroom is illuminated by a ceiling lantern and a specially designed light fixture over the medicine cabinet. In some of the bedrooms where it was found impracticable to install two track lighting on the bureaus a specially designed ceiling fixture has been installed.

The lighting of the central portion of the ballroom on the twenty-fourth floor is accomplished by six 400-watt signed reflectors placed in a cove around the stage, each side of the room also being lighted by ceiling fixtures. The stage is equipped with footlamps arranged on two circuits controlled from the panels by dimmers. These dimmers can also be arranged to control the lighting in the main body of the room upon special occasions.

The lighting of the building is planned so that each of the large rooms is controlled by special readers and individual panels. The lighting of the typical bedroom floors is divided into zones, with a panel for each zone, the wiring being so arranged that the ceiling outlets in the bedroom are on one circuit and the brackets and bedside receptacles on another. Double-pole switches at the Man-



motors operating brine pumps. These are the same units suggested originally, including controls and the cooling/freezing unit, which is not needed in the proposed Ecolife system. All goes to the York Manufacturing Company.

Other structurally active polymers are the polymeric-type systems, which are used as the conventional  $\alpha$ -n



ciple; the vacuum-cleaner system, consisting of two eight-sweeper plants installed by the Vacuum Cleaner Construction Company, New York, and fans for hot-blast heating and mechanical ventilation, furnished by the Buffalo Forge Company.

An unusually extensive signal and telephone system has been installed in the hotel. For fire-alarm use there are the usual break-the-glass stations throughout the building and also ordinary watchman's stations. A special signal system is arranged in connection with these stations, connections being made to an annunciator in the telephone room which indicates the routing of the watchmen and enables the telephone supervisor to locate one of them at any time. At the entrance of each room or suite there is

#### MOTOR EQUIPMENT OF McALPIN HOTEL

Number of Motors	Machines	Motor, Hp
<b>Main laundry:</b>		
10	42-in. by 64-in. washers	2
1	Panel control	1.5
5	32-in. extractors	4
1	Steam-drying tumbler	1
1	Two-section cabinet dry room	1
1	Five-roll flat-work ironer	5
2	Six-roll flat-work ironer	8
<b>Guests' Laundry:</b>		
2	37 in. by 54-in. washers	2
1	26 in. extractor	1
1	Shirt starcher	1
1	14-in. starcher	1
1	Cabinet dry room	1
1	Conveyor dry room	2
1	36-in. body ironer	1
1	Bosom press	1
1	Air pump	1
1	24-in. ironer	1
1	Shaping table	1
<b>Help's Laundry:</b>		
1	Cabinet dry room	1
<b>KITCHEN EQUIPMENT</b>		
<b>Sub-basement:</b>		
1	Ice crusher	1
1	Ice cuber	3
<b>Help's kitchen</b>		
2	Vegetable peelers	1
1	Dish-washing machine	2
1	Meat chopper	2
<b>Main kitchen</b>		
1	Coffee mill	1
1	Butter worker	1.5
1	Horseradish grater	1
1	Dough mixer	2
1	Vienna ice-cream freezer	1.5
1	Brine ice-cream freezer	1
1	Almond crusher	1.5
3	Whipping machines	2
1	Meat chopper	1
2	Dish-washing machines	3
1	Silver buffer	2
1	Dust collector	1
1	Knife cleaner	1
<b>Officers' kitchen, third floor:</b>		
1	Dish washer	1
<b>Twenty-third floor kitchen</b>		
1	Dish washer	2
<b>Twenty-fourth floor</b>		
1	Dish washer	1
1	Knife cleaner	1

a maid's signal, the annunciator being located in the main telephone room under the control of the telephone supervisor. A large number of telautographs are in use for various purposes.

There are at present in use in the hotel nearly 1700 telephone stations, which is said to be as many as are in service in the kingdom of Greece. To connect the stations to the switchboard it was necessary to install cables and wires with an aggregate length of conductors of about 600 miles.

The building and all its mechanical and electrical details were designed by F. M. Andrews & Company, New York, under the immediate supervision of Mr. Newton L. Schloss, superintendent of the company. The electrical installations of the hotel were made by the Thompson-Starrett Company, New York.

#### Hydroelectric Development on the White River

At the convention of the Missouri Electric Association, held at Kansas City, Mo., on April 17, 18 and 19, as noted in our last week's issue, a paper on "Hydroelectric Development of White River" was presented by Mr. T. O. Kennedy, of the White River Construction Company. Following is an abstract of Mr. Kennedy's paper:

Up to the present there is only one power plant on the White River, but this does not mean that all the available power of this stream is being utilized. The river flows for several hundred miles through Missouri and Arkansas, with an average fall of about 2 ft. per mile. The present development is being carried out by Henry L. Doherty & Company, who became interested late in 1911, the parties owning the site of the proposed dam and power house previously having made some preliminary surveys and stream-flow gaging.

The principal market for electrical energy is the Empire mining district, near Joplin, where the several plants of the Empire District Electric Company supply the necessary auxiliary service to enable the maximum output to be contracted for.

When construction work was started on the dam and power house it was necessary to establish a camp of sufficient size to accommodate a large number of men, as the



FIG. 1—UPSTREAM SIDE OF DAM—WORK NEARING COMPLETION

site is 7 miles from the railroad. Considerable attention was paid to this matter of camp, and as a result there have been absolutely no labor troubles. Living conditions in the camp, said the speaker, are more healthful, more pleasant and cheaper than in any other town in the county, and during the greater part of the time there has been a larger population of men, women and children than in any other town in Taney County.

The dam is of the familiar Ambursen type, consisting of a thin reinforced concrete deck plate supported at an angle of approximately 45 deg. from the vertical by means of concrete buttresses or piers seated on solid rock and spaced 18 ft. apart throughout the length of the dam. The center line of the dam runs east and west. On the east side of the river a vertical cliff rises about 200 ft. On the west side the ground is more rolling but rises to an elevation 75 ft. above the riverbed in about 1200 ft. from the cliff on the east side.

The power house, being 200 ft. long, extends well into the east bank and reaches to the middle of the old river channel. Provision is made for eight main units and two exciter units.

On account of the sudden high rises for which White River is noted it was decided to provide 600 ft. of spillway, although the width of the natural channel at the site was only one-half that figure. The spillway terminates on the

west bank in a cellular concrete abutment rising from solid rock to a height 25 ft. above the crest of the spillway. From this abutment there was built 400 ft. of earth embankment, with a concrete core wall extending to high ground to prevent flood waters from getting around the end of the dam.

Seventy thousand cubic yards of earth and 20,000 cu. yd. of rock were excavated by means of "clam-shell" and "orange-peel" grab buckets operated by cableways and derricks. Some of the excavated earth was placed in the embankment, but most of it was sluiced into the river and wasted.

Each of the nine wheel chambers in the power house is provided with steel headgates operated either by hand or motor. In each of the headgates two small filler gates are provided to equalize the pressure and overcome friction when the gates are being raised.

At this time only five of the main units will be installed. Each waterwheel unit consists of a pair of 52-in. Smith turbines mounted on a horizontal shaft and set in a closed concrete flume. The draft tube is made of plate steel and measures 14 ft. in diameter at the bottom and is 18 ft. long.

These units will operate at working heads from 40 ft. to 54 ft. The output will vary from 2000 hp to 4000 hp, the mean effective head of 50 ft. developing 3600 hp.

Two exciter units are being installed, each being driven by an 18-in. Smith turbine developing 200 hp at a net working head of 50 ft. The speed of each unit is controlled by an individual Lombard governor.

A 2250-kva generator is mounted on the same shaft with each waterwheel generating three-phase, 25-cycle alternating current at 2300 volts. The speed of these units is 214 r.p.m. The direct-current exciter units, rated at 175 kw and 125 volts at 600 r.p.m., are also directly connected to the wheels.

The transformer equipment will ultimately consist of three banks or nine transformers. Two banks and one spare unit are now being installed. These 2000-kva transformers step up the emf to 660 volts, which is the transmission voltage.

The switchboard will be erected on the transformer balcony overlooking the generator pit. All high-tension wiring is on the third floor, where electrically operated oil switches will control the outgoing line. The power-house equipment will be protected by the usual choke coils and electrolytic lightning arresters, which will also be located on the high-tension floor.

To handle the heavy apparatus from the railroad to the power house two 30-ton barges were built. A stiff-leg derrick at Branson enables the machinery to be transferred

line is carried on wooden poles and follows a route highways to Springfield, a distance of 20 miles, and thence to Joplin, a distance of 100 miles.

In the steel-tower line the supports are spaced on an average 450 ft. apart. The regular line structure is a flexible A-frame tower with one anchor or square tower per mile of line. The longest span in this section of the



FIG. 3—WHITE RIVER WITH WATER ABOVE THE SPILLWAY

line is 1000 ft. The line consists of three No. 00 bare, stranded, hard-drawn copper conductors, two 5/16-in. Siemens-Martin galvanized ground wires and four No. 8 B. & S. gage copper-clad telephone wires. Pin-type insulators are used throughout. Switch towers are so installed that the line can be divided into 7-mile sections for locating and repairing breakdowns.

In the wooden-pole line the supports are spaced 150 ft. apart. White cedar poles are used except for corners and switch points, where square steel towers are installed. Pin-type insulators are used, except for dead ends, where suspension type are substituted. Between Ozark and Springfield the equipment of the line is the same as that of the steel-tower line except that the telephone wires are No. 10 hard-drawn copper. Between Springfield and Joplin the conductors are No. 6 bare, solid, hard-drawn copper.

To prevent interference on telephone lines from the high-tension current the telephone wires are transposed at every span on the tower line and at every second span on the pole line. The ground wires on the pole line are run to earth at every second span.

The Springfield substation is equipped with step-down transformers and frequency changers delivering for distribution, 60 cycle, 2300-volt energy.

The Joplin substation is equipped to link together the 66,000-volt line and the 33,000-volt lines from the various plants in the Lumsden district and also to distribute 2300-volt, 25-cycle energy.

### New York Edison Meter No. 1 Still in Service

After seventy-one years of continuous service, meter No. 1 of the New York Edison Company is still in use, as was discovered quite by accident recently. This meter, which came to New York in 1846 with the first shipment of the present type, and after being tested was installed in a fire-goods warehouse. Since then it has been moved six times. In the last ten years it has been at the same place, and was in the Pigmarket Street building, now working with the same accuracy that it had when first it was set up.

Although No. 1 is the oldest meter in the company of the company, it was not the first meter installed, for during the days of the primitive meters the old-fashioned meters were used, as described in the following paragraph in the first days of commercial service. When the present type of meter No. 1 was installed, it was the first of its kind in the career.

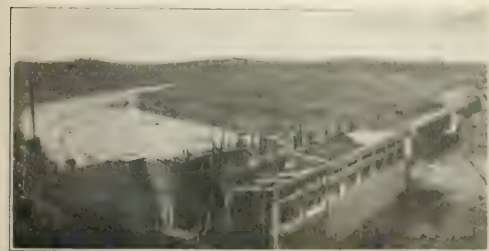


FIG. 2—POWER HOUSE AND DOWNSTREAM FACE OF DAM

from cars to boats and a similar derrick at the power house places the load under the traveling crane. The heaviest pieces to handle are the generator rotors, which weigh 22 tons.

The present transmission system comprises 150 miles of line. The first 20 miles is carried on steel towers across very rough country to Ozark, Mo. The remainder of the

## Weight of Electrical Apparatus and Prime Movers

By LEONARD A. DOGGETT.

Frequently it is desirable to know the approximate weight of a given machine. To offer some assistance in this matter the curves here reproduced have been prepared after consulting a great many sources, not only the bul-

Weight in pounds of a transformer, including case and

$$\text{oil} = 1800 \left( \frac{\text{kva}}{\text{frequency}} \right)^{3/4}$$

Referring to Fig. 1, which was obtained from data given by Mr. W. B. Hird, in the *Journal of the Institution of Electrical Engineers*, September, 1912, it is evident that electric apparatus on the average is lighter than the prime mover for the same (kva)  $\div$  (r.p.m.).

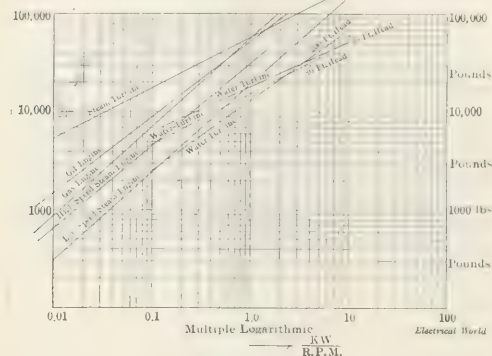


FIG. 1—CURVES FOR OBTAINING APPROXIMATE WEIGHT OF PRIME MOVERS

letins of American and European manufacturers, but also the whole literature as given in periodicals and textbooks, the only requirement being that the data must be less than ten years old and preferably not over five years.

Although the curves contain the meat of the matter, a short discussion and explanation would not be out of place. First in explanation, logarithm paper was used, because it gives straight line plots and is very economical of space. Curves of this nature can easily be extrapolated as the dotted curves in Fig. 2 whereby the weight of the smallest motors and transformers can be easily estimated. In using the curves it should be noted that for transformers the upper scale of Fig. 2 is to be used. For the machines "pounds" means weight of active material plus weight of

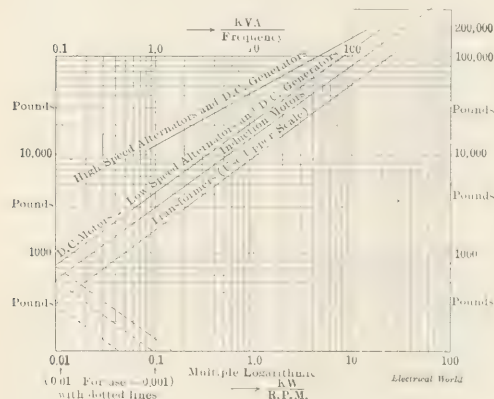


FIG. 2—CURVES FOR OBTAINING APPROXIMATE WEIGHT OF ELECTRICAL APPARATUS

shaft, spider, bearings, etc.; in other words, the total weight of the machine. In the case of alternators the abscissas are (kva)  $\div$  (r.p.m.); for induction motors (kw output)  $\div$  (r.p.m.).

In commenting on the curves of Fig. 2 it is obvious that any of these curves can be expressed in the form of an equation, for example:

## A Method for Spot-Testing Incandescent Filaments

By C. F. LORENZ

In studying and inspecting incandescent filaments it is desirable to have means of detecting slight unevennesses in brilliancy at different parts of the filament. Bright or dark places on the filament are usually called "spots," even though they may be, say, an inch, more or less, in length. Such spots are in some cases so pronounced as to be seen readily by direct observation and in other cases they are so faint as to escape detection entirely unless use is made of some means of exaggerating them. A delicate method of detecting such spots has recently been devised and found useful in the physical laboratory of the National Electric Lamp Association. A description of this method follows.

### USE OF A LUMINOUS BACKGROUND AND A COLOR SCREEN

The plan consists in mounting the lamp or filament to be tested in front of a brightly illuminated background and using a suitable color screen, so that an adjustment of the current through the filament will make the latter disappear against the background. The "spots" will then show up distinctly as bright lines. Another way of observing is to adjust the current until the "spots" just match the background. The main part of the filament then appears as a dark line, with an apparent gap at the "spot."

The background may take the form of a piece of "flashed-opal" glass illuminated by one or more tungsten lamps put in position back of it. Since this gives a background which differs in color from the red-burning filament, the latter cannot be made to disappear against the background by mere adjustment of the current through the filament, even though the candle-power per unit area of the filament be made the same as the candle-power per unit area of the background. The use of a color screen of some kind is necessary, and one may be applied in two distinct ways.

### MONOCHROMATIC SCREEN METHOD

One way is to use a screen transmitting only a limited region of the spectrum (a monochromatic screen), this being interposed between the eye and the lamp to be tested. Equality of color appearance of the background and the filament is thus insured, and it is only necessary to adjust the current through the latter until it disappears. The plan will work no matter what color is chosen for the screen except that the transmission of the latter must be confined to a narrow region of the spectrum—thus it may be red, yellow, green or blue. But not every red, yellow, green or blue glass will do; for example, most ordinary kinds of yellow glass transmit red, orange, yellow and green light and with such a glass the red-burning filament cannot be made to disappear against the background illuminated by a tungsten lamp, no matter at what intensity the filament is run.

Considering only monochromatic screens, the question arises as to the color to use. In one respect a blue or even a violet glass would be the best, because the percentage rate of variation of intensity of light emitted by an incandescent solid with change in temperature is greater the shorter the wave-length. On the other hand, the actual intensity of the light reaching the eye may in some cases



be so much lower with a blue screen than with, say, a red screen that the advantage of using the shorter wave-length is more than lost on account of the diminished illumination. A good screen to use in any particular case may readily be selected by trial. The use of a blue screen in place of the ruby screen gives a match at a higher temperature of the filament with a given background brightness, because the light from the tungsten lamp contains a greater percentage of blue than does the light from the filament operated at low voltage. Ordinary "cobalt-blue" glass cannot be used because it transmits some red light. It is necessary to choose a blue screen which transmits no red light.

This arrangement is evidently a form of optical pyrometer, but much simplified because all lenses and images (excepting, of course, those in the eyes) are done away with. The fact that some parts of the filament are at different distances from the eyes or background introduces no trouble, as can easily be seen by considering the nature of the case or by trial; if the lamp is turned the spots move with it.

A further modification, described in the next paragraph, does away with the necessity of looking through a colored glass.

ORANGE-SCREEN METHOD

The other method of applying the color screen consists in placing it between the opal glass and the source of illumination and choosing it of such spectral transmission that it will modify the latter to match the color of the fila-

ment to the leading in wires, or filament of the lamp, or the background. The brightness from the higher temperature of operation comes from the background along the filament to which the cooling effect of the leading-in and anchor wires extends. In an ordinary test, running the filament at an arc gives very reliable measurements; but of rather high candle-power will serve for illuminating the background. When it is desired to have the filament as bright as possible, the background must also be very bright, as the low resistance and percentage of blue-wave-length radiations given in the light of the background from the light of the filament. Using a 200-watt tungsten lamp, an opal glass surface one 2 in. by 2 in., can be suitably illuminated to match a carbon lamp at the arc at about 50 per cent voltage, and this can be somewhat increased by using very small or special lamps. With an arc lamp one can go much higher. As an illustration, it may be mentioned that the voltage at the terminals of a 110-volt filament was 84 volts at a match, with blue glass. This does not necessarily illustrate and must not be considered the limit.

The three pairs of photographs were respectively the appearance of a filament as viewed against a black background and as matched against a luminous background for three different tests. In the latter case it is easy to see the "spots." It should be added that a photographic plate may be made to be more sensitive or less sensitive than the eye in detecting inequalities in the brightness in different



FIGS. 1, 2 AND 3—EFFECT PRODUCED BY THE USE OF DIFFERENT BACKGROUNDS AND SCREENS IN FILAMENT TESTING

ment. Since the filament is operated at a rather low degree of incandescence its own light is deficient in the shorter wave-lengths. The screen used to modify the background light should therefore be such as to transmit red, orange and yellow light and to tone down the green, blue and violet. Such a screen has an orange appearance. A suitable orange screen may readily be prepared by dyeing a gelatine-coated plate very thinly with "Diamond dye scarlet." Such a plate looks red by daylight, but when placed in front of a tungsten lamp it has just the right orange-red tint. It should be emphasized that the plate must be thinly dyed. More exact specifications in regard to spectral transmission are unnecessary because a suitable screen may readily be prepared by a trial or two made in the manner indicated. The dyed plate should be placed close to the lamp and preferably several inches from the opal glass so that any inequalities in the color screen will not show on the opal glass.

As a convenient, practical way of operating the orange-screen method will probably be selected.

TEMPERATURE OF OPERATION

In looking for spots it will usually be best to run the filament at a low degree of incandescence because, as is well known, the rate of variation of brightness with temperatures is greater at low temperatures than at high temperatures. If it is necessary to study the filament very close

parts of a filament, especially in the case of a black background. The illustrations given are made so as to exhibit approximately what the eye sees and are not intended to show what is possible to do in the way of "spot testing" by photography. In photographing the color matching is evidently not necessary; in showing exactly, however, the color match is essential in obtaining disappearance of the filament against the background.

The play of matching lamp filaments for color and intensity against a luminous background in the manner above indicated may readily be applied in testing or when using a lamp will have a great efficiency. Consequently, along this line will be found much interesting work.

Water-Power Development in California

The United States Federal Bureau of San Francisco reports that during the past several years the hydroelectric development of western life within the national domain of California. Private interests have been greatly stimulated by the new federal method. The new regulations of the Federal Bureau have with a few important changes in the method of obtaining rights-of-way for hydroelectric power. The new regulations are as follows: The Federal Bureau of Reclamation will provide fully and completely the necessary facilities.

# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Electric Pop-Corn Parties for the Children

At a number of its properties in North and South Carolina the Carolina Power & Light Company has been attracting public attention and interest by holding pop-corn parties on Saturday afternoons, when corn popped by electricity is distributed to the children of the community who visit the



A SATURDAY AFTERNOON POP-CORN PARTY

company's office. Announcements of the parties are made in advance in the local newspapers, and on the afternoon set electric grills are installed in the office show windows and presided over by picked youngsters who gleefully pop the tasty white dainty. Attendants are meanwhile kept busy packing the pop-corn into paper cones which are distributed freely among all the little people who come to the party. Mr. J. L. Kirkpatrick is commercial manager for the Carolina company.

the part of the defendant, or that the latter had failed to remedy the defect with reasonable alacrity, the trial judge was justified in withdrawing the case from the jury.

## Electric Sign for Chicago & Northwestern Railroad

Railroad companies are extensive advertisers and shrewd ones also. Quite a number of them make use of spectacular electric signs, apparently with satisfactory results. One of the most recent installations of this kind, and also one of the largest, is the sign which has been placed on a freight house in Chicago on the north bank of the Chicago River facing Rush Street. This sign, which is 50 ft. square, depicts one of the latest type Mogul locomotives attached to a train of cars. A semaphore arm outlined in incandescent lamps displays "clear" and "danger" signals.

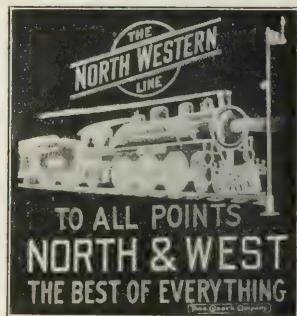
When the danger signal is displayed the locomotive stands still and smoke appears to curl out of the stack. With a clear track signal, the wheels of the locomotive begin to revolve and the side rods are shown in motion. At the same time, the smoke issuing from the stack appears to trail back over the roofs of the cars and the track seems to move. The complete cycle of events is limited to eight seconds so that passers-by may see all of the operations.

The steel framework supporting the sign weighs 29,500 lb. and the metal work on the face of the sign weighs 8000 lb., making a total weight of 18.75 tons. To give the effects mentioned, 3860 10-watt tungsten lamps are employed, necessitating the use of 30,000 ft. of wire. Color effects are secured with lamps dipped in a special coloring mixture.

Because of the weight of the sign, it was necessary to strengthen the building beneath it. Ten piers on each side of the building were reinforced by securing them to 16-in.

## Liability of Operating Company for Failures of Circuits

The question of the liability of an operating company for accidents arising through breaks in its circuits was brought up in a case before the Pennsylvania Supreme Court (85 A, 1117). A child left home for work and was found a few minutes later lying in the street with a burn on his hand from contact with a broken wire. Subsequently tetanus set in, the child died, and a trespass action was brought by his parents to recover damages. The claim was made that the poles were spaced improperly for safety, so that, owing to excessive sag and a large arc of sway, the wire was finally broken through crystallization (fatigue) of the metal. The trial judge ordered the jury to return a verdict for the defendant, on the ground that no specific act of negligence on the part of the defendant was shown; neither was there sufficient evidence to prove that the spacing of the poles (184 ft. apart) was a direct cause of the accident, nor was evidence introduced to show that the break occurred through sagging or swaying of the wire or through contact with an adjacent wire. In sustaining the judgment of the lower court, the Supreme Court held that, inasmuch as the evidence failed to show the cause of the break, or that it was due to negligence on



A RAILROAD COMPANY'S ELECTRIC SIGN

square oak posts set on a concrete foundation running parallel to the edges of the building. Four 15-in. I-beams were also used to distribute the weight of the sign.

A Reynolds-Dull flasher operates the display, energy for which is furnished by the Commonwealth Edison Company. The sign was designed and built by the Thomas Cusack Company.







## Motorcycles for Repair and Inspection Men

The use of motorcycles in speeding the work of the repair and inspection crews of public-service corporations is being generally adopted. Having recently added a powerful twin-cylinder machine to the fleet which it has employed very successfully for some time, the Louisville (Ky.) Lighting Company now has five motorcycles. The Kentucky Utilities Company, of Lexington, recently purchased three twin-cylinder mounts with which to equip its line forces. In the case of the former company a great deal of urban territory must be covered speedily and economically, and in the case of the Lexington corporation the demand is for means of covering suburban and rural territory, as the Kentucky Utilities Company has acquired a number of plants in central Kentucky cities and towns which are within comparatively short distances of each other. The motorcycle is working admirably in both lines of service. Five machines are in the hands of the "hurry-up" force of the Louisville company, and, as it rests with the men to inspect and overhaul their mounts thoroughly every twenty-four hours, practically no mechanical trouble and a minimum of tire trouble is experienced. For inter-urban use the cycle has proved itself eminently practicable, according to the experience of the Lexington company, for the two-wheeler is frequently able to carry a man safely and speedily over roads which would be impassable for a heavier vehicle.

## Satisfactory Ice-Electric Plant in Iowa

Some readers who have been interested in the data published from time to time in the *Electrical World* concerning the commercial opportunities offered to small central stations by the manufacture of by-product ice have advanced the opinion that these plants thrive only in the Southern States. The accompanying data for a plant which operates in Iowa will, it is thought, show that a long way above the Mason and Dixon line a chance to earn a handsome dividend is afforded the progressive central-station manager.

The plant referred to is an 18-ton equipment used in a town of 4500 inhabitants. During the seven months of 1912 when the plant was in operation 3500 tons of the frozen product were made and disposed of. The following is a detailed account of the operating expenses over that period:

Fuel .....	\$1,690.77
Labor and office help .....	2,000.00
Water .....	200.00
Supplies, miscellaneous .....	150.00
Delivery .....	1,803.87
<b>Total .....</b>	<b>\$5,844.64</b>

It is estimated that the actual plant cost of producing a ton of ice at the platform is \$1.32. Rates have been established whereby the amount of ice used by a customer in a season determines the price per ton which he shall pay. To all groceries, hotels, restaurants and similar customers using from 1 ton to 5 tons of ice during the season deliveries are made at a rate of \$8 a ton; if the consumer uses from 5 tons to 20 tons, \$5 per ton is charged, and if an amount between 20 tons and 50 tons is used, the rate charged is \$4 per ton. All customers who use more than 50 tons of ice yearly have special contracts with the company. Ice is delivered to all residences at a flat rate of \$8 a ton. The following table shows the annual receipts and disbursements:

Yearly gross income from the business .....	\$13,039.74
Yearly expense (including interest, depreciation, etc.) .....	6,826.68
<b>Net income from ice business .....</b>	<b>\$6,213.06</b>

The total plant investment, inclusive of delivery wagons and storage facilities, amounts to \$12,200. In commenting

upon the success of this ice-electric plant, which shows a 50 per cent net return, its manager very modestly says that he has found the by-product ice business satisfactory. He attributes not a little of the success to the practice of handling all sales by the coupon-book system, no cash sales being made from the wagon.

## Comparative Operating Expenses of Horse, Electric and Gasoline Commercial Vehicles

Perhaps the ideal method of comparing operating expenses on different types of commercial vehicles would be to give the unit cost per ton-mile. It is not always practicable to secure this information, however, owing to the variation in methods of figuring costs by those operators of commercial vehicles who keep records. In the present article the figures are given per car-day, and they are derived principally from the carefully kept comparisons of the Commonwealth Edison Company of Chicago relating to horse and electric vehicles, with some additional data relating to gasoline wagons obtained from Marshall Field & Company, of the same city.

### HORSE VEHICLES IN CENTRAL-STATION SERVICE

During the year 1912 the Commonwealth Edison Company had 130 horses, 107 horse vehicles and 72 electric vehicles in service. Allowing a deduction of 6 per cent in the number of wagons in service at a time because of repairs or of horses being shod, idle or sick, there remain 101 horse vehicles with which to average the expenses. These expenditures are grouped under the following heads:

Feeding, shoeing and veterinary service .....	\$29,712
Labor in barns and repairs to buildings .....	20,176
Repairs on horse vehicles .....	11,088
<b>Total for the year 1912 .....</b>	<b>\$60,976</b>
Cost per horse vehicle per month .....	\$50.31
Driver's salary .....	60.00
Supervision per vehicle per month .....	4.6
Rent of barn per vehicle per month .....	4.05
Municipal wheel tax per month .....	0.4
Interest at 5 per cent, depreciation at 10 per cent, taxes at 1.5 per cent, insurance at 1 per cent .....	5.73
<b>Total cost per month .....</b>	<b>\$125.18</b>
Average cost per day per horse vehicle in service, on the basis of 25.5 days a month .....	\$4.91

### USES FOR ELECTRIC VEHICLES IN CENTRAL-STATION SERVICE

Twenty of the seventy-two electric vehicles owned by this company are used in carrying supplies from warehouses to customers' premises. About thirteen cars are employed for making lamp renewals, and ten trucks are used for installing small overhead-line extensions which do not involve the setting of poles. The remaining vehicles are used for delivering meters, for underground-line work, installing signs and pulling cables through conduits by means of the vehicle motors.

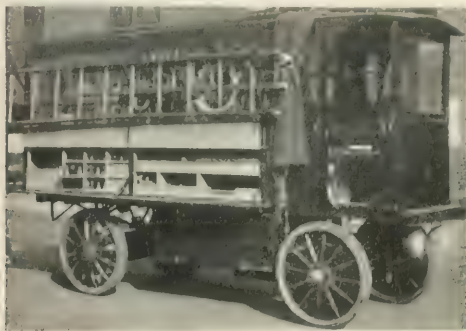
In size the electric vehicles range from 700 lb. to 4000 lb. in carrying capacity, the average being about 2500 lb. As the average time that they have been in service is about twenty-six months, the owner figures that the maintenance charges have reached a value that can be regarded as fairly typical of the service.

The electric wagons used by the overhead department were designed to carry all of the tools and materials used for installing the customer's service wires. Compartments for holding the supplies are arranged so as to be readily accessible to the linemen. Above these compartments are racks for holding cross-arms. Hooks are arranged on both sides of the truck for supporting coils of ropes and extension ladders. There is no room on the truck for anything except what is absolutely required, thus preventing the accumulation of junk.

In addition to the seventy-two electric commercial vehicles mentioned, the Commonwealth Edison Company owns three large electric trucks capable of carrying 3.5, 5 and 6 tons each. The largest one is used for hauling coal and the other two are employed for carrying reels of cable. The results obtained with the electric vehicles have been so satisfactory that this company is contemplating placing in service thirty more, some of which have been ordered already.

#### OPERATING EXPENSES FOR ELECTRIC VEHICLES

Operating, repair and other maintenance charges on the electric vehicles owned by the Commonwealth Edison Company for the year 1912 are tabulated below. The number of vehicles in service at a time is taken as forty-seven in averaging the operating expenses.



ELECTRIC VEHICLE OF CENTRAL STATION

Although the maintenance charges on electric vehicles are about 50 per cent more than those on horse vehicles, this increased expense is more than offset by the saving in time in traveling from one job to another. A horse vehicle can cover about 15 miles a day in delivery work, while an electric vehicle averages about 29 miles a day on

#### DATA ON COMMONWEALTH EDISON ELECTRIC VEHICLES

Expenses	Total 1912	Cost per Month per Vehicle	Cost per Day per Vehicle in Service
Supplies	\$2,948	\$5.21	\$0.20
Painting	.901	1.60	0.06
Tire replacement	2,888	5.03	0.20
Battery repairs	4,858	8.61	0.34
General repairs	11,574	20.32	0.81
Washing, placing wagons on charge and minor repairs	8,136	14.43	0.57
Maintenance of garage building, including rental	8,743	16.09	0.57
Total	\$50,188	\$86.66	\$2.75
Operating and repair as shown above			\$2.75
Energy at 1 cent		\$1.28	.05
Driver's salary		65.00	2.50
Supervision		1.00	.04
Wheel tax and state license		3.00	.12
Depreciation (total cost of wagon, less annual cost of tires and battery, less overhead costs)		21.00	.80
Interest, tax and insurance		8.00	.30
		\$188.00	\$2.46

Average miles per vehicle per month, 1,325

similar work. The saving may not be apparent here, but in case men who are paid 40 cents an hour are being transported to a job, any time saved represents a net profit.

#### SOME GASOLINE VEHICLE FIGURES

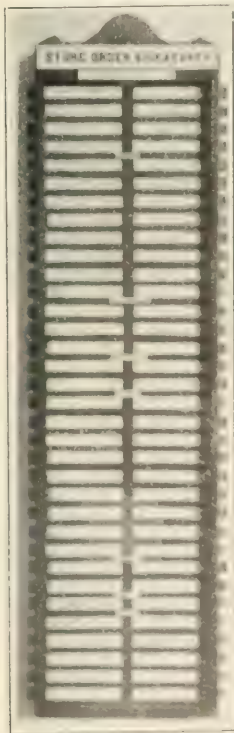
Although the electric vehicles used by the Commonwealth Edison Company and the gasoline vehicles used by

Marshall Field & Company, of Chicago, are used in distinctly different kinds of business, yet they operate under practically the same traffic conditions and both are used for making deliveries. The electric vehicles under consideration are subjected to severe duty because of the heavy material handled, while the large gasoline truck of the department store are used for hauling packages that are of large size but of very much less weight than the material carried by the electric vehicle.

Marshall Field & Company, however, estimate that their cost of doing business is not as high as that of the electric vehicle. To explain this high figure, it may be said that they are then confined to one, the transporting, purpose in most of their business, which is in the center of business in Chicago, so that perhaps a larger volume of work. It would be necessary for them to be taking in some way to bring the operating cost down to that given by the Commonwealth Edison Company for its electric vehicles, which are said to average 29 miles a day. If the gasoline cars did cover 29 miles a day, they would working under the most favorable conditions in the business require of gasoline cars over electric vehicles in maintenance, namely, in their hauls.

#### Signature Frame for Storeroom Reference

In the storerooms of the consolidated Gas, Electric Light & Power Company, of Baltimore, Md., the usual method of notifying the storekeepers and attendants by letter concerning which officials are authorized to approve orders for material and supplies has been replaced by the simpler scheme of using a "five signature" frame like that illustrated.



SIGNATURE FRAME

The frame is made up of small wooden pulleys covered with white paper and fitted into grooves behind the glass front. The names written on these pulleys can be quickly referred to by the storekeepers, who, in turn, it was necessary for these men to pass over numerous letters to ascertain if signatures appearing on store orders were "O. K." to draw material. These pulleys may be readily changed, meeting as in the case at all times.

Store orders, sent to the Chief Superintendent from the other stations, are first referred to the general department where they are given a stamp which allows the receipt of them, and then to the storekeepers for their approval. The pulleys are then placed in the frame and the order is ready to be issued.

The Chief Superintendent is allowed to use these orders from time to time, and it is said that the quantity of work of the material department can be reduced by using the frame. The frame itself may be made of wood or metal.

It is said that the frame is made of wood and is used in the storerooms of the Baltimore Gas, Electric Light & Power Company.



# Illumination and Wiring

## Back-Porch Meter Installations

In a great many small towns and villages where overhead distribution prevails, and where the service is usually brought in through an attic or down to the cellar from above through conduit, meters must of necessity be installed in out-of-the-way places within the house, so that once a month at least the occupants are disturbed to permit the meter reader to see the index of the meter. In not a few localities meters are installed in upstairs closets or in bathrooms, because country houses are not always provided with cellars. At any rate, the house must be entered in order to read the meter register, and if the owner or tenant is not at home the meter reader is compelled to call a second and in some instances a third time.

In small communities where the consumption of electrical energy is small and where the houses are all detached the central station must keep down labor costs as much as possible. If, for example, a meter reader receives \$2 a day and it is necessary for him to make two or three separate trips in order to read a meter, the time consumed figured in cents represents possibly more than the profit derived from the sale of energy to the customer in question that month.

To render it possible for a meter reader to read a maxi-

um number of meters in a minimum of time, many companies have established the policy of locating meters on the front or back porch of dwellings. To some managers this practice does not appeal, because the meter is exposed to climatic conditions and it is an easy matter for persons outside to tamper with the meter or even steal it.



FIGS. 1 AND 2—SERVICE ENTRANCE AND METER INSTALLATIONS ON PORCHES

Where meters have been thus installed, however, the experiences of the companies show these fears to be groundless. There is only one drawback where meters are placed outside in cold climates, and that is that in winter they cannot be tested with any degree of comfort. This, however, is only a minor consideration, as companies can arrange to have these meters tested before cold weather sets in and thus obviate the necessity, except in rare instances, of testing meters during the winter months.

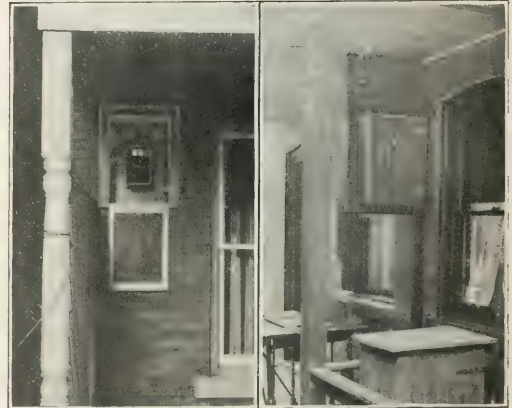
One of the first companies, if not the first, to establish the practice of installing meters on back porches was the Renovo Edison Light, Heat & Power Company. Renovo is a railroad town of approximately 4500 inhabitants in the mountains of Pennsylvania. Situated between high hills, it is compactly built. With the exception of the main business streets, however, the houses are all detached, being separated usually by small alleyways. Experience extending over a number of years has enabled the company to standardize its meter practice so that architects and build-



FIG. 3—INSTALLATION ON SEMI-DETACHED FRAME HOUSES

Noecker, the general manager of the plant, who takes upon himself the duty of reading all the meters.

The outdoor method of installation has other advantages. It is unnecessary to enter a house to read a meter, so that it makes no difference whether the owner is at home or not. It avoids any ill feeling on the part of the housekeeper toward the lighting company by reason of the fact that a meter reader may have forgotten to wipe his muddy shoes before entering the house. It avoids the probability of a customer tampering with the meter, because if he did



FIGS. 4 AND 5—METER CABINET SET FLUSH IN BRICK WALL, AND CABINETS ON PARTITION

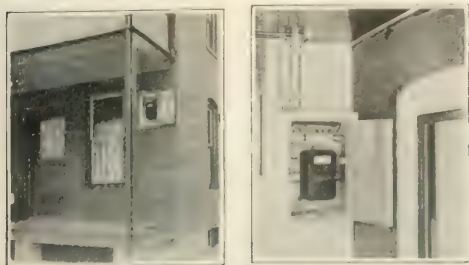
so his next-door neighbor would see him. Altogether, the scheme has worked excellently.

In the business sections where detached houses do not prevail and where there are a number of tenants in the same house the meters are installed in closets in the main halls, where they are accessible without climbing stairs, a consummation devoutly longed for by many a weary meter



reader. That the practice of the Renovo company may be more readily comprehended, a few typical installations have been selected for description. In all cases the meter box is installed at the expense of the customer.

Fig. 1 shows an old frame house with the meter box installed on the side porch. Three circuits are provided on the house side of the meter, two for lamps and one for



FIGS. 6 AND 7—CABINET SET IN BRICK WALL AND ON PORCH OF BRICK DWELLINGS

heating devices. It will be noticed that an inexpensive box with a glass in the door is employed and that in this instance the cabinet is not built in the wall.

A better method is that used with many of the newer frame houses, where the meter box is built into the partition of the house on the back porch. Three circuits are connected to the meters as in the installation shown in Fig. 4.

Fig. 3 shows an installation on semi-detached houses, the cabinet being set in the partition of the house on the back porch and the service being run on knobs across the porch from house to house. This illustration shows an every-day condition, and certainly if the work is safe the meters ought to be more so.

Fig. 4 shows an installation in a brick wall, the cabinet being set in the wall and having a sliding door flush with the surface. Another method of mounting meters on brick houses is shown in Fig. 5, illustrating the back porch of a double brick dwelling. The back-yard entrance is through a subway over which the meter box is built. The middle partition serves as the back for the two meter boxes and, extending to the porch ceiling, forms a raceway for the wires of each side of the twin residence. The support next the brick wall forms a raceway to the cellar for a flexible steel conduit containing the heating circuit. The practice of the company is to run heating circuits under the first floor and up into the rooms.

The type of meter box construction shown in Fig. 1 is employed where there is not sufficient room to build the

set in the wall with the door flush with the finished wall. Fig. 7 shows another instance of a double brick dwelling where the cabinet could not be built in the wall for lack of space. The extension at the top of the box reaches to the porch roof, forming a raceway for the wires for the interior circuits, the porch ceiling and the ceiling of the first floor of the building being at the same height. The builder is usually provided with the number of mounting pieces to lay in the wall at this point between the ceiling and floor so that the wires from one building will span the building. Here again it may be observed that if the household necessities shown are safe the meter ought also to be safe. Another view of the same installation is given in Fig. 2, in order to illustrate the present practice of the company in running service to the building. The secondary race shown is much heavier and more substantial than three separate brackets. It should be mentioned in this connection that in all cases where the address is on the outside the service lines run directly to the cabinet before entering the building. Where the meter cabinet is inside the building, as in Fig. 6, the service continues to the main front of the outside of the building to the meter cabinet.

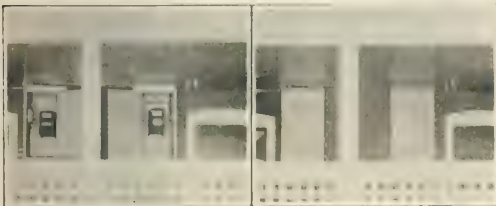
It will be noted that in every installation the meter cabinet door is fitted with a pane of glass, with ordinary wooden doors instead. Of course, where the glass is



FIGS. 10 AND 11—METER CABINETS IN APARTMENT HOUSES AND METER TRANSFER WITH DOOR SHUT

employed it is unnecessary to reach up to open the door, and the meter can be read very quickly. In many instances, however, the owners and builders prefer wooden doors and the tendency is toward more meter construction of the cabinets. This is illustrated in Fig. 8 and 9, which show an installation on brick houses with the doors open and closed. When the door is shut, as it always is found by the minute it is opened to read the meter, the cabinet is less conspicuous even than a shutter.

Fig. 10 shows the method of mounting of grouping meters in business blocks and apartment houses. The meter panel is located in a public part of the building, usually the hallway, but is from view when the building is not the scene of distribution the cabinet and panel is on the rear wall. In cabinets of this type a recessed ceiling fixture is tapped to the main line ahead of the meter so that a fuse can be inserted and lighted in a new building for trouble or a circuit. This group can be easily inspected when the meter is taken. From a cabinet this can also be meter and the appearance of the exterior of the building is shown in Fig. 11, which shows the same meter with the door shut. There is nothing to indicate that the door belongs to a meter cabinet, making the door and glass meter the main entry and from the building.



FIGS. 8 AND 9—METER CABINETS OPEN AND CLOSED

meter cabinet in the wall of the building. The meters are within easy reach from the porch floor, and the bottom of the cabinet is at the same height as the bottom of the upper window sash so that it does not interfere with the light entering the kitchen.

Another illustration showing a meter box on the rear porch of a detached house is given in Fig. 6, the box being

The Renovo Edison Light, Heat & Power Company started this method of installing meters twelve years ago, and during all that time, the manager states, not a meter has been disturbed nor has a single case of theft of electrical energy been detected. Moreover, the meters have not shown any appreciable effect from weather, because, being inclosed in a cabinet containing still air, the inside temperature of the cabinet was not affected as much as one would suppose. Fully 80 per cent of the company's electric meters are now accessible without requiring the meter reader to enter the private part of any building in which they are located. The boxes are lined with asbestos to meet the underwriters' requirements.

### Lighting the Way to Business

A somewhat unusual installation of display lighting is illustrated in the accompanying photograph of an alley at Hartford, Conn., leading to a popular restaurant in the



DISPLAY LIGHTING IN A HARTFORD ALLEYWAY

downtown district. The alley is roughly 100 ft. long and 8 ft. in width, and each side is illuminated by forty-one 16-cp incandescent lamps wired in multiple and carried on pipe conduit run along the sides of the bordering buildings at an average height of about 8.5 ft. above the sidewalk. The lamps are spaced about 30 in. apart on centers and give a pleasing and attractive aspect to the approach to the restaurant, establishing an avenue of light to its front door during the evening hours.

At each end of the alley is an electric sign of semi-circular shape, bearing the name of the establishment, and near the ends two 40-watt lamps have been hung over the center of the walkway to provide an even more brilliant illumination. The side lamps are supported immediately under reflecting troughs painted white on their under sides, and the whole installation is attached to the building walls by short iron brackets and braces. The use of electricity in this case goes far to offset the disadvantages ordinarily arising from a location somewhat removed from the main thoroughfares of travel.

### Electric Signs in City Streets

At a recent meeting of the committee on downtown streets of the Chicago Association of Commerce Mr. John F. Gilchrist explained the position of the Commonwealth Edison Company in relation to electric signs projecting over sidewalks. Mr. Gilchrist said that his company would be glad to co-operate to mitigate any possible abuse in the matter of projecting electric signs. He reminded the committee of the illuminating value of street signs, stating that it has been noticeable in Chicago that when the city lighting service is not in operation the decrease in illumination in downtown streets is hardly noticeable on account of the flood of light from electric signs, window lighting and various forms of decorative exterior illumination.

In Chicago electric signs, erected in compliance with the requirements of the ordinance, are permitted to project over the sidewalks as far as the curb. This is the practice in a large number of other cities, although in a few municipalities other restrictions are made. In New York, for instance, projecting signs may extend from 5 ft. to 8 ft. beyond the building lines. St. Louis permits signs to project not more than 24 in. on broad streets and 18 in. on narrow streets. In Philadelphia projecting electric signs are not permitted at all at the present time on four of the principal streets. On the other streets there are no restrictions. A San Francisco requirement is that signs shall be rung on pivots, permitting them to be swung back against the building during the day. In many European cities it is forbidden to extend signs of any character beyond the property lines.

### Recent Telephone Patents

#### RECEIVERS

Almost all telephone receivers have employed the system whereby the direct magnetic action of the poles was brought to bear upon the diaphragm. An exception to this method was the electro-motograph used by Edison wherein the diaphragm was driven by a friction point trailing on a moistened revolving cylinder. The friction between the point and cylinder varied with the current through their contact; thus the mechanical power of rotation was adapted to drive the receiver diaphragm.

The telephone receiver recently patented by Mr. S. P. Grace, of Pittsburgh, uses this principle, in that mechanical energy of a rotating cylinder is used to drive the diaphragm. In this case, however, the friction drive is done away with and the mutual inductive reaction of eddy currents serves to transmit the power. The usual receiver-pole pieces are supplemented by a pivoted magneto frame, one leg of which is associated with each pole piece. This auxiliary pole piece is so formed that it spans a considerable area of a thin copper disk with a very small length of air-gap. The disk is caused to rotate constantly and a uniform turning moment is developed in the auxiliary pole structure owing to the constant action of the permanent magnet in the receiver. This turning moment is resisted by the diaphragm, which is connected by a link to the top of the auxiliary pole piece. When the field magnetization is varied by incoming currents, the reaction between the auxiliary pole piece and the revolving disk is varied accordingly. Thus the mechanical rotative force is transmitted to the diaphragm, providing a means for increasing the energy at the receiver.

Mr. C. L. Chisholm, of Marysville, New Brunswick, has patented a receiver. The novelty of this appliance lies in mounting the diaphragm in a ring, so as to avoid any initial strains when the ear cap is screwed home, and in turning the ends of the pole pieces into a plane parallel with the diaphragm. The ends are then so shaped that the field is virtually circular and concentric with the diaphragm.



## SWITCHBOARD CIRCUIT SYSTEMS

Mr. H. P. Clausen, of Chicago, describes a system in which the line relay is permanently connected to one side of the line but becomes shunted by the low-resistance apparatus of the cord circuit. According to a second patent a relay with a double winding serves as the battery feeder to the line during the calling period, the life relay being included in the circuit. The double-wound relay at this time is differential and remains stationary while the line relay operates. When a plug is inserted the balance is disturbed. Then the double-wound relay responds, short-circuiting both the line relay and one of its own windings. This permits the second winding to co-operate with the cord circuit in retarding battery current during the talking period. Both of these patents are assigned to the Stromberg Carlson Company.

A third patent granted to Mr. Clausen and assigned to the Stromberg-Carlson company describes a switchboard circuit system. In this system the most noticeable feature is the method of controlling the line relay. This is so connected that as soon as it is operated it is automatically locked in, and the line lamp is energized constantly after the first attempt to call until the response of the operator in the line jack. Other features of the invention concern details of arrangement of the usual parts.

Another patent assigned to the same company has been granted to Mr. C. L. Goodrum, of Philadelphia. In this



CENTRAL ENERGY TELEPHONE SYSTEM

system, shown in the accompanying illustration, the circuit may be traced, showing the line relay shunted by one section of the repeating coil. The doubling back of the supervisory lamp circuit through the strapped tip and test-ring contacts of the jack is also shown.

Mr. N. L. Johnson, of Chicago, has made particular provision for a pilot lamp in the cord signals of his circuit. He uses direct acting magnetic signals to display the lamp. A back contact is made in series with an auxiliary contact in the jack. The latter is closed when a plug is in. The pilot lamp is included in this circuit and glows from the time the signal is restored till the plug is removed. This patent is assigned to the Corwin Telephone Manufacturing Company.

## IMPROVED APPARATUS

Successful operation of make and break contacts requires platinum points. However, in telephone work on account of the very minute currents employed the weight of platinum required is fixed by the required physical manipulation rather than by the current carrying capacity. An invention by Mr. F. M. McBERTY, of New Rochelle, N. Y., is devoted to the co-ordination of these two factors. He uses a very thin sheet of platinum foil upon one side of which copper is electrolytically deposited. The platinum thickness suggested is one-thousandth inch; the copper thickness one-fiftieth. The contact pieces are stamped from this stock and inserted in the contacting parts under pressure so that they flatten out and lock themselves into place. The patent for this invention is assigned to the Western Electric Company.

Two antiseptic devices for transmitter have been invented and patented by Mr. G. S. Bennett, of San Francisco. Sanitary paper is used for both. They have as a special feature a compulsory change of paper. To this end one of the types has an automatic device for feeding the paper while the other has a shunt which opens to prevent the use of the transmitter in order to permit the use of the telephone. This removal both from paper.

## Letters to the Editors

## Co-operation Between Central Station and Manufacturers

To the Editors of the Electrical World.

SIR:—I refer to the article in the recently issued Electrical World, entitled "Co-operation Between Central Station and Manufacturers." The plan of the Society seems hardly better adapted to assist the new-business manager of central station. It seems strange to the writer that central stations have not been willing to spend more money in installing electric-planting devices. Nearly every one is now maintaining a display room, but none of them seems to meet with the kind of success that is obtained when the manufacturer goes out and sells the goods. (I have been told by the fact that the manufacturer sends out a specialist, which, however, the central station should be because the larger end of the profit falls to the central station. The fact is that the central stations buy one or two appliances and merely place them in the show window. They may even send out a few circulars with their monthly bills, but they have no proper and complete information system. The whole aim and substance of the matter is that both sides are waiting for the other person to become active.

The central station should force the development of electric cooking by sending directly from the manufacturer and by active public demonstration, following this up by active canvassing. They should place the appliances in the household in easy terms, as for instance, putting them in on a payment plan, with the income in monthly installments, and should advertise this fact in the local papers. By featuring this excellent method of installed consumption they will reap the ultimate profit. This cannot expose the manufacturer to spend all his profit in building up a business for them. In other words, the central station should help the development of the business by co-operating with those manufacturers who are ready to bring their goods to build up a profitable trade.

Yours truly, J. J. FINE, Manufacturing Engineer.

Cambridge, Mass.

## Skin Effect

To the Editors of the Electrical World.

SIR:—In your letter of page 683 of issue for March 20 Mr. Lloyd G. Allen makes use of a formula for the value which differs somewhat from the formula for the value used by other writers. The difference, which is not that could easily have been seen in transcription, and probably the error in form is attributable to this point.

Pasadena, Cal.

M. W. ALEXANDER.

To the Editors of the Electrical World.

SIR:—I am glad that Mr. Alexander has called attention to the error in the formula given in my letter. The correct formula is as follows:

$$r_{eff} = r \left( 1 + \frac{1}{2} \frac{\mu^2 \omega^2}{\rho^2} \right) \quad \text{and} \quad \rho_{eff} = \rho \left( 1 + \frac{1}{2} \frac{\mu^2 \omega^2}{\rho^2} \right)$$

A summation of the formula with the  $\mu^2$  term in the letter will show plainly that the error was in the

Philadelphia, Pa.

JOHN L. LUTHER.



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Troubles Due to Non-Use of Circuit-Breakers

By F. W. HARRIS

Sometimes trouble develops on the best of apparatus owing to a misunderstanding of the proper care necessary, and often such trouble is very easily preventable. A common source of complaint is the heating of the contacts of carbon circuit-breakers after the instrument has been in service for a long period. These breakers, as commonly constructed, have a laminated brush made up of thin leaves of copper, and any temperature over a certain very well-defined maximum will result in the brush becoming soft and losing its elasticity. Therefore the heating becomes very much worse, rapidly approaching a crisis which results in a more or less total ruin of the brush and sometimes a shut-down of the plant.

Troubles of this kind are commonly attributed to the design of the circuit-breaker itself, and while it is true that different makes of such instruments show a different degree of resistance to this trouble it is more or less general among all types under certain conditions. The writer, who has personally examined a great many cases of such trouble, was soon convinced that a great deal of the difficulty was due to conditions against which no modifications of the design could be expected to guard.

Heating of contacts is very noticeable in steel mills, and one case of long-continued trouble resulted in dismantling the circuit-breakers on three successive July Fourth's, this being the most convenient day to the mill superintendent. The case was quite typical of general conditions, the instruments being rated at 10,000 amp and running on a load much below this. After they were put in first-class condition they ran quite cool for some months, the heating gradually increasing until they had to be overhauled again. As stated, the total cycle was about one year. Significant was the fact that there were some additional circuit-breakers of the same type in the same plant that were carrying a load somewhat in excess of their rating and were daily called upon to open heavy overloads and yet gave no trouble.

An examination of conditions showed that the trouble-some circuit-breakers were connected on a circuit that was never opened except upon dead-short-circuit conditions, and it further developed that these conditions did not obtain more than once or twice a year. In other words, the circuit-breakers were left closed for months at a time. The other instruments were on an individual motor circuit and opened every time the motor was overloaded, which might be several times a day. In addition, they were opened manually whenever the motor was shut down, which was always several times a day.

The whole trouble was traced to a gradual oxidation of the contacts and to the fact that the troublesome circuit-breakers were never opened and closed to rub off the oxide. It was found that if the instruments were opened and closed a few times on Sunday it was possible to keep the contacts bright. The circuit-breakers that gave no trouble were naturally satisfactory, as they opened many times a day and that kept the contacts clean.

In general, where open air-type switches are not operated frequently it is an excellent plan to clean them with emery cloth at least once a month, and where the contacts are

not easily accessible, as in this case, they should be opened and closed vigorously say a dozen times once a week. This is no great burden to the operator and will save repair bills.

## Replacing a Broken Valve Seat

By W. H. WAKEMAN

The engineer in charge of a certain improved Greene engine concluded that there was something out of order with his exhaust valves, as a slight noise indicated that some of the parts were loose or broken. On taking these valves out for examination, he found that the head-end valve and seat were in good order, but the valve seat on the

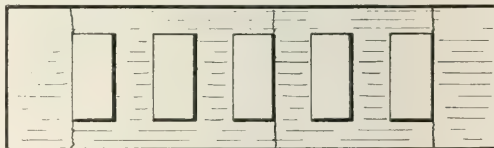


FIG. 1—CRANK-END VALVE SEAT SHOWING THE POSITION OF THE THREE BREAKS

crank end was broken in three places, as indicated in Fig. 1. This seat was not cast with the cylinder, but was made separate and fitted into a circular place provided for it. Two cap screws, put in from the under side, hold it in position, one at each end, as shown in Fig. 2, which is a side elevation of the seat. The ports are cored out enough to make a weak casting, as it is not supported at the center.

The fractures were not new, but had been there so long that the slight motion of the broken parts caused by the valve moving over its seat had worn the surfaces perfectly smooth.

Although the engine had been running in this condition for an indefinite time, the engineer declined to run it longer until a new seat was put in. A suitable casting was secured from the builders and machined until it fitted into place. The valve face was planed off, making a good fit on the seat, thus preventing all leakage at this point.

If this valve seat had been cast in one piece with the cylinder, it would not have broken. On the other hand, this



FIG. 2—CROSS-SECTION OF THE BROKEN PART AND TAP SCREWS WHICH HELD IT IN PLACE

part does not wear evenly and it is therefore often desirable to replace it. One edge of each port wears more than the other; hence ridges are formed that cause the valve to leak, especially if it is found necessary to lengthen or shorten the valve stem to give more or less compression to secure quiet operation. With a removable seat it is possible to plane the surface at small expense, thus restoring perfect conditions.

## Supply of Cooling Water for Power Stations

By FRED BOCH

With the immense size of water-cooled transformers now coming into use and the introduction of water jet ejectors and water-cooled apparatus in the power house the problem of the cooling-water supply and distributing system is receiving considerable more attention than was the case only a few years ago. Water was formerly taken from the

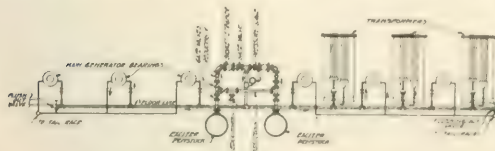


FIG. 1. DIAGRAM FOR HIGH HEAD DEVELOPMENT

nearest convenient place, almost regardless of requirements or conditions. A pipe line with a screen at the intake end and a cut-out valve in the power house then seemed quite sufficient and no working drawings were considered necessary. However, with the rapid growth of the size of apparatus and the general changes and advances in power-house layouts, the cooling-water system has been obliged to keep pace, until at present it has developed into a more or less complex system that requires the same care and attention as do the more intricate parts of power plants.

The water supplied for cooling the shaft bearings and transformers must be free from silt or grit and suspended matter, and sometimes free from air. To accomplish the former, strainers are fitted into the intake lines, and where this will not suffice settling basins or tanks must be resorted to, while for the latter de-aerating or storage tanks are frequently built at considerable expense. Where this water is required at a certain low pressure due to the design of the coils within the oil-immersed transformers, these tanks are located at the proper elevation to give the desired pressure and all water is passed through the tanks. The water must be taken from at least two separate and independent intakes so as to present a deficiency in the supply, regardless of shut-downs or accidents. Controlling valves must be arranged so as readily to by-pass from either intake to the distributing header, and these valves should be in the most accessible place in the power house within instant reach of the operator.

### HIGH-HEAD DEVELOPMENTS

In power plants with a high head of storage water it is customary to take the supply for the cooling system from the main or exciter penstocks in the power house floor, as this will require the least piping. The pressure, however, should be reduced unless the cooling coils within the transformers are especially designed to withstand this pressure. Fig. 1 shows diagrammatically the arrangements for such conditions in a power house having six main generators and three large water-cooled transformers. Water is taken from the exciter penstocks through saddle mules and a cross-connection between the two fitted with cut-out valves so that the distributing system may be supplied from either penstock. From the cross-connection the water passes through one of the two sets of pressure-reducing valves and basket strainers to the distributing headers leading to the transformers, main generator bearings and toilet rooms. There is also a connection for the water jet ejectors used for pumping out the sump in the substructure. These ejectors are used occasionally only while the cooling system is in constant use. In the case here shown the ejector connection was of the same size as the intake pipes from the penstocks, and cut-out valves were therefore arranged so that the distributing system could receive water from one penstock while the ejectors took their supply from the

other and thus there would be a full supply of water in both systems.

The requirements for cooling the oil in the transformers are usually specified by the makers. In this case the pressure desired was 25 lb. and the velocity from 3 ft. to 4 ft. per second. As the pressure at the intake end of the system was about 100 lb., a pressure-reducing valve reducing from 100 lb. to 25 lb. was fitted and a basket strainer applied to catch the floating matter. The wire baskets in these strainers are easily removable from the casing and the cleaning will therefore not require much time. It is good practice to apply the strainers with an inlet and outlet end about twice the diameter of the line into which they are to be fitted so there will be no straining of the water as it passes through the fine mesh of the basket, especially when these have become more or less clogged. Special flanges to fit the strainers must be specified and submitted for cutting on the strainers and the reducing valves from the line so that they may be changed or removed. It is for this reason that two of these flanges are supplied the water being passed through one line while the other is being put back into working order. In the case coming from the strainer to the distributing header a pressure gauge is fitted to act as a telltale and indicate that the reducing valves are working properly. As these valves are apt to "kick" and go wrong, this relief arrangement is very desirable.

Where the pressure reduction is great it may become necessary to fit two reducing valves in series, the first reducing the pressure from say, 200 lb. to 100 lb. and the other from 100 lb. to 25 lb. With this series arrangement there is no great strain on the reducing valves and they will not "fail" so easily as would otherwise be the case. Most reducing valves must be cut out from the line by closing the gate valves on both sides of them before any overhauling or readjusting can be done, but there has recently been placed on the market a regulating valve for which the makers claim that it can be put back into working order in a very few moments without shutting down the system and without losing any of the pressure in the line, unless regaining is necessary. The latter valve is arranged that it can instantly be adjusted to any desired pressure by simply turning a handle once, then second and examined with the water flowing through the valve at service pressure. This valve is made by the Crane company.

### LOW-HEAD DEVELOPMENTS

Where no great pressure is developed at the intake, or where water is plentiful at all times and pressure is of less importance, no pressure reduction should be necessary provided the cooling coils in the transformers and all other fixtures are designed to meet the pressure. In this case an arrangement such as shown in Fig. 2 is indicated. Water

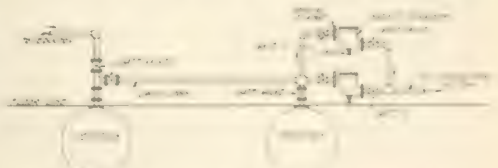


FIG. 2. DIAGRAM FOR LOW HEAD DEVELOPMENT

is taken from the penstock system of main storage water are supplied to the pressure-reducing valve in Fig. 2, except that the pressure-reducing valve had a relief pipe back into the sump. It will be found that this same valve does not necessarily require any of the other pressure-reducing valves, but it may be necessary to install a pressure-reducing valve in the line between the penstock and the valve. In the case here shown the water is taken from the penstock and passes through the valve into the distributing system, and the pressure-reducing valve is fitted to the line between the penstock and the valve.

each branch line and throttling down the flow by means of the two valves. This applies especially to the transformers, where otherwise large amounts of water would be wasted.

The basket strainers here shown differ from those in Fig. 1. There are several types on the market and all are good for freeing the water from leaves, sticks, etc. Where silt or sand is encountered, however, they would be of little use and a better water supply should be looked for, and if this is not available a different method of cleansing the water must be resorted to.

#### DE-AERATING OR STORAGE TANK

The storage tank shown in Fig. 3 is one of the simplest and most practicable methods of clearing excessively dirty water from sediment. This system is also resorted to where the transformers are fitted with iron cooling coils instead of brass and where it is therefore necessary to free the water from all air before it is allowed to enter the distributing headers, as otherwise the coils would be rapidly affected by corrosion. The tank is divided into two compartments and the water supply conducted into the smaller compartment, where all sand and silt settles to the bottom and the clear water spills over the top of the division wall into the storage compartment. This latter compartment is kept filled to the top, or nearly so, and the supply for the power house drawn from the bottom so that it will be seen that there is no chance for air to get into the distributing system.

In the case shown the requirements in the power house were 240 gal. per minute at a pressure of 25 lb. and a velocity of about 3 ft. per second. The tank was built to store a one-hour supply and was located at the proper elevation on the side of the hill to give the desired pressure. Connections for supply water to the tank were made to the penstocks at the power house and a cross-connection was installed with all the necessary cut-out valves and by-pass connections so that if at any time the supply from the tank failed water could be taken from the penstocks directly through a strainer into the distributing system. All valves were located at a convenient place in the power house where they could be quickly reached by the operator. The supply was controlled by an automatic float valve in the tank, the pressure in the penstocks at the power house being approximately 100 lb. The outlet pipe from the tank was fitted with a galvanized-iron strainer with a net area through the holes of the strainer equal to three times the net area of the pipe. The tank was fitted with a large drain from each compartment so that water could be run out from time to time and the impurities removed. It was also

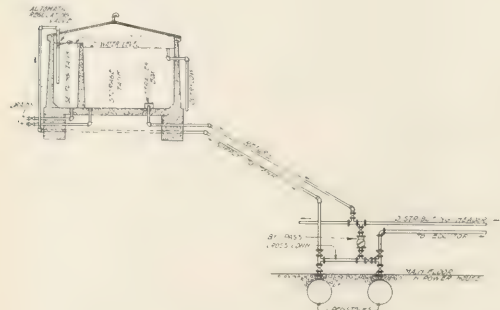


FIG. 3—STORAGE TANK

fitted with an overflow from the storage compartment and a device for registering the depth of water in the tank. It was built of concrete and covered with a roof on account of the more or less severe frosts.

This system is, of course, more expensive than the preceding ones on account of the cost of the tank, but in the

above case it could not be avoided as the transformers had been ordered with iron coils and it was therefore necessary to free the water from air. The average cost of a tank of this kind is about 1.5 cents per gallon of water stored. Steel tanks are not desirable on account of requiring almost perpetual painting and scraping, while wood tanks

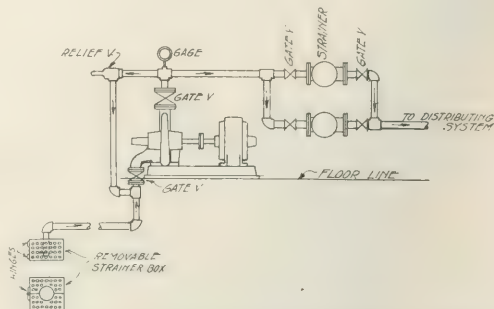


FIG. 4—TYPICAL ARRANGEMENT WHERE WATER IS PUMPED

are cheaper in first cost but their life not so long as that of the reinforced-concrete tanks.

#### PONDS AND RESERVOIRS

Fig. 4 shows a typical arrangement where the water is pumped from a settling basin or storage reservoir. The piping details do not differ greatly from those previously described. The galvanized-iron strainer box at the intake end of the suction pipe should be made in two parts and hinged on one side so that it can be opened and removed for scraping and cleaning without disturbing the pipe. In order not to waste any water the discharge end of the pump is fitted with a pressure gage and relief valve, the overflow from the latter being piped back to the reservoir or the suction end of the pump. Basket strainers are used as before, but no connection has been provided for the eductor. With this pump there would scarcely be pressure enough to operate the eductor, and the work of cleaning out the sumps would have to be done by pumping exclusively.

Where water is taken from the city supply system the pump connections may be as shown in Fig. 4, but the strainer box will not be required. However, a Venturi meter or any other good type of meter must be installed complete with all the necessary recording mechanism. While any type of pump of sufficient capacity may be used, the general prevailing idea among engineers seems to be that where priming conditions are favorable and the lift is not too great a small centrifugal pump is the best to use, as it supplies all the water required at a very low pressure, and in that case the by-pass from the pump discharge back to the suction pipe may be omitted. While the sketch shows a motor-driven pump, a steam pump may be more desirable or more economical in certain cases.

#### Air-Gap Length of an Induction Motor

Kindly inform me whether increasing the air-gap length in an induction motor increases the watts input or merely increases the volt-amperes?  
O. A. R.

The wattless component of the current taken by an induction motor increases almost directly as the length of the air-gap. The watts input is affected but little by a change in the air-gap. Thus if an ammeter and a wattmeter were connected in an induction motor circuit and an increase in air-gap was effected the ammeter would show an increased value of current, but there would be no appreciable increase in the reading of the wattmeter.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Self Synchronizing Machines.**—I. ROBINSON. An illustrated paper, in abstract, presented before the (British Institution of Electrical Engineers. The scope of the synchronous motor, self-starting synchronous motors, rotary converters and methods of synchronizing are discussed. A new method introduced by the author allows self-synchronizing of a rotary converter with small armature current, prevents sparking on the brushes and prevents the reversal of the field of the rotary converter. A starting motor is connected in series with the slip-rings of the rotary converter. As a starting motor an ordinary squirrel-cage poly-phase motor is nearly always used, but the explanation of the method is simplest by assuming a single-phase rotary converter and a single-phase commutator motor for start-

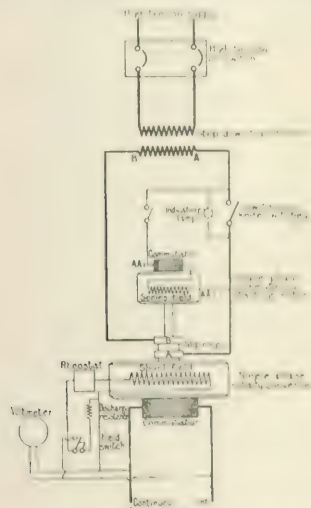


FIG. 1. DIAGRAM FOR SINGLE PHASE ROTARY CONVERTER AND SINGLE PHASE COMMUTATOR MOTOR.

ing (Fig. 1). There are no starting tappings on the main transformer. One low-voltage terminal *B* of the transformer is connected directly to one slip-ring *B* of the rotary converter, while the other terminal *A* has a straight connection through a single-pole main switch and another connection if the main switch is open through the single-phase starting motor. A small switch is shown in series with the single-phase motor, but is not essential. If the high-tension switch of the transformer and the switch of the starting motor are closed, the main low-tension switch being open, the current will flow through the starting motor into the rotary converter. The starting motor limits the current to a fraction of the full load current of the rotary. The rotary armature represents very little impedance. The starting motor takes practically the full voltage of the transformer terminals, and as with a properly designed rotor this current of 30 per cent can produce a very good torque which is far in excess of the starting

torque, it will start and bring the motor up to speed very quickly. A portion of this torque is not sufficient to supply the residual magnetism of the motor's excitation. The full current of the rotary converter remains connected across the continuous-current brushes, and the motor is preferably put into such a position as to make the starting resistance slightly below that required for normal locked excitation. As the full load current flows, a certain minimum current starts to flow in the motor's field winding, and excitation. As soon as it approaches synchronism, the machine will, therefore, readily pick itself like any other continuous-current machine. Just before attaining synchronism, speed the voltage will be suddenly reduced, and it becomes steady as soon as synchronism is reached. The voltage can now be adjusted and the machine motor short-circuited. Across the main low-tension switch an indicating lamp can be fitted, as shown in Fig. 1. This lamp will flicker before synchronism is reached and will be dark after the rotary has slipped into synchronism. When there is impressed on the slip-rings of a self-starting rotary converter an alternating current voltage equal to 44 or 45 per cent of full voltage a 500 or 43 or 41 per cent is induced and the machine is excited from the armature with a number of ampere-turns slightly less than 43 or 41 per cent of the normal field ampere-turns. About nine-tenths of the magnetomotive force will be absorbed in the air-gap and the iron of the armature. One-tenth of it that is from 3 to 5 per cent of the normal field ampere-turns—consumed in the field core. The magnetic force of the field is smaller by 1 to 2 per cent, and therefore the magnetism of each pole will be reversed every time the rotary slips a pole. If, on the other hand, a series-connected starting motor limits the voltage impressed on the rotary slip-rings to 6 per cent, the magnetomotive force induced in the field is only about 10 per cent of the normal field ampere-turns and is not able to reverse the residual magnetism, which represents from 3 to 4 per cent. An arrangement similar to that shown in Fig. 1 can be made for a three-phase rotary converter connected in series with a three-phase squirrel-cage motor. *London Electrical Review*, April 10, 1913.

**Three-Phase Series Motor.**—LUDWIG BINDER.—An illustrated article in which the author first gives a diagram for the three-phase series commutator motor in the most simple construction. This diagram permits one to find quickly the relative ampere-turns of the field, motor winding, series voltage, speed, torque, current and power. Following is a diagram showing the stability of load of addition of the operation of the motor, showing the torque at any speed to stator turns and induction also the torque at any speed here in order to meet economy of purchase. The author then takes up the discussion of the motor's construction, the use of brushes, etc., and the use of a diagram of the motor in order to meet economy of purchase. The author then takes up the discussion of the motor's construction, the use of brushes, etc., and the use of a diagram of the motor in order to meet economy of purchase. The author then takes up the discussion of the motor's construction, the use of brushes, etc., and the use of a diagram of the motor in order to meet economy of purchase.

**Illustrations of Direct-Current Machines.**—R. E. BROWN. An article illustrated by diagrams and a series of photographs illustrating the construction of direct-current machines. The author shows that the usual method of estimating the total excitation is liable to give very erroneous

results. He establishes by analysis some essential principles which lead to a method which may be easily applied by designers and yields little-complicated curves and results which agree with the facts. —*La Lumière Elec.*, March 22, 1913.

**Commutation.**—L. GRAZMUTLER.—An outline of a new theory of commutation. Instead of trying to estimate the current density of the parasitic currents (the local currents in the brushes), the author calculates the potential differences between the segments under the brushes—potential differences which are produced by the currents which are intentionally circulated in the windings. If this potential difference has not more than a certain empirical value, no destructive parasitic currents will occur.—*La Lumière Elec.*, March 22, 1913.

**Hunting.**—C. P. STEINMETZ.—An article in which the author explains the nature of synchronizing power and synchronizing force and shows that the hunting of a synchronous machine—a cumulative oscillation—is not a function of the synchronizing force, but is a true hysteresis effect, the result of a lag of the synchronizing force behind the position displacement which produces it. He draws an analogy between such electromechanical hunting and the purely mechanical hunting of a belt on its pulley and also states that a further analogy is provided by electromagnetic hunting in transformers and arcing grounds.—*Gen. Elec. Rev.*, May, 1913.

**Synchronous Converters.**—J. L. BURNHAM.—An article which contains a number of illustrations showing details of the latest construction of representative types of converters.—*Gen. Elec. Rev.*, May, 1913.

#### Generation, Transmission and Distribution

**Automatic Attachment for Motor Starters.**—A note on a recent British patent (No. 6599, 1912) of W. A. Clatworthy. To a pivoted lever are attached a weight or spring and a movable detent. A pivoted quadrant has a notch or projection for engaging the detent and is attached to the motor starter, of the ordinary non-automatic type, by a flexible coupling. A pivoted tripping arm is also provided for tripping and maintaining the detent in its non-engaging position. The pivoted lever and tripping arm are manually operated in one direction only. It is suggested that a suitable application of this gear would be to a hoist operated through fast and loose pulleys and where the starter may be operated for starting and stopping by unskilled persons from different floors by a rope.—*London Elec. Eng'g.*, April 10, 1913.

**Power House.**—The first part of an illustrated description of the new central power house in the Staffordshire potteries district, which gives a supply to the federated towns of Burslem, Hanley, Longton and Stoke and the districts of Tunstall and Fenton. For the new power house three-phase high-tension generation and transmission was decided upon. Use will be made of rotaries and motor-converters in the substations. The article is to be concluded.—*London Electrician*, April 11, 1913.

**Dangerous Rises of Voltage.**—M. GIERLICH.—The first part of a paper read before the Niederrhein Electrical Society on protection apparatus used by the municipal electric station of Neuss. The author describes the different ways in which dangerously high voltages may occur on transmission lines and then begins to discuss the different protection devices. The article is to be concluded.—*Elek. Zeit.*, April 10, 1913.

#### Traction

**Single-Phase Traction Motors.**—MARIUS LATOUR.—An article giving comparative notes on the different single-phase commutator motors which have been tried in the tests of the Compagnie des Chemins de fer du Midi in France. The motor types experimented with comprised the Westinghouse series motor, the simple repulsion motor (Brown, Boveri & Company), the compensated-repulsion

motor (Allgemeine Elektrizitäts Gesellschaft), the series motor with space-quadrature and time-quadrature local field for compensating the emf of short-circuit under the brushes (Jeumont), and the series motor with elliptic field (French Thomson-Houston Company). After giving notes on the characteristic features of these different types the author compares them with respect to the value of the sliding surface of the brushes in contact with the commutator and with respect to weight. The author insists upon the superiority of the series motor with local commutation field for a frequency of 15 cycles but thinks that the repulsion motors and especially the compensated repulsion motor are to be preferred at higher frequencies. The selection of the type of motor to be employed is, therefore, intimately connected with the numerical value of the frequency.—*La Lumière Elec.*, April 5, 1913.

#### Installations, Systems and Appliances

**Swedish Central-Station Statistics.**—R. NAUCLER.—Statistical data on the condition of central stations in Sweden in 1910. The stations are divided into two classes. The first comprises the pure power plants (all of them being water-power plants) and their number is twenty-one. Some figures about the five most important of these plants are given in the following table, in which the first column of figures gives the equipment rating in kilowatts in 1909, the second the rating in 1910, and the third the length of the transmission lines in miles:

DATA ON SWEDISH CENTRAL STATIONS

	1909, Kw	1910, Kw	Miles
Trollhättan.....	840	29,400	185
Gulispång.....	11,560	12,500	96
Yngeredalers.....	7,383	7,383	77
Hemsejo.....	5,650	5,650	76
Dejeters and Frickfors.....	3,600	4,000	53

The ratio of maximum load to total rating of connections varied in most of the plants between 0.47 and 0.75. The ratio of the yearly total production in kilowatt-hours to the maximum load of the station in kilowatts varied between 1767 and 5220 hours. The mean annual load of the different stations averaged about 50 per cent of the maximum load. The total first cost, including land, hydraulic developments, buildings, transmission lines and motors, varies between \$150 and \$242.50 per kw of rating. The cost of operation, without interest and amortization, is, with one exception, below 0.25 cent per kw-hr. The lowest cost is 0.08 cent. The annual receipts per kilowatt connected average \$17.50. The second class of works described are those which distribute electrical energy for lighting, motor service and traction. They have either their own generating plants or buy the energy in bulk from plants or combine both methods. In 1910 there were sixty-five such plants, of which thirty-five were owned by municipalities and thirty by private parties or corporations. Fifty supplied energy for lighting and motor service, fourteen for lighting, motor service and traction and one for traction alone. Twenty-four used direct current, nineteen alternating current, and twenty-two a mixed direct-current and alternating-current system. Numerous data are given for these plants concerning connections per inhabitant, maximum load, first cost, receipts, etc.—*Elek. Zeit.*, April 10, 1913.

**Current-Limiting Devices.**—J. B. PICOT.—An illustrated article on the different limiting devices which have come into use during recent years in systems in which a flat rate is charged and the consumer is disconnected (or at least warned by a flickering of the lamps) as soon as he consumes more power than he is permitted to do. The author



refers to the disadvantages of devices in which use is made of mercury or a hot wire and states that electromagnetic devices are to be preferred. Two such devices are described in detail, one of which is shown in Figs. 2. The interrupter has two pieces of carbon, one, *A*, being fixed and the other, *B*, being movable and mounted at the end of the lever *L*, which can rotate around the axis *O*. Under normal circumstances the two carbons *A* and *B* are in contact. Between the lever *L* and the piece of soft iron *D* an electromagnet *C* is provided which is excited by the current in the line and which attracts the soft-iron piece *D*

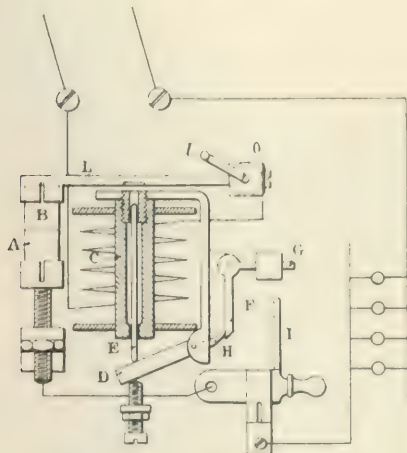


FIG. 2.—CURRENT-LIMITING DEVICE

when the current used rises above a certain value. The soft iron piece *D* pushes the rod *L* upward in the hollow center of the core of the electromagnet against the lever *L*, thus breaking the contact between the carbons *A* and *B* whereby the main circuit is broken. When *D* is attracted upward the lever arrangement *L-G* begins to oscillate and prevents the soft iron piece *D* from coming back into its former position until the load is reduced below its permissible value, when the circuit may be closed again by means of the hand-operated switch *I*.—*La Lumière Elec.*, April 12, 1913.

**Regulation of Distributing Systems.**—A note on a recent British patent (No. 6212, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. As applied to a three wire system each dynamo or balancer has in the field circuit a resistance which is short-circuited through a relay controlled by another relay with two balancer windings, one across each outer and the neutral. It is thus arranged that one resistance is in circuit while the other is out, so that rapid following of load variations is possible.—*London Elec. Eng'ing*, April 10, 1913.

**German Central Stations.**—G. STEGEL.—A paper giving data on the importance of the electric central stations in the economic life of Germany. Numerous statistical tables and curves are given.—*A. E. G. Review Mon.*, March, 1913, abstracted in *La Lumière Elec.*, April 5, 1913.

**Arcing of High-Tension Switches.**—W. HUBER.—An English translation in abstract of his recent German paper on arcing phenomena on high-tension switches.—*London Electrician*, April 11, 1913.

**Electric Heaters.**—H. O. SWOBODA.—An illustrated article on the different typical devices used as electric heaters and utilizing either the Joulean effect, the electric arc or the electric spark.—*Elec. Jour.*, April, 1913.

**Switchboards.**—C. H. SANDERSON.—A continuation of

his illustrated article on remote mechanically controlled switchboards, in *Engineering*, June 1912, continued in *Electr.*, April, 1913.

#### Wires, Wiring and Conductors

**Problems in High Voltage Systems.**—An interesting article in which it is suggested that the continuity and reliability of supply is better assured with a system of many small substations in series than with a system of a small number of large substations. It is necessary to use circuit-breakers which do not operate in the case of an overload but open in the case of an accidental ground on the system.—*La Lumière Elec.*, April 10, 1913.

**Theorem of Reciprocity in Electric Networks.**—A brief mathematical paper by H. A. W. Klinkhamer on the reciprocal coefficients in electric networks. Some critical remarks on the mathematical consequences of the authors' proof are added by J. J. Stroud.—*La Lumière Elec.*, March 29, 1913.

**Repairs of Fuses.**—H. PIERRE.—A note commenting again the fact brought out before in several other reports that repaired fuses are not only uneconomical but may be dangerous. A properly repaired fuse is not cheaper than a new one and the customer should be in no way deceived.—*Elek. Zeit.*, April 10, 1913.

**Slide Rule—Factors Required.**—The author describes a new slide rule which permits one to make in a very simple manner the common calculations of electric lines with respect to voltage drop and cost and also to make multiplications and divisions in the same way as with the ordinary slide rule.—*Elek. Zeit.*, April 10, 1913.

#### Units, Measurements and Instruments

**Measurements of Inductance.**—A. Q. ADAMS. In a report to the British Association in 1883 it was pointed out by Lord Rayleigh that there is a marked difference in the behavior of a galvanometer used for null methods of inductance measurements according to whether the balance is continuous or merely aggregate. The latter case, of course, tends to give uncertainties. The report identifies a particular case and shows that two conditions must be fulfilled if the balance is to be continuous, but no proof is given that these are sufficient conditions, and yet it might at first be supposed that there would be others. The expression for the quantity passing along any arm of the network consists in general of four terms, each of which must in the galvanometer arm be identically equal to zero for a continuous balance. Moreover, no general method is indicated for discovering the necessary and sufficient conditions in other cases, if there are such conditions. Lastly, it seems that in the cases where there is not a continuous balance it would be well to know roughly the duration of the flow through the galvanometer in the two directions successively, so as to judge whether the instrument is sufficiently ballistic. These matters form the subject of the author's discussion, and most of the ballistic laboratory methods are dealt with. The author discusses Maxwell's original plan for comparing an inductance with a capacity, Rungius's method, Nyquist's method, W. Stroud's method, Anderson's method, F. J. Taylor's comparison of mutual inductance with capacity, Maxwell's method of comparing two *M*'s, Maxwell's method of comparing the *M* of two coils with the *L* of one of them, Brillouin's method, and Meyer's method of comparing the *M* of two coils with the *L* of the third. In five of the twelve methods mentioned a continuous balance is not necessarily attained if a balance is attained at all. In four such a balance cannot be attained at all, and in only three is the continuous balance dependent upon conditions. Moreover, in these three cases it is usually so realized by introducing a double ballistics setting which is usually regarded as fatal to the practical utility of the method. The advice to "fulfil the condition for a continuous balance when



such a condition exists" may well be supplemented by further advice to choose a method (when possible) in which no special condition need be fulfilled. This is the case in three methods, namely, W. Stroud's method and Anderson's method of comparing an inductance with a capacity and Maxwell's method of comparing the  $M$  of two coils with the  $L$  of one of them. The paper is highly mathematical.—*Philos. Mag.*, April, 1913.

*Electric Dynamometer in the Automobile Industry.*—CARL F. SCOTT.—An illustrated article in which the author explains the principle of the electric dynamometer and enumerates its marked advantages in the testing of all types of gasoline engines, describes its construction, shows how the readings of torque and speed are obtained, explains the control system and the method of absorbing the load, and describes the procedure for conducting the tests on the engine. The latter part of the article deals with the chassis-testing electric dynamometer, and a summary of the reasons why the automobile factories are finding that this method of testing chassis pays—a method in which the tire bill is eliminated, labor costs are reduced, whole-time operation of men and plant is made possible and economies are effected which quickly outrun the entire costs of the complete electrical equipment.—*Gen. Elec. Rev.*, May, 1913.

*Sphere-Gap as a Means of Measuring High Voltage.*—F. W. PEEK, JR.—An illustrated article in which the author shows that by using spheres for the electrodes of spark-gaps much more consistent results are obtained than with the present extensively used needle-gap. Correctly proportioned sphere-gaps are not nearly so sensitive to the modifying effects of varying degrees of humidity; there is no corona formation preceding spark-over, and consequently no heating of the air by the streamers; the space-factor is smaller, while several thousand measurements can be made before repolishing becomes necessary. The results of some calculations and tests on gaps formed between spheres of different size are shown in the shape of curves. A few simple formulas are given to assist in calculating special cases.—*Gen. Elec. Rev.*, May, 1913.

#### Telegraphy, Telephony and Signals

*Trunk Telephone Transmission.*—A. B. HART AND W. J. HILYER.—A paper, in abstract, read before the (British) Institution of Post Office Electrical Engineers, discussing standards of reference for speech and transmission, best distribution of copper in line circuits, effects of loading and losses, the design of a transmission scheme, trunk-circuit design, simultaneous telephone and telegraph working, long-distance work and communication between England and continental Europe.—*London Electrician*, April 11, 1913.

*Submarine Cable Signaling.*—H. W. MALCOLM.—The first part of an article illustrated by diagrams on a comparison of the methods of submarine cable signaling. To provide a quantitative test of the relative merits of different methods of signaling in submarine cables, a standard word is supposed sent through a representative cable, and its shape as received is calculated. The methods of signaling considered are: (a) siphon recorder code, (b) ordinary Morse code, (c) the Gott form of Morse, and (d) the Picard form of Morse. The shape of the received word is illustrated graphically, and the effect of various modifications in the sending conditions is discussed.—*London Electrician*, April 11, 1913.

#### Miscellaneous

*German Electrical Industries.*—The conclusion of the series of reviews of the German electrical industries in 1912. A. Schnée discusses electrotherapeutics and the uses of Roentgen rays, Schwerin discusses electric signals, Berger telegraphy and telephony over wires, O. Jentsch wireless telegraphy and telephony. The report of the German government telegraph and telephone department for 1912 is added.—*Elek. Zeit.*, April 10, 1913.

*Thefts of Electricity.*—E. DE LONGUEVAL.—An article describing several clever devices by which fraud has been committed in France in changing the meter readings so as to reduce the bill for energy consumed. The article is illustrated by diagrams.—*La Lumière Elec.*, March 29, 1913.

*Organization.*—C. B. AUER.—A lecture on the formation and organization of a large manufacturing corporation, giving in diagrams a scheme of such an organization, a sample balance sheet and a sample income and profit and loss statement.—*Elec. Jour.*, April, 1913.

*Economics of Engineering.*—W. A. J. O'MEARA.—A long abstract of a lecture to the students of Faraday House on the economics of policy and the economics of practice making up the science of engineering economics. The subject is discussed under the following four headings: Markets; methods of management of engineering enterprises and the technical details relating thereto; diversity of interests of employers and employed; effects of legislation on engineering enterprises.—*London Electrician*, April 4, 1913.

*Engineer in Charge.*—A. E. PENN.—An abstract of a paper read before the (British) Association of Engineers in Charge on the province of the engineer in charge.—*London Electrician*, April 4, 1913.

## Book Reviews

*HYGIENE FOR THE WORKER.* By William T. Tolman, Ph. D., and Adelaide Wood Guthrie. Edited by C. Ward Crampton, M.D. New York: American Book Company. 225 pages, illus. Price, 50 cents.

A very practical and clearly written book intended especially for the reading of boys and girls from thirteen to eighteen years old. It contains much useful information both as to the regulation of normal life and also as to how to act in an emergency. It is easy to read and is well illustrated. In our opinion too much stress is laid on what the worker should expect from his employer and too little on what an employer should expect from his employee; but if this is a well-founded criticism, it is only fair to add that any such one-sidedness of advice is apparently unintentional. The book will interest many persons outside of the youthful members of society for whose particular benefit it has been prepared.

*DIE VERANSCHLAGUNG ELEKTRISCHER LICHT- UND KRAFTANLAGEN UNTER BENUTZUNG VORGEDRUCKTER FORMULARE.* Für die Praxis erläutert von Oberingenieur. By B. Jacobi. Munich and Berlin: R. Oldenbourg. 207 pages. Price, 7 marks.

In the progress of electrical engineering we begin with scientific discovery and advance through the work of physicists and inventors to the activities of the constructing, installing and operating engineers. When the work becomes so far advanced that the operating engineer, the last member of the series, standardizes it the question of costs and accounting becomes important. Unless standard methods of accounting are followed, comparisons between different sets of accounts are ambiguous and unreliable. The book written by Mr. Jacobi presents a standard system of accounting and cost sheets for plants and stations whereby the machinery, apparatus, wiring and materials may be tabulated and itemized conveniently and to the best advantage. Twenty schedules are set up and analyzed relating to direct-current and alternating-current generators and stations, transformers, storage batteries, lightning arresters, conducting systems, motors of various types, lamps of various types and converters. The work will appeal to manufacturers, central-station engineers and accountants interested in German methods.

# New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed  
Manufactured Products of Interest to Electrical Readers

## Interchangeable Socket

The illustration shown herewith represents a keyless socket embodying the interchangeable feature. This socket is fitted with a groove which permits it to be used with shade holders and is equipped with a 3/8-in. aluminum cap at the top. The manufacturers of this socket have recently put upon the market a line consisting of fifteen standard parts from which it is possible to make twenty-four different combination sockets and receptacles both with and without keys. The interchangeable feature permits the jobber to carry in his stock a variety of sockets and receptacles without the outlay of a great deal of capital. These sockets are manufactured by Pass & Seymour, Inc., Solvay, N. Y.



INTERCHANGEABLE SOCKET

## Chain-Pull Attachments for Lamp Sockets

The firm of Harvey Hubbell, Inc., Bridgeport, Conn., has just placed on the market a pull socket with a permanent



FIG. 1—CHAIN-PULL ATTACHMENT FOR BARE SOCKET

chain-pull attachment and also an attachment for ordinary pull sockets, the two devices being shown in Figs. 1 and 2 respectively. The construction of the former is evident



FIG. 2—CHAIN-PULL ATTACHMENT FOR SHADED LAMP

from the illustration. The latter can be attached directly to any pull socket. A stiff spring band is clamped around the socket. A slot in the end of the band hooks over a screw which tightens the attachment. When properly fastened it cannot wobble, bend or get out of order. The chain is connected to the end of the curved lever, which comes directly opposite the chain eyelet. The downward

pull of the cord effects a forward pull of the chain. There is no strain on the socket or chain and the lamp is free from harmful jarring.

## Semi-Indirect Lighting Fixture

The fixture illustrated herewith, called the "Phoenixlite," is simple and efficient and, according to the manufacturer, it absolutely eliminates glare. The lamp is totally con-



SEMI-INDIRECT LIGHTING FIXTURE

cealed and the quality of the glass is such as to produce a daylight effect. In using this fixture the color and other conditions at the ceiling are said to be immaterial. The reflector is easily kept clean, consequently efficiency of the installation is maintained.

This fixture is manufactured by The Phoenix Glass Company, 15 Murray Street, New York.

## Severe Test of Motor in Dayton Flood

By E. W. BAINES

In the recent flood at Dayton, Ohio, electrical apparatus installed in central stations, as well as in industrial plants, received a test for which they were never designed. Many interesting tales have been reported of electrical apparatus salvaged from the flood, having survived in the conditions of modern machinery.

One interesting case concerned a 10-hp. motor (110, 220-volt, 60-cycle motor) made by the General Electric Company. This motor, in its original enclosure, was used with continued running switch. The owner had been taken to the customer, the Worthington Lumber Company, by the Dayton Lighting Company, two days before the flood. The building in which this motor was installed was inundated to a depth of 15 ft., the motor being totally submerged and full of mud and oil for two weeks. On examination it was found that the oil in the bearings had thoroughly protected them against rust and that the internal starting switch had effectively blocked out most of the rotor so that there had been almost no contact. It was found from the time of shipment the owner had been thoroughly checked with a hose and water, in the manner shown in the illustration, but was found to operate and running light. There was no need to look for the motor, so it was delivered unharmed to supply current and

let the motor dry itself out. This was accomplished by connecting it directly to the line, the starting resistance first being entirely cut out of circuit by means of the internal switch. For a moment the rotor threw out water like a miniature waterwheel, but it soon settled down to normal operation, without causing trouble.

The age and previous condition of service of this motor



WASHING SILT FROM MOTOR

make its performance most interesting. On investigation it was found that the motor was ten years old, it having been purchased by the Dayton Lighting Company in 1903. It had been previously used by that company in making all sorts of operating tests in various industrial plants for extended periods and had been subjected, in consequence, to severe overloads and treatment.

### A Compact Condensing Plant

A compact surface-condensing plant, consisting of a surface condenser with turbine-driven air, circulating and hot-well pumps, has recently been built by the C. H. Wheeler Manufacturing Company, Philadelphia, Pa., to operate in conjunction with a 3500-kw Westinghouse-Parsons turbo-generator. The condenser illustrated here-with contains 13,500 sq. ft. of tube surface made up of seamless drawn brass tubes 18 ft. 2 in. long, secured by ferrules at both ends and rolled into Muntz metal-tube sheets. The condenser is of the two-pass type arranged for full counter-current operation. The exhaust steam enters at the bottom of the shell through a 48-in. exhaust inlet and passes upward on the outside of the tubes toward the air-pump suction, which is at the highest point of the shell. The water, entering at the top, travels along the top bank of tubes, then reverses and passes through the middle bank of the tubes, and then through the bottom bank

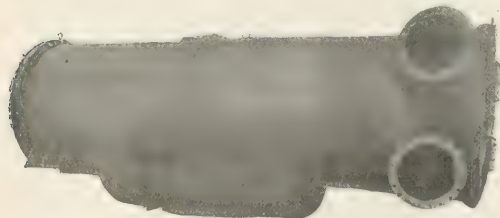


FIG. 1—SURFACE CONDENSER

of tubes and out at the 24-in. opening on the bottom of the water box. At the under side of the condenser shell is provided a hot-well chamber in which condensed steam collects to be removed by the hot-well pump.

Fig. 2 shows the pump combination. It is in this arrangement of the air, circulating and hot-well pumps that the special features of the equipment are involved. The

unit consists of a 20-in. high-speed low-head centrifugal entrainment-type air pump and a two-stage centrifugal hot-well pump. The entire combination is driven by a 125-hp Terry steam turbine of special design. The condensing equipment will handle 60,000 lb. of exhaust steam per hour and produce a vacuum of 2.25 in. absolute with circulating water available at 85 deg. Fahr. This condi-



FIG. 2—TURBINES AND PUMPS

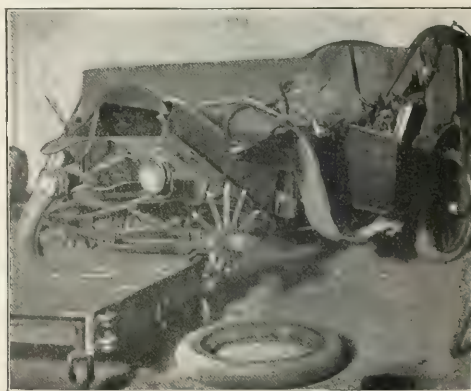
tion is equivalent to a vacuum of a little better than 1.5 in. absolute with a normal temperature of 70 deg.

The normal speed of the combined pump unit is 1450 r.p.m. This speed, however, can be varied by adjusting the governor of the turbine to suit varying water temperatures and take care of heavy overloads.

### The Sturdy Vehicle Battery

Interesting stories are coming in from the territory swept by the recent cyclone and floods, and all show the great recuperative powers of the electrical interests. A remarkable example of the sturdiness of electric-vehicle equipment was discovered in the ruins of the Omaha Electric Garage. A Detroit electric roadster owned by the Omaha Electric Light & Power Company was buried under tons of brick and wreckage, and when the debris was cleared away a cable was attached to the front axle and it was hauled out.

The car contained a battery of forty Edison alkaline cells. The forward metal hood over the battery had been crushed in, short-circuiting the cells and burning off the



WRECKED ELECTRIC VEHICLE

connecting jumper cables, but the cells themselves appeared to be uninjured. Later a test was made by taking individual cell readings, and it was found that neither the weight of the falling wall and short-circuiting nor the subsequent storage of the battery had damaged a single cell. Even the electrolyte was found at practically its normal level.



### Indirect Illumination of Salesroom

The Firestone Tire & Rubber Company, Chicago, has recently had its salesrooms and offices equipped with so-called Alexalite lighting fixtures made by the Central Electric Company, 320 South Fifth Avenue, Chicago.

Ten such fixtures fitted with 250-watt lamps are installed



SALESROOM WITH INDIRECT LIGHTING.

in the salesroom shown in the illustration. An effective illumination of 4 ft.-candles is said to be obtained at a consumption of 0.66 watt per square foot. In this connection it should be noted that the interior decorations are in fumed oak, which is a poor reflecting medium. Shadows are said to be entirely eliminated below the fixtures. In this case the brightest spot is said to be directly beneath the bowl. The excellent light distribution is credited to the design of the diffuser bowl and the fact that the diffusing medium is porcelain-enameled steel.

### Vertical Motor for Cement Mills

In order to provide a thoroughly satisfactory drive for vertical machinery such as grinders and pulverizers in cement mills and other places where the service is very severe, the Westinghouse Electric & Manufacturing Com-



FIG. 1—VERTICAL CEMENT MILL MOTOR.

pany, East Pittsburgh, Pa., has built a line of vertical motors in sizes varying from 75 hp to 200 hp for both direct-current and alternating-current service.

A special feature of this motor is its strong, rugged construction. The motor frame is supported by a massive cast-iron base, which rests on slide rails with belt-adjusting screws. The shaft is of very large proportions and the

bearings are designed to withstand severe stresses. The weight of the motor and the major part of the horizontal thrust due to belt tension are carried by a ball bearing mounted within the motor base. This bearing is housed in an iron case and can easily be removed if the necessity arises. The bearings are automatically oiled, the oil being

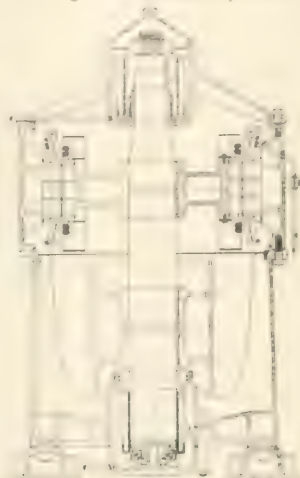


FIG. 2—SECTION THROUGH CEMENT MILL MOTOR.

forced between the bearing surfaces whenever the motor is in motion. The ball thrust bearing runs concentric to the shaft. The commutation of the direct-current motors is said to be practically sparkless.

### Emergency Motor-Driven Pumps for Theaters

Notable electrically driven equipments of fire-fighting apparatus are installed in the Alhambra Theater, New York City and the Orpheum Theater, Brooklyn. The fire-

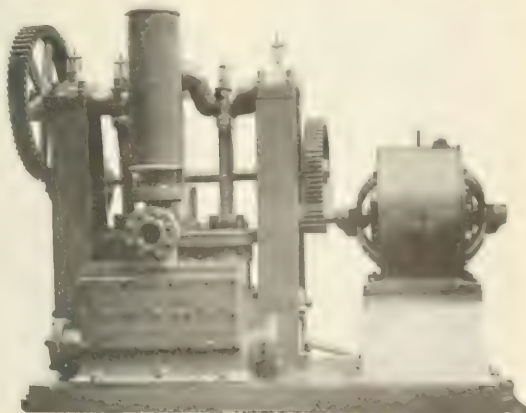


FIG. 3—EMERGENCY PUMP, WESTINGHOUSE.

apparatus shown in the illustration is built in two sizes, namely of 25 hp. and 50 hp., and is manufactured by the Dodge Manufacturing Company, Chicago, N. Y., and the Douglas Duplex pump manufactured by W. S. D. Douglas, Middletown, Conn. The pump is fitted with a special form of automatic controller which causes the pump to operate at a constant speed. These pumps are used to maintain

pressure in the fire lines for emergency use. They deliver 250 gal. of water per minute, operating at 50 r.p.m. against a pressure of 100 lb. per sq. in.

### Motor Equipment of a Cigar-Box Factory

The modern cigar-box factory includes, besides the woodworking machinery, also presses for printing of trademarks and names, bronzing and embossing. In the plant

MOTOR EQUIPMENT OF CIGAR-BOX FACTORY

Number	Rating in Hp	Type	Application
1	15	Slip-ring	Operating elevator; motor suspended from ceiling.
1	3	Squirrel-cage	Driving paper cutter; motor mounted on floor.
1	1	Squirrel-cage	Driving bailing press; motor mounted on wall bracket.
2	0.5	Slip-ring	Driving small job presses; speed control by means of circular-plate speed regulators mounted on wall; motors on floor.
1	2	Slip-ring	Driving embossing press; drum-type speed controller mounted on press; motor on floor behind press.
1	2	Slip-ring	Driving pony flat-bed press; face-plate-type speed regulator mounted on wall next to press; motor on floor.
1	3	Squirrel-cage	Driving bronzing press; motor under press on floor.
1	3	Slip-ring	Driving a flat-bed press; drum-type controller mounted on press; motor on floor.
2	3	Slip-ring	Driving small flat-bed press; drum-type controllers mounted on presses; motors on floor.
1	0.5	Squirrel-cage	Driving small circular saw used for trimming cuts, etc.; motor on floor.
1	0.5	Squirrel-cage	Driving empty wheel and buffer.
1	0.5	Squirrel-cage	Driving small circular saw.
2	5	Squirrel-cage	Driving 30-in. planer; motors on floor, inclosed in boxing.
1	2	Squirrel-cage	Driving paper cutter; motor on floor.
1	0.25	Squirrel-cage	Driving gluing machine and belt.
1	10	Slip-ring	Blower system.
1	15	Slip-ring	Driving group of seven small presses, six nailing machines, three circular saws, freight elevator and two circular saws on floor above; motor located in old section of plant.

of the C. B. Henschel Manufacturing Company, Milwaukee, there are fifteen presses for such purposes and a

The wood when purchased from the mills is a little thicker than that used for the boxes and is run through a 30-in. planer driven by 5-hp squirrel-cage motors. The wood is then cut in lengths and widths to suit the requirements, most of the boxes being a standard size.

In the basement there are fourteen motors. Three flat-bed presses are operated by slip-ring-type motors, controlled by drum-type controllers. A bronzing press run at a slow speed is driven by a 1-hp back-gear squirrel-cage motor, with the starter mounted on the frame. A small gluing machine for applying glue to the paper lining is driven by a 0.25-hp motor. This machine consists of several rolls, one of which runs in glue kept in a liquid state by means of a steam coil. Glue is applied to one side of the labels and lining by passing the sheet between the upper rolls, whence it is carried on an endless belt between two tables where it is picked up and applied.

The total rating of the motors in use is 76¾ hp, and energy for them is furnished by a 28.8-kva, 240-volt generator. A service connection to the lines of The Milwaukee Electric Railway & Light Company is installed for supplying energy in emergency cases. Three-phase, 60-cycle Watson motors, made by the Mechanical Appliance Company, Milwaukee, are used in the plant.

### Oil-Pressure Bearings for Large Turbo-Generators

The power plant of the Mississippi River Power Company now in course of construction at Keokuk, Ia., will ultimately contain thirty 10,000-hp generating units. At the maximum head of 39 ft. the output will be approximately 14,000 hp per unit. The waterwheels are of the single-runner type operating at 57.7 r.p.m. They are directly connected to vertical, low-speed generators. The turbines are the largest ever built.

The thrust bearings are a combination roller and oil-pressure bearing. As the total weight of the unit which each of these bearings has to support is 275 tons, the importance of the oil supply is very apparent. The oil is



INTERIOR OF CIGAR-BOX FACTORY, SHOWING MOTOR DRIVE



TRIPLEX PRESSURE PUMP

total of twenty polyphase induction motors, all but one driving a separate machine or press. The motor excepted, rated at 15 hp, is part of the original equipment and drives seven small presses, six nailing machines, five circular saws and a freight elevator. It is planned to split up this large group as it is often necessary to run this motor when only a few of the machines are operated.

pumped to the bearings by means of triplex pressure pumps made by the Goulds Manufacturing Company, Seneca Falls, N. Y. It is supplied at a pressure of 250 lb. per sq. in., which is sufficient to lift the unit so that it floats on the oil and relieves the rollers of the load.

The pumps have 6½-in. cylinders and 8-in. stroke. They are operated by chain drive from a line shafting.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Found Oil Engines in Demand Abroad.**—W. R. Hayne, 30 Church Street, New York, who is the United States representative of Carls Freres, the well-known builders of Diesel oil engines at Ghent, Belgium, upon his return from Europe this week, said to a representative of the *Electrical World* that during his trip he found that great interest is being shown throughout Europe in the Diesel engine and that all of the many companies building this type of engine are exceedingly busy. "One very impressive feature of the Diesel engine field abroad," he said, "is the large extent to which this engine is being manufactured in countries in which no oil is produced. Nevertheless, all of the larger engine builders and manufacturers of power plant equipment are building Diesel engines of some size and type; all are very prosperous and are from eight to sixteen months behind in filling their contracts for Diesel engines. In many cases the greater percentage of the output of these manufacturing plants, which formerly built steam or gas engines, is now Diesel engines in units varying from 50 hp to 3000 hp in rating. In the majority of cases abroad nowadays the central-station managers, municipal authorities and heads of manufacturing industries do not buy power-station equipment without first considering the Diesel engine, using either crude petroleum, residue oils or coal-tar oils. In the greater number of instances, and particularly in the case of the foreign central-station companies, the final selection is the Diesel type of engine. The installation of a 1000-hp two-cycle Carls Diesel engine in the Brussels central station, to be used to help the turbine equipment carry the peak load, is an example of one of the uses of the crude-oil engine abroad. Oftentimes the Diesel engines are used to carry all of the very light loads in the latter part of the night. Very large central stations that are being built in Havre, Bucharest, Lucerne and various other European cities to-day will undoubtedly contain Diesel units. One of the European governments, after a very exhaustive study, has decided to purchase forty-six Diesel engine generating sets for fortification work. It is also very interesting to see in England that some of the largest industrial plants, such as the Daimler Motor Company, the Hoffman Manufacturing Company and others, have Diesel engine power plants varying from 1000 hp to 3000 hp and use fuel oil which costs them 7½ cents per gallon, net, delivered in their storage tanks, when they could buy coal delivered in the boiler room at \$3.25 per ton."

**The Tariff and Business Conditions.**—While there is some apprehension in certain quarters concerning the effect on business of the proposed changes in tariff rates, the general sentiment in various branches of the electrical and allied industries seems to be that no changes of a radical nature are impending and that such changes as are imminent will not affect business greatly. What dissatisfaction there is in evidence seems to be among the smaller concerns and is in all probability traceable to purely local conditions. The larger companies say, almost without exception, either that their sales are increasing or that they are steady and satisfactory in volume. The general impression reflected from large dealers in various lines is that competition has been pretty severe and that, while sales have been large in volume, prices have inclined to vary considerably. A prominent firm of mica importers, when interviewed, expressed the opinion that the proposed tariff rates on mica would not materially affect the industry. They thought that the lower grades costing under \$7 per lb. and imported mica would be affected unfavorably and that the higher priced grades and formed mica would be hurt by these changes. If anything, they said, the manufacturer of built-up mica plate would be a little benefited at the expense of the importer, but the difference would be small. Several of the

leading makers of insulated wire and cable here in the opinion that the proposed reduction rates would have little effect on the electrical industry and that, on the other hand, the amounts lost are so comparatively small and speculation is so active that they feel the tariff is a matter of secondary importance.

**Activity Continues in Ornamental Lighting-Pole Business.**—We have had one or two most successful seasons thus far," said the manager of a well-known ornamental lighting-pole company this week, "and one very surprising thing is the high rate of activity in our business at the present time. Ordinarily things begin to slacken up at this season of the year, but so far there has been no let-up in the volume of orders and inquiries. That shows a widespread interest in ornamental standards is indicated by the large amount of business we are getting in all parts of this country and elsewhere. During the past month we shipped a great many standards to Panama, Santo Domingo and Canada in addition to filling many orders from people in this country. I have seen that there is hardly a town of any importance in the country where electric light is available in which the question of installing an ornamental lighting system has not been considered. Light improvement associations are continually asking us for information. Only recently I had a request from a religious organization for advice along the line of ornamental street lighting systems. This association works in connection with a number of welfare agencies in the religious community in a certain state and is preparing and looking out plans for community betterment. One of the subjects it is studying very carefully in this connection is that of street lighting as a deterrent to crime and as a means of better government. In view of the rapidly growing interest shown in better lighting, I look forward to maintenance of the excellent conditions in our line."

**Reduction in Price of Carbon Lamps.**—Manufacturers of incandescent lamps recently placed in effect a new price schedule for carbon-filament lamps. The regular 20, 25, 30, 35 and 60 watt, 100 to 300 volt lamps with specific consumptions of 1.15, 1.20, 1.25, 1.3 and 1.4 watts per candle respectively, are now listed at 12 cents plain and 14½ cents frosted, in standard package quantities of 25, subject to a discount of 15 per cent on standard package quantities. The regular 100 watt and 150 watt incandescent lamps having specific consumptions of 1.5 watts per candle are listed at 18 cents plain and 21 cents frosted in standard package quantities of 25, subject to the same discount. The new 20 watt and 25 watt, 100 to 300 volt lamps having specific consumptions of 1.15 and 1.20 watts respectively, are listed at 12 cents plain and 14½ cents frosted, in standard package quantities of 25, subject to the same discount. For the 30 watt and 35 watt lamps having specific consumptions of 1.25 and 1.30 watts respectively, the price is 14 cents plain and 17 cents frosted, in standard package quantities of 25, subject to the same discount. For the 60 watt lamp having a specific consumption of 1.40 watts per candle, the price is 21 cents plain and 24 cents frosted, in standard package quantities of 25, subject to the same discount. The reduction is approximately a 25 per cent decrease in the present list prices.

**Present Sales of Gasoline Engines Large.**—The Fairbanks Morse Company, which has the largest production of gasoline engines in the country, says that it is to be very large and that it is selling at an exceptionally high price. The company is selling at a high price because of the high cost of the raw materials and the high cost of the labor. The company is selling at a high price because of the high cost of the raw materials and the high cost of the labor. The company is selling at a high price because of the high cost of the raw materials and the high cost of the labor.



### Transmission-Line Equipment for Panama Canal.—

Awards have been made for the greater part of the material required in the construction of the Cristobal-Balboa electric transmission line, 48 miles long, which will be the principal feeder of the proposed Isthmian transmission system, connecting a terminal substation at Cristobal with a similar one at Balboa. The contract for the fabrication and assembly of 627 steel track-span bridges for single track, and for 150 track-span bridges for double track, together with 3108 anchors, 7 ft. long, has been made to the United States Steel Products Company, which agrees to begin delivery in 150 days and complete it in 305 days. The only other bidder on the above material was the Riter-Conley Company of Pittsburgh. The plan of manufacturing this material at the company's shops and then assembling it on the Isthmus, the Canal Commission furnishing the erecting shed, necessary trackage and transporting facilities, quarters for the company's employees, etc., has been adopted. The successful bidder already has a force on the Isthmus working on other contracts. Award was also made to the United States Steel Products Company for supplying 1,500,000 ft. of No. 00 copper wire, and 500,000 ft. of 5/16-in. copper-clad wire, in competition with the National Brass & Copper Tube Company, the only other bidder. The contract for furnishing 4000 insulators, three-unit, suspension type, with monel-metal fittings, and 2500 insulators, three-unit, strain type, with monel-metal fittings, was awarded to the Locke Insulator Manufacturing Company of Victor, N. Y., in competition with the General Electric Company and the National Electric Supply Company. No award has yet been made for the substation equipment. The ground plates required for the work will be manufactured from old copper and cable now on the Isthmus.

**Emerson Electric Manufacturing Company's Plans for Fan Season.**—With few exceptions, the Emerson Electric Manufacturing Company has made no radical changes in its fan-motor product for the 1913 season. The line of alternating-current fans formerly known as the Trojan has been eliminated, however, the company feeling that by concentrating upon the manufacture of the higher grades of Emerson fan, the trade will receive better service from the larger stocks than when two lines were carried. The company's prices have been reduced noticeably since last season on both desk and ceiling fans of the induction type. No changes have been made in the quality of the product, and the company is offering its fans to the dealers this year with a five-year factory guarantee which the dealer can give to the purchaser with every Emerson desk, oscillating, ceiling or column fan. The improvements in induction desk and oscillating fans which the company made last year, such as the elimination of all moving contacts and the securing of improved speed regulation, have been tested by a year's service, and these, combined with the various standard features of the induction type, make a product which, the company feels, has demanded no radical changes in design. The Emerson oscillating fans are mechanical types, equipped with a worm and gear device which is now in its fourth season. The ceiling fans are unchanged from last year, except that the Trojan ceiling fan has been replaced with a new, plain-type Emerson model corresponding in design to the plain-type fan of the former Trojan line. A line of 12-in. and 16-in. three-speed, alternating-current and direct-current ventilating fan motors has been added to the list of the company's products.

**A New Non-Continuous Filament Lamp Promised.**—As a result of recent experiments by a leading German firm of lamp makers there is to be placed on the market shortly a new form of drawn-filament tungsten lamp with a non-continuous filament. The difference between this and the usual lamp lies in the fact that the filament is doubled at the upper supports, which construction it is claimed will add materially to the length of life when burned in a vertical position. The American sales are to be handled through the Union Light & Supply Company, New York City. The company states that the new lamps will be sold under a guarantee against breakage in transit and blackening in service and will have a specific consumption of 1.2 watts per candle for the smaller sizes and 1 watt per candle for the larger lamps.

**Western Electric's Retail Store at Seattle.**—In order to take care of the needs of individual customers, the Western Electric Company has opened a retail store in the retail district of Seattle, Wash. This store is at 907 First Avenue and handles all electrical appliances and supplies required by householders and business concerns. The line includes batteries, interphones, vacuum cleaners, lamps, motors, generators, wire and conduit. W. O. Preston, who was formerly associated with the Western Electric's distributing house in Seattle as house salesman, is manager of the retail store. The retail store organization is under the direct supervision of H. D. Brainard, who is sales manager of the Seattle branch and was until recently assistant sales manager at Dallas.

**New Haven Electrification Nearing Completion.**—According to advices from New Haven, Conn., the work of electrifying the line of the New York, New Haven & Hartford Railroad between Stamford, Conn., and New Haven is going forward rapidly and testing trains will be operated over portions of the line within the next two or three weeks. The structural work for carrying the overhead wiring is nearly completed, while the wiring is practically completed as far east as South Norwalk and will soon be finished as far as Bridgeport. Some delay has been caused by a strike of the electrical workers, but it is probable that everything will be in readiness for electrical operation by Aug. 1 at the latest.

**Bell Electric Motor Company Enlarging Its Plant.**—The Bell Electric Motor Company is adding two modern fireproof factory buildings to its present manufacturing plant at Garwood, N. J. These new buildings will be about 200 ft. long, will be of steel and concrete construction, and will be completed in about three months. In addition to the thoroughly modern design of the buildings, provision will be made for the installation of up-to-date testing apparatus by means of which single-phase, two-phase and three-phase current at all commercial voltages will be made available. The company states that its sales of single-phase motors have doubled during the past year.

**Orders for Transmission Towers.**—The Riter-Conley Company, Pittsburgh, has shipped 200 galvanized transmission towers on a rush order from the Pearson Engineering Corporation and 100 towers for the Ebro Irrigation & Power Company, which is the name of the electric-service company for which the Pearson syndicate is building a large hydroelectric development near Barcelona, Spain, as was described in these columns Jan. 25, 1913. A shipment of 100 galvanized towers will be begun shortly to the United Gas & Electric Company, Lancaster, Pa., and 445 towers are under order from the Salmon River Power Company.

**Electric Railway Supplies in Demand.**—The Ackley Brake & Supply Company, New York City, states that recent sales have been satisfactory. It has disposed of about 1500 ft. of automatic trolley guard, the largest purchasers being the Selma Street Railway Company, Selma, Ala.; Tri-City Railway Company, Davenport, Ia.; Saginaw & Bay City Street Railway Company, Saginaw, Mich., and Scranton Railway Company, Scranton, Pa. Large sales of "Monarch" refillable fuses are also reported to the United States, Carnegie and Lackawanna Steel companies, Standard Oil Company, New York Central Railroad, Lehigh Valley Collieries and Diamond Match Company.

**New Pacific Coast Facilities for Paragon Sellers Company.**—The Paragon Sellers Company, Chicago, has announced the transfer of its San Francisco stock to 440 Market Street, in charge of Paine, Bailey & Company, and of its Los Angeles stock to 443 East Third Street, in care of F. F. Foster & Company. Full stocks of Paragon ground cones, ironite wire, self-tying knobs, handy lamp brackets, battery boxes, etc., will be maintained at the above locations, where the company's facilities for the rapid handling of orders have been greatly improved.

**Argo Electric Vehicle Company Increases Capital Stock.**—The Argo Electric Vehicle Company, Saginaw, Mich., has increased its capital stock from \$400,000 to \$500,000.

**Electrical Energy for Coal Mines.**—The mines of the Providence Coal Company, near Punxsutawney, Pa., are to be equipped for electrical operation.

**Reorganized Corporations Liable for Debts of Predecessors.**—The practice of reorganizing corporations in order to escape burdensome contracts or payments to unsecured creditors received a severe setback this week through a decision handed down April 28 by the United States Supreme Court. According to this decision, a creditor of a corporation not a party to its reorganization can hold its successor for his debt. The principle in the matter, as laid down by Justice Lamar, was stated as follows: "Corporations insolvent or financially embarrassed often find it necessary to scale their debts and readjust stock issues with an agreement to conduct the same business with the same property under a reorganization. This may be done in pursuance of a private contract between bondholders and stockholders, and though the corporation property is thereby transferred to a new company having the same shareholders, the transaction would be binding between the parties. But, of course, such a transfer by stockholders from themselves to themselves cannot defeat the claim of a non-assenting creditor. As against him, the sale is void in equity, regardless of the motive with which it was made. For, if such contract reorganization was consummated in good faith and ignorance of the existence of the creditor, yet when he appeared and established his debt the subordinate interest of the old stockholders would still be subject to his claim in the hands of the reorganized company. There is no difference in principle if the reorganization instead of being effectuated by private sale is consummated by a master's deed under a consent decree."

**Commonwealth Power, Railway & Light Company to Expand.**—Plans have been formulated for the acquisition by the Commonwealth Power, Railway & Light Company, Jackson, Mich., of the Union Railway, Gas & Electric Company, which controls and operates a number of public utility properties in Indiana, Illinois and Wisconsin, the Michigan United Railways Company, of Jackson, Mich., and the Springfield (Ill.) Light, Heat & Power Company. If the plan for taking over these properties is ratified by the stockholders of the various companies, the Commonwealth company will exchange its stock for stock of the other companies, increase its capital stock to \$31,000,000 and issue \$7,500,000 in bonds to provide the funds needed for extensive improvements and for construction work already completed and under way. Representatives of Hadenpfl, Hardy & Company, New York, and of F. V. Clark & Company, Philadelphia, the concerns interested in the merger, met on April 29 and arranged the details of the plan. A majority of the stockholders of the Commonwealth company have large holdings in the three other companies, according to interests affiliated with the first-named company, who stated also that the proposed merging of interests is merely a reorganization to centralize control, reduce expenditures and provide funds for the extension of interurban lines owned by the various companies. Commonwealth stockholders will meet May 21 to vote the plan.

**New Company Takes Over Chicago Electrical Supply Dealers.**—A new Chicago mail-order house was incorporated on April 21. It is known as Harris Brothers Company and will issue \$2,000,000 in preferred stock and \$8,000,000 in common stock. The new company has absorbed the Chicago House Wrecking Company and the Harris Steel & Wire Company. These companies have been dealers in electrical materials among other things. The former has an extensive establishment at Thirty-fifth and Erie Streets and owns real estate which it values at \$2,000,000. The officers of the new company are: President, A. Harris; vice-president, D. C. Harris; treasurer, F. Harris; secretary, S. H. Harris. Maurice Rothschild, the general manager, says that the parcel post opens great possibilities in the mail-order business, and that the new organization plans to take advantage of this opportunity by establishing branches in various parts of the country.

**Western Demand for Hydraulic Machinery and Pipe.**—Orders aggregating about 200,000 hp in hydroelectric machinery are reported by the Pelton Water Wheel Company. Turbine installations of 1200 hp by the Ottetail Power Company, Fergus Falls, Minn.; 20,000 hp by the City Electric Company, San Francisco, Cal.; 45,000 hp (three units) for the Los Angeles Aqueduct, and 60,000 hp by

the British Columbia Electric Railway Company, Vancouver, B. C., are in progress, and an order for 4000 hp has been received from the Great Falls project. The large welded pipe have also been large, including 1700 tons for the California-based Power Company, the order for the San Joaquin Light & Power Company, and more than for the Los Angeles Aqueduct.

**Consolidated Gas, Electric Light & Power Financing.**—At a special meeting on April 29, the stockholders of the Consolidated Gas, Electric Light & Power Company, of Baltimore, authorized an increase of the company's authorized capital stock to \$10,000,000. The new company, which was organized in December, 1911, for the purpose of financing the \$2,500,000 bond issue of the old company, is now authorized to issue \$10,000,000 in bonds. The company is now authorized to issue \$10,000,000 in bonds. The company is now authorized to issue \$10,000,000 in bonds.

**Postpone Adoption of Northern Colorado Power Financing Plan.**—Directors and stockholders of the Northern Colorado Power Company, Denver, Col., met on April 24 and decided to postpone the adoption of a plan between stockholders and bondholders for the reorganization of the company until May 1. The plan, which was adopted in March, 1912, is now being reconsidered. The company is now authorized to issue \$10,000,000 in bonds. The company is now authorized to issue \$10,000,000 in bonds.

**New Combination Shade and Lamp Lock to Appear Soon.**—Frederick Hall, New York City, announces that he will put out shortly a new shade and lamp lock which will meet the demand for a suitable and secure device for use on ornamental fixtures. The seal is both applied and removed by means of a small tool, resembling a paper punch, and the entire operation consumes not more than a minute.

**Canadian Allis-Chalmers Company Chartered.**—The Canadian Allis-Chalmers Company, Limited, was incorporated at Ottawa, Ont., on April 25 with a capital of \$1,000,000. It will take over the Allis-Chalmers Engine Company, of Montreal, and will have its headquarters at Toronto.

Industrial Securities

Security	Price	Yield
Aluminum Co. of Am.	100	4.00
Am. Electric & Light	100	4.00
Am. Gas & Electric	100	4.00
Am. Ice & Cold Storage	100	4.00
Am. Lumber & Shipbuilding	100	4.00
Am. Paper & Board	100	4.00
Am. Steel & Wire	100	4.00
Am. Traction & Power	100	4.00
Am. Water & Sewerage	100	4.00
Am. Zinc & Lead	100	4.00
Am. Iron & Steel	100	4.00
Am. Coal & Coke	100	4.00
Am. Oil & Gas	100	4.00
Am. Rubber & Tire	100	4.00
Am. Textile & Apparel	100	4.00
Am. Food & Drug	100	4.00
Am. Chemical & Allied	100	4.00
Am. Machinery & Equipment	100	4.00
Am. Transportation	100	4.00
Am. Public Utilities	100	4.00
Am. Real Estate	100	4.00
Am. Insurance	100	4.00
Am. Finance & Banking	100	4.00
Am. Miscellaneous	100	4.00

NEW YORK METAL MARKET PRICES

Metal	Price
Copper	15.00
Lead	10.00
Steel	12.00
Aluminum	18.00
Iron	11.00
Brass	14.00
Gold	16.00
Silver	13.00
Platinum	17.00
Palladium	15.00
Rhodium	14.00
Iridium	13.00
Osmium	12.00
Vanadium	11.00
Nickel	10.00
Cobalt	9.00
Manganese	8.00
Chromium	7.00
Molybdenum	6.00
Tungsten	5.00
Zinc	4.00
Barium	3.00
Strontium	2.00
Calcium	1.00
Sodium	0.50
Potassium	0.25
Lithium	0.10
Fluorine	0.05
Bromine	0.02
Iodine	0.01
Chlorine	0.005
Oxygen	0.001
Nitrogen	0.0005
Hydrogen	0.0001

OLD METALS

Metal	Price
Heavy cast iron	10.00
Brass	14.00
Steel	12.00
Aluminum	18.00
Iron	11.00
Brass	14.00
Gold	16.00
Silver	13.00
Platinum	17.00
Palladium	15.00
Rhodium	14.00
Iridium	13.00
Osmium	12.00
Vanadium	11.00
Nickel	10.00
Cobalt	9.00
Manganese	8.00
Chromium	7.00
Molybdenum	6.00
Tungsten	5.00
Zinc	4.00
Barium	3.00
Strontium	2.00
Calcium	1.00
Sodium	0.50
Potassium	0.25
Lithium	0.10
Fluorine	0.05
Bromine	0.02
Iodine	0.01
Chlorine	0.005
Oxygen	0.001
Nitrogen	0.0005
Hydrogen	0.0001

COPPER EXCHANGES IN APRIL

Exchange	Price
London	15.00
New York	15.00
San Francisco	15.00
Chicago	15.00
Philadelphia	15.00
Boston	15.00
St. Louis	15.00
Portland	15.00
Seattle	15.00
San Diego	15.00
Los Angeles	15.00
Houston	15.00
Dallas	15.00
Fort Worth	15.00
Memphis	15.00
Indianapolis	15.00
Cincinnati	15.00
Cleveland	15.00
Pittsburgh	15.00
Butte	15.00
Phoenix	15.00
Tucson	15.00
Albuquerque	15.00
Salt Lake City	15.00
Denver	15.00
Colorado Springs	15.00
Leadville	15.00
Idaho Falls	15.00
Boise	15.00
Spokane	15.00
Portland	15.00
Seattle	15.00
San Francisco	15.00
Los Angeles	15.00
Houston	15.00
Dallas	15.00
Fort Worth	15.00
Memphis	15.00
Indianapolis	15.00
Cincinnati	15.00
Cleveland	15.00
Pittsburgh	15.00
Butte	15.00
Phoenix	15.00
Tucson	15.00
Albuquerque	15.00
Salt Lake City	15.00
Denver	15.00
Colorado Springs	15.00
Leadville	15.00
Idaho Falls	15.00
Boise	15.00
Spokane	15.00



## Electric Securities

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding	DIVIDEND		LAST QUOTATION	
		Per Cent	Period	Bid	Asked
Adirondack Electric Power, c.	\$9,500,000			15	18
Adirondack Elec. Power, pf.	2,500,000			55	60
Amer. Gas & Electric (\$50), c.	2,500,000	2	Q	78	81
Amer. Gas & Electric (\$50), pf.	1,537,500	1½	Q	44	46
Amer. Light & Traction, c.	10,395,400	2½	Q	370	375
Amer. Light & Traction, pf.	14,236,200	2½	Q	105	107
Amer. Power & Light, c.	5,631,400	1½	Q	73	74
Amer. Pwr. & Lt., 6% cum. pf.	5,631,400	1½	Q	79½	81
Amer. Pwr. & Lt., opt. warr.	1,604,000			12	14
Am. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	99	100
Appalachian Power, c.	6,000,000			17	18
Appalachian Power, pf.	2,180,000			60	63
Arizona Power, c.	3,000,000			10	14
Arizona Power, pf.	850,000			45	50
Asheville L. & P., 1st s.f. 5s, '42	1,100,000	2½	S	91	96
Aug'ta-Aiken R.&E., s.f. 5s, '35	2,588,000	2½	S	89	92
Augusta-Aiken Ry. & Elec., c.	2,250,000				
Augusta-Aiken Ry. & Elec., pf.	1,500,000	1½	Q		
Augusta Ry. & El., 1st 5s, '40	967,000	2½	S	100	
Central Maine Power, 1st, 5s.	2,502,000	2½	S	94½	97½
Cities' Service, c.	5,499,430	5-12	M	115	116
Cities' Service, pf.	10,195,360		M	85½	86½
Columbus R. Gas & El., 1st 5s, '36	2,454,000	2½	S	93	95
Columbus Ry., G. & Elec., c.	2,000,000				
Columbus Ry., G. & Elec., pf.	840,000	1½	Q	50	
Commonw. Edison, cap stock.	37,764,140	7	A	131	
Con. Gas, El. & Pr. (Balt.), 4½s	11,564,000	2½	S	87½	88
Consum. Pwr. (Mich.), 5s, '36	10,088,000	2½	S	94½	97½
Consum. Pr. (Minn.), 1st 5s, '29	9,528,000	2½	S	87	88½
Dallas Elec. Corp., 5s, '22	3,659,000	2½	S	95	97½
Denver Gas & El. Lt., c.	7,001,300	½	M	220	
Denver Gas & El. Lt., gen. 5s.	6,000,300	½	S	95	95½
Edi. El. Ill., Boston, cap stock.	15,603,700	3	Q	275	
Federal Light & Traction, c.	4,750,000			29	32
Federal Light & Traction, pf.	2,500,000	1½	Q	79	81
Fort Worth Pwr. & Lt., 1st 5s	1,500,000	2½	S	94	96
Harwood Electric, 5s, '39	1,000,000	2½	S	100	103
Kansas City Rwy. & Lt., c.	9,543,080			14	17
Kansas City Rwy. & Lt., pf.	9,407,500	1½	Q	34	37
Kan. City R. & Lt., 1st ref. 5s.	10,200,000	2½	S	86	89
Kan. City R. & Lt., con. 6s, '12	4,478,000	3	S	88	90
Lincoln Gas & Electric, c.	2,250,000			30	32
Lincoln Gas & Electric, 5s, '41	796,000	2½	S	78	80
Mobile Elect. Co., pf.	852,000	1½	Q	92½	95
Mobile Elect. Co., 1st 5s, '46	1,696,000	2½	S	86½	88
Northern States Power, c.	5,975,000			20½	21½
Northern States Power, pf.	8,386,700	1½	Q	81½	83
Pacific Gas & Electric, c.	31,908,750	1½	Q	56	57
Pacific Gas & Electric, pf.	10,000,000	1½	Q	91½	92
Philadelphia Electric (\$25)...	24,987,750	1½	Q	22½	
Portland General Electric, 5s.	8,000,000	2½	S	99	101½
Republic Railway & Light, c.	5,200,000			34	25½
Republic Railway & Light, pf.	6,360,000	1½	Q	74½	76½
Sierra & San Francisco Pwr., 1st 5s	6,500,000	2½	S	92½	94½
St. Joseph's R., L., H. & P., 5s	4,637,000	2½	S	98	99½
Seattle Electric Co., con. 5s, '29	7,417,000	2½	S	90½	93
Southern Calif. Edison, 5s, '39	10,043,000	2½	S	93	96
Southern Power, 5s	5,000,000	2½	S	98	100
Standard Gas & Elec. (\$50), c.	9,343,150			14	15
Standard G. & Elec. (\$50), pf.	10,977,950	2	Q	43½	45
Tennessee R., L. & Pwr., c.	20,000,000			19½	20½
Tennessee R., L. & Pwr., pf.	10,250,000	1½	Q	74	75
Western Power	14,670,000			16	17½
Western Power, 6% cum. pf.	6,000,000			47	49
Western States Gas & El., c.	3,503,000			43	48
Western States Gas & El., pf.	1,800,000	1½	Q	80	86
W. Sta. G. & E., 1st & 2d 5s, '41	3,400,000	2½	S	90	95

## Personal

Mr. R. J. Lee has been appointed contract agent of the Toronto (Ont.) Hydro-Electric System, as successor to Mr. F. R. Ewart.

Mr. J. B. Kitchen has been appointed engineer of operation of the Toronto (Ont.) Hydro-Electric System, vice Mr. A. C. McCallum.

Mr. George Stevenson has been promoted to the position of general inspector with the Toronto (Ont.) Hydro-Electric System, replacing Mr. H. D. Ord, resigned.

Mr. Engene C. Bacot, recently connected with H. M. Byllesby & Company in the Chicago office, is now assistant engineer with McMeen & Miller, engineers, Chicago.

Mr. I. E. Moulthrop, formerly mechanical engineer of the Edison Electric Illuminating Company of Boston, has been promoted to the position of assistant superintendent of construction.

Mr. W. R. Sweany, until very recently acting general manager of the Toronto Hydro-Electric System, was appointed sales manager of the Toronto Electric Light Company, Ltd., May 1.

Mr. D. W. Roper, assistant to the chief operating engineer of the Commonwealth Edison Company, has been elected chairman of the Chicago Section of the American Institute of Electrical Engineers.

Mr. J. Orr, formerly connected with the Toronto (Ont.) Electric Light Company, Ltd., has been appointed general superintendent of the Toronto (Ont.) Hydro-Electric System, to succeed Mr. H. C. Smith, resigned.

Mr. C. L. De Mural, of the electrical engineering department of the University of Michigan, has received a month's leave of absence that he may go to Germany as a consulting engineer on some railway electrification work.

Mr. Thomas Duncan, of Princeton, Ind., has been appointed chairman of the Public Service Commission of Indiana by Governor Ralston. Mr. Duncan will begin his term of office on May 1, when the utility act takes effect.

Mr. C. H. Dudley, late of the Northern Electric & Manufacturing Company, Toronto, Ontario, has been appointed manager of the appliance department of the Toronto Hydro-Electric System, Toronto, Ont., succeeding Mr. Clark.

Mr. G. W. Thompson, superintendent of the Westmount (Ont.) municipal lighting plant, who has been appointed acting controller for the city, was formerly connected with the Lachine Rapids Company of Montreal and the Montreal Light, Heat & Power Company.

Mr. W. O. Vickery, who has been in the employ of the Trinidad (Col.) Electric Transmission, Railway & Gas Company, has been appointed superintendent of the southwest division of the Federal Light & Traction Company, which also controls the Trinidad property.

Mr. Mason D. Pratt has been appointed engineer of the United Railways & Electric Company, Baltimore, Md., under Mr. John M. Hood, Jr., consulting engineer of the company. Mr. Pratt is a graduate from Lehigh University and has been engaged in consulting engineering practice at Harrisburg, Pa., since 1904.

Mr. H. K. Smith, electrical superintendent of the Fifth Division of the Panama Canal Zone, has resigned, and the position has been abolished. Mr. C. W. Lawton, station engineer, has received charge of the Miraflores electric plant, and Mr. H. E. Wilkins is to have supervision of the outside electrical work of the Fifth Division.

Mr. E. F. Putnam has been appointed commercial manager of the United Electric Light & Water Company, of Greenwich, Conn. Mr. Putnam was at one time connected with the Public Service Electric Company at Camden and Newark, N. J., and at the time of his appointment he was sales engineer of the lamp works of the General Electric Company.

Mr. Arthur J. Sweet has tendered his resignation as commercial engineer of the Holophane Works of the General Electric Company, to become a member of the firm of Vaughn & Meyer, consulting engineers, of Milwaukee, Wis. Mr. Sweet has been identified with research and commercial





## Construction

### New England

**MANCHESTER, N. H.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 26 for alterations in the heating apparatus, alterations in lighting fixtures and construction changes in the United States post office and court house at Manchester, N. H., in accordance with drawings and specifications, copies of which may be obtained at the above office or at the office of the custodian. O. Wenderoth is supervising architect.

**CHATHAM, MASS.**—At a town meeting held recently the Selectmen were instructed to grant the Buzzards Bay El. Co., of Falmouth, a franchise to construct and operate an electric-light plant here.

**SOUTHBURIDGE, MASS.**—Plans and specifications for improvements to the lighting system in Southbridge, involving an expenditure of about \$15,550, have been submitted to the Selectmen by the Webster & Southbridge Gas & El. Co. It is proposed to replace the arc lamps now in use with tungsten lamps. On Main Street ornamental standards carrying five-lamp clusters will be erected.

**SUTTON, MASS.**—The Worcester Consol. St. Ry. Co., of Worcester, has been granted permission by the Selectmen to erect feed wires over the highway between West Millbury and West Sutton and from the West Sutton road to North Oxford.

**PROVIDENCE, R. I.**—Bids will be received at the office of the Board of Contract and Supply, City Hall, Providence, until May 21 for furnishing a 30,000,000-gal. pumping plant at Petaconest pumping station, Cranston, as follows: (a) For a high-duty steam engine and plunger pumps, with boilers; (b) electric motor-driven centrifugal pumps; (c) steam-turbine-driven centrifugal pumps with boilers. Plans and specifications may be procured at the office of the city engineer, city hall. Joseph H. Gainer is Mayor and chairman of Board of Contract and Supply.

**BRISTOL, CONN.**—The Bristol & Plainville Tramway Co. has entered into a contract with the Connecticut Co., of New Haven, whereby the latter will furnish electricity to operate the railway system of the former from the power plant at Falls Village when completed.

**NEW BRITAIN, CONN.**—The city of New Britain has applied to the State Legislature for amendments to its charter allowing it to take over the electric-light and power plant, to be owned and operated by the municipality.

### Middle Atlantic

**BINGHAMTON, N. Y.**—The city has purchased a site on Noyes Island for the municipal electric-light plant. Douglas Sprague, 39 Cortland Street, New York, is consulting engineer.

**BUFFALO, N. Y.**—Bids will be received by the commissioner of public works, Room 5, Municipal Building, Buffalo, N. Y., until May 9 for furnishing material and construction of a two-story bathhouse, to be known as Public Bathhouse No. 2, including electric wiring, lighting fixtures, plumbing, gas-fitting, heating, ventilating, radiation, etc., to be located on Penn Street. Francis G. Ward is commissioner of public works.

**FORT H. G. WRIGHT, N. Y.**—Bids will be received until May 19 for construction, including plumbing, heating, electric wiring and fixtures, of addition to and alterations of hospital at Fort H. G. Wright. For further information address Captain G. Robinson, constructing quartermaster.

**MARCELLUS, N. Y.**—The Marcellus Ltg. Co. has applied to the Public Service Commission for permission to acquire the plant and franchises owned by Frank W. Knapp in Marcellus and to exercise franchise for distributing electricity here.

**NEW YORK, N. Y.**—Bids will be received by the commissioner of water supply, gas and electricity, Department of Water Supply, Gas and Electricity, Room 1903, 13 to 21 Park Row, New York, until May 9 for furnishing and installing the electric-lighting system and gas fitting in the Ninety-eighth Street pumping station. Blank proposal forms, specifications, etc., can be obtained upon application to the above office. Henry S. Thompson is commissioner.

**NYACK, N. Y.**—The Rockland Lt. & Pwr. Co., of Nyack, has petitioned the Public Service Commission for approval of the exercise of franchises for the distribution of electricity in the villages of Hillburn and Suffern.

**OSWEGO, N. Y.**—The People's Gas & El. Co. will soon begin work on the extension of its transmission line from Fruit Valley to South-west Oswego, a distance of 3 miles. The company also contemplates extending its lines to other towns. R. F. Whitney is manager.

**PLEASANT VALEY, N. Y.**—The Poughkeepsie Lt., Ht. & Pwr. Co. has been granted a franchise to furnish electricity in Pleasant Valley and also a contract for lighting the streets of the village. H. J. Halstead is village clerk.

**CHAMBERSBURG, PA.**—The City Council has adopted a resolution providing for improvements and installation of new machinery in the municipal electric-light plant, the cost not to exceed \$30,000.

**EASTON, PA.** The Borough Council of Glendon has granted the

**Easton, Pennsylvania Pwr. Co.**, of Easton, a franchise to erect transmission lines in the borough to furnish electricity for lamps and motors.

**LEBANON, PA.**—The Lebanon Valley El. Lt. & Pwr. Co. is building foundations for a pair of Babcock & Wilcox boilers, with a rating of 250 hp each, at its plant at First and Lehman Streets. The company will soon begin the erection of a new brick power station to take the place of the present power house. The new equipment will also include two electric generators having a rating of 250 kw each.

**PHILADELPHIA, PA.**—Application will be made on May 5 to the Governor of the State of Pennsylvania by John Barbey, Frank Battles and Walter T. Bilyeu for charters for 20 electric-light corporations to operate in Bucks County as follows: The Borough of Bristol Lt. Co., South Langhorne Lt. Co., Langhorne Manor Lt. Co., Langhorne Lt. Co., Yardley Lt. Co., Bristol Townships Lt. Co., Borough of Doylestown Lt. Co., Hulmeville Lt. Co., Lower Makefield Lt. Co., Morrisville Lt. Co., Falls Lt. Co., Upper Makefield Lt. Co., Middletown Lt. Co., Solebury Lt. Co., New Hope Lt. Co., Taylorsville Lt. Co., Wrightsville Lt. Co., Buckingham Lt. Co., Newton Lt. Co. and Doylestown Lt. Co. The companies will operate in the townships from which they take their name.

**SOMERSET, PA.**—The Penn El. Ser. Co., a subsidiary of the Citizens' Lt., Ht. & Pwr. Co., of Johnstown, has taken an option on the property of the Somerset El. Lt., Ht. & Pwr. Co. The Citizens' company proposes to erect a high-tension transmission line from Johnstown to Somerset and to secure contracts for the lighting of Hollsopple, Hooversville, Stoyestown and other places. The Somerset plant will be operated until the new system is completed.

**YORK, PA.**—The Secretary of State has approved the application of the Edison El. Lt. Co., of York, to increase its capital stock from \$250,000 to \$1,100,000.

**CHATHAM, N. J.**—Bids will be received by the Board of Commissioners of the borough of Chatham until May 12 for extensions and additions to the municipal water and light system as follows: (1) For alterations and additions to power house; (2) one 100-kw turbo-generator unit; (3) one 100-hp condenser; (4) two 150-hp water-tube boilers and breeching; (5) one 75-kw, three-phase, 2300-volt generator and exciter; (6) one switchboard complete; (7) one 500,000-gal. motor-driven pump; (8) radial brick chimney; (9) industrial railway complete with charging car and scales. Specifications and blank proposals may be obtained from C. E. Hewett, of Durham, N. H., engineer, or from W. S. Angel, borough clerk, Chatham. Plans may be seen at the office of the borough clerk.

**NEWARK, N. J.**—Plans are being considered for making improvements to the electric-lighting plant in the city hall to provide for emergencies. The installation of a 50-kw generator and engine is under consideration.

**EASTON, MD.**—The property of the Easton Lt. & Fuel Co. has been sold to Samuel R. Kirkpatrick & Co., of Philadelphia, Pa. Improvements will be made to the plants by the new owners. The officers of the new company are: Frederick H. Treat, president, and Samuel Kirkpatrick, secretary and treasurer, both of Philadelphia, Pa.

**GRAHAM, W. VA.**—Preparations are being made by the Appalachian Pwr. Co. for remodeling the entire electric-light system in Graham, involving an expenditure of from \$7,000 to \$10,000. The distributing system will be rebuilt and new street lamps installed. The contract for poles has been awarded to McMullin & Hart.

**WHEELING, W. VA.**—A permit has been granted to the West Penn Trac. Co. for the erection of a large addition to the Water Street power house of the Wheeling Trac. Co. The cost of the improvements is estimated at about \$25,000.

**EAGLE ROCK, VA.**—The installation of an electric-light plant in Eagle Rock is under consideration. J. E. McInnis is interested in the project.

**WASHINGTON, D. C.**—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 20, at the various navy yards and naval stations, for the following supplies: Washington, D. C. Schedule 5395—one automobile ambulance. Brooklyn, N. Y., Schedule 5401—5000 ft. 3/4-in. galvanized-steel conduit. New York, N. Y., Schedule 5384—one motor-driven punch press. Applications for proposals should designate the schedule desired by number. T. I. Cowie is postmaster-general, U. S. N.

### North Central

**CHEBOYGAN, MICH.**—The Cheboygan El. Lt. & Pwr. Co. will begin work at once on the construction of the Pellston line. The company will connect the circuit at Black River dam with that on the Maple River dam near Pellston, which it purchased last fall.

**MARQUETTE, MICH.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 13 for a conduit and wiring system, gas piping, lighting fixtures, etc., in the United States post office, Marquette, Mich., in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian, Marquette. O. Wenderoth is supervising architect.

**MUSKOGON, MICH.**—An agreement has been reached between the City Council and the Chamber of Commerce whereby the arc-lamp light-



ing station on Western Avenue and be repaired by a central system.

**PONTIAC, MICH.**—Bids will be received by the Board of Education, Pontiac, Mich., until May 15 for erecting, wiring and equipping the high school building now being erected on Huron street. The specifications may be obtained at the office of G. L. Jones, board president of schools, Pontiac, Mich., or at the office of J. J. Street, Chicago, Ill., architects, and John W. Case, 37 Saginaw Street, Pontiac, associate architect.

**QUINCY, ILL.**—The Oliver Iron Mining Co. is about to install a hydroelectric power plant to furnish electricity for its mining machinery at the Chapin Mine. A steel and concrete frame house will be built and equipped with two 2,800-hp turbines, each to be driven by a netted to a 187½-kv., three-phase, 60-cycle, 120-ft. generator. Electricity will be transmitted at 13,200 volts. The turbines and generator are erected on steel towers to the No. 2 shaft at the Chapin Mine.

**ARION, OHIO.**—The Northern Ohio Trust & L. Co., of Akron, has closed a contract with the B. L. Goodrich Co., of Cleveland, for the installation of rubber tires and other rubber goods, to be used in the repair of the street of 100 ft. to be used in connection with the new power plant. The company guarantees a continuous service and to insure this will duplicate feed wires between the power station and the electrical plant.

**CINCINNATI, OHIO.**—Plans are being considered by the Union Gas & L. Co. for the construction of a new plant to convert gas into electricity and \$4,000,000. The acquiring of the plant in the future for the purpose of transforming it into a subway and to be used for the distribution of the electric plant at Main Street and the canal. The new plant will probably be located on the site of the old West End plant. J. C. Leach is president of the company.

**FINDLAY, OHIO.**—Plans have been submitted to the City by John S. Riegler, electrical engineer, for the erection of an overhead distributing system. The estimates submitted provide only for the distribution of street lighting and do not include the distribution of electricity for commercial lighting or for generating electricity. It is proposed to purchase energy to operate the system. The cost of the distributing system is estimated at \$42,000.

**GALION, OHIO.**—The city of Galion is contemplating the installation of cluster lamps on 12 blocks. F. B. Ray, of Cleveland, is engineer. Henry Hacker is director of public service.

**MARIETTA, OHIO.**—The City Council has passed an ordinance authorizing the director of public service to enter into a contract with the Parkersburg, Marietta & Intermountain Ry. Co. for lighting the streets on a city for a period of ten years. The company will begin at once on the installation of a new lighting system, involving an expenditure of from \$10,000 to \$20,000. The municipal electric light plant was destroyed by the flood.

**TOLEDO, OHIO.**—Bids will be received by the Board of County Commissioners of Lucas County at the office of the county auditor, Court House, Toledo, Ohio, until May 15 for furnishing material and construction of power house for the Lucas County Jail and House of Correction for tuberculosis. Bids will be received at the same time and place for furnishing and installing the mechanical power plant equipment for the power house. Plans and specifications for power house and equipment are on file at the office of the county auditor and at David L. Stine, architect, Valentine Building, Toledo. Charles E. Schroeder is electrical engineer.

**LOUISVILLE, KY.**—The Seelbach Hotel Co., of Louisville, has received a permit for the erection of a six-story hotel in the rear of the hotel on Fourth Avenue and Walnut Street, to cost approximately \$75,000. A large electric light and power plant will be installed in the new building.

**GOSHEN, IND.**—Bids will be received at the office of William A. Books, city clerk, until May 15 for furnishing material and labor and constructing an electric light plant as follows: (1) for the installation and installing a 250-hp generator, switchboard, are regulators, lamps and all electrical equipment; (2) for furnishing and installing engine compressors and piping; (3) for furnishing and installing all material and equipment for ornamental street-lighting system; (4) for furnishing and installing water and the dismantling and removal of old machinery. Plans and specifications are on file at the office of the city clerk, Goshen, and at the office of Burns & McDonnell, Searritt Building, Kansas City, Mo., consulting engineers.

**INDIANAPOLIS, IND.**—Improvements to the lower part of the Merchants' Bldg. & L. Co., located on West Washington Street, to cost approximately \$100,000, will begin within the next few days. The plans provide for the erection of an addition, 84 ft. by 65 ft. to the present power station in which a battery of eight boilers of 500 hp each will be installed. Provision will be made to double the boiler capacity when necessary. E. Darrow is general manager.

**LAFAYETTE, IND.**—Notice has been filed at the incorporation of the Merchants' Ltg. Association, at Lafayette, and the Grandville Ltg. & Wtr. Co., and some smaller companies of the same kind under the name of the General Service Co. The new company is capitalized at \$900,000. The incorporators are: William H. Green, Thomas P. Frazer and Henry H. Beach.

**TERR HAUTE, IND.**—Steps have been taken by the civic organizations, the City Council and the Board of Public Works for the installation of an ornamental street-lighting system in the business district.

ing station on Western Avenue and be repaired by a central system.

**WABASH, IND.—7**—The city of Wabash is about to install a new electric light and power plant on the site of the old plant.

**LAVERGNE, ILL.**—The city of Laverne is about to install a new electric light and power plant on the site of the old plant.

**ATWOOD, ILL.**—The city of Atwood is about to install a new electric light and power plant on the site of the old plant.

**HOOPESTON, ILL.**—The city of Hoopston is about to install a new electric light and power plant on the site of the old plant.

**CHICAGO, ILL.**—The city of Chicago is about to install a new electric light and power plant on the site of the old plant.

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WINONA, MINN.—The installation of an ornamental street-lighting system in the business district is under consideration. The Commercial Club is interested in the project.

ADEL, IA.—The Adel Mill Co. has been granted franchises in De Sota and Van Meter to furnish electricity in both towns. The company will begin work at once on extensions of its transmission line. A new generator is being installed in the plant of the Adel Mill Co.

ANAMOSA, IA.—The Smith-Dows-Reed Lt. & Pwr. Co. is reported to have taken over the plants and holdings of the Anamosa-Oxford Junction Lt. & Pwr. Co., which operates in Anamosa, Wyoming, Olin and Oxford Junction.

CHARLOTTE, IA.—We are informed that it is not proposed to install an electric-light plant in Charlotte, as reported in the issue of April 19.

DAVENPORT, IA.—The Iowa & Illinois Ry. Co., of Davenport, has been granted franchises to furnish electricity for lamps and motors in the towns of Camanche, Princeton and Le Claire. The service will be furnished from the transmission lines of the company and no separate power plants will be erected. P. P. Crafts is vice-president and general manager.

DES MOINES, IA.—The Department of Streets is negotiating with the Des Moines El. Co. for a special rate for lighting the Seventh Street viaduct. There are 80 lamps to be maintained on the structure.

KEOKUK, IA.—The City Council has agreed to pay the cost of maintaining an ornamental street-lighting system on Main Street. The property owners will pay the cost of the installation of the system. The Keokuk El. Co. will erect the lamp standards.

MARCUS, IA.—Arrangements are being made by K. C. Gaynor, of Sioux City, for the installation of an electric-light plant in Marcus. Three-phase alternating current will be used. Most of the machinery for the plant has been purchased. The company will be known as the Marcus El. Co.

MARENGO, IA.—The Cedar Rapids & Iowa City El. Lt. & Pwr. Co., of Cedar Rapids, has purchased the property of the Marengo El. Lt. & Pwr. Co.

MOUNT AYR, IA.—The Mount Ayr Lt. & Pwr. Co. contemplates improvements to its plant during the summer and fall involving an expenditure of about \$10,000. New equipment, including engines, boilers and generators will be installed.

TIPTON, IA.—The Tipton Lt. & Htg. Co. will soon begin work on the construction of a new substation.

MARSHFIELD, MO.—The Marshfield El. Co. is contemplating the installation of an upright (marine-type) direct-connected electric-generating unit and will soon ask for estimates on cost of same. The company will furnish electricity for lamps in Marshfield and later may furnish power for motors.

ROLLA, MO.—The City Council is contemplating the purchase of a new boiler for the municipal electric-light plant and water-works system.

WELLSTON, MO.—Steps have been taken by the Wellston Business Men's League to secure funds for the installation of an ornamental street-lighting system extending from the business center of Wellston to the grounds of the Universal Exposition Co.

ELGIN, N. D.—The installation of an electric-light plant in Elgin is under consideration.

ARMOUR, S. D.—We are informed that the city of Armour has not voted bonds for the installation of a municipal electric-light plant as reported in the issue of April 26. The local electric plant is owned by the Interstate Pwr. Co., of Wagner, which owns several plants in this locality. The Interstate Pwr. Co. is said to be contemplating building a central power plant to furnish electric service to all the neighboring towns, and discarding its small plants.

LENNOX, S. D.—The Lennox Milling Co. has been granted a 20-year franchise to install and operate an electric-light system here.

PIERRE, S. D.—The proposition to install an electric-light plant and water-works system in Pierre will soon be submitted to the voters.

WILMOT, S. D.—Bids, it is reported, will be received by R. H. Eastman, city auditor, for the following equipment for the municipal light and water plant: For one 56-in. by 16-ft. return tubular boiler, built for 100-lb. pressure; one 40-ft. stack, guy ropes, etc.; one automatic, high-speed steam engine, or one kerosene engine, complete, less air compressor and tank, and band wheel or pulley of proper size to operate generator with 18-in. pulley at speed of 900 r.p.m.

RULO, NEB.—Bonds to the amount of \$10,000 have been voted for the installation of an electric-light plant.

SILVER CREEK, NEB.—At an election held April 15 the proposition to issue bonds for the installation of an electric-light plant and water-works system was carried.

AUGUSTA, KAN.—Worley & Black, of Kansas City, Mo., consulting engineers, are preparing plans for the proposed municipal electric-light system. The plant will be driven by two gas engines. Joseph R. Switzer is city engineer.

FORT LEAVENWORTH, KAN.—Bids will be received at the office of the constructing quartermaster, Fort Leavenworth, Kan., until May 8 for furnishing electrical supplies as follows: For 1420 outlet boxes, 310 electric-lamp brackets, 2730 bushings, 70 conduit clamps, 310 insulating joints, 21,810 ft. electric conduit, 25 electric condulets, 1860 outlet box

covers, 3000 conduit lock nuts, 1325 receptacles, 500 bases, 1900 standard stools, 384 Holophane shades, 295 fixture studs, 40 lb. solder, 48 lb. tape, 22,100 ft. stranded conductor, 300 ft. lamp cord, 2000 ft. rubber-covered fixture wire, 6 panelboards, 6 panelboard cabinets, 2 switchboard panels, 12 units, 24 terminals, 1 slate, 1200 gross screw anchors, rubber matting, etc. For further information address Lieut. Col. Thomas H. Slaveas, constructing quartermaster.

HERINGTON, KAN.—The proposition to issue \$40,000 in bonds for improvements to the municipal water and light plants will be submitted to the voters. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are consulting engineers. George F. Brockman is superintendent of the municipal light and water plant.

SCOTT, KAN.—Bids will be received by the city of Scott, Kan., until May 27 for the construction of an electric-light plant and water-works system. The cost of the plant is estimated at about \$35,000. The Alamo Engine & Supply Co., of Omaha, Neb., has charge of the engineering work. Charles A. Kilson is Mayor.

## Southern States

FORT CASWELL, N. C.—Bids will be received at the office of the constructing quartermaster, Fort Caswell, N. C., until May 26 for the following projects, the government to select the one it considers best for the purpose: (1) For constructing an 8-in. water main, pump house, necessary machinery and power transmission line; (2) constructing an 8-in. water main to the Southport side of the river and furnishing water to the Southport end of the main; (3) for all material, labor, machinery and accessories necessary to install a complete distilling and preliminary water-softening plant, including brick or reinforced-concrete building, and the necessary boiler, tanks, piping and accessories needed to furnish not less than 3000 gal. per hour, or 70,000 gal. daily. For further information apply to James R. Campbell, constructing quartermaster.

NEWTON, N. C.—The Conover Lt. & Pwr. Co. has been granted a franchise to erect transmission lines along the public roads for the distribution of electricity.

WINSTON-SALEM, N. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 2 for extension, including plumbing, gas piping, heating apparatus, electric conduits and wiring and approaches, to the United States post office at Winston-Salem, N. C. Plans and specifications may be obtained at the above office or from the custodian at Winston-Salem. O. Wenderoth is supervising architect.

ABBEVILLE, GA.—The contract for construction of the municipal electric-light plant has been awarded to the J. B. McCrary Co., of Atlanta.

DAWSON, GA.—Bonds to the amount of \$12,000 have been voted, the proceeds to be used for the electric-light, water and fire department and for school purposes, etc.

WEST POINT, GA.—The Columbus Pwr. Co., of Columbus, has closed a contract with the Lang Mfg. Co. to furnish electricity to operate its plant. The company will erect a substation in West Point equipped to handle 2500 hp.

JACKSONVILLE, FLA.—The Pine Springs Development Co. has purchased 400 acres of land along the Suwanee River and proposes to develop Pine Springs as a resort. The plans include the construction of a hotel, turbine power plant and sewer system and operation of a 25-mile railroad. The cost of the work is estimated at \$250,000. The offices of the company are located at 1009 Bisbee Street, Jacksonville. N. J. Phillips is president.

JACKSONVILLE, FLA.—The electrical committee has decided to recommend to the Board of Bond Trustees the purchase of additional equipment for the municipal electric-light plant, including a battery of boilers with a rating of 1080 hp, to cost \$15,000; three transformers of 1000 hp each, to be located in the old water-works plant, at a cost of \$8,000; 100 new magnetic-arc lamps for street lighting, costing \$4,000, and line regulators for the Riverside section, etc. R. E. Wheeler, Alex. R. Merrill and George H. Mason are members of the electrical committee.

WEST PALM BEACH, FLA.—The Ariston Ice & El. Co. is preparing to extend its transmission lines north and south at Palm Beach to furnish electrical service to the residences along the lake shore. The company also proposes to erect transmission lines along the county road to Delray, a distance of 18 miles, to furnish electricity to the towns of Boynton, Lake Worth and Delray and to residences along the route of the line.

PARIS, TENN.—The city has voted to issue \$65,000 in bonds for improvements to electric-light plant, sewerage system, schools, etc.

HATTIESBURG, MISS.—The Hattiesburg Trac. Co. has submitted a proposition to the city commissioners for improving the street-lighting system. Under the present contract the company furnishes 70 arc lamps and 26 tungsten lamps. The new proposal provides for the removal of 45 arc lamps and the erection of 135 tungsten lamps, which would give the city 177 tungsten lamps and 31 arc lamps.

CUSHING, OKLA.—The Board of Trustees has accepted the proposition of the Cushing El. Lt. Co. to furnish electricity to operate the municipal water plant at 2 cents per kw-hr.

**DURANT, OKLA.**—The Texas Pac. & El. Co., of Dallas, Tex., has submitted a proposition to the City Council requesting to build and to maintain the municipal electric-light plant and furnishing the city with electric lighting purposes.

**FORT SILL, OKLA.**—Bids will be received at the office of the constructing quartermaster, Fort Sill, Okla., until May 26 for constructing wooden storage tank and installing motor-driven tripper, equip with necessary piping. A. F. Faulkner is constructing quartermaster.

**INGERSOLL, OKLA.**—The town of Ingersoll has been granted a franchise to erect a transmission line from the town of Ingersoll to and within the limits of Ingersoll.

**MARIETTA, OKLA.**—The City Council has engaged the Thomas Engineering Co., consulting engineer, 127 American National Bank Building, Oklahoma City, to prepare plans for extension and improvement to the electric light and water works system.

**MCCURTAIN, OKLA.**—J. N. Taylor and B. A. Little, of Okemah, have purchased one-half interest in the local electric-light plant from the McCurtain State Bank. It is understood that the plant will be thoroughly overhauled and new machinery installed. A streetcar system will be installed here and in Chanit.

**FORT WORTH, TEX.**—The Fort Worth El. & Pow. Co. has closed a contract with the Beveler Mills to furnish electricity to operate the flour mills. Motors aggregating 600 hp will be installed, ranging in size from 300 hp to 7½ hp. The steam plant at the Beveler Mills will be abandoned as soon as the motors are in place. The company has entered into a contract with the Texas Railway Mfg. Co. to supply electricity to the amount of 300 hp to drive electric motors. The steam plant will be discarded.

**HOUSTON, TEX.**—Bids will be received at the office of the assistant, just office box 17, Houston, Tex., until May 10 for the heating, plumbing and electric work in the two-story addition to the building of the William M. Rice Institute, Houston. Plans and specifications may be obtained upon application to Gram, Goodrich & Co., Inc., Sanitary Building, Houston, for which a deposit of \$50 will be required. A check for plans, to be refunded upon return of plans.

**HEMBLE, TEX.**—The power house at the Hemble Mill, on the Red Co., was destroyed by fire on April 18, causing a loss of about \$7,000.

**PALESTINE, TEX.**—Bids will be received at the office of the assistant, just office box 17, Houston, Tex., until May 10 for the heating, plumbing and electric work in the two-story addition to the building of the William M. Rice Institute, Houston. Plans and specifications may be obtained upon application to Gram, Goodrich & Co., Inc., Sanitary Building, Houston, for which a deposit of \$50 will be required. A check for plans, to be refunded upon return of plans.

## Pacific States

**CHEMUNIS, WASH.**—H. T. Wilkerson, president of the Chemunis Townsite Co., of Portland, Ore., is under contract to construct a large water-power project in the Cowhitz Valley, near Chemunis, Wash.

**PORT ANGELES, WASH.**—The city engineers has been authorized to make investigations and secure the cost of machinery for an electric lighting plant.

**TACOMA, WASH.**—Plans have been completed by Deeks & Hall, electrical contractors and engineers, for constructing electrically driven machinery in the large incinerator factory at E. S. Hanson & Co. Tacoma motors ranging downward from 20 hp will be installed.

**HOOD RIVER, ORE.**—We are informed that the city of Hood River does not contemplate the installation of a municipal electric-light plant as reported in the issue of April 19. H. E. Howe is the engineer.

**LAKEVIEW, ORE.**—Bonds to the amount of \$10,000 have been voted for the installation of a municipal electric-light plant and water works system.

**PORTLAND, ORE.**—The city auditor has been authorized to advertise for bids for lighting the streets of the city and municipal buildings. The present contract with the Portland El. & Pow. Co. expires at the end of the year.

**BARSTOW, CAL.**—The State Railroad Commission has granted the Barstow Utilities Co. permission to sell its electric and water plant to the Southern Sierras Pow. Co. of San Bernardino, Cal. Under the Southern Sierras contract will continue the plant and water works system.

**CLAREMONT, CAL.**—The Clarendon El. & W. Co. has applied to the State Railroad Commission for permission to purchase the plant and water works of the Clarendon Domestic W. Co. for \$75,000.

**FRESNO, CAL.**—Plans have been completed by the Fresno City Engineer, Supervisors of the Fresno El. & M. Co. for the construction of a power house to supply electricity for the city and motors for the various public buildings, also for lighting the city house building and rail. The cost of the plant located in the power house grounds is estimated at \$200,000 and the cost of the plant at \$200,000.

**LIVERMORE, CAL.**—The State Railroad Commission has granted the Livermore W. & Pow. Co. authority to sell its electric and water plant to the Fresno Gas & El. Co., of San Francisco, for \$242,000.

**LOS ANGELES, CAL.**—The city engineers has been authorized to make investigations and secure the cost of machinery for an electric lighting plant.

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## Canada

**OTTAWA, CAN.**—The city engineers has been authorized to make investigations and secure the cost of machinery for an electric lighting plant.

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PETERBORO, ONT.—The Legislature has passed the bill giving the city of Peterboro power to expropriate the plant of the Peterboro Lt. & Pwr. Co.

LANGHAM, SASK.—The ratepayers have approved the by-law authorizing an issue of \$12,000 in debentures for the installation of an electric-light plant. The contract for the entire equipment has been awarded to the British Canadian Engineering & Supply Co., of Winnipeg. The equipment will include a Ruston Proctor suction gas engine and gas-producer plant.

### Miscellaneous

TANANA, ALASKA.—The Tanana Wtr. & Pwr. Co. is planning a power project in the Tananika country, 100 miles from Fairbanks. John L. Timmins is interested in the company.

PANAMA.—Bids will be received at the office of the general purchasing agent Isthmian Canal Commission, Washington, D. C., until May 17 for furnishing dynamite, copper wire, copper brass tubing, bronze steel, steel chain, track bolts, etc. Blanks and general information relating to this circular letter (No. 775) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

SAN JUAN, P. R.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 14 for construction of two 300-ft. steel towers at the naval radio station, San Juan, P. R. The cost of the work is estimated at about \$15,000. Plans and specifications may be obtained on application to the above bureau. William M. Smith is acting chief of bureau.

## New Industrial Companies

W. H. CHAPMAN & COMPANY, of Detroit, Mich., have been organized by W. H. Chapman and A. T. Barley for the purpose of carrying on a general consulting engineering business. The company proposes to prepare plans, let contracts and supervise the installation of heating, ventilating, illuminating, power transmission and fire protection systems and power plants, etc. The offices of the company are located at 724 Hammond Building, Detroit, Mich.

THE DETROIT TUNGSTEN LAMP COMPANY, of Detroit, Mich., has been incorporated with a capital stock of \$10,000 by George W. Harder, Albert W. Marshall and P. H. Willard.

THE IDEAL NOVELTY & LAMP MANUFACTURING COMPANY, of Chicago, Ill., has been chartered with a capital stock of \$2,500 to manufacture lighting devices and equipment. The incorporators are: Arthur F. Bond, Oscar J. Bond and Jerome Levinson.

THE RESEARCH COMPANY, of Chicago, Ill., has been incorporated with a capital stock of \$100,000 by Forest E. Marsh, Edward E. Gray and L. H. Marsh. The company proposes to manufacture mechanical and electrical devices.

THE SAVAGE NOVELTY COMPANY, of New York, N. Y., has been incorporated with a capital stock of \$10,000 by John H. Hawley, Gustav H. Haupte and Robert M. Simpson, 2 Rector Street, New York, N. Y. The company proposes to deal in electrical and other machinery.

THE THOMAS MOTIVE POWER COMPANY, of Newark, N. J., has been incorporated with a capital stock of \$125,000 by M. A. Smith, of Newark, N. J.; A. B. Van Liew and J. H. Thomas, of Bloomfield, N. J. The company proposes to manufacture mill supplies and to do an electrical engineering business, etc.

## New Incorporations

BIRMINGHAM, ALA.—The National Pwr. Co. has been incorporated with a capital stock of \$1,000,000. The officers are: W. W. Wallace, president; M. J. Harper, secretary, and W. B. Burton, treasurer.

EAST ROCHESTER, NEV.—The Rochester Wtr., Pwr. & Mill Corp. has been incorporated with a capital stock of \$500,000 by E. A. Ludwick, J. L. Garner and W. H. Whitmore. East Rochester has not a post office.

NEWARK, N. J.—The Tri-County Pwr. & Trac. Co. has been incorporated with a capital stock of \$150,000 to operate electric power plants and traction systems. The incorporators are: George H. Williams, George G. Teller and Wilbur F. Brower. The offices of the company are located at 816 Essex Building, Newark.

HASTINGS, OKLA.—The Hastings Lt. & Pwr. Co. has been incorporated with a capital stock of \$6,000 by W. J. Bell, of Hastings; A. M. Bell, of Duke, and S. A. Fowler, of Gould, Okla.

ANAWALT, W. VA.—The Jeanette Lt. & Trac. Co. has been chartered with a capital stock of \$10,000. The incorporators are: R. L. Johnson, A. C. Davis, J. J. Stuart and others.

MISHICOT, WIS.—The Mishicot Lt. & Pwr. Co. has been incorporated with a capital stock of \$35,000 by Ira Beyer, Rose Beyer and Ahlva Heyroth.

## Trade Publications

ELECTRIC-ARC HEAD-LAMPS.—Bulletin A 4061 of the General Electric Company is devoted to electric-arc head-lamps.

CLOTH PINIONS.—The General Electric Company has issued Bulletin No. A4110, which contains data relative to tooth dimensions and instructions for the selection of pinions.

OIL SWITCHES.—Oil switches for small industrial application are treated in Bulletin No. A4113, issued by the General Electric Company. It illustrates and describes type F, forms P3 and P6 oil-break switches.

FIREBRICK.—A complete illustrated catalog of its clay products has been issued by the Evens & Howard Fire Brick Company, St. Louis, Mo. Blast furnace bricks, boiler tiles, patent grate settings and fire-clay chimney tops are described among other clay products.

WIRE PRICE LIST.—The Standard Underground Cable Company, Pittsburgh, Pa., has issued a new price list on Sterling new-code rubber-covered wire. It is published in convenient booklet form, on durable paper. A list of electric wires and cables and cable accessories is included in the booklet.

ELECTROTYPING MACHINERY.—Bulletin No. 241 of the Sprague Electric Works of General Electric Company, New York, has for its subject electric motor drive for stereotyping and electrotyping machinery and refers to special electrotyping generators. Some typical installations of this class of machinery are shown.

GUY ANCHORS.—W. N. Matthews & Brother, St. Louis, Mo., are sending out a leaflet containing a reprint from *Telephony* of an article by Mr. Claude L. Matthews on "Predetermination Versus Demonstration," referring to guy anchors. The reprint is accompanied by a leaflet showing by pictures the method of placing Matthews guy anchors.

WATT-HOUR METERS.—In a twenty-page bulletin, No. 35, the Sangamo Electric Company, Springfield, Ill., gives a comprehensive illustrated description of its type "D" and "D4" two-wire mercury motor watt-hour meters for direct-current circuits. The principle of these meters and their general construction are fully treated. The pamphlet contains considerable information of general interest on its subject matter.

FLEXIBLE COUPLINGS.—Bulletin No. 18, issued by the Francke Company, New Brunswick, N. J., Smith-Serrell Company, Inc., general sales agent, 90 West Street, New York, describes the Francke flexible coupling. This coupling is made in sizes from that suitable for a 1/4-in. shaft up to those as large as any in use. It is adapted for steam and gas engines, water and steam turbines, motors, pumps, blowers, printing presses, etc. Special types are made for automobiles and motorboats.

WOOD SUBSTITUTE.—The American Mineral Wood Company, Poughkeepsie, N. Y., has issued a booklet describing the uses for "Eterno," a fireproof and waterproof substitute for wood. It briefly refers to "Eterno" asbestos lumber, asbestos wood, asbestos wall boards, ebony boards and insulating boards and points out the many purposes for which "Eterno" may be used. This product is the invention of Mr. John Ferla, C. E., of Lausanne, Switzerland, where is located the original factory for "Eterno."

HOUSEHOLD DEVICES.—In connection with the general educational advertising campaign on its household specialties, addressed to prospective consumers, the Hotpoint Electric Heating Company, Ontario, Cal., is making a special offer to dealers for "Hotpoint day," May 10. Recent advertising literature addressed to the electrical trade includes a facsimile of a much enlarged telegram in which a special 30 per cent discount offer on "El Tostovo" (electric toaster stove) is made. The reverse side gives a description of this device and tells briefly about the numerous appliances made by this company.

## Business Notes

THE GOULD STORAGE BATTERY COMPANY has moved its offices from 341 Fifth Avenue to 30 East Forty-second Street, New York City.

MEYER & JONES.—Mr. Henry C. Meyer, Jr., and Mr. Bassett Jones, Jr., have moved their offices to the Architects' Building, 101 Park Avenue, New York.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY has moved its Eastern offices from 90 West Street to 30 Church Street, New York City. Mr. J. G. Kipp will remain in charge of the office.

THE AMERICAN DISTRICT STEAM COMPANY, of North Tonawanda, N. Y., has opened Pacific Coast offices in the Hoge Building, Seattle, Wash., with Mr. Eugene L. Barnes as district manager.

MR. WILLIAM W. RANDOLPH, M. E., has moved his offices to the Woolworth Building, 233 Broadway, New York, where he will continue his consulting engineering practice in matters relating to gas and electric-service properties.

THE CLARK ELECTRIC & MANUFACTURING COMPANY, 149 Broadway, New York, is to furnish the splicing sleeves for use on transmission lines in the Canal Zone. Other orders were received recently by the company for use in India. Another order comes from a power company on the Pacific Coast. This shipment includes tinned copper sleeves for steel ground lines.



# Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRADING COMPANY. Secretary, F. D. H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Mellor, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. I. W. Iard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Based on electrical work monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cooperstown, N. Y., June 23-27.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. W. Macon, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 5, 6 and 7.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary-treasurer, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreuccetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SYSTEM ENGINEERS. Secretary, P. W. Dixon, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. E. Bowlen, Birkbeck Building, Toronto, Ont., Can. Annual convention, Port Arthur, Ont., June 23-25.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas E. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Marquette Block, Chicago. Meets every Thursday night at 11th St. Station.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MASSACHUSETTS. Secretary, Ernest S. Cowie, 1615 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Alfred Petchemann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Herbert P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1321 Land Title Building, Philadelphia, Pa. Executive committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Frank Peterson, 121 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Cullagh, 411 South Clinton St., Chicago, Ill. Standing order, Chicago, May 26-28.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stacey, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE UNITED STATES. Secretary, Albert H. Elliot, Harding Building, 43 East 58th St., New York. Annual meeting, San Francisco, Sept. 10-12, Thursday of each month.

ELECTRIC DEVELOPMENT ASSOCIATION, INC. Secretary, John W. Cullen, 53 State St., Boston, Mass.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, R. S. Emerson, 124 West 42d Street, New York. Monthly meeting, New York, each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. NEW YORK SECTION. Secretary, L. L. Edgar, 39 Bowdoin St., Boston.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Society, 100 West 27th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Ball, Norman, Okla. Annual convention, Oklahoma City, May 6-8.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Harrison, Peoria, Ill.

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Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Thursday of each month.

NEW YORK ELECTRICAL CREDIT ASSOCIATION (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of directors meets second Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, United Traction Co., Albany, N. Y.

NORTHWESTERN CEDARBURNERS' ASSOCIATION. Secretary, H. H. McKinney, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 15-17.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Kilkeny, St. John's, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. E. Rosenberg, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. Secretary-treasurer, Philip S. Dodd, 29 West 39th St., New York. Meeting executive committee, May 13, 1913.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTHWESTERN GAS AND ELECTRIC ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, Tex., May 21-24.

TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Secretary-treasurer, J. W. Neave, Salisbury, N. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill.

WESTERN RED CEDAR ASSOCIATION. Secretary, R. L. Bayne, Spokane, Wash.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

## Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 22, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

- 1,059,342. PROCESS FOR REDUCING ZINC OXIDES; C. F. Burgess, Madison, Wis. App. filed Oct. 8, 1909. Electricity heats zinc oxide to temperature of volatilization; simultaneously heats mass of carbon and conducts vapors of zinc oxide into contact with carbon mass.
- 1,059,348. RESETTLE DEVICE FOR HEAT-COILS; F. B. Chapin, Detroit, Mich. App. filed March 23, 1907. For restoring relatively displaced parts of an operated thermal protector; has supporting members for the protector and means for restoring normal relation of the parts upon the application of heat thereto.
- 1,059,351. ARMATURE; O. F. Conklin, Anderson, Ind. App. filed Nov. 5, 1912. Inner and outer windings, a commutator for each, and a channeled support for one commutator which receives the leads of the inner winding.
- 1,059,366. PROCESS OF PREPARING FILAMENTS FOR INCANDESCENT LAMPS; W. G. Hruskeper, Philadelphia, Pa. App. filed Aug. 6, 1910. Simultaneously passes differently phased electric currents through different portions of the filamentary material.
- 1,059,390. ELECTRIC WELDING MACHINE; R. C. Pierce, Cincinnati, Ohio. App. filed Nov. 14, 1912. Plurality of differently shaped, swingingly operated die-carrying horns capable of being selectively moved to operative position.
- 1,059,397. ELECTRICAL TERMINAL DEVICE; O. S. Schairer, Edgewood Park, Pa. App. filed Aug. 6, 1910. Receptacle with upwardly projecting prongs and a body of mercury in the receptacle partially surrounded between the prongs.
- 1,059,416. SWITCH; T. S. Watson, A. C. Rhine and C. H. Keeney, Milwaukee, Wis. App. filed Jan. 13, 1911. Handle must be moved from the "off" to the starting position before it can be moved to the running position.
- 1,059,435. ELECTRIC TRANSFORMER; C. E. Campbell, Lynn, Mass. App. filed Nov. 1, 1909. Core with plurality of legs, a primary winding on one leg divided in sections located near end of leg, low-tension secondary on the same leg between sections of primary and a high-tension secondary on another leg of the core.
- 1,059,451. ARC LAMP; G. Geiger, Munich, Germany. App. filed Aug. 9, 1909. Armature of the solenoid in series acts directly upon upper carbon holder and effects at the same time the movement of the lower carbon holder.
- 1,059,499. ELECTRIC FURNACE; E. Stassano, Turin, Italy. App. filed Nov. 29, 1912. A circular conical motion is imparted to the axis of the melting chamber.
- 1,059,505. ELECTRIC BATH OR TREATMENT APPARATUS; R. N. Tuttle, Battle Creek, Mich. App. filed Sept. 15, 1911. Tubular foldable frame rests upon the bathtub.
- 1,059,529. TELEGRAPH TRANSMITTER; P. P. Dow, Montreal, Quebec, Canada. App. filed Sept. 25, 1911. Means for delivering the impulses representing the dots in the telegraph alphabet is electrically engaged during the period of silence and manually released to effect the dots.
- 1,059,583. ELECTRIC-CIRCUIT LOCK; D. W. Wilt, San Diego, Cal. App. filed Aug. 26, 1911. For ignition circuits of automobiles, etc.; rotating element with two angular arms, one to close the circuit and the other to be engaged by a rotatable locking means.
- 1,059,586. FIRE ALARM; A. Allan and T. Bowling, Wellington, New Zealand. App. filed May 11, 1909. Bent tube provided with an offset pocket adapted to hold a quantity of mercury to close circuit through terminals entering the pocket.
- 1,059,617. SOCKET FOR ELECTRIC LAMPS; G. C. Knauff, Chicago, Ill. App. filed April 22, 1912. Socket with means for anchoring a lamp in one end and a wire terminal plug in its opposite end and contact members carrying current from terminals of plug to terminals of lamp.
- 1,059,629. INSULATOR; T. M. Platt, Philadelphia, Pa. App. filed June 10, 1911. Has angularly disposed slots and arc engaging flanges to receive and hold the wire.
- 1,059,650. PLUG CONNECTION FOR ELECTRICAL WORK; A. A. Warner, New Britain, Conn. App. filed May 1, 1912. Resilient jaws bent into triangular form and a protecting case having a chamber of angular form to receive the jaws.
- 1,059,651. COIL TELEPHONE REPEATER; D. H. Wilson, New York, N. Y. App. filed June 15, 1911. Plurality of coils connected to main line, a commutator to circuit with the coils, a receiver associated to actuate the commutator, and a coil associated with the first coil and connected with the receiver.

- 1,059,706. SELECTIVE RELAY; E. R. Brodton, Mobile, Ala. App. filed Aug. 28, 1909. Continuity of the circuit is established by relays in succession up to the relay designed to respond actively.
- 1,059,717. SAFETY ATTACHMENT FOR ELEVATOR DOORS; R. K. S. Dobson, New York, N. Y. App. filed July 16, 1912. Circuit-controlling devices render it impossible to start elevator until doors have been closed.
- 1,059,737. INCANDESCENT LAMP; A. S. Knight, Newark, N. J. App. filed May 13, 1909. Filament extends in zigzag form between supporting members in a plane substantially normal to the axis of the bulb of the lamp.
- 1,059,738. SUPPORT FOR INCANDESCENT-LAMP FILAMENTS; A. S. Knight, Newark, N. J. App. filed Aug. 6, 1910. Support has containing gases laterally, medium, and the filament embraces the support at one side of the laterally bent portion and is united thereto at its extremity.
- 1,059,745. TELEPHONE METERING SYSTEM; E. H. Martin, Webster City, Ia. App. filed March 17, 1911. Spring-actuated meter mechanism is mounted within the bell of the receiver.
- 1,059,758. TELEPHONE TIME SIGNAL; W. Pothen, Murdock, Minn. App. filed June 10, 1911. Clock at central station and means actuated by its striking mechanism to make and break the circuit to ring the bell at the substation.
- 1,059,759. ELECTRIC ALARM FOR LOCKS; J. H. Preston, Ottawa, Canada. App. filed March 9, 1912. Uses special switch which is insulated, so as not to give the alarm; ordinary key, being uninsulated, serves to give an alarm.
- 1,059,763. RELAY FOR UNDULATORY CURRENTS; E. Reisz, Vienna, Austria-Hungary. App. filed Jan. 30, 1911. Discharge tube containing gases laterally, medium, with electrodes positioned in said medium; conductivity of space between the electrodes is altered.
- 1,059,771. SYSTEM OF CONTROL FOR INDUCTION MOTORS; A. Scherbius, Baden, Switzerland. App. filed June 27, 1908. Induction machine and commutator machine with mechanical connection between rotor of induction machine and the commutator and electrical connections from the rotor of the commutator to the stator of the commutator machine.
- 1,059,772. DRIVING OF SINGLE-PHASE MOTORS; K. Schnetzler, Baden, Switzerland. App. filed March 19, 1910. Stator of one motor is directly attached to the network while other motor obtains suitably varied voltage by means of a transformer.
- 1,059,786. PROCESS AND DEVICE FOR LIGHTING SUBMERGED ULTRA-VIOLET-RAY STERILIZING LAMPS; P. G. Triquet, Paris, France. App. filed May 9, 1912. Lamps are lighted by a rapid angular motion about their longitudinal axis crossing the mercury mass of the end chambers.
- 1,059,809. MANUFACTURE OF PERSULPHATES; G. Adolph and A. Pletsch, Munich, Germany. App. filed Oct. 6, 1910. Undissolved sulphate of an alkali metal is caused to react on a bath of ammonium persulphate.
- 1,059,831. ELECTRIC SIGNALING DEVICE; G. Christian, Detroit, Mich. App. filed July 8, 1912. Gong construction; hammer is pivoted intermediate to its ends and a resiliently mounted armature has an arm engaging the hammer.
- 1,059,846. ELECTRIC SWITCH; F. C. De Reamer, Schenectady, N. Y. App. filed Nov. 1, 1912. Pivoted pole piece, rotary crank transverse to the pivotal axis of the pole piece, and a spring connecting the crank and pole piece to exert a biasing effect upon the pole piece alternately in opposite directions.
- 1,059,863. INSULATOR WITH FUSE; K. Petersen, Sarpsborg, Norway. App. filed May 2, 1912. Insulator with attached fuse plug has a hole in the body of the insulator and a hook is secured in the said hole.
- 1,059,928. ELECTRICAL DISTRIBUTION SYSTEM; G. Blank, New York, N. Y. App. filed April 26, 1912. When service circuit is closed an automatic switch acts to disconnect one branch of the feed circuit from the service circuit and to connect the other branch of the feed circuit with the service circuit and a shunt circuit.
- 1,059,931. TROLLEY WHEEL; M. E. Drake and D. B. Barnett, Bessemer, Ala. App. filed Oct. 17, 1912. Spring arms on trolley pole carry guard disks engaging the opposite flat faces of the trolley shoe.
- 1,059,944. CALLING DEVICE; F. R. McBerry, New Rochelle, N. Y. App. filed Feb. 27, 1908. Switching mechanism at distant end of circuit is controlled by calling device for purpose of causing switching mechanism to connect the associated circuit with any one of a number of other telephone lines.



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No. 19

of New York requires all public works to be performed using steam and electrical power, to get to home. It is a somewhat unusual, although fairly standard, rule as part of a public service commission's. That is, the details of this kind. The rules adopted are comparatively simple and straightforward and ought to protect any industrial service or providing certain classes of workers. That these are not the case. And because certain of requirements can prevent any other direction of industry or workmen is hardly to be expected. It is always the unexpected which happens, as any well-trained accident insurance man will tell you. The work can still be made



of all sorts of curious happenings in power plants as certification of the truth of this trite old saying. The companies concerned have a most careful and friendly interest in the subject, and it is safe to say that the rules adopted will be carried out in spirit just so far as is possible. To carry them out to the letter may at times be somewhat difficult.

For instance, the second rule in the list, which requires all exposed high-tension cables to be inclosed by screens or otherwise protected, is one not always easy to carry out without leaving incidental risks of other kinds. A high-tension cable carried unscreened and in full view, but well out of reach, is quite as safe as it would be with anything but a very elaborate system of inclosure. Incidentally, it would be an exceedingly good thing if every high-tension conductor were to have a distinctive color, such as bright red or yellow, leaving the ordinary finishes for low-tension wiring exclusively. This would be, in fact, an extension of the suggestion of the rule requiring that wiring diagrams shall be conspicuously posted and wires and cables and connections properly tagged and numbered. The rule requiring generators to be protected by railings and gratings for the safety of the operators is one that is already generally carried out where it is needed, but if literally enforced it would lead to some very curious constructions, as would also the rule requiring the inclosing or similar protection of all belting. If sensibly and reasonably applied, as they certainly will be, the safety measures here laid down are useful and reasonable and will tend to prevent a good many forms of accident.

In this connection the report we publish on the safety measures adopted by the New York Edison Company is very illuminating. As most of our readers know, the New York Edison Company, like most broad-minded central-station organizations, has for a long time pursued a most enlightened and liberal policy in dealing with accidents, a policy far in advance of that enforced by most of the workmen's compensation acts which have been recently coming into vogue. To furnish an injured employee with medical attendance and keep him at full pay on the disability payroll until well and able to resume his duties is a long way in advance of anything yet set down in legal enactments. But the most interesting part of the story is the record of accidents in this particular organization. The total from recent statistics was nearly 1000 a year, of which 55 per cent were so trivial as in no way to interfere with the employment of the workman for a time longer than that required to go to the doctor for inspection and what treatment might be necessary. Less than a quarter of the total number involved absence from duty for a week, and only 3 per cent resulted in disability for a month or more. Of the total number of accidents recorded only 13 per cent were from purely electrical causes, by far the greatest group consisting of bumps and contusions and that sort of thing which might as well happen in any other place as in a central station. Fifteen per cent were due to cuts and jabs from articles with edges and points, while about the same number resulted from falls of various kinds, ranging from slipping on the floor to falling from scaffoldings. Eighty-five per cent of the total number

seem to have been due to ordinary carelessness. Such an analysis of the causes of accidents in central stations shows how relatively little importance is to be attached to the purely electrical dangers. However careless a central-station workman may be, he has a wholesome respect for high-tension wires, and these are as a whole put effectively out of his way, so that accidents from high-voltage conductors are exceedingly rare. In view of this fact one should not consider the employee of a central station as engaged in a dangerous occupation. His likelihood of receiving injury is, on the whole, rather less than that incurred among workmen in general, and the risks peculiar to his business—that is, the electrical ones—have been reduced almost to a vanishing quantity by wise precautions applied almost as a matter of course.

### Specifications for Street Lighting

The very interesting and important paper on the standardization of street-lighting specifications read by Mr. Trotter before the British Illuminating Engineering Society is worthy of serious attention on this side of the water. It is a somewhat daring project to standardize street illumination, yet certainly something can be done toward rendering at least the point of view more uniform in considering so difficult a subject. This is what Mr. Trotter has attempted to do, not so much to set a hard and fast rule as to suggest important points in drawing the specifications. The British viewpoint on such matters seems to differ materially from the American, and hence much of Mr. Trotter's work may be regarded as of dubious applicability in this country. In the first place, it seems to be the fairly uniform custom abroad to define illumination by its horizontal component resolved upon a plane a meter above the roadway. This standard of comparison is upheld by very few American engineers, who on the whole are inclined to favor a measurement normal to the ray and consequently taking into consideration the light in one direction only. With rather closely spaced lamps, such as are in use in first-class streets abroad, these two specifications do not differ materially, for it is not unusual in English and Continental cities to find lamps spaced at about four times their height apart; but aside from this difference the chief point suggested by Mr. Trotter's specification is that the basis should be fundamentally the minimum illumination measured on the horizontal plane, most of the details being left to the contractor.

We cannot speak with personal authority regarding British conditions, but we are reasonably certain that a specification of this kind applied to American practice is simply a temptation to the worst possible illumination and a grievous provocative of subsequent litigation. A given minimum with a free hand to the contractor means as low average illumination as possibly can meet the minimum requirement if the bids are put on a fairly competitive basis. We do not believe that light flux is to be put aside as inconsequential in street lighting. Moreover, the lack of precision in illumination measurements made on the street is so notorious that such measurements should not under any circumstances be made the criterion on which payments for

service depend. If a city is spending \$500,000 per annum on its street lighting under a contract based on illumination, an error of 1 per cent in determining that illumination would mean a difference of \$5,000, and it is notorious that the probability of error is nearer 5 per cent than 1 per cent. This uncertainty of itself ought to put out of the question illumination measurements made in the street as a basis on which the fulfilment of the contract is to be determined. The place in which to measure the performance of specified illuminants is the laboratory and not the street. The standard working conditions for a specified illuminant can be defined in such wise that they can be determined by measurements of the lamps in place, whether gas or electric, with a reasonable degree of precision. This is not true of illumination measured on the street. Given a source, whether gas or electric, working under specified conditions, the performance of that source from the standpoint either of light flux or of illumination at a particular angle can be determined in the laboratory once for all with much greater precision than on the street. Hence we are extremely dubious as to the basis of illumination set forth in the proposed British specification, and we are not in the least surprised that the propositions were far from meeting with universal acceptance.

### Revision of German Standardization Rules

The *Elektrotechnische Zeitschrift* has recently published the revised edition of the standardization rules of the Verband Deutscher Elektrotechniker. The German standardization committee, in formulating these rules, refers to the recent work of the International Electrotechnical Commission and of the American Institute of Electrical Engineers. The proposed new German rules, as might be expected, differ only in details from those of the last edition. It is interesting to observe, however, that in general the modifications are in the direction of the recommendations of the I. E. C. It is reasonable to assume that, since the I. E. C. is an international body which arrives at its decisions by a process of international discussion in committee work and debate, each nation's successive editions of standardization rules will converge toward the I. E. C. consensus. It is to be hoped and expected that a continuation of this process will lead ultimately to the adoption of a single set of international rules—those of the I. E. C.—with translations and minor local reservations in the various countries.

The proposed new German rules recommend, as do the proposed new American rules, that the rating of machines be determined by their maximum measured temperature, attained under prescribed conditions of service, the maximum temperature being measured at the hottest externally accessible places of the windings. Different classes of insulation call for different limits of temperature. Considering only unimpregnated cotton insulation, on conductors embedded in grooves and carrying alternating currents, the German rules propose a maximum measured temperature of 75 deg. C., while for paper or impregnated cotton insulation they propose 85 deg. C. The American rules propose 90 deg. C. in the latter case. Whereas, however, the Ger-

mans assume 35 deg. C. as the maximum ambient temperature, the Americans assume 40 deg. C. Thus, 50 deg. C. temperature elevation is normally permitted by both sets of proposed rules. In the ultimate analysis, however, it is the maximum permitted measurable temperature which determines the rating; so that if the technique of thermometric measurement is assumed to be the same in both countries, the German 85 deg. C. compels a lower rating and output, under cases of specially severe local temperature conditions, than the American 90 deg. C., although for the average machine, under ordinary local conditions, the two sets of rules would be substantially on a parity, since each permits of 50 deg. C. rise.

The German rules call for certain overload conditions, namely, for generators, motors, converters and transformers, 25 per cent overload for half an hour, provided the temperatures do not exceed the specified safe limits. This means, presumably, that while the heat rating controls in all cases, there must be a margin of 25 per cent overload, for half an hour, in regard to mechanical strength, pressure regulation, commutation, etc. Motors, converters and transformers are furthermore called upon to withstand 40 per cent overload for three minutes, and all rotors must be able mechanically to withstand 15 per cent increase in speed for five minutes. In general, the proposed German rules seem to us to embody a satisfactory advance over the preceding edition in the direction of international agreement upon essential elements of rating.

### Submarine Cable Signaling

A very interesting article by Dr. H. W. Moleculs has recently appeared in the *London Electrician* on a comparison between siphon recorder signaling, Murray-Morse signaling, Gott-Morse signaling and Picard-Morse signaling in the light of arrival-curve theory. Assumption is made of a cable of given electrical length—that is, of given time-constant—and of the transmission of a certain set of signals such as those of S. V. from battery-powered electric duration, corresponding to a certain code of transmitting messages. The arrival curve of current at the receiving end is then computed and plotted with its good rheostatic terminal connections. From the shape of the computed graph for the series of signals under the two different types of transmission compared, deductions are made as to their relative advantages. These deductions appear to be well warranted for the particular case assumed.

The principal deductions are that the siphon recorder has the advantage over the type of Murray-Morse, especially in the cross letters. The speed of signaling with the recorder is always limited to that at which the line favored non-cross letters can be deciphered. The Gott-Morse has a distinct advantage over ordinary Morse and even over siphon recorder with an automatic battery. It is suggested that Gott-Morse increased signals might be improved by slight modifications in the location of the leading signal, under the control of a machine transmitter. Unfortunately, such modifications would be different for different letters of the Alphabet.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### New York Legislature Passes Hydroelectric Bill

The Murtaugh-Patrie hydroelectric bill was passed by the Legislature at Albany, N. Y., last week, and is now in the hands of the Governor of the State. The bill provides for the immediate expenditure of \$650,000 for the construction of a state power plant at Vischer Ferry, where electricity is to be generated with surplus water from the Barge Canal. Under the bill the State is authorized to build distribution lines for carrying the energy to the eight municipalities within the capital district. The municipalities may dispose of the State-developed electricity to private consumers in addition to using it for the lighting of streets and public buildings. The working out of the scheme will be intrusted to the Conservation Commission, and should the experiment prove successful, the system will be extended to other parts of the State. The measure passed both houses of the Legislature with large majorities, and it will depend upon the Governor whether or not the State will be committed to an experiment in the ownership and operation of hydroelectric plants.

### Paris Meeting of British and French Electrical Engineers

At the joint meeting of the British Institution of Electrical Engineers and the Société Internationale des Electriciens which is to be held at Paris on May 21, 22, 23 and 24, 1913, the following papers will be presented: "Continuous-Current Thury System," by Mr. J. S. Highfield; "Three-Phase Systems," by M. Maurice Le Blanc; "Lighting by Means of Vapor-Tube Lamps," by M. Claude, and "Wireless Telegraphy," by Commandant Ferrié. In addition to the above-mentioned papers the program contains many other items of interest, chief among which are a visit to the aerodynamical laboratory of M. Eiffel at Auteuil, an inspection of the wireless-telegraph installation on the Eiffel Tower, a visit to the electrical installations of the Metropolitan, the Nord-Sud and the Compagnie des Omnibus, and a visit to the aerodrome at Buc, where an exhibition of aero-plane flying will be seen.

### The Largest Turbo-Generator

What will be the largest unit in the world producing electrical energy has been ordered by the Commonwealth Edison Company of Chicago from the General Electric Company. The unit will be a 30,000-kw horizontal turbo-generator to be placed in the Northwest generating station. It will be delivered about July 1, 1914.

The exciter will be installed on the shaft of the machine, and the length of the unit over all will be 60.5 ft. The width will be 18 ft. 4 in. and the height 14 ft. The generator will be a 9000-volt, 25-cycle, three-phase machine with two poles, operated at a speed of 1500 r.p.m. and designed for an output of 1925 amp per phase. The turbine will be operated at a steam pressure of 230 lb. with a supertemperature of 200 deg. Fahr. The weight of the entire unit will be about 1,000,000 lb.

It is a noteworthy fact that the order for this 30,000-kw

unit is placed while work is under way on an addition to the Fisk Street station of the company, which will provide for an increase in output of 45,000 kw—25,000 kw from an English Parsons horizontal unit and 20,000 kw from a General Electric horizontal unit.

### Electrical Manufacturers' Meeting

(By Telegraph)

At a meeting of electrical manufacturers held at Hot Springs, Va., on May 7 and 8 the subjects of profit-sharing, industrial welfare and the patent situation were discussed, and the plans of the Society for Electrical Development were outlined by General Manager J. M. Wakeman.

### Convention Preparations

Mr. David R. Forgan, one of the leading financiers of Chicago and president of the National City Bank of that city, has been secured to make an address before the Commercial Section during the forthcoming Chicago convention of the National Electric Light Association. His subject will be "How to Protect Business from Disturbances Caused by Panics."

An arrangement will no doubt be carried into effect at the Chicago convention by which the registration of out-of-town members and local members will be divided, thus facilitating the work of registration, as a very large attendance is expected.

### Plans of Society for Electrical Development

When the slogan committee of the Society for Electrical Development met at the office of the society in the Engineering Societies Building, New York, on May 5, the members had a rather overwhelming task presented to them. There were upward of 2500 answers to the announcement inviting competitors to send in slogans and trade-marks. The committee made a selection for each, but is unable to announce the result because its decision has to be approved by the executive committee, before which the matter will come next week.

On May 6 the committee on plans had an all-day session and considered exhaustively many suggestions of ways and means that have come before the officers of the society during and since the general conference held in New York last March. Although the findings of the committee must go before the executive committee, in a general way it may be stated that it will recommend for immediate action two lines of procedure—first, the establishment of a department of publicity which will be in charge of an expert publicity man in the office of the society in New York; second, a general campaign of advertising which will be handled through an advertising agency yet to be selected. In this connection the committee will transmit to the executive committee the names of one or two agencies considered especially competent to handle this work, and the recommendation of the committee will be that all advertising be of an educational character.

The committee on plans will further recommend for



Future consideration, as opportunity and time may permit a number of other lines of work, such as films for movie picture shows, portable electric shows to be exhibited in one town after another, the operation of a central power in charge of the work of co-operation for the purpose of harmonizing the relations between contractors, dealers and jobbers and to appear before boards of trade and chambers of commerce with a view to promoting co-operative relations in communities where such work is needed, the appointment of a committee to work with underwriters' laboratories, etc. Mr. George Williams suggested the construction of a number of electric signs bearing slogans and catch-words calculated to impress upon the public mind the advantages to be derived from the use of electricity. These signs would be sent to one city after another and used by the local lighting companies, which would furnish both the electrical energy and the space in which the signs would be displayed.

The members of the committee were enthusiastic in their work and expect important results from their plans when finally adopted by the executive committee.

### A. I. E. E. Convention

At the convention of the American Institute of Electrical Engineers to be held at the Hotel Biltmore, Cooperstown, N. Y., during the week of June 23, the following papers will be read and discussed: "Standardization of Method for Determining and Comparing Power Cost of Steam Plant," by Messrs. H. G. Stott and W. S. Gorsuch; "The Electric Strength of Air," by Messrs. J. B. Whitehead and T. T. Fitch; "The Positive and the Negative Corona," by Prof. W. W. Strong; "A Theory of Rupture," by Mr. F. W. Peek, Jr.; "An Oscillograph Study of Corona," by Prof. Edward Bennett; "Test of an Artificial Aerial Telephone Line at a Frequency of 750 Cycles per Second," by Dr. A. E. Kennelly; "The Behavior of Synchronous Motors During Starting," by Mr. F. D. Newbury; "The Industrial Use of Synchronous Motors on Central-Station Lines," by Mr. J. C. Parker; "Automatic Substations," by Mr. H. R. Summerhayes.

The educational committee of the Institute has made arrangements for a symposium to be introduced by Prof. H. H. Norris, during which the following subjects will be discussed: "Legislation in Vocational Education," by Prof. W. I. Slichter; "Results Obtained by the Pennsylvania Railroad in the New Apprentice School," by Prof. I. P. Jackson; "A Special Feature of Vocational School Work," by Prof. A. J. Rowland; "Vocational Training in the Far West," by Mr. William Sibley; "New National Association of Corporation Schools," by Mr. William Hendricks.

Mr. S. D. Sprong, electrical engineer of the Edison Electric Illuminating Company, Brooklyn, N. Y., is chairman of the convention committee.

## Wireless to Supplement Telephones

The Southern California Edison Company has installed a wireless telegraph set in its Ken-Ridge plant for regular communication with the other stations in the canyon. For the past year the company has been experimenting with wireless telegraphy in the operation of its hydroelectric plants, having set up a fully equipped outfit at Lytic Creek plant rated at 2 kw with a sending range of about 300 miles. The Lytic Creek installation has been found very useful during breakdown of telephone lines, being in regular operation with a smaller set located at the station known as Mill Creek No. 3. Aside from its use in connection with the system operation the wireless set has been very serviceable in picking up the regular weather reports sent out from all government stations along the Pacific Coast and reporting them to Los Angeles each day.

## Report of the Economy and Efficiency Commission on the Patent Office

The report of the Committee on Learning and Planning, creating its recommendations to the District Council, is confirmed by resolution of Congress\* during the last Administration was a formidable document of the paper and is bound together whether all the are succeeded in being reformers. had opportunity to give this report, some other efforts to reform, have interesting document, signed by Messrs. A. W. Leonard, W. W. Weaver and J. C. Chance, formerly comm. on Learning and Planning, enters into the more particulars of the current process, bringing out the different and complex nature of the present methods of improvement. The following abstract of the report it is thought was rather more than the time to study the original in detail.

As the time for the annual report of the American Medical Association has come, we have collected for this correspondence some of the comments that have been made on the report. It is a fact that all the large associations in the country have approved the report, and the expenditure of \$20,000, and that the report should have been prepared and published three and a half months after the resolution was approved. This in itself is a worthy example of "efficiency and economy." With these things in mind, in addition to the results of the hearings on the H. R. 20,449, we have (see report No. 116, to accompany H. R. 20,449, in H. W. A. Circular, House of Representatives, 65th Congress, second session, 1917), our strong opinion for the revision of our patent system will have to work much simplified.

Certain defects in the handling of the personnel of the Patent Office were pointed out, but, primarily, it was mentioned that there are no efficiency records for the examining force and that no means have been taken to have examinations for the purpose of determining the efficiency of examiners and regulating their promotions and reductions. Such efficiency records, in conjunction with an examination system, would tend to encourage all employees to do their best work and would make adequate salaries a real and lasting benefit to the service.

Emphatic stress was laid on the responsibility of the present Patent Office quarters, as follows:

In the preliminary survey concerning the accommodations the commission was surprised to find that the existing building accommodations for the Puerto Rican population were as to render extremely difficult any substantial improvement in the north of the state. This impression has been changed as a result of the investigation and it has become a settled conviction that any improvement is bound to be the quantity and quality of work done for others. It came at a reasonable time when all signs previous being made for education, other social services, for the form of some three and people concerned in the

trast with the enormously increased development of our country.

As to the needed changes in our patent laws, the remark is made that the present law is substantially the same as the act of 1836. There is a significant allusion to the conservatism of lawyers and their opposition to any changes in procedure. On this point the commission said:

"No change, however much it may be needed to keep pace with changed conditions, can be made without vigorous opposition due to a large extent to that inherent prejudice against disturbing the daily routine life and the inconvenience of adapting one's mind to a new course of action. . . . Recommendations made by the present Commissioner of Patents for the amendment of laws to effect what he considers are improvements in the methods of the office and to expedite its work are opposed by those who do not agree with him as to the wisdom of the changes as well as by those whose financial interests would be affected unfavorably. . . . The commission is convinced that any proposed change in the patent law and almost any proposed change in the methods of procedure in the Patent Office will arouse opposition from some persons interested in securing patents."

This statement is very well corroborated by the answers to the list of questions sent out by the commission to members of the bar, inventors and others interested in matters before the Patent Office. More than 400 replies were received. On most questions there was a considerable divergency of opinion. But even here it is significant that on question No. 24, relative to the desirability of creating a single Court of Patent Appeals, the answers were practically all affirmative and only a few opposed.

Questions 1, 2 and 3, asking opinions as to the advisability of abolishing one of the two appeals in the office and creating one appeal board of five or six members, were answered in the affirmative in about 80 per cent of the replies. The direct negative to these question was less than 20 per cent. The trend of the opinions expressed lies decidedly toward a single appeal to a board in the office, particular stress being laid on the importance of having the work of the primary examiner performed in a thorough and capable manner. The great majority of answers opposed the sitting of the commissioner, the assistant commissioners or any administrative officer on this board, the idea being expressed that the commissioner should be left free to devote his time to purely administrative duties.

Answering question No. 14, "To what extent should the decision on such appeal operate as a final adjudication of patentability?" a small number answered that the decision should be final, and a few that it should not be final. Some favored it being final only as to adverse decisions. Other suggestions were: It should be final, but not as against newly discovered prior art, in case of litigation under the patent; decision of the Patent Office in interference cases to be final and only to be opened in court upon new evidence found, as the proceedings are far less expensive in the office than in the courts.

Chapter 4 is devoted entirely to an examination of our cumbrous and time-robbing system of interference. The commissioners conclude that it would be better not to make any important changes in our present interference procedure. They seem to overlook the fact that our interference system, as it stands to-day, hardly protects the "first" inventor if the latter does not possess the abundant cash required to defend his rights against wealthy opponents. Furthermore, a good patent system should be devised in the interest of the nation, the public at large, and not for the limited individual benefit of one inventor or another. The essence of good patent law is to induce inventors to disclose their invention as promptly as possible, so that the public may have the early benefit of such publication. Our interference proceedings, in conjunction with other defects in the methods of allowing patents, encourage sys-

tematic delay in the publication of patents; in reality, a premium is now put on such delays. All this would be much simpler if in all interference cases priority were allowed to the independent inventor who has first filed his application, provided he has not copied or stolen the invention from others.

The German law bestows an almost absolute claim to priority on the earlier applicant. That system, therefore, has the great advantage of simplicity over the practice in the United States, but it may become a source of injustice in case the later applicant is really the earlier inventor. However, the later applicant has only himself to blame if he does not file his application in due time, instead of following present custom in America and wilfully postponing the filing of his claims, under the immunity of our interference rules. This finally comes down to the question whether it is better to confer the right of priority on the earliest date of application which can clearly and instantly be established or on the date of conceiving the invention and reducing it to practice, which is attended with many uncertainties and frequently makes our interference proceedings so absurdly long, complicated and expensive. Our present interference rules are undeniably a great handicap to the inventor of limited means, and our system is detrimental to the best interests of the nation. Indeed, it delays the essential benefit of publication of the invention, and furthermore, in some cases it becomes a positive danger to any industrial enterprise when no one can determine whether he is not infringing some unpublished patent rights which have been silently ripening in interference proceedings, protected by all the possible customary delays sanctioned by our rules of practice.

The German and British systems permit the filing of opposition proceedings within a certain period after a patent is allowed, and this is an excellent simplified substitute for our interference proceedings. Members of the German Patent Office have invariably declared that they attach considerable importance to the maintenance of this system, because it tends to reduce the responsibility of the examiners and to enhance public confidence in the integrity and capability of the board of examiners; this in itself tends to check the criticism which inventors are sometimes prone to make after encountering disappointments in the office. I have noticed the same uniformly favorable opinion among German inventors, as well as patent attorneys and manufacturers, concerning the advantages of the so-called opposition proceedings. Many of them, however, are of the belief that the British system, which permits opposition to a patent during a certain period after the latter has been printed and published, is more practical and expedient than the German method where opposition has to be filed before the patent has been printed and before copies are readily obtainable except by means of special copies made from the pending application at the Patent Office.

As another check against worthless patents, the German law provides a safeguard in the method of annulment proceedings. Such proceedings are quite distinct and independent from any infringement proceedings. Any person, whether sued for infringement or not, may apply to the Patent Office for the annulment of any patent if he can prove that at the time of application the subject matter was publicly known, or was claimed in a prior patent, or was illegally appropriated by the patentee. However, in the latter case, annulment proceedings can be instituted only by the person from whom the invention was appropriated. In a similar manner, a person who believes he can prove that he is a prior inventor of an invention patented by another, and that the patentee has stolen his invention, can sue the patentee for an assignment of the patent to him. There is still another safeguard in the German law, called the right of prior use (*Vorbenutzungsrecht*), which prevents the dangerous possibility now existing in the United States that a business enterprise, started in good faith, may be



held up at any time on account of a long-pending patent application, which is secret until allowed. In Germany any person who at the date of application of a patent has already used the invention in that country, or made the necessary preparations for such use, has the right to use the invention for the requirements of his own business in his own works; but this right can only be transferred to others together with the good-will of the business.

It should be noted here that sometimes the suggestion has been made to cut down entirely our examination system, as well as our interference system, and to come back to a plain registration system, which was abandoned in this country seventy-six years ago, but is now known as the French system. However, the report of the commission says emphatically:

"To return to such a system would be a backward step. While there are some persons interested in the subject who believe that the United States should return to the system of registering patents and allow all questions of validity and priority of invention to be determined in the courts, these persons are decidedly in the minority."

In France a patent may exist for years before an examination is made as to priority and patentability, because such scrutiny only takes place in case of a patent suit, and even then the examination is not made by technical experts but by the ordinary courts, who may or may not decide to hear experts. This absurd system accounts for the scant esteem with which patents are treated in the Latin countries where the French system is in use. The French system has certainly not shown the stimulating effect on invention and enterprise which the American system has produced in such nations as Germany, England and the Scandinavian countries, which have adopted it in more or less modified form. It should be mentioned, furthermore, that in all countries where the French system is used a patent really begins to be looked upon as serious only after the corresponding German patent has been issued. This in itself is the best tribute to the practical value of the preliminary examination system.

The most striking incongruity in our American system is that, after a patent has been granted by a technical board, in infringement cases this same patent is re-examined as to validity and patentability by a non-technical judge in a non-technical court. This is the main reason why our system has been defined as the "best in the world for lawyers and worst for inventors."<sup>4</sup>

In this relation the following words from the commission's report are very significant:

"The commission has been unable to see the benefit of the present system, by which every question relating to a patent can be litigated in any part of the country.

"When the Patent Office shall have been furnished with adequate quarters and equipment and the most efficient personnel it will be time to consider to what extent the decision of this office ought to be final in patent matters. When that time comes it may be found advisable to consider whether a patent should not be made valid by law to the extent of giving the patentee a right to an injunction in a case against alleged infringers.

"This would probably require the adoption of the practice of publishing applications when ready for allowance, with the opportunity for anyone to file opposition within a limited time, and if none were filed or it was decided that the patent should issue, it ought to be held valid for all purposes until declared invalid by court. Such a system would probably require also that any person claiming to be injured by the grant of a patent could file simultaneous proceedings within a limited period. . . .

"There is a general complaint, although the commission is not advised as to the facts of the matter, that a grant of a patent is of no value to an inventor if it is in the inter-

est of any person or corporation of financial strength to infringe it. The result of a patent suit or an infringement suit are often not of real benefit to him, for if he survives the suit the actual recovery of adequate damages is exceptional.

"It would seem that the remedy for many of the difficulties of the present situation regarding patents will be found in the development of the Patent Office as an administrative court in which all questions relating to patents, excepting the question of infringement, will be finally decided, subject only to a review by an appeal to a court of patent appeals, with possibly a provision for certain questions going to the Supreme Court. Giving such jurisdiction to the Patent Office, and to an extent will tend to the development of a system of patent law that will be a benefit to the public and a protection to real inventors."

Chapters 5 and 6 of the report are devoted to the classification division and to the scientific library and the search room. They point out the existing defects and contain many excellent suggestions. The fact that in the files of the Patent Office there are still missing copies of 60,000 German patents and of three French patents is significant. But it is true that for a certain period France discontinued publishing her patents. Several other countries—for instance, Canada and Belgium—do not publish their patents excepting by title. Yet almost every one of the patents published in these countries must be available in our search room; indeed, many of these patents contain important disclosures which have a direct bearing on the validity of the patents issued by the United States Patent Office. It would not involve an exorbitant expense to have typewritten copies made of the patents filed in those countries, although a more satisfactory method would be to compel all countries which belong to the International Union to print every patent issued in brief. This subject should be taken up at the next meeting of the International Convention and could hardly cause any opposition, in as far as almost all countries belonging to the convention already print these patents.

A very detailed criticism of the totally inadequate conditions of the building and the equipment of the Patent Office was made, and specific recommendations were advanced for remedying this important condition. Nevertheless, the commission concluded the fact that the equipment of a new patent office will never be complete unless provision be made for chemical, physical and mechanical laboratories, where simple tests can be made under the supervision of two or three experts, including a chemist, a physicist and an engineer, in that many simple questions which now baffle the examination in their decisions are satisfactorily could easily and quickly be decided by direct test. Such a laboratory now exists in the German Patent Office building.

The report is accompanied by several appendices, all of which make interesting reading. These are as follows:

- A. History of the Patent Office system in Germany.
- B. United States laws and rules of practice relating to patents, trade-marks, and prints and designs.
- C. The German patent law.
- D. The English patent law.
- E. Discussion of the German patent law and patent procedure.
- F. A comparison of the patent law and procedure in Germany, England and the United States.
- G. Methods of examining applications.
- H. Classification of the Patent Office.
- I. Statement of the business in the Patent Office.
- J. Infringement in the United States Patent Office.
- K. Classification of patents and printed publications.

Especially interesting are Appendices E and F, written expressly by Prof. Dr. Albert Reusswirth and Mr. A. de Buss-Reynold, both of famous and leading authorities on their subjects. The former paper not only compares the

<sup>4</sup>H. Ward Leonard, *Electrician*, 1907, Vol. 54, page 1985.



advantages of the laws of Germany, England and the United States but points out the relative defects which experience has proved to exist, and furthermore discusses the differences in procedure in these countries. This discussion of the advantages and defects of the leading patent systems of the world is a most valuable contribution and will be very useful in the consideration of changes that are suggested in the patent law and procedure of the United States.

It is particularly interesting to read the comments on the practical value of the co-called compulsory working clause or compulsory license clause in Germany and England, in view of the fact that an attempt is being made by means of the Oldfield bill and other proposed measures to introduce this innovation in the United States. In Germany the compulsory working of patents has practically been abandoned and is merely kept up as a club to force some countries like England, France and others into reciprocity treaties waiving the compulsory working of patents. To the credit of the present Commissioner of Patents it should be mentioned that he has already negotiated a treaty to that effect with Germany.

The United States, in accord with Germany, might have a decisive influence in abolishing this compulsory working clause in foreign countries, so irksome to American patentees, by passing a law whereby foreigners are compelled to work their patents in the United States unless their country waives compulsory working of patents issued to American inventors. The first Oldfield bill had a clause of the kind, but it was so erroneously worded that in some paradoxical way it gave superior advantages to foreigners over American inventors.

As to the compulsory working and compulsory license in Germany, it might be best to quote Professor Osterrieth:

"In fact, very few patents have been revoked in Germany for non-working (one patent out of more than 2000). On the other hand, the working clause always threatens the patentee, hanging over his head like the sword of Damocles, as a great expert in patent matters once said. Besides, experience has shown that petitions for revocation are mostly entered by patent infringers, using the working clause as a defence.

"This explains why in the last fifteen years there has been a very strong movement in Germany for abolishing the working clause. This first induced the German government to abolish the obligation of working by international treaties in the relations with Italy, Switzerland and the United States. And finally the old working clause of the first patent law was abolished by the law of June 6, 1911.

"Since this law came into force—that is, July, 1911—no obligation to work a patent exists in Germany. No patent can be revoked on the ground that it is not being worked. Yet, considering the legislation of some countries which threaten foreign patentees with revocation of these patents if the invention is exclusively or mainly manufactured abroad, the German government resolved to provide for a similar clause applicable at least against countries where German manufacturers have to suffer from such legislation.

"It has, therefore, been stated in the above-mentioned law of 1911 that a patent can be revoked, as far as international treaties do not provide to the contrary, if the invention is exclusively or mainly manufactured or carried out outside the German Empire and its possessions. This clause does evidently not apply to citizens of the United States, even if an American has acquired a German patent from a patentee belonging to another country. Yet this might lead to abuses. Therefore, there has been provided a complementary clause saying that transferring a patent to another person is ineffective if this transfer has been made only with the intention of avoiding revocation.

"According to the former German law a patent could be revoked, after expiration of three years from the date of

granting, if it appeared in the public interest that permission to use the invention be granted to others but the patentee refused to give such permission in return for adequate remuneration with adequate security. This clause has proved most ineffective as no single case of revocation of a patent on this ground has been known. Therefore, when the abolition of the working clause was discussed, it was suggested to do away also with that clause on the obligation of granting licenses. It was objected that cases might happen where the use of a patented invention by others than the patentee would be necessary for the public welfare, for instance manufacturing certain drugs in case of an epidemic.

"This consideration seemed to justify the insertion of the following clause in the new law of 1911:

"If the patentee refuses to grant license to another for using the invention upon the offer of an adequate compensation and security, such grant for using the invention can be allowed (compulsory license), if such granting seems necessary in the public interest. The grant may be limited or subject to special conditions."

This detailed report of the Commission on Economy and Efficiency is supplemented by some specific recommendations which follow:

1. That a new building specially designed, equipped and furnished be constructed on a suitable site in the city of Washington for the exclusive use of the United States Patent Office.

2. That the number of officers and employees of the United States Patent Office be increased and the increases and readjustments of salaries be made as shown in detail in this report, involving an increase of thirty-six in the number of employees and a total increase of \$236,550 in the payroll.

3. That the Commissioner of Patents be the head of the Patent Office; that his duties be the same as are now prescribed by law, excepting that he be relieved from the consideration of cases on appeal; that he be aided by an assistant commissioner and seven supervising examiners in the administrative work, including control of the methods and procedure of the forty-three examining divisions in the allowance and rejection of applications for patents.

4. That one appeal within the United States Patent Office be eliminated; that the number of members of the board of examiners-in-chief of the Patent Office be increased from three to five; that all appeals within the office be taken to that board; that its decision be the decision of the Patent Office; that the appeal therefrom be to the Court of Appeals of the District of Columbia, as now allowed from the decisions of the Commissioner of Patents.

5. That the fee for filing an application be increased from \$15 to \$20; that appeal fees be adjusted to the conditions arising from the elimination of one appeal; that a fee of 25 cents be charged for each additional patent, etc., included in one instrument presented for record; that all fees be paid directly to the Patent Office; that refundment of fees paid by mistake be made by the financial clerk and not by warrant from the Treasury.

6. That the life of a patent be so limited as to expire nineteen years from the date of filing the application therefor, excluding the time (not exceeding two years) during which an application may be involved in interference.

7. That the work of reclassifying patents and digesting of printed publications and providing facilities for simplifying and making more accurate the search be recognized by an appropriation for an adequate force to be employed upon such work.

8. That the subscription price of the *Official Gazette* be increased from \$5 to \$10 and the method of distribution to libraries be changed to reduce the number of copies so distributed.

9. That all the work of producing the publications of

the Patent Office, including copies of patents in files at the Government Printing office.

10. That an appropriation be made for the repair of the rooms occupied by the Patent Office and for the installation of suitable lighting and ventilating facilities and for the purpose of new furniture and appliances.

## Charles Bourseul and the Electric Telephone

By BROOKER FOWLER.

It is now a few months since passed died a Frenchman whose name must find a place in the history of the electric telephone. Little is known about the life of Charles Bourseul by name, save that he was a telegrapher by choice; that he made in the first a beautiful suggestion on the possibility of the transmission of speech by electrical means; and that he died on Nov. 23, 1912, in the eighty-third year of his age. His claim not only to recognition but also to perpetual remembrance is based on the one fact that he appeared, at a very early hour, as a prophet in the world of theoretical telephony. His appearance, it must be added, was meteoric, for, after sharing his contemporaries with the brilliant idea which he had of the possibility of conversing with a friend at a distance by means of a battery, a pair of vibrating disks and connecting wires, he disappeared from the scene, never to be heard from again.

This was in 1854, seventeen years after Dr. Page, of Salem, Mass., had startled scientific Americans with what was called at the time "galvanic music," ten years after the opening of the earliest telegraph line in America, and just four years after the submergence of the first gutta-percha cable wire between Dover and Calais. From all this we see that the transmission of intelligence by means of electricity was in the air; it was the all-absorbing problem of the time. It attracted widespread attention, and it evidently had a peculiar fascination for the genius of Bourseul, who sought to solve it in an entirely new manner, not by the fitful movements of responsive needles, but by the actual transmission of the human voice.

One is tempted here to ask whether the telephonic suggestion which Bourseul made public in the summer of 1854 was merely a happy guess, like that of the astronomers of the flying island of Laputa, who informed Gulliver of the existence of two satellites of the planet Mars a century before Professor Hall saw them in the Washington telescope, or whether it was the result of reflective thought on the laws of the vibration of metallic plates taken in connection with the possibilities of the electric current. We have the word of Du Moncel for it that Bourseul was a good physicist and one who knew much about the differentiating properties of musical notes and articulate sounds. It is, therefore, well in the nature of things that we may, even then in his twenty-fifth year, find well in mind the whole *modus operandi* of the transmission and not merely a happy idea of it. The only paper which he published appeared in the pages of *L'Illustration*, of Paris, for Aug. 18, 1854. The details which he gives are meager indeed; disappointingly so considering the theoretical knowledge and the subsequent practical development of the subject. Briefly stated, the system consisted of an electric current which was made and broken by the vibration of a light needle the frequency in accordance with the impact of sound waves due to the voice of the speakers. As the disk advanced and retreated it sent into the line successive trains of intermittent currents which were supposed to reproduce in the receiving end vibrations and resulting sounds similar to those sent out at the transmitting end.

Some of his conclusions about the matter are:

"We know that sounds are made by vibrations which are rendered sensible to the ear by the small vibrations which

are caused by the bodies which are set in motion by such vibrations. These vibrations, both continuous and interrupted, with the aid of speaking tubes and diaphragms, are reproduced by the ear. That is the principle of the telegraph; that a body moving more or less rapidly, and continuously or in interrupted trains, causes the diaphragm of the ear to be set in motion by the vibrations of the sound, and that the diaphragm vibrating makes and breaks successive trains of electric currents which are sent out by the wire and which will stimulate the ear at the distant station."

After enlarging a little on the application of his small system, Bourseul ends with a certain complacency the prophetic remark that "in a more or less distant future it is quite certain that such a line of transmission by means of a few well-chosen instruments of fine vibration. They are delicate and cannot bear long use and pressure, but the approximations obtained promise a favorable result."

Farther than these speculations Bourseul did not go. Supinely indifferent to developments, he left to others the patient experimentation, the trials and failures by which ultimate success was attained. The work was taken up in 1859 by Philipp Reis, of Frankfurt, who was not unmindful of the mere names by which Bourseul and himself were placed in 1854 in an entirely different way to those of the other. During all the time and long afterward Bourseul refrained from saying for whom he had made and given. Even when all Paris in the scientific world applauded over the performance of the French telephonic he remained silent, apparently content with his identity. It is only fair to add, however, that like many men of his kind he was poor in the quality of earth as he was poor in perchance, in his straitened circumstances an explanation of his retirement from the public eye and his utter inactivity when the solution of the telephone problem was uppermost in the minds of many.

Du Moncel, a disclaimer of rank in no wise, devoted a page of his *Exposé des Applications de l'Électricité* to Bourseul's theoretical telephony. He quoted accurately from *L'Illustration*, without, however, giving the author's name otherwise than thus: B———. In his appreciation of the idea of his modest fellow-citizen he qualifies it as a *conception fantastique*, and yet the renowned French physicist lived long enough after perusing these words to witness the marvelous realization of what he then considered to be a Utopian idea.

For many years before his death Bourseul received a pension from the French Post Department, but a year too late for the electric telephone with its incalculable electric currents he would never see realized, although long before the author of *Les Monnaies* mentioned *monnaies* and thought of his telephonic as a *monnaie* in a banking system for help from the public mints.

## Electrical Exhibits at the Panama-Pacific International Exposition

The electrical exhibition at the Panama-Pacific International Exposition at the Panama-Pacific International Exposition is the most complete and up-to-date ever seen in this country. It is the result of the efforts of the Electrical Department of the Exposition, which has been working since the beginning of the year to secure the most complete and up-to-date electrical exhibition ever seen in this country. The exhibition is the result of the efforts of the Electrical Department of the Exposition, which has been working since the beginning of the year to secure the most complete and up-to-date electrical exhibition ever seen in this country.

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*Synchronous Apparatus.*—Synchronous generators, all types; synchronous motors, synchronous condensers, synchronous frequency changers, synchronous rotary-phase converters.

*Stationary Induction Apparatus.*—Transformers and auto-transformers, all types; potential regulators and reactors, all types; induction starters.

*Rotary Induction Apparatus.*—Induction generators, all types; induction motors; induction condensers; induction frequency changers; induction rotary-phase converters.

*Unipolar (Acyclic) Apparatus.*—Unipolar (acyclic) apparatus.

*Rectifying Apparatus.*—Rotating commutators; electric valves (including mercury rectifiers); vibrating commutators.

*Luminous Apparatus.*—Arc lamps, all types; incandescent lamps, all types; vapor lamps, all types; vacuum lamps, all types.

*Measuring, Indicating and Recording Apparatus.*—Instruments for switchboard use; instruments for mounting apart from switchboard; portable instruments; laboratory instruments.

*Apparatus for Protection of Electric Apparatus and for Control and Distribution of Electric Energy, Other than Railway Material.*—Complete switchboards; lightning arresters and accessories; devices for opening and closing circuits and controlling flow of current therein; devices and material used in distribution of energy and control of distribution circuits other than in stations and on main circuits, including fuses and fuse holders, conduits, cables, wires, insulators, junction boxes, cabinets, cut-outs, sockets, fixtures, electric sign mechanism, and other subsidiary apparatus not otherwise classified.

*Electrochemical Apparatus.*—Storage batteries; primary batteries.

### The Electric Vehicle at Boston

A regular meeting of the Electric Motor Car Club of Boston was held at the Hotel Thorndike on May 1, and plans were outlined for a convention to be held at Boston on May 20 and 21, with headquarters at the Engineers' Club, for the purpose of illustrating the progress lately made in New England in the electric-vehicle field and bringing the central-station manager, the vehicle and accessory manufacturers and their local representatives into closer touch, stimulating a broader co-operation between all interested parties in the carrying forward of the electric motor-car campaign. Mr. E. S. Mansfield, of the Boston Edison company, chairman of the convention committee, announced that the program as prepared includes the following papers: "The Growing Popularity of the Electric Vehicle," by Mr. H. H. Rice; "Opportunities in the New England Field for Electric Vehicle Development," by Mr. F. M. Kimball; "How the Central Station Can Increase Its Electric Vehicle Load," author not designated; "Constructive Criticisms," by Mr. E. R. Davenport; "The Proper Selling of Electric Cars," author not designated; "What Service Should the Central Station Furnish Owners of Electric Cars?" by Mr. L. R. Wallis; "Advertising the Electric Vehicle from the Manufacturer's Standpoint," by Mr. F. N. Carle, and "The Electric Vehicle as an Advertising Proposition from the Central-Station Standpoint," by Mr. E. W. J. Proffitt.

In connection with the convention it is expected that an outing will be planned for one afternoon, with an alternative visit to one or more large industrial plants related to the production of electric automobile and truck equipment. Efforts are also to be made to encourage electric-vehicle owners to pass their equipments through a designated square between stated hours, in order to afford a visible demonstration of machines actually in service in Boston to visitors from distant points. The convention is not in-

tended to compete with the annual gathering of the Electric Vehicle Association of America in October, but is designed to show representative manufacturers and others from outside New England the actual progress of the past two years and to increase their interest in supporting further efforts to electrify highway transportation in that territory.

It was announced at the meeting that plans are maturing for the publication twice a month of a club bulletin giving news of forthcoming meetings, additions to the membership, location of charging stations and other information, including references to important articles in the technical press of interest to electric-vehicle men. The recent establishment of charging facilities at York Harbor, Me., by the York Lighting & Heating Company; at Kennebunk, Me., by the Leatheroid Company, and at Biddeford, Me., by the Pepperill Manufacturing Company, was announced. Secretary Draper announced that he was in possession of a list of all the electric-vehicle users in Massachusetts, and that an early classification is in prospect according to municipalities. A protracted discussion took place bearing upon the importance of having the location of all possible charging stations, both public and private, available in emergencies to electric-vehicle users. It was proposed that users of machines be provided with a list of electric-vehicle owners in every city and town in New England, and that for the Boston Edison territory of 600 sq. miles a list of all public and private charging stations be filed at the company's main switchboard, so that in case of becoming stalled any vehicle operator can telephone for information as to the nearest point at which a temporary boosting charge may be had.

Mr. F. D. Stidham outlined the plans of the club for the publication of a pamphlet entitled "Pastime Journeys for the Electric Automobile," which is to appeal to the car owner and prospective owner along different lines from the ordinary automobile catalog. The new publication will describe in narrative form various trips from Boston as a center to historic places and spots of natural beauty in eastern New England, giving full details as to mileages, charging points, road characteristics, turns, routes, boosting points and all necessary information to facilitate covering the best parts of the country within a radius of 300 miles from Boston by every prominent make of electric vehicle now built. The copy will also include various articles explaining the noteworthy features of the electric machine, the purposes of the Electric Motor Car Club and general information.

Colonel E. W. M. Bailey and President Baker emphasized the changed attitude toward the electric vehicle now manifested by the public, which is beginning to realize the possibilities of this type of automobile. Colonel Bailey said that two years ago references to electric-vehicle performance were often greeted with derision, but that to-day, thanks to the publicity work in the industry, a good operating record challenges admiring comments even from laymen. Mr. Baker cited the extension of charging facilities into new regions, and as an illustration said that in traveling through the remote rural parts of Connecticut a few days ago he came across a modern rectifier installation in a farmhouse miles away from town, the apparatus having been put in by the farm owner to charge the electric vehicle of a Chicago doctor boarding on the premises each summer.

During the meeting it was announced that seventy-seven new electric trucks have been registered in Massachusetts since Jan. 1. Forty-nine per cent more electric passenger cars have been registered to date this year than were on the books of the Highway Commission at the same time a year ago, and there has been a gain of 103 per cent in the number of trucks registered this year compared with the number taking out annual licenses a year ago. The importance of using tires designed for electric cars was also discussed, several speakers bringing out the point that from



50 to 100 per cent greater mileage can be obtained by proper tire equipment. The tire manufacturers should be made to see the injurious effect of selling gasoline-car tires for electric service and the need of close co-operation in this direction was strongly urged.

### Banquet of New England N. E. L. A. Section

Three hundred and fifteen members and guests of the New England and Boston Edison company sections of the National Electric Light Association assembled at the American House, Boston, on the evening of May 2 for a "get-together banquet of live wires," in place of the former spring convention of the New England Section. During the dinner lantern slides and moving-picture displays carrying hits of an electrical nature, popular songs, photographs of prominent members and pithy messages to the electrical fraternity of New England were in continuous operation, and the resources of a small orchestra were heavily taxed to make the music heard amid the enthusiasm which prevailed.

Following the dinner, addresses were made by Mr. Howard T. Sands, general manager of the public service properties controlled and operated by C. H. Tenney & Company, Boston, on "The Evidence of Things Unseen," and by Mr. La Rue Vredenburg, assistant to the general superintendent of the Boston Edison company, on "Edison—The Master and the Man." Mr. Sands set forth the modern spirit of co-operative public-utility administration along the lines of square dealing, publicity and constructive policy; emphasized the responsibilities of the modern central station to its customers and the community at large and advocated a one-price service under similar conditions, with equitable rates, close attention to complaints, high personal loyalty on the part of employees and the education of the public to see that public-service corporations must be successful to render the best service. Mr. Vredenburg presented a personal sketch of Mr. Edison which aroused the utmost interest and enthusiasm and paid a high tribute to the ability of the inventor. President A. F. Townsend of the New England Section announced that the annual fall convention of the section would be held at the Hotel Vermont, Burlington, Vt., on Sept. 17, 18 and 19.

### Safety Measures Adopted by Public Service Commission

The Public Service Commission for the First District of New York adopted an order on April 25 requiring all public-service corporations within its jurisdiction using team and electrical apparatus to employ certain safety appliances and take certain precautionary measures to protect their employees against injury by contact with live wires, etc. There were thirty-nine companies represented at the hearings on the measure, and while the importance of safeguarding employees was recognized by all, there was no unanimity in the practices of the various companies. Accordingly the appliances and measures recommended by the electrical engineer of the commission were prescribed. These are as follows:

1. All high-tension-switch compartments shall so far as their construction will permit be so inclosed as to make it impossible, except when necessarily opening the compartments, for employees to come in contact with electrically charged parts either from or above the floor level.
2. All exposed high-tension cables in generating stations or substations shall be inclosed by screens or otherwise protected.
3. There shall be posted in conspicuous places in all the generating stations and substations diagrams describing and showing the relative location of wires and cables (except

light and signal wires) and the switches, etc., controlling them, and all such wires, cables and connections shall be so tagged and numbered that they may be readily identified.

4. All machinery for the generation of electricity or connected with such generation shall be so protected by railings and gates as to prevent persons and objects from coming in contact with moving or electrically charged parts.

5. There shall be no bare live operation on any rotary converter stations delivering energy at 500 volts or higher when the same are in operation.

6. All water-level glasses or gage glasses on tanks, stand pipes or other service structures under pressure shall be protected by screens to prevent injury in case of a bursting glass.

7. Test cords on water columns shall be fitted with extension rods or chains so as to be operated from the boiler-room floor level.

8. All stop valves on steam lines shall be of the automatic self-closing type.

9. Outlets of all safety valves shall be covered.

10. All fire doors of boiler-rooms shall be fitted with latches or catches to prevent them from being blown open.

11. All moving parts of stokers shall be so protected, wherever possible, as to prevent accidental contact with such moving parts.

12. All large main cut-out stop valves shall be provided with means whereby the same may be closed from the boiler-room or engine-room floor or other remote point.

13. All large steam lines shall be fitted with automatic self-closing valves.

14. All high-speed engines shall be fitted with automatic safety stops.

15. Elevator wells shall be properly and substantially inclosed, secured or guarded and shall be provided with proper traps and automatic doors in or at all elevator bases, so as to furnish substantial enclosing when closed and to open and close by action of the elevator when descending or ascending.

16. All openings in floors shall be closed off or protected by railings when left unguarded, and in addition a red light shall be displayed in the immediate vicinity when the location is unlighted or poorly lighted.

17. All stairways shall be provided with safety railings, kept free from oil and water, and be properly protected with hand rails.

18. Shafting running over in passing through floors shall be housed or enclosed in enclosures properly guarded.

19. All belting shall be inclosed in substantial protection wherever accidental contact is possible.

20. Hoisting cable drums completely enclosing the drums shall be fitted to all cranes, hoists and be kept in place when such tools are being used.

21. Set screws and keys in secured portions of moving machinery and starting shall be continuously in place and properly protected.

22. Holes, cracks and loose work shall be protected so as to prevent accidental contact with live wires.

23. Circuits and wiring shall be inclosed in security guarded and equipped with hand and control rope or flow of force, protected against.

24. Control wires shall be protected by enclosures and used in their proper manner and not used for any other purpose.

25. A sufficient number of lines of electricity used shall be kept in all generating stations, substations, switchboards and switching stations.

26. Control wires, circuits, wires, lines, and switching stations shall be protected with a substantial enclosure.

ber of chemical fire extinguishers of such a type that their contents cannot act as an electrical conductor. No other extinguishers shall be kept for use unless conspicuously labeled that they are not to be used until circuit has been killed.

27. All generating stations, substations, auxiliary and switching stations and shops shall be provided with a first-aid or emergency kit.

28. Provisions shall be made whereby pulmotors will be available in case of accidents.

### Wooden Molding Prohibited in New York City

Commissioner Henry S. Thompson of the Department of Water Supply, Gas and Electricity has issued to the electrical interests a warning to the effect that in accordance with the Electrical Code of the city of New York, edition 1912, the use of wooden molding for wiring will be prohibited on and after June 1, 1913. This prohibition does not apply to equipments for which applications are on file with the department on or before May 31, 1913.

### Sale of Municipal Energy Restricted

The Massachusetts Gas and Electric Light Commission has informed the municipal electric light board of the town of Westfield that the town cannot be permitted to furnish electric energy to the residents of the town of Southwick without the passage of a special legislative act of authorization. Manager Logie has notified the Southwick authorities that if they will build a line to the boundary the town of Westfield will build a connecting line for the delivery of electricity for distribution by the town of Southwick, but there is little probability that this will be done, as the residents of Southwick are anxious to secure service without delay. A proposition by the Amherst Power Company, which operates a large high-tension hydroelectric and steam system in the middle Connecticut Valley, will probably be accepted by the citizens of Southwick.

### Public Service Commission News

#### NEW YORK COMMISSIONS

The Public Service Commission for the First District has effected an arrangement with the Newtown Gas Company of Queens for a reduction in the price of gas charged by that company from \$1 to 95 cents per 1000 cu. ft. This reduction is to hold until May 1, 1914. As a result of the arrangement the commission has dismissed the complaints of more than 100 gas consumers who sought a reduction in the rates. The complainants accepted the proposition to try the 95-cent rate for one year, and the proceeding was dismissed without prejudice to the rights of either party after May 1, 1914.

The Belt Line Railway Corporation has received permission from the Public Service Commission for the First District to change its motive power on certain lines covered by its franchise from horse-power to electric storage batteries. This company owns the Fifty-ninth Street cross-town line and the East and West belt lines in Manhattan. The Fifty-ninth Street line is already electrified and operated by underground trolley. The company now proposes to use storage-battery cars on the East and West belt lines.

The Public Service Commission for the Second District has ordered a reduction in the price of electricity charged by the Suffolk Light, Heat & Power Company in the village of Southampton from its present rate of 25 cents per kw-hr. to summer residents taking service confined to the summer months, so that the rate shall not exceed 22 cents

per kw-hr., with a discount of 10 per cent from the amount of all bills paid within ten days. After the expiration of two years the rate is to be 20 cents with a discount of 10 per cent.

#### NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has sent to the borough of Glen Rock a copy of the report of the chief inspector of its utilities division, on a complaint of the borough, to the effect that the Public Service Electric Company is preparing to run a high-tension line through the borough to supply electricity to North Paterson and Hawthorne and to furnish energy to a fertilizer plant in the former borough. The borough objected to the line being installed, fearing that it would be a menace to public safety. The report of the inspector shows that the company has set a number of poles in the borough and has put a galvanized-steel cross-arm on the top of each with three insulators, ready to receive the wires, and that the work has been done in a substantial manner, in accordance with specifications of the National Electric Light Association for work of that kind. There was no objection on the part of abutting property owners to the installation of the line, and while it is reported that the line would not immediately benefit the borough of Glen Rock, if the demands of the borough increase, better service can be given from the new substation than from the Paterson plant. The inspector expressed the opinion that there is no reason why the line should not be constructed.

#### WISCONSIN COMMISSION

Upon complaint of poor and inadequate service, the board of water and light commissioners of Bayfield has been ordered by the commission to rehabilitate the municipal water and light plant and to replace the obsolete apparatus contained therein with modern equipment.

The commission has decided to hear testimony upon the valuation of the Brodhead Electric Light & Power Company's property before determining upon the price to be paid for the property by the city of Brodhead. The city has exercised the right afforded by the public utility law to purchase an existing utility at a valuation set by the Railroad Commission.

The Muscodo Mutual Telephone Company has been ordered to abolish its present practice of discriminating between stockholders and non-stockholders in the matter of rates and to establish a uniform schedule of rates as prescribed by the commission. The free service hitherto given is to be discontinued. A rental fee is to be paid subscribers owning their equipment and a uniform switching fee of \$3 per instrument affected is to be levied against all lines receiving switching service at the Muscodo exchange.

#### CALIFORNIA COMMISSION

The Railroad Commission of California has rendered its decision in the case of the city of Palo Alto against the Palo Alto Gas Company, the contention of the former that the rate of \$1.50 per 1000 cu. ft. of manufactured gas is unreasonable being upheld. The gas distributed is purchased by the respondent from the Pacific Gas & Electric Company at a price equal to 50 per cent of the gross income from its sale, under a contract made in 1905 for a term of ten years. The point of manufacture is approximately 23 miles from Palo Alto, other communities along the line being served from the same transmission system. Upon the hearing held and investigations made it was found that the fair value to be assigned to respondent's property used and useful in the public service is not in excess of \$69,250, due consideration being given to the element of going concern value; that a rate of return of 8 per cent is at least a fair and equitable rate; that the total cost of manufacture, transmission and distribution, including the above rate of return on the investment, does not exceed, at a liberal figure, \$1.19284 per 1000 cu. ft. Accordingly







Mayor or City Council. Many persons object to projecting signs on esthetic grounds and as possible obstructions to firemen in case of fire. On application, the Mayor has ordered the taking down of projecting signs on several occasions in certain downtown streets. This has been done recently in a portion of State Street. It may be that eventually no projecting signs will be allowed in the central business district. Electrical men view the situation with equanimity, however, because experience has shown that with the disappearance of projecting signs the number of flat signs increases.

\* \* \*

**PERMANENT QUARTERS FOR MONTREAL JOVIAN CLUB.**—The Montreal Jovian Club, a Canadian branch of the Jovian Order, has secured as permanent quarters the entire fourth floor in the Cooper's Restaurant building, which is situated in the heart of the downtown business district. The main room is 25 ft. by 50 ft., and there are several rooms in the rear of the main one. The rooms have been tastefully decorated and are being furnished by the Jovian Club. In order to make the club popular rather than exclusive, the initiation fee was placed at \$5 and the annual dues at \$6. It was estimated that with the incoming class there would be approximately 200 Jovians in Montreal, and if they all joined the club the initiation fees would amount to \$1,000 and the dues would be sufficient to pay the running expenses of the club. The club has prospered, seventy-five candidates having been initiated at a recent rejuvenation, and a larger number is expected at a forthcoming meeting. Jovian matters are progressing in Montreal, the order including among its membership some of the foremost men in the electrical field. Mr. W. J. Doherty is statesman-at-large of the Montreal Jovian Order.

\* \* \*

**ELABORATE BURLESQUE CIRCUS.**—The elaborate nature of the preparations made for the burlesque circus of the Commonwealth Edison Company Section of the National Electric Light Association in the Medinah Temple, Chicago, on May 10, may be judged from the fact that regular lithographed single-sheet circus posters, each 28 in. wide and 42 in. long, were employed to advertise it. The performance is given entirely by the employees of the company, and all the expenses of the one-night entertainment, which are considerable, are defrayed by the company. These expenses include the rent of the hall, which is the same one to be occupied by the convention of the National Electric Light Association, the advertising material and a large number of elaborate "properties" (many made in the shops of the company) and costumes. About 200 persons take part in the affair. No admission fee is charged, the show being given for the employees of the company. A feature is a number of side-shows in the basement of the building. A big entertainment of some sort has been given every year for the last few years by the Commonwealth Edison Section of the N. E. L. A., and it involves months of preparation and a great deal of hard work on the part of many persons. Mr. M. L. Eastman is the circus director. The circus posters and bills were prepared under the direction of Mr. D. H. Howard, advertising manager of the company.

\* \* \*

#### SOCIETY MEETINGS

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS.**—At the spring meeting of the American Society of Mechanical Engineers, to be held in Baltimore, Md., on May 20, 21, 22 and 23, there will be three sessions devoted to the presentation and discussion of papers, namely, a professional session, a gas-power session and a fire-protection session. During the professional session the following papers will be read: "Test of a Hydraulic Buffer," by Mr. Carl Schwartz; "The Present Condition of the Patent Law," by

Mr. Edwin J. Prindle; "Cost of Upkeep of Horse-Drawn Against Electric Vehicles," by Mr. W. R. Metz.

\* \* \*

**ELECTRIC CLUB IS GUEST OF CHICAGO TELEPHONE COMPANY.**—About 200 members of the Electric Club of Chicago were the guests of the Chicago Telephone Company at a luncheon served in the company's new building on May 1. Mr. H. M. Webber, who is claim agent for the telephone company and who is also one of the managers of the Electric Club, presided at the meeting. Mr. B. E. Sunny, president of the Chicago Telephone Company, spoke of the intimate connection which exists between the public and the telephone company. Concerning the growth of the Bell telephone business in Chicago, Mr. Sunny said that in five years there has been an increase of 94 per cent in subscribers and 62 per cent in traffic. Mr. George C. Keech, president of the club, spoke briefly, and Mr. H. E. Niesz called for three cheers for the company, which were given with a will. Following the luncheon, the visitors were taken through the building, employees of the company acting as guides. The method of handling local and long-distance calls was explained, and the interesting and intricate processes of a modern telephone exchange were described.

\* \* \*

**LOS ANGELES SECTION, A. I. E. E.**—On April 22 the Los Angeles Section of the A. I. E. E. held a meeting at which Mr. Lee Hagood, of the Oro Electric Corporation, San Francisco, Cal., presented a paper on "Transmission Lines and Synchronous Condensers." Mr. Hagood gave a synopsis of the conditions of the electric operation of the Utica (N. Y.) Gas & Electric Company before and after the introduction of synchronous condensers. This system operates at 22,000 volts and contains several generating stations and several centers of distribution. The speaker then outlined the design of a 100,000-volt transmission line 154 miles in length carrying a maximum of 40,000 kva. Mr. Hagood suggested several short cuts which will save some labor in the tedious process of analyzing the condition of operation of a transmission line. The paper was discussed by Messrs. George A. Damon, R. W. Sorenson, Ralph Bennett, H. A. Barre and Budd Frandenfeld. Professor Sorenson will be the speaker at the next meeting. Plans have been completed for two excursions, one to the Long Beach plant of the Southern California Edison Company and the other to the Big Creek substation of the Pacific Light & Power Corporation.

\* \* \*

**ACTIVITIES OF THE PHILADELPHIA ELECTRIC COMPANY'S SECTION, N. E. L. A.**—At a recent meeting of the Philadelphia Electric Company's Section of the N. E. L. A., held in the Franklin Institute, an address on the subject of "Aptitude Plus Application" was delivered by Mr. Leslie M. Shaw, formerly Secretary of the United States Treasury and Governor of Iowa. At the most successful meeting which the meter department branch has had during the year Mr. Louis C. Smith performed a number of experiments demonstrating some of the peculiarities of high-frequency currents. A paper on "Certain Features of Underground Line Construction," by Mr. J. W. Sylvester, and a paper on "Certain Features of Overhead Line Construction," by Mr. Thomas Sproule, were presented before the engineering department branch. The total membership of this branch is now 326. At the meeting of the accounting department branch "Coal, from Mine to Ashes," was discussed by Mr. Joseph H. Nickell, statistician for the accounting department. The April meeting of the commercial department branch was held in conjunction with the Illuminating Engineering Society and the National Commercial Gas Association. Mr. Thomas W. Rolph, of the General Electric Company, read an interesting paper entitled "Industrial Lighting."

# Subterranean Swedish Generating Plant

Hydraulic-electric generating and transmission equipments of the Vesterdalälven Power Company at Mockfjärd, part of 65,000-hp interconnected system

IN 1894 the Grängesberg Mining Company opened its first hydroelectric station at Hell Lake. This station was one of the first in Sweden built for the transmission of any appreciable amount of energy. This first installation had an output of 400 hp and at that time it was doubted if at any time such a "large" quantity of power could be used by the company. However, two years later additional equipment was installed for the generation of 300 hp, and the following year a new 300-hp station was built at Enkullen. In 1898-99 some of the power in the Lennbo River was utilized and after extensions made in 1904 and 1906 the station on this river had a total rating of 4000 hp. Nevertheless, more power was needed at the Grängesberg mines, and after several hydroelectric projects had been investigated and rejected the question was solved through

the co-operation of the Grängesberg-Oxelösund Railway Company and the Stora Kopparbergs Bergslags Company which resulted in the purchase of the Stop Rapids in West Dal River near Mockfjärd. For the utilization of these falls there was formed a new company, the Vesterdalälven (West Dal River) Power Company. The available power aggregated 20,000 hp, half of which was to be transmitted to the mines of

Grängesberg. This plant was recently placed in operation.

The reconstruction of the older stations at Hell Lake and Enkullen, now in progress, will include the building of reservoirs for storing water from other sources so as to provide an even and ample water supply for all stations at all times.

In interconnecting the Mockfjärd station with the older stations of the Grängesberg Company and those of the Stora Kopparbergs Bergslags Company the aggregate rating of the system will be 65,000 hp.

## LOCATION OF PLANT

The Mockfjärd plant utilizes the Stop Rapids, which are about 2.8 miles long. A maximum discharge of 25,000 cu. ft. per second has been observed during periods of floods, but this is reduced during three months of the year to 1000 cu. ft. and is known to have been as low as 500 cu. ft. The part of the rapids now developed has a head of 78.1 ft., but whenever it is considered advisable to increase this head a very material addition can be had by making use of the rapids which are found above the present dam.

The dam is built on bedrock with steel and concrete piers

laced with steel plates on the upper surface. The spillway crest has an elevation of 944 ft. There are only four wooden gates rising with movable steel gables, providing large openings for removal of debris, four steel headgates, and one large steel sluiceway, which is 19.7 ft. wide and 26.3 ft. deep and is divided horizontally into two parts.

Through the sluiceway provision is made for discharge during floods and for draining the pool for repairs of the dam and the sluiceway. The reason for putting the gate in halves is to avoid a large superstructure and to make available the use of the lower part of the gate for regulating the water level, this part always being free from ice, even at very low temperatures. All gates are operated either by hand or by electric motor.

There is connected with the dam a 6500-ft. long steel

tunnel for conveying water to a distance of 400 ft. of timber penstock. Penstocks are also made for a return way and for tailrace.

## GENERATING PLANT

The wheel chambers, placed into the steel lining, back-filled with concrete, and are of a circular shape 27 ft. in diameter. Four double-runner Francis turbines, each rated at 3000 hp at 200 r.p.m., are mounted in a horizontal position at the bottom of these chambers with the shaft entering 11 ft. above the lowest tailrace level.

Two wheels discharge into the same tailrace tunnel. These tunnels are about 100 ft. long and have a rectangular cross-sectional area. At a distance of 10 ft. from the turbines there are large valves in the wall, each of about 2000 sq. ft. These valves are interconnected and provided with several shafts, the object being to prevent water hammer. So far tests and experience have shown that this arrangement works satisfactorily.

The wall between the generating rooms and the wheel chamber has a minimum thickness of 18 ft. and consists mainly of the natural rock formation. The generator room is 30 ft. wide and 100 ft. long. It has an arched reinforced concrete roof and the maximum height of the room is 20 ft.

An inclined shaft serves as a communication between the subterranean generating room and the main surface house. In the bottom of this shaft there are ropes for cables and track for the hoists. The tunnel and the shaft are lined with reinforced concrete.

From the wheel chambers lead tubes 4.25 ft. in diameter and back-filled with concrete lead through the rock and



FIG. 1.—SWITCH AND TRANSFORMER HOUSE OF MOCKFJÄRD PLANT.

the generator room. Through these tubes, the diameters of which have been made as small as possible in order to preserve the rock, are taken the turbine and rocker ring shafts, spaced 2.5 ft. center to center. This single rocker ring shaft is in the wheel chamber parted in two shafts placed diametrically opposite each other along the turbine.

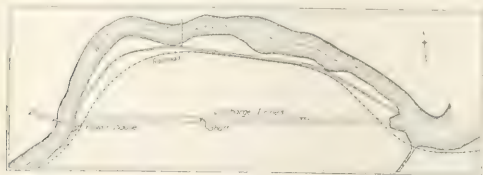


FIG. 2—LOCATION OF MOCKFJÄRD DEVELOPMENT

The governors are belt-driven from the turbine shafts and all parts are mounted on the same bedplate. They are provided with hydraulically and mechanically operated hand-controlled, gate-setting devices. Small electric motors, controlled from the switchboard, are provided for synchronizing the units.

The generating equipment consists of four 4500-kva, 6600-volt, three-phase units operating at 225 r.p.m. and 60 cycles. They are totally inclosed and provided with intake and outlet for cooling air. The warm air, liberated from the top of the generators, rises through a vertical shaft to the pump and fan house directly above, whence in the

the field coils and the slip-rings are carried in a slot along the shaft. In tests made by the Elektriska Pröfningsanstalten, Stockholm, the efficiency values shown in the accompanying table were obtained.

#### SWITCH AND TRANSFORMER HOUSE

The switch house contains all the transformers and the switch gear. The step-up transformers are divided into two groups, each of three single-phase transformers placed in separate fireproof compartments. The transformers are delta-connected on the 6600-volt side and star-connected on the 50,000-volt side. Each group can carry continually 8650 kva, which corresponds to the load of two generators. A reserve transformer of the same size is also installed. All the transformers are oil-insulated and water-cooled. The core and the cooling coils are rigidly connected to the tank cover, which makes it very simple to remove the transformer proper from the tank.

In order to protect the oil from expansion and moisture the oil tanks are provided with expansion chambers. Further protection against moisture in case the transformer should stand unloaded for any length of time has been provided by the installation of an electric-heating element operated on a low-voltage circuit. The temperature of the oil can be read on thermometers on the switchboard. The transformers are also provided with signal thermometers which sound an alarm in case the temperature of the oil or the cooling water should rise above a certain predetermined value.

According to tests, the percentage efficiency of the trans-

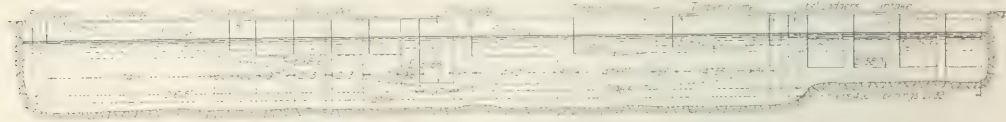


FIG. 3—DETAILS OF DAM

winter it is distributed for heating of switch house and also for heating the ice racks. For the air intake is provided a small tower on the switch house. The air enters through double screens and is conducted through the main tunnel to channels in the generating-room floor, the latter terminating in the pits under the generators.

The temperature rise of the air in passing through the generator once is only from 20 deg. to 30 deg., depending upon the amount of air passing and the load on the ma-

former groups at unity power-factor has proved to be as follows: At 8650 kva per group, 99.02; at 6500 kva per group, 98.95; at 4325 kva per group, 98.75; at 2165 kva per group, 97.85.

TABLE I—GENERATOR EFFICIENCY IN PER CENT

Load, Kw	1.0 Power Factor	0.8 Power Factor
3500'	95.9	94.5
2800'	95.3	94.2
1400'	92.1	91.3

chine. In the cold climate of Sweden, where a very low temperature is commonly experienced in the winter, this temperature rise would be insufficient for heating purposes. On this account arrangements have been made for passing the air through the generators several times, thereby bringing the temperature up to such value as to make the air useful for heating purposes. Tests seem to indicate that these arrangements will work out very satisfactorily under all outside-temperature conditions.

Stator and bearings rest on one solid bedplate. The bearings are water-cooled and are of such size and proportions that the temperature rise is only about 40 deg. without artificial cooling. The slip-rings are mounted outside the commutator of the exciter, and the connections between

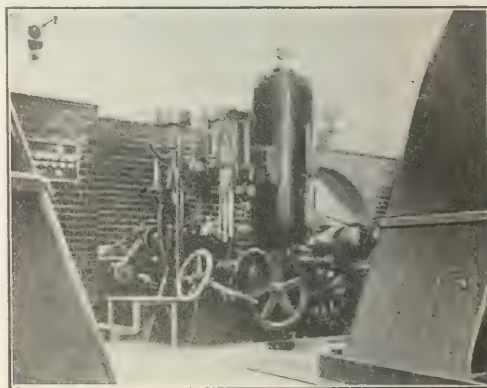


FIG. 4—TURBINE GOVERNOR

In the generating station there is only one disconnecting switch at each generator terminal and one similar switch for the neutral, the latter being grounded through a common neutral resistance calculated for two and one-half times the normal rating of one generator under thirty seconds.



The conductors from the generators consists of iron-covered lead cables placed in separate channels in the tunnel between the generating room and the switch house. The switch arrangement for the 6000-volt equipment is grouped in a so-called ring system consisting of bare copper buses placed on insulators, separated by partitions and

field coils with oil. The excitors receive their field current from a direct-current unit which is operated in parallel with a storage battery. In this manner the exciter field currents are independent of the speed and voltage variations of other

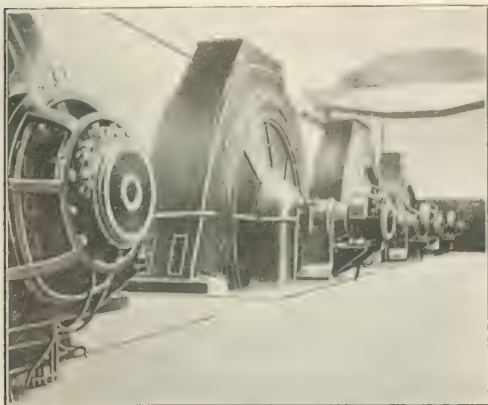


FIG. 5—INTERIOR OF SUBTERRANEAN GENERATING ROOM



FIG. 7—PART OF BUSBAR AND SWITCHGEAR IN SWITCH ROOM

protected by doors of perforated sheet iron. The collecting busbars are divided into six sections, one for each generator and one for each transformer group. Each generator circuit is provided with an automatic circuit-breaker, a disconnecting switch, a wattmeter, a watt-hour meter, one ammeter in each phase lead and one ammeter in the field

installed in a separate room in the switch house are a 75-kw motor-generator and a 125-kva station transformer for the operation of a number of three-phase auxiliary motors driving fans, pumps for water and oil, cranes, gates, etc.

The 6000-volt buses are connected through disconnecting

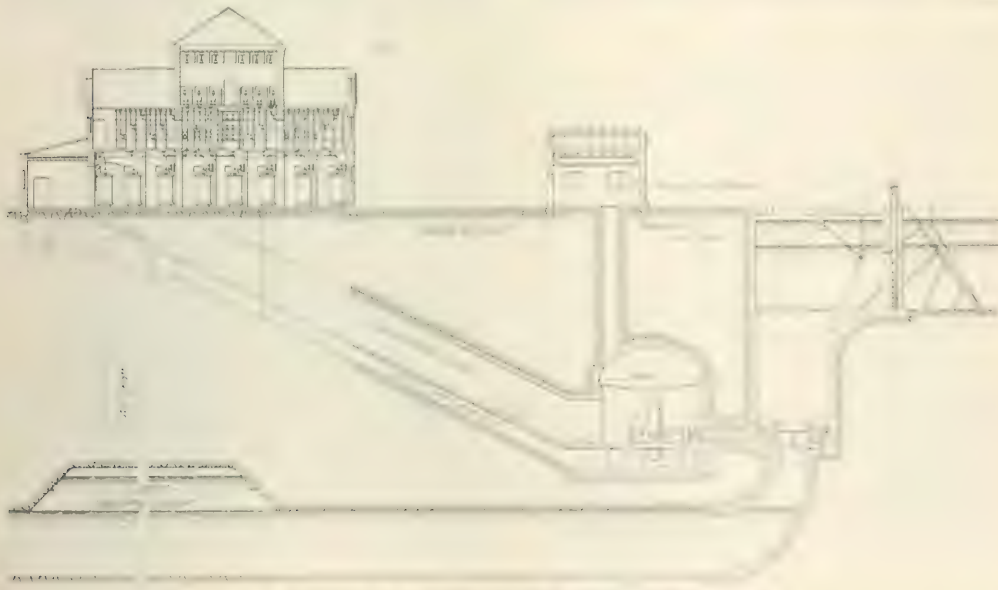


FIG. 6—LAYOUT OF POWER PLANT

circuit. To the 6000-volt buses are also connected watt-hour meters which register the total energy generated by the units. There are also installed recording voltmeters, phase meters and frequency meters. The bus system is provided with water-spray protecting apparatus.

The excitors are directly connected to the generator

switches and instruments in the switch house and the station transformer. The motor-generator and the station transformer are connected to the bus system through a number of three-phase auxiliary motors driving fans, pumps for water and oil, cranes, gates, etc. The buses are divided into two sections. These buses are protected by automatic lightning arresters, water earth

indicators and condensers. From the 6000-volt system a tap is made for the station transformer previously mentioned, and another tap is provided for future needs.

The two main lines of the 50,000-volt system are provided with automatic oil circuit-breakers, one ammeter in each phase lead, induction coils of flat and hour-glass types

In the same room there is an ordinary upright switch-board with panels for the outgoing 6000-volt lines, for the direct-current generator and storage battery circuits, and one panel for the recording voltmeters, phase meter and frequency meter on the 6000-volt system. On this panel are also mounted the thermometers for the transformers.

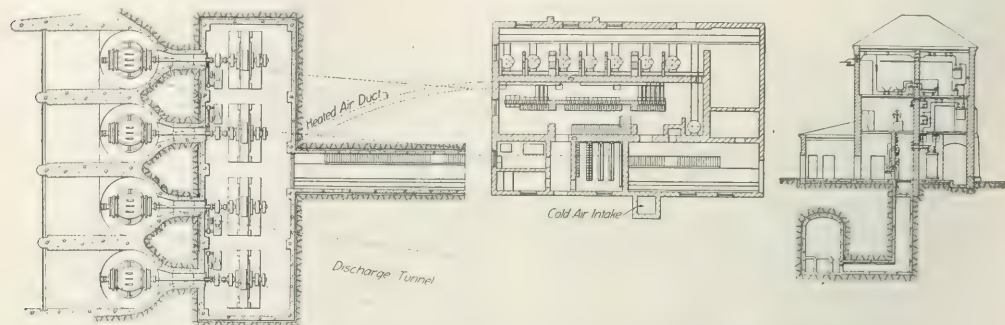


FIG. 8—PLAN OF GENERATING ROOM AND SWITCH HOUSE AND CROSS-SECTION OF SWITCH HOUSE

and double horn-gaps with oil and running-water resistors. Each line has connections for series and shunt transformers for the watt-hour meters.

The switch room is located on the second floor of the switch house, and from this room there is complete control of the whole station with the exception of the hand-operated turbine control. All the previously mentioned instruments are mounted on a benchboard which is divided into panels for the generators, transformer groups and outgoing 50,000-volt lines. It also contains the remote-control apparatus for the circuit-breakers, with red and green signal lamps.

In the desk are inlaid miniature copper buses giving a diagram of the connections with miniature disconnecting switches and circuit-breakers which are controlled by the operating switches. The exciters are also controlled from this desk.

Orders from the switch rooms to the operators in the

From this board are also controlled the lamps and all direct-current motors which must be in service when the generator equipment is not operating.

Particular attention has been paid to the circuit-breakers, which have been designed to open the heaviest short-circuits which possibly could occur. All the circuit-breakers are placed in compartments with partitions between each phase and with a top cover consisting of a molded plate. For the convenient removal of the oil tanks the smaller circuit-breakers have been provided with removable levers and the larger ones with permanent hoisting equipments. All the circuit-breakers are remotely controlled through solenoids and provided with trip relays.

The circuit-breakers for transformers and the outgoing 50,000-volt lines are provided with so-called charging resistors by means of which the gradual charging of the line and transformer is accomplished.

The disconnecting switches are of heavy construction

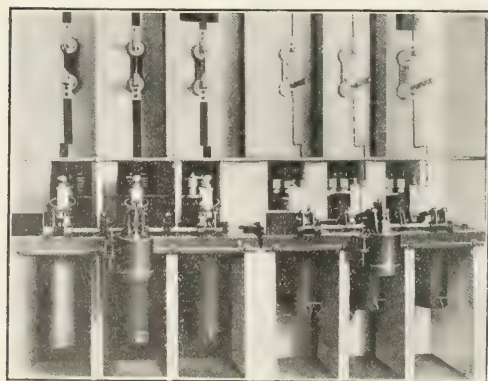


FIG. 9—6000-VOLT CIRCUIT-BREAKERS

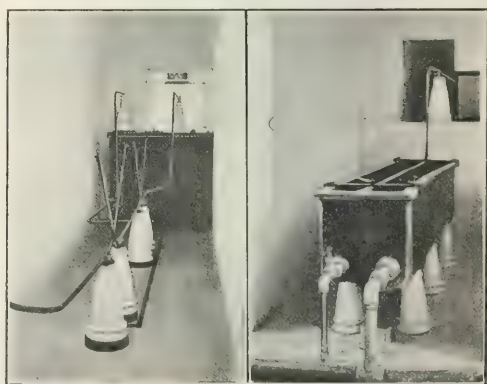


FIG. 10—SPRAY AND RUNNING-WATER PROTECTIVE DEVICES

power station are given by means of lamp signals which are repeated in the same manner by the engine-room operator. The turbine regulators are operated electrically from the desk as far as the phase adjustment or the generators is concerned. On a switch column at the center of the desk are mounted a synchroscope, phase voltmeters and phase-signal lamps.

and double-pole type. Those placed in the ceiling are provided with a locking mechanism, the unlocking and opening of the switch being made in one movement.

Protection on the 50,000-volt side is obtained through choke coils and double series-connected horn-gap lightning arresters with series and shunt resistors and water-spray devices. There are one ordinary hour-glass-type choke

coil and a number of flat coils submerged in oil, all connected in series. The smaller horn gap is of the metal-resistor type in oil. It is designed for a current of 5 amp and provided with a safety device operating at a temperature of 212 deg. The larger horn gap is series-connected with a running-water resistor, the latter being regulated by

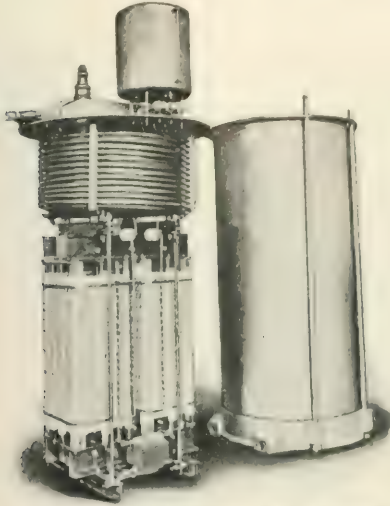


FIG. 11—TRANSFORMER WITH SHELL REMOVED

varying the water level. The water-spray devices for 50,000 volts are of the open-spray type and those for 6000 volts are of the glass-tube type, each being designed for 0.1 amp. There is one ammeter in each phase, normally



FIG. 12—FLEXIBLE STEEL TOWER FOR TRANSMISSION LINE

short-circuited through a disconnecting switch which is opened only for meter readings.

All 50,000-volt and 6000-volt conductors are placed in fire-proof compartments with iron doors and other wiring is carried in pipes. The transformer oil is boiled and filtered in a room especially equipped for this purpose and the oil is pumped from the clean-oil storage tank directly

to the transformer. The old transformer oil can be pumped to another storage tank at the transformer, may be emptied through special piping system, or the same may prove desirable.

For transportation of materials and supplies to the subterranean generating room there is an inclined railway through the tunnel. Diesel engines are employed for operation of the cars, which are controlled from both terminals and also by push-buttons in the cars.

From Stockholm there are two railway connections

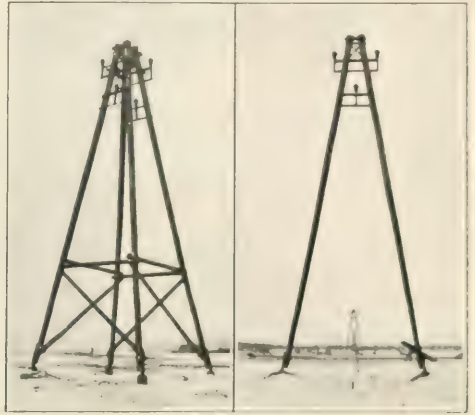


FIG. 13—STEEL AND FLEXIBLE TOWER FOR TRANSMISSION LINE

lines to Grangsborg and Umeå respectively. The former is 30 miles long with a double circuit of 110,000-volt, 110,000-volt conductors of six-stranded copper with hemp core. The insulators made by the Kierulff Company are tested



FIG. 14—STEEL TOWER FOR TRANSMISSION LINE

for 100,000 volts. The towers shown in Figs. 12 and 14 are spaced at intervals of 100 ft. The tower with tower is a steel tower with a lattice structure, while the intermediate towers are of the A-frame type. The towers are constructed of steel with a steel core of about 10,000 lb. weight. The towers are designed by Elekriske Ingeniörskontor, Stockholm.



The Domnarfvät transmission line is about 20 miles long and consists of three seven-stranded aluminum cables of approximately 120,000-circ. mil cross-section. The towers are made of wooden poles 46 ft. long and 9 in. in diameter, placed inverted on concrete foundations. The average span is about 540 ft. and the maximum nearly 900 ft.

On the Grängesberg line there are two substations, at

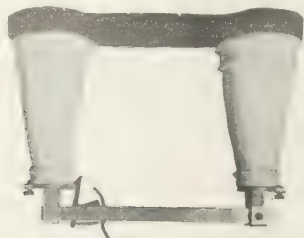


FIG. 15—DISCONNECTING SWITCH FOR CEILING MOUNTING.

Nyhammar and Grängesberg. The former has two 48,000-to-20,000-volt oil-cooled transformers and is equipped with lightning arresters, circuit-breakers and disconnecting

TABLE II—COST OF ENTIRE DEVELOPMENT

Water rights and real estate. . . . .	\$223,640
Dwellings and engineering. . . . .	17,240
Dam, flume and tunnels. . . . .	478,980
Generating room and switch house. . . . .	102,320
<b>Machinery:</b>	
Turbines and governors. . . . .	\$31,720
Generators. . . . .	64,250
Transformers. . . . .	28,290
Switch gear. . . . .	42,360
	<u>66,820</u>
<b>Distribution system</b>	
Grängesberg-Mockfjärd. . . . .	\$112,860
Nyhammar substation. . . . .	21,270
Secondary lines. . . . .	5,310
Overhead charges, interest, etc. . . . .	113,530
	<u>252,970</u>
	\$1,241,970
Cost per horse-power. . . . .	\$62.10

switches of the same type as those used at the main stations. The Grängesberg substation has four single-phase transformers, one being a reserve unit, all of the type used in the main station but connected for a secondary pressure of 8500 volts. The protective devices in this station are similar to those in the main station.

The entire electrical equipment of this system was furnished and installed by the Nya Förenade Elektriska

## Development of a New Quartz-Tube Mercury Arc Lamp

By E. WEINTRAUB

In the development of the mercury-arc lamp there has been a curious co-operation between German and American inventors and investigators. Several times the development has been carried up to a certain point in one of the two countries and has then been taken up in the other and another progressive step added to the work.

The first theoretical investigations of the mercury arc in an exhausted space and of its application to laboratory purposes were made in Germany by Arons. Important work was then done in this country which led to the invention of a number of commercial forms of the mercury-arc lamp and also to the invention and commercial development of the mercury-arc rectifier by Hewitt and Weintraub. The scene of activities was then transferred to Germany, and there was designed by Küch a high-pressure mercury-arc quartz-tube lamp which has found quite extensive use on the Continent.

The present article describes the development of a new type of quartz-tube mercury-arc lamp, which represents a considerable step toward perfecting that type of illuminant.

The beneficial results which it is expected will accrue from this advancement are as follows: The lamp is simpler, more efficient and can be more cheaply manufactured. It is applicable to direct current and alternating current and to multiple and series circuits. The possibilities opened are large, and work is progressing along different lines. The time for a detailed description is not yet at hand.

### THE TUNGSTEN SEAL

The new development had its beginning in the efforts which were made to do away with the ground joints used in the previous types of lamps for the introduction of the energy. The difficulty of sealing a metal into quartz is due to the high temperature at which the quartz melts and to the difference in coefficients of expansion of quartz and metal. The coefficient of expansion of quartz is approximately  $0.5 \times 10^{-6}$ , and that of platinum is about  $9 \times 10^{-6}$ , the difference being enormous.

In comparing the coefficients of expansion of different metals it was noticed that the coefficient of expansion of metals diminishes as the melting point rises. The metal, therefore, which would have the lowest coefficient of expansion would be the one with the highest melting point, and it was expected that tungsten and molybdenum would be the two metals with the smallest coefficient of expansion.



FIG. 1—SOLID ANODE

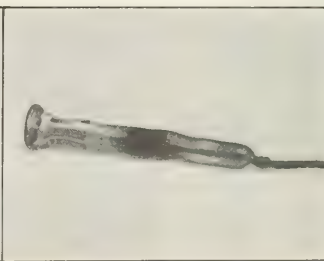


FIG. 2—TUNGSTEN SEAL

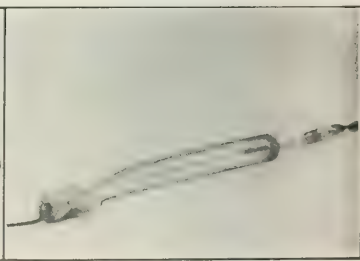


FIG. 3—THE LAMP COMPLETE

Aktiebolaget, Ludvika, after designs of the Elektriska Proöfningsanstalten, Stockholm. The turbines were made in Aktiebolaget Försämrhyttan, Sweden.

For the information contained in this article and for the photographs illustrating same we are indebted to Mr. Sven Lison Depken, chief engineer of the Nya Förenade Elektriska Aktiebolaget.

A measurement of the coefficient of expansion of tungsten and molybdenum showed it to be about  $3.5 \times 10^{-6}$ . The difference between this expansion coefficient and that of quartz is three units instead of eight and one-half in the case of platinum. The difference, although considerably reduced, was found to be still too great for direct sealing-in.

A glass with a high melting point and a coefficient of expansion equal to  $3.5 \times 10^{-6}$  was then sought. A borosilicate glass was found to answer perfectly, and tests have shown that this glass "wets" and adheres to tungsten in such manner that a seal between it and tungsten wire is vacuum-tight and is not only equal but superior in many respects to the usual seal between platinum and lead glass.

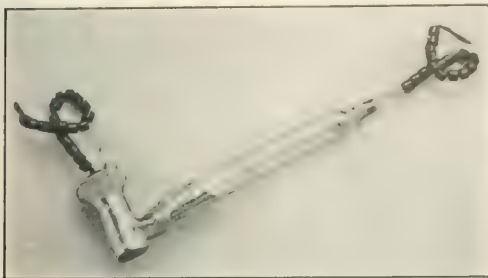


FIG. 4—LAMP WITH VERTICAL BULB FOR MERCURY

On account of the higher electrical and thermal conductivity of tungsten as compared to platinum at least three times the current value can be introduced through the same cross-section. The higher melting point of the glass and the lower coefficient of expansion make possible higher temperatures without leakage. Moreover, this seal is considerably cheaper, which is a point of great importance when heavy currents are to be introduced. The low-expansion glass is joined to the quartz by means of a "graded seal" consisting of a number of glasses of varying coefficients of expansion.

Thus a new method of sealing electrodes into exhausted vessels was found. It is thought that this method of sealing will change the methods of introducing current into exhausted apparatus, such as rectifiers, incandescent lamps, X-ray tubes and the like.

#### THE SOLID ANODE

The introduction of the tungsten seal and of the "graded seal" has dispensed with the necessity of the ground joint found on the old type of quartz-tube lamp and with the expense of the heavy quartz parts used in these joints, eliminating thereby a source of possible leakage and vacuum deterioration. In addition it has led to the use of a solid anode.

In the type of quartz-tube lamp on the market at present both electrodes consist of mercury. The mercury



FIG. 5—220-VOLT DIRECT CURRENT MULTIPLE LAMP

anode has a large number of disadvantages. The volatilization of the mercury of the anode needlessly increases the vapor pressure in the tube. The mercury at the anode volatilizes faster than the mercury at the cathode, and in order to counterbalance this heat-dissipating devices in the form of metallic vanes had to be placed on the two reservoirs, or else a large condensing bulb had to be used

near the anode. These reservoirs had to be made large enough to give a large surface on which to collect the water, which increased the cost in quartz, labor, etc., and gave the tube a ground appearance on short tubes for the volt operation. The remedy is a vacuum-tight seal on light.

The use of the seal as described, while perfectly compatible with the use of two mercury electrodes, naturally leads to the use of a solid anode, especially as the tungsten seal is almost impervious to high temperatures. Balancing of the mercury vaporization at the two electrodes then becomes unnecessary, the heat-dissipating devices disappear, and the lamp is simplified in design.

One difficulty, quartz lamp, when an attempt is made to use a solid anode, namely, the disintegration of the anode and the subsequent shorting of the tube. This difficulty is more pronounced in a quartz-tube lamp than in a glass-tube lamp, both on account of the high-temperature and because the duration of the light-emitting time renders the effect more harmful. The development of forged double tungsten by the General Electric Company has brought to the fore a remedy for this trouble. Tungsten has a very low vapor pressure, and if normal pressures are taken a tungsten anode can be used in the quartz-tube lamp without causing shorting.

The tungsten seal and the tungsten anode can be made of one piece of metal and the anode can thus be sealed directly into the tube. Fig. 4 shows the present form of anode and Fig. 5 shows the anode sealed into the graded seal.

#### DESIGN OF THE LAMP

After these preliminaries the design of the lamp as shown in Fig. 3 will be understood. The tube has a length

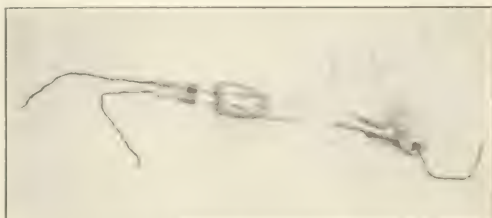


FIG. 6—ALTERNATING-CURRENT LAMP

depending on the voltage to which the lamp is adapted. The tungsten anode at one end is sealed in by means of the graded seal. At the other end there is a small mercury reservoir with a graded tube and metal shield inside. Enough mercury is introduced in the tube to cover on slight tilting a continuous bridge between the anode and shield so that when the tube tilts back to its normal position the cathode pool is destroyed so that the arc will start immediately whenever the tube is put in use. The striking features of this design are its simplicity and its economy in the use of quartz. The small mercury reservoir can be made of cheap quartz, the use of compressed quartz being restricted to the tungsten tube itself, which is a very few inches long. As compared to the present type of lamps, quartz and labor are reduced to about 10 per cent of the cost of many former lamps. At the same time the absence of water in condensing bulbs makes the saving in dissipated heat and the absence of large mercury columns exceedingly more than sufficient to compensate.

The arc of an arc lamp described is a quartz tube with an arc of 50 mm. across the arc. The limiting arc is about 3.5 in. long and the length of the tube being slightly in excess of 2 in. As the arc is direct current multiple lamp the following data are applicable. Watts at the arc, 320; watts across the arc, 1,000; arc length, 3.5 in.;

candle-power, 630; watts per mean spherical candle-power, 0.7.

Fig. 4 shows another type of construction, having a vertical bulb for the mercury container. This construction is also applicable to all the other types of lamps described later.

The 220-volt direct-current multiple lamp is represented by Fig. 5. It differs from the previous type in that it has a greater length (7 in.) of the luminous arc. The overall dimension is about 9 in. The unit developed at present operates at from 3.5 amp to 4 amp with a potential of 170 volts applied across the arc. The following data are obtained from its operation: Watts at the arc, 680; watts at the lamp, 880; mean spherical candle-power, 1600; watts per mean spherical candle-power, 0.55.

By a slight modification of the design it is possible to produce lamps for other voltages and for smaller or larger current values—that is, of smaller or larger power input. For smaller power inputs the efficiency of the lamp is decreased to some extent.

#### ALTERNATING-CURRENT LAMP

The simplification in design and the reduction in manufacturing cost both with regard to quartz and labor are

especially noticeable in the alternating-current lamp shown in Fig. 6. This lamp is built on the principle of the rectifier. Mr. Standerwick, of the General Electric Company, has designed a small auto-transformer with the result that neither in the mechanism nor in the operation is this lamp much more complicated than the direct-current lamp. Its efficiency is higher than that of the direct-current lamp at the same watt input because the loss is smaller in the auto-transformer and reactor than in the steadying resistor of the direct-current lamp.

#### LAMPS FOR SERIES CIRCUITS

Up to the present the quartz-tube mercury-arc lamp was not available for series circuits. The lamp as described above is, however, capable of operating in series circuits. The efficiency of the series lamp is nearly 30 per cent higher for a given watt input than that of the multiple lamp. For a unit of 600 watts or 700 watts on a series circuit the very excellent specific consumption of 0.35 watt per mean spherical candle-power is obtained.

The type of quartz-tube lamp described herein adapts itself well to the construction of a vertical lighting unit suitable for ornamental lighting. With the vertical lamp shown in Fig. 7 better light distribution has been obtained. A vertical type of lamp with series solenoid mechanism is an entirely new departure in the design of quartz-tube mercury-vapor arc lamps.

The writer finds it a pleasure to acknowledge the assistance offered in this work by Mr. Standerwick on the design of different mechanisms and by Messrs. Crawford and Devers on the design of the lamp itself, as well as by Messrs. Greiner and Wayringer, expert quartz blowers.

### Prevention of Accidents in Central Stations

Prompted by the magnificent humanitarian reports of the public policy committee of the National Electric Light Association, or spurred to action by purely selfish motives, there appears to be a manifest movement in the central-station industry toward the conservation of human life and the amelioration of human sufferings. It is worthy of

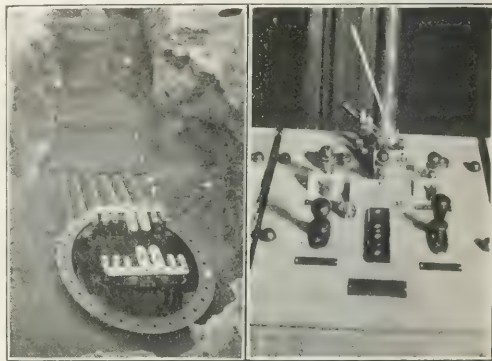


FIG. 1—LESS DANGEROUS TYPE OF MANHOLE AND WARNING TAGS ON SWITCHBOARD

note and a fact of which the electrical industry might well be proud that the electric light companies of the country are foremost in this movement of uplift and consideration for the welfare of the employee. The movement may be said to have had its rise with the gradual introduction of alternating currents and the higher potentials incident thereto, but it has been only within the past few years that it has made itself felt. In a great many instances it has even gone beyond the accident prevention stage and broadened into schemes for profit-sharing, investment funds, pensions, etc. However, it is not the purpose here to consider the latter phases of the situation, but rather to treat of the

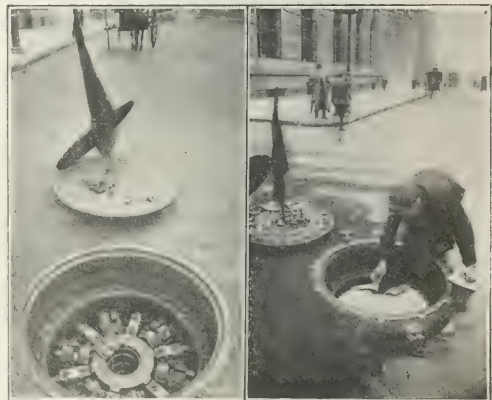


FIG. 2—DANGER FLAGS AT MANHOLE AND ASBESTOS COVERING TO PROTECT WORKMAN

practice of one company which has been foremost in the movement of accident prevention. An account of the work of this corporation, the New York Edison Company, cannot but be of interest, for in recognition of its fight against accidents the American Museum of Safety recently awarded to it the gold medal instituted by the Travelers' Insurance Company.



Until ten years ago the employees of the New York Edison Company had been accustomed to handle dynamos, switchboards, underground conductors and electrical apparatus of all kinds carrying electrical currents of low potential which could be touched with impunity, and it was necessary only to guard against short-circuits caused by wrong connections or by breakdowns of the apparatus.



FIG. 3—INSTRUCTION IN USE OF DYNAMO

With the introduction of high-tension apparatus, however, carrying currents of higher potential, contact with which is hazardous, new problems presented themselves for solution, and not the least important was the protection of workmen against accidents due to negligence, overzealousness or forgetfulness born of previous long experience in the handling of apparatus in which the danger from mere personal touch had been entirely absent. An important element in this system of protection is the provisions for safety in handling conductors above and under ground and in safeguarding workmen against all those innumerable minor accidents and personal injuries which are incidental to every kind of industrial operation. The treatment furnished to employees injured in its service has been an important feature of the New York Edison Company's welfare work for many years past.



FIG. 4—NOTICES POSTED IN RIVER AVENUE STATION

#### TREATMENT OF INJURED EMPLOYEES

In case of an injury during employment, regardless of whether the accident may have been due to negligence on the part of the employee or of the company, it is the company's earnest desire to return the employee to work as far as possible in the same physical condition in which he was prior to the accident and without financial loss to him-

self. This the company endeavors to do in a systematic, practical way as a part of its ordinary business routine. Every injured employee is given notice of the four physicians in the employ of the company, and the patient remains under medical treatment until such time as he has fully recovered from his injury. In the meantime the employee is carried under full pay on the disability payroll.



FIG. 5—MANHOLE BOARD AND MOTOR-DRIVEN AIR PUMP

With but few exceptions the company has been fortunate in escaping accidents resulting in permanent injury. This may be attributed to the protective devices with which all employees have been surrounded and also to the prompt care an employee receives when needed. In case of fatal accidents all mortuary and incidental expenses are paid in full by the company and a special appropriation is almost invariably made by the directors in the response to the amount depending on the circumstances of the case. When the injury is of too trivial a nature for a doctor's attention, the employee receives emergency treatment from one of the company's medical cabinets. These cabinets, which are equipped with such simple and easily applied remedies as have been suggested by the experience of the company's physicians, are installed in each station and substation throughout the city, but it has been the policy of the com-



FIG. 6—SYSTEMS USED BY COMPANY FOR ELECTRICAL

pany to have every employee, whether an expert or not, know how to handle the most dangerous of electrical equipment. For years past the company has been giving these same regular instructions to every one of its employees in the operation of the various mechanical parts of its equipment, and it is true there is a small amount of such instruction and instruction in the

and employees have been thoroughly instructed in the manner of operating this apparatus. (See Fig. 3.)

There has been no attempt to withhold from the employee the knowledge that there are certain advantages accruing to the company from this liberal system of treat-



FIG. 7.—WORKMAN USING SPECIAL GOGGLES PROVIDED BY THE COMPANY

ment, the idea being fully to inform the employee of rights and privileges and to deal with him with entire frankness and fairness. In perfecting its system the ethical side has

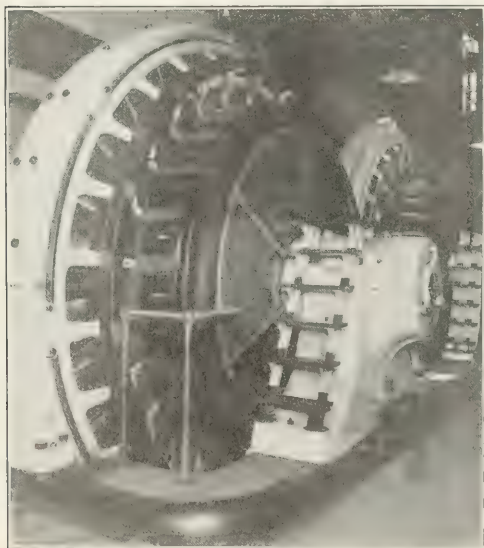


FIG. 8.—RUBBER MAT, GUARD RAIL AND SCREENS ON ROTARY CONVERTERS

by no means been lost sight of, and the New York Edison Company's method of compensation and treatment for injuries received in its service is not only more liberal than the most advanced legislation that has been thus far suggested but it has also served as a model after which the

systems in use by other companies engaged in the same industry have been patterned. In all the accidents that occurred during the six years from 1906 to 1911 less than twenty employees refused to accept its method of treatment and finally brought suit against the company. The majority of these cases were dismissed by the courts upon their merits, the remaining few being adjusted out of court.

#### RECORDS OF ACCIDENTS

The company's record of accidents embraces all kinds, however trivial or insignificant, many consisting of a superficial scratch or harmless bruise. From 1906 to 1911 inclusive there was a total of 5552 accidents of all kinds to the company's employees, entailing an expenditure by the company of over \$200,000, an average of \$37.22 per case. This covered disability wages, medical attendance and incidental expenses. An analysis of the accidents shows that they resulted from the following causes:

Struck by falling bodies (this in 99 per cent of the cases

### NOTICE.

THE Company assumes no responsibility whatsoever for treatment furnished from this cabinet and it must be distinctly understood that any aid so given is merely as an emergency measure and is preliminary to a visit to the Company's physician.

#### DIRECTIONS.

1.—It is most important that the parts immediately surrounding the wound be **thoroughly cleansed with soap and water** before making any application.

#### BURNS

2.—Severe, of a general nature—**Carron Oil** or **Picric Acid Solution**—if the burn is severe apply the oil or solution liberally, then bandage with gauze moistened with oil or solution.

#### BURNS

3.—From lime or Caustic Alkali—**Boric Acid Solution**—apply this solution to the eyes or any part of the body burned by lime or Caustic Alkali.

#### BURNS

4.—From Acid **Bicarbonate of Soda**—this may be used pure or dissolved in a little water for burns of the eyes or body from acids.

#### BURNS

5.—If slight—**Edison Ointment**—apply; this ointment only if the burn be trivial.

#### CUTS

6.—**Carbolic and Borax Wash**—for open cuts apply a piece of gauze or bandage wet with the wash.

#### BLEEDING

7.—Apply a clean piece of dry gauze over the wound with a firm steady pressure—Do not mop the wound as it interferes with the blood clotting.

#### FAINTING AND UN- CONSCIOUS

8.—Attacks—bathe the head with cold water and pass the smelling salts to and fro under the nostrils.

#### SORES

9.—**Edison Ointment**—apply this ointment to old sores but do not use on fresh cuts or wounds.

#### SPRAINS and BRUISES

10.—Apply cotton or gauze wet in **cold water**, bind firmly with a bandage to prevent swelling.

FIG. 9.—FIRST-AID CHART POSTED IN ALL STATIONS

was the result of the carelessness of fellow-employees working overhead in dropping tools, bricks, bolts, bits of wood and material of different kinds), 220, or 3.96 per cent.

Results of falls while on a level; slipping, sliding on pavement or station floors and stumbling over something on the floor, 401, or 7.21 per cent.

Falls while on stairs, 165, or 2.97 per cent.

Falls from ladders, scaffolds, top of boilers, machinery, etc., 253, or 4.55 per cent.

Injuries while moving or unloading material, 568, or 10.2 per cent.

Struck by material (this covers all kinds of bruises, knocks, jammed fingers and injuries of a minor nature impossible to classify under any specific head), 1089, or 19.8 per cent.

Material in the eye, due to failure to use special protecting glasses provided for the purpose (see Fig. 7), 400, or 7.2 per cent.



Injured while operating ash cars and working at ash and coal chutes, getting the foot under the wheels of the ash cars, etc., 72, or 1.2 per cent.

Burns from acids, solder, compound, etc., usually due to work in street manholes, junction boxes, etc., 184, or 3.31 per cent.

Burns by direct contact, and from steam, hot water, etc. (the result of employees striking their arms or hands against the hot ironwork of furnaces, boilers, etc., grasping live-steam pipes and occasionally getting hold of the hot end of a poker or fire hoe), 234, or 4.21 per cent.

Burns from short-circuit flashes (the result of making improper or accidental connections while installing or inspecting service, testing meters, working at service mains, etc., while the circuit was alive), 694, or 12.5 per cent.

Injuries while handling tools and working around moving machinery of various kinds, 400, or 7.21 per cent.

Punctured wounds from stepping on nails, thrusts from wires, sharp material, etc. (stepping on nails is responsible for more than 50 per cent of this class of accident), 378, or 6.8 per cent.



FIG. 10—SAFETY APPLIANCES AND MEDICAL CABINET PROVIDED IN STATIONS

Cuts from knives, glass, jagged edges of material, etc., 413, or 7.43 per cent.

Sprains and strains of various kinds, 81, or 1.46 per cent.

During the past year the company has found it desirable for statistical purposes to classify also "infected wounds," of which there were fifty-two during the year. Despite the company's endeavors to have the employee report every injury to the doctors, it was found that in many cases he neglected to carry out the instructions for treatment until several days later, when the wound had become infected and in more than one case of this kind the man's limb was endangered and in one case life was jeopardized.

It may be of interest to note that of the total number of accidents occurring during the six years only 13 per cent were from causes purely electrical and that the greater number of these accidents were of a most trivial nature, the result of short-circuit flashes while testing meters, wiping joints, stripping armor from cable and working on low-tension wires. With the possible exception of one or two cases the employees did not come in contact with high voltage current at all.

Regarding the responsibility for the accidents in question, careful tabulation shows that:

Eighty-one per cent resulting from accidents were directly due to negligence or carelessness on the part of the employees.

Six per cent were caused by the actions of fellow-employees.

Two per cent were due to causes for which outside contractors were responsible.

In seven per cent the company assumed responsibility for the occurrence.

As to the length of the period of disability resulting from the accidents in question the company's records are as follows:

Fifty-five per cent suffered no absence from work at all except the time consumed in getting to and from the doctor.

Fourteen per cent were absent from one day to three days.

Nine per cent were absent from four to six days.

Eleven per cent were absent from six to two weeks.

Eight per cent were absent from two to four weeks.

Two per cent were absent from four to eight weeks.

One per cent were absent eight weeks or more.

It will be evident, therefore, that the great bulk of the accidents were of a most trivial nature, occurring from circumstances over which the company has but little control. From the data at hand it would appear that from 75 to 85 per cent of the accidents were due directly or indirectly to the employees themselves, and these no provision of protective devices by the employer, no foresight or supervision and no operating rules or regulations would have prevented or mitigated. It is also apparent that the provision of safety appliances and safeguards is a remedy for but a small percentage of the accidents, and, important, necessary and useful as the provision of these may be, in the case of the New York Edison Company they afforded only a partial solution of the great problem of accident prevention. Thus a company may install all kinds of protective devices, may issue drastic rules, may do all in its power as an employer to protect its employees in the health, welfare and happiness of its employees, but it must admit its inability to accomplish what is desired unless it obtains proper appreciation on the part of the worker of his share of responsibility and duty in the premises. The spirit with which the New York Edison Company pursues this work is not that of charity or sentiment, but that of duty and responsibility to those who have contributed so largely and so loyally to the success of the central-station business in New York City. The illustrations shown herewith are self-explanatory and need no words in the safety measures which surround them.

### Electrification of the Swedish Railroads

Electrification of the line of the Swedish State railroad from Kiruna to Rönnskär is under construction, and the government is now planning the electrification of the large trunk lines from Stockholm to Malmö and from Stockholm to Gothenburg. The power for all these energy from a plant to be built by the government near the town of Malmö, and for the power plant energy will be purchased by the government from a large central station on the River Egoth. The company will be supplied directly from the government plant at Rönnskär. The line from Kiruna to Malmö will also be electrified. The cost of the lines at present under construction will be nearly \$10,000,000. The power plant and transmission stations and lines will cost about \$10,000,000 and the new generating station and plant in the power load of \$10,000,000.



# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Loose-Leaf Meter Reader's Book

A convenient loose-leaf meter reader's book serviceable for a year is in use by the Clifton Forge Public Service Corporation, which has now become the Virginia-Western Electric Company of Clifton Forge, Va. A binder with canvas cover and indexed alphabetically holds enough leaves to cover one entire district of the three into which

Amp.		Street Section
READ ON	FOR MONTH OF	DIFFERENCE
	Dec.	
	Nov.	
	Oct.	
	Sept.	
	Aug.	
	July	
	June	
	May	
	April	
	March	
	Feb.	
	Jan.	
Reading Bro't For'd		

The Clifton Forge Public Service Corporation  
ELECTRIC LIGHT AND POWER

PAGE FROM LOOSE-LEAF METER-READER'S BOOK

the city is divided. The location of the meter and the name of the customer are typewritten at the top of the sheet, and space is provided for recording the meter readings for twelve months. The meter reader's book is handed to the bookkeeper, who transfers the reading to a "meter ticket," as it is called, and from the ticket to the ledger. No bills are sent to customers, all of whom are required to come to the office of the company to ascertain and pay what is due. One bookkeeper is thus enabled to keep all the retail accounts of the company. The meter reader covers the entire city in three days and also acts as general electrician, superintends construction work on the lines, all new and old wiring work and looks after complaints. The meters in Clifton Forge are as a rule located on the front or back porches without any protection from weather, there being only about a dozen meters placed within doors. The system of keeping the meter records is, of course, applicable only to communities of less than 5000 inhabitants. Its chief merit aside from its convenience is in keeping down the cost of bookkeeping.

## Electric Vehicles in British Columbia

A campaign for the introduction of electric vehicles is being conducted this spring in the coast cities of British Columbia. More than 5000 automobiles of all kinds are now in use in the Province, but hitherto the gasoline car has been the prevailing type, with only a small scattering of electric vehicles. The present energetic campaign has, however, brought the electric automobile before the public in a way never before attained.

The 1913 campaign is intended to stimulate interest in both pleasure vehicles and commercial cars. Nearly all types of electric vehicles are already represented on the coast by agencies which for some years past have been selling a small number of cars annually. The introduction of these pioneer cars, with their advantages of cleanliness, silent running, ease of control and low cost of maintenance and operation, has, of course, attracted local attention to the electric type of vehicle and has rendered the advance campaign which is being carried on this spring much easier than it would otherwise have been. Accurate statistics as to the number of electric pleasure cars in service in Vancouver and Victoria are not available, but reports from the agencies indicate that the total is now worthy of note and that it will probably be doubled before next season.

One firm in Vancouver which operates a garage has made an attractive offer. This concern provides for the garaging of the car, charging of battery and delivering and calling for vehicle daily, all for \$30 per month, thus placing the electric pleasure vehicle at the service of the owner at a cost of \$1 per day.

In the field of electric trucks, the British Columbia Electric Railway Company, Ltd., this year took an agency for the General Vehicle Company and has been pushing the claims of commercial cars vigorously. The company itself operates a fleet of five electric trucks in connection with its Vancouver lighting and power service, and it is probable that this number will be increased shortly. One 3-ton elec-



ELECTRIC VEHICLES IN SERVICE OF VANCOUVER CENTRAL STATION

tric truck has been in constant service in Vancouver for the last seven years and is to-day still giving perfect satisfaction. In Victoria also a number of electric trucks are in use, and the list will be increased this season through repeat orders from both satisfied users and new firms won over by the operating records shown by the earlier vehicles.

Public charging stations are maintained by the central-



mediate gain of \$3,000 a month. When the railway company began to generate its own electricity a change was at once experienced, and the net earnings dropped \$3,000 a month. Mr. Bennett said that it was shown that the cost of furnishing electric motor service by the company was merely the cost of coal and oil and a small charge for the wear and tear of machinery. He pointed out that this led to the intensive cultivation of the day load.

In 1908 the company had a large excess of motor-service business which it knew was of a temporary character. Two of the larger customers were the Boston Woven Hose & Rubber Company, which paid about \$21,000 per year for central-station service, and the J. P. Squire Company, paying about \$39,000 per year. Also in the years 1910-11 the Cambridge company furnished electric service twenty-four hours per day and month after month for the construction of the Cambridge subway, the total receipts from this service being about \$30,000. It was figured by the company that of these amounts probably two-thirds was net profit, and as the business of all three installations was temporary in character, it was decided to declare an extra dividend on two occasions to the stockholders, since the profits were casual and special. Mr. Bennett said that there was no question in his mind that the company was justified in laying aside the money made from special temporary work for use as extra dividends.

### The Small Central Station and the Young Technical Graduate

The comparatively small central station offers a field for the trained engineer for the reason that it is often the one most neglected, declared Prof. George D. Shephardson, of the electrical engineering department, University of Minnesota, St. Paul, before the recent St. Paul convention of the Minnesota Electrical Association.

The small amount of business, high operating expenses and small profits of such a station do not usually seem to warrant the employment of very expensive talent. If the operating engineer keeps the plant running so that the customers are reasonably well satisfied, the owners generally feel that he is doing the best possible under the circumstances. The commercial end of the plant is sometimes also operating under similar imperfect conditions. The small station is nevertheless often warranted in securing technically trained men, even if it cannot hold them very long. A few examples will illustrate.

#### SAVED 100-KW PLANT \$2,000 PER YEAR BESIDES SALARY

In one instance, cited Professor Shephardson, a newly graduated technical man took charge of a small plant of not over 100-kw rating and by correcting poor engineering and business methods effected a saving of more than \$2,000 annually above his own salary.

In another case a graduate after one year's experience managing a 60-kw plant effected a saving of about \$5,000 annually in a plant of 200-kw rating.

The owners of small central stations, observed the speaker, do not always appreciate the true economy of good engineering, sometimes suspecting that men with theoretical training are necessarily permeated with new-fangled ideas that are not bread-winners. It is of course conceded that others are.

#### THE OPPORTUNITIES BEFORE THE YOUNG GRADUATE

The small station offers a more attractive field to some young engineers than would a large one, since the small plant's operating conditions are more easily grasped, its financial matters are more likely to be accessible to him, and he can sooner secure an understanding of the whole economic situation. The young graduate should therefore

become capable of assuming responsible charge in a small station much more quickly than in a large one. Men of somewhat different make-up will prefer to obtain their initial experience in a large company where things are on a larger scale, where the engineering force is organized with more specialization and where there is a long line of promotion in one company.

A young man entering the employment of a central-station company should bear in mind that his predecessors have kept the company going and that they could probably continue to do so without his services. The new man will usually occupy a comparatively unimportant position at first and should be advanced as he proves his worth. In general, a young man should not attempt or propose any radical changes in the practice of the company until he has become thoroughly acquainted with its operating and financial conditions. He should, however, strive to make the best he can of the equipment and facilities available. He should call for new or added equipment only after he has proved his ability to make the best possible use of that already at hand. A high grade of skill is required to secure good results from poor equipment, and the young man who can secure better results with the same equipment will certainly win the confidence of his superiors.

The young engineer with a technical training should soon be able to diagnose conditions of poor operation and to prescribe suitable remedies. To show that these generalizations are not simply ideal abstractions, a few illustrations from actual experience are submitted.

#### REDUCED FUEL BILLS 30 PER CENT

By correcting leaky boiler settings and an insufficient stack which had prevented complete combustion, one young engineer effected a saving of 20 per cent of the fuel bill. The same man in another position reduced the fuel consumption by 30 per cent, simply by properly cleaning the feed-water heater and boiler. This young man in another case decreased the fuel consumption 30 per cent by proper setting of the valves after taking indicator cards. The chief engineer owned an indicator but did not know how to interpret the cards to find the cause of the poor performance.

Another young man, who had not yet completed his technical course at the university, was sent to look over a 220-volt lighting plant which was so heavily overloaded that the owners were about to install larger machines. By careful inspection he was able to discover so much loss from poor insulation that after overhauling the lines he increased the number of lamps installed by about one-third and even then the load was 20 per cent less than before his arrival.

#### DOUBLE CAPACITY MADE AVAILABLE BY METERING

In another case the load on the station was reduced 50 per cent by introducing the general use of customers' meters. This allowed the connection of a large additional load without any increase of equipment except the meters and service wires. Experience in this case also showed that the reduction of the load by changing from flat rates to meters did not involve a corresponding decrease in revenue.

Attention to the proper care of customers' meters has also resulted in a marked increase in revenue. One young man reported that when he took charge of a station it was quite common to find monthly meter charges of only a few cents, even in winter time. After cleaning and correcting meters and establishing a minimum monthly charge, the financial gain was equivalent to his salary several times over.

The fact that a technically trained man is likely to remain with a small company only a short time should not deter the small company from employing him. For if he has good judgment he will more than earn his salary while with the company and the practices which he will inaugurate will in all probability continue to benefit the company long after his active connection with them has ceased.



Proper illumination does not mean the mere illumination of light in rooms, studies, dwellings, but means making them visible at different heights and distances, complete or partial, at the same time, producing an effect which is as efficient as possible. The great problem is, among the illumination, an adequate saving of electricity, of the purpose for which each room is to be used and to make information as a whole, so the procedure is varied in furniture and fixtures, in which the color of the walls, the ceiling and the floor should be chosen, as a dark tinted floor may remain for a long time than one with a bright finish. The ceiling and side of the room should be painted in white, that the illumination may be strong and clear, and the effect which is most desired.

In connection with these specifications it must be known to what extent economy is desired. Too often a good scheme of illumination has been ruined by a desire to reduce the electric-light bill, whereas had the matter of economy been discussed in connection with the original design a more efficient, though perhaps less esthetic, installation could have been substituted.

The exterior lighting of large buildings, which is often completely omitted, deserves consideration from the advertising standpoint. Not many sights impress the imagination more strongly than does that of an inspiring piece of architecture viewed at night. This emphasis may be secured by outlining the architectural lines of the structure, by the use of cluster posts on the sidewalk or by using luminous-arc lamps placed at the curb line and at points of prominence on the building.

In the main lobby of the building, especially if it is a large hotel, the color of the light should tend toward the yellow or reddish tinges, and the effect should be that of brilliant lighting even if good illumination has to be sacri-

ficed to some extent in accomplishing this end. The cold, cheerless light from the older type of arc lamps with their poor regulation should not be tolerated. The public must be invited to enter, and there can be nothing which extends a more cordial invitation than cheerful, bright illumination.

ordinarily the intensity of light necessary for comfortable vision would be 2 ft.-candles, but to have a brilliantly illuminated room it is well to increase this to 3 ft.-candles. As the floor area is 2025 sq. ft., a total of 6075 effective lumens must be provided to accomplish this result. At the clerk's desk, key rack, writing tables, cigar stand and at the reading chairs additional light will be desired. This will require specific lighting in addition to the general illumination.

The total illumination to be provided must include the 6075 effective lumens and all light losses. It may be safely assumed that the loss from the absorption of walls, ceilings and floors will not exceed 40 per cent. As 80 per cent of the useful light—that is, 4850 lumens—will come from reflection, and as 40 per cent will be absorbed, 3240 lumens will be lost by absorption.

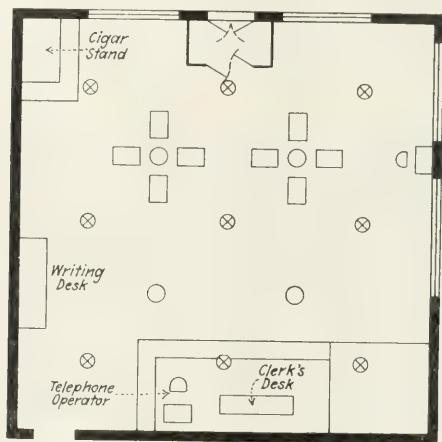
A dense opal globe will absorb 60 per cent of the light which falls on it, or probably 70 per cent of the total flux of the lamp. Hence 40 per cent of the total light flux generated, or 6140 lumens, is absorbed in this fixture. The total flux required is now 15,355 lumens, to which is added 25 per cent for losses due to the inevitable collection of dirt on walls, ceilings and fixtures. This gives a grand total of 18,945 lumens to be supplied from the nine light sources, or 2105 lumens from each source. A 250-watt tungsten lamp burning at normal voltage will give 2350 lumens, while the next smaller size, the 150-watt lamp, will give only 1260. The 250-watt lamp is then the correct one to select.

For the local lighting a simpler means of computing the additional light required may be adopted—that is, the intensity of the light will vary inversely as the square of the distance from the source. Assuming, for instance, that brackets are placed at a height of 6 ft. on the two front columns, a reading plane 2 ft. above the floor and 2 ft. out from the light source may be assumed for computation. The distance is then about 4 ft. If a lamp and reflector are selected which will give an intensity of 32 cp at 30 deg. with the vertical, the illumination will have been increased by 2 ft.-candles. This could be done by a 25-watt tungsten lamp equipped with an efficient reflector or by a 40-watt lamp with a less efficient but perhaps more attractive shade.

In the various other rooms of a hotel the use to which the room is to be put is a large factor in determining the nature of the illumination with which it shall be provided. In the dining room of a popular New York hotel three different intensities of illumination are provided. In the guest chambers cognizance must be taken of the fact that light must be available for reading and writing and provision must be made for ample illumination near the mirrors and dressing table. Lamps in hotel halls should be so placed that there will be no direct light glaring through the transom over a door into the rooms.

In office buildings the effect to be produced is not one of cheerful welcome but of clear-cut efficiency. The entrance should be brilliantly illuminated with as few curiously designed fixtures as possible. Indirect lighting may be used to advantage on account of the neat appearance presented by the fixtures. The best effects in lighting the rooms of office buildings can be obtained by studding the ceiling with small lamps. The results of some valuable research work on office lighting by Mr. C. E. Clewell show that units should be evenly spaced on centers approximately 7 ft. apart.

It is in the halls of the modern office buildings that the present-day illumination is shown to greatest advantage. The dimly lighted halls of the older office buildings have given way to cheerful well-lighted passageways which impress a visitor with their businesslike attractiveness.



FLOOR PLAN OF HOTEL LOBBY

ficed to some extent in accomplishing this end. The cold, cheerless light from the older type of arc lamps with their poor regulation should not be tolerated. The public must be invited to enter, and there can be nothing which extends a more cordial invitation than cheerful, bright illumination.

In the lobby of a quiet family hotel the effect should be subdued but cheerful. The effect of the quiet light from the open fireplace is what is desired, not that of the mortuary chapel, which is too often found.

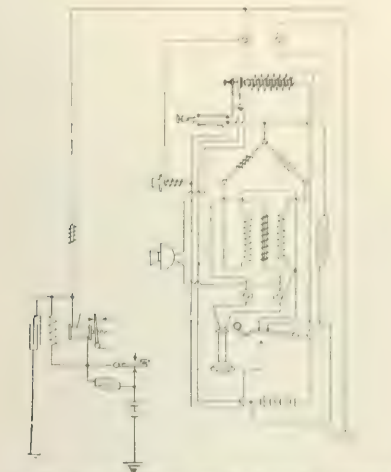
A description of the method used in making a detailed analysis of the lighting design for the lobby will illustrate the procedure necessary in all parts of the building. The first step must be a determination of the working areas of the room, the intensity of the light flux and the direction it should have over these areas. These factors can be obtained from an architect's plan and from a knowledge gained by experience in similar installations.

To illustrate how a problem of this kind is attacked such a lobby as is shown in the accompanying figure is assumed. The floor area, which is 45 ft. square, is divided by four pillars into nine bays. The ceiling height is assumed as 18 ft. and the architecture as of the style of the early French Renaissance. The walls are to be buff in color, the ceiling a very light cream and the floor white tile. The rear of the room is devoted to the clerk's desk, telephone operator's booth, bookkeeper's office, etc. On the left wall is a writing desk; in the front left corner the cigar and



### Recent Telephone Patents

In the accompanying illustration is shown the circuit of a combined telephone and telegraph system patented by Mr. C. L. Bopp, of Hawkeye, Ia. The operation depends upon an association of impedance and resistance to form a balanced circuit neutral to telegraph currents, while unbalanced and sensitive for telephone currents.



COMBINED TELEPHONE AND TELEGRAPH SYSTEM

Mr. D. W. Kneisly has described the circuits and apparatus and the method of operating for a lockout party line system. This patent is assigned to the Dayton Telephone Lockout Manufacturing Company.

## Letters to the Editors

### The Constant-Current Series System

To the Editors of the *Electrical World*:

SIRS:—As a veteran of the days of the series-arc dynamo and the constant-current-arc circuit motor, I have been greatly interested in your recent editorials on the Thury constant-current transmission system.

I inclose herewith copy of Patent No. 493,842, which was issued to me in 1893, claim No. 1 of which covers broadly the Thury system with means for automatically varying the number of generators in the series circuit.

My series system was warmly indorsed by the late Dr. Coleman Sellers, who was chief engineer of the Niagara Falls development at the time when there was much discussion as to the relative merits of the compressed-air and hydraulic systems as well as of the direct current and the then almost unknown polyphase alternating current.

Although I have lived to realize the wisdom of the international commission of engineers in adopting the alternating system for Niagara, it is some comfort to note, even at this late date, that my youthful efforts were not altogether misdirected.

Plainfield, N. J.

SAMUEL W. RUSHMORE

[Claim No. 1 of the patent referred to is as follows:—  
"1. In a system of electrical distribution the combination of two or more electrical generators, means for connecting them in series, a circuit containing translating devices arranged in series supplied by said generators, and devices controlled by the current in the said series circuit for connecting more or less of the said generators in the series

whereby a constant current is maintained in the circuit under changes in the number of translating devices in circuit, substantially as set forth." In describing the invention, the patentee stated: "The main object of my invention is to enable constant-current circuits in which translating devices are employed in series, such as arc-lighting circuits, to be supplied in an effective and convenient manner by constant-potential generators such as are ordinarily used for incandescent electric lighting and for electric motor work; thus by my invention I am enabled to supply from the same generators and the same central station both arc lights and incandescent lights, as well as electric motors, whereby an increase of economy and profit is obtained."—*Eds.*]

### The Institute as Defendant

To the Editors of the *Electrical World*:

SIRS:—The editorial in your issue of April 25 under the caption "The Institute as Defendant" shows such a complete misunderstanding of the question at issue and so entirely misrepresents the plaintiff in this action that I think it necessary to request you to publish this letter in order that the issue may be clearly stated, and not garbled as you have it.

You say, "to a suit to restrain the American Institute of Electrical Engineers from transferring any person to the grade of Fellow or Member in accordance with the special section of the Institute constitution." This is an incorrect statement. The suit does not attempt to restrain the Board of Directors from making transfers under the special section but does attempt to restrain transfers under the procedure adopted by them. This is a very different matter, as it does not at all question the right of the Board of Directors to make transfers under the special section provided the transfers are made legally and in accordance with it.

You again say, "The point under discussion relates exclusively to the legality of the so-called special section." This is the second incorrect statement. The legality of the special section is in no way questioned. The procedure adopted by the Board of Directors to give effect to the section is questioned.

You again say, "The claim by the persons bringing the suit is that the special section is nullified by other parts of the constitution with which it is in conflict." This is the third incorrect statement. The claim is not made that the special section is "nullified" or that it is "in conflict" with anything. The entire contention is that the special section can, and should be read as part of the constitution, and that properly interpreted there is no conflict.

You will thus see that you totally misrepresent the matter, possibly through careless copying of the papers in the case, but whatever the reason, you are very thoroughly for such misrepresentation.

Further, you say, "The point under contention in this suit is a perfectly proper one for discussion by the membership as a whole." The Institute, too, would not have been aimed at, either. The inference from this is that the opponents on this matter are, in your opinion, responsible for "airing" the subject, and this is true to the extent that they have originated the suit. This, however, has been at your best known only that some of the members of the Institute do believe the Board of Directors to be wrong in the matter at issue, and for directly discussing the subject with the Board of Directors to demand to see them at private instructions that the matter is "aired in public." The responsibility is upon the Board of Directors and not upon the plaintiffs in this case. In order that there may be no misunderstanding of this matter, I wish to state again that several steps have been taken pending this suit.

The interpretation of the special section and the procedure to be adopted under it were matters of controversy



from the very first moment; the Board of Directors in the beginning had no clear understanding of the matter and adopted contradictory by-laws, as is evidenced by those of May 21, 1912, and of June 27, 1912. The dispute regarding the interpretation of the special section was next, in September, transferred to the law committee of the Institute; two opinions were given, four members favoring an interpretation consistent with that of the plaintiffs and one, the chairman, a different interpretation. This was the status when the Board of Examiners took the matter up in October, when they sent a letter to the Board of Directors, concurred in by all five members of the Board of Examiners, requesting the Board of Directors to refer these applications to the Board of Examiners, stating their belief that the Board of Examiners had the duty conferred upon it under the constitution of passing upon all transfers. The Board of Directors refused this.

The second attempt on the part of the Board of Examiners was the submission to the Board of Directors of a legal opinion sustaining the position of the Board of Examiners, with a further request that applications be referred to the Board of Examiners. The Board of Directors refused this second request.

The third attempt was embodied in a letter signed by a number of prominent members of the Institute requesting the Board of Directors, in view of the differences of opinion existing between it and the Board of Examiners, to refer the entire matter to arbitration of counsel, to be agreed upon by the parties. The Board of Directors refused this third request.

The fourth attempt was embodied in a joint letter signed by prominent members of the Institute requesting the Board of Directors, in view of its refusal to arbitrate the matter, to refer it to the Appellate Division of the Supreme Court of this State under a stipulation by the two sides in the controversy—this is a body which is frequently called upon to give a definitive opinion in regard to the interpretation of legal documents. Had this been done there would have been no "airing in public." The Board of Directors refused this fourth request.

It was only after the failure of these four attempts to adjust the matter that the decision was made to bring a suit which will result in finally getting the matter before the Appellate Division of the Supreme Court, where it might easily have been taken by the Board of Directors some months ago.

Under these circumstances, it is easy to see who is responsible for "airing the matter in public," and it is not the plaintiffs in this action.

They have only one object in this action—to maintain the professional standards of the Institute. They believe it to be vicious to permit, by any procedure, an Associate who does not even pretend to be an engineer to assume this label: "An electrical engineer by profession. As such, under general direction, he shall have designed and taken responsibility for important electrical engineering work; he shall have been in the active practice of his profession for at least five years." Under the interpretation of the special section adopted by the Board of Directors any Associate, regardless of his professional or moral character, must be made a Member, upon application, provided he can find four of his friends to "certify" that he fulfils the requirements of the grade of Member. It is, of course, notorious that such certifications mean nothing; any one can, by trying long enough, find four friends who will sign anything presented to them. Men do not discriminate in matters of this kind. Such a procedure is puerile as a guarantee of the qualifications of the applicant. Those of lowest standard and least qualified are the very ones who will find this means of gaining a false position. The experience of the Board of Examiners in rejecting a large percentage of those who apply for transfer under the regular procedure show that even carefully considered indorse-

ments are not by any means conclusive in proving the qualifications of the applicant for transfer.

The transfer to Fellow is a matter of less consequence, inasmuch as all former Members were professional engineers, and the question is merely one of degree, not one of kind, as it is with the Associate.

In brief: No attack is made in the action upon the validity of the special section, but it is claimed that the procedure adopted by the Board of Directors is improper and illegal in so far as the provisions of the special section are treated by the Board of Directors as wholly independent of and unaffected by the other provisions of the constitution, and as making it obligatory upon them to transfer, as a matter of course, and without inquiry into or regard to their professional standing or qualifications, such persons as are certified under the provisions of the special section.

They believe that all members of the Institute who have its best interests at heart, and who desire to maintain its dignity and standing before the profession and the community, should sympathize with the purpose of this action  
New York. GARY T. HUTCHINSON.

[We are unable to read into our editorial the misrepresentation of facts implied by our correspondent. The facts are matters of Institute and court records and can well speak for themselves.

According to the court records the plaintiffs in the suit demand that "the defendants composing the Board of Directors of the defendant American Institute of Electrical Engineers be forever enjoined and restrained from transferring or electing any person to the grade of Fellow or Member in the membership of the defendant American Institute of Electrical Engineers as a matter of course, or without fairly considering and deciding on the merits whether such person has the qualifications required by said Constitution, or without fairly considering and deciding on the merits whether such person's character, reputation or professional conduct would make him in their opinion an undesirable member, whether or not such person has been certified under the provisions of the Special Section of its Constitution."

According to the Institute records the "Special Section of the Constitution" referred to is as follows:

"Special Section: Any person who shall be a Member at the time this group of amendments is adopted, shall, on written request to the Secretary prior to May 1, 1913, without the payment of the transfer fee, or increase of life membership fee, have the right to become a Fellow, provided he refers to at least five Fellows or Members who, upon inquiry, shall certify that he meets the requirements of the grade of Fellow, as herein defined.

"Any person who shall be an Associate at the time this group of amendments is adopted shall, on written request to the Secretary prior to May 1, 1913, without the payment of the transfer fee, or increase of life membership fee, have the right to become a Member, provided he refers to four Fellows or Members who, upon inquiry, shall certify that he meets the requirements of the grade of Member, as herein defined.

"The dues of Members and Associates transferred under the provisions of this special section shall not be increased until May 1, 1913."

Since the Board of Directors, which is the only legally authorized governing body of the Institute, has been made the defendant in the present suit because of its refusal to interpret the "special section of the constitution" otherwise than in accordance with its wording, it is at once evident that what the plaintiffs really demand is that the special section be set aside in view of other portions of the constitution. Although not wishing to take sides in the present controversy, we cannot refrain from stating that it should never be necessary to resort to a lawsuit to determine how the affairs of the Institute shall be conducted.—EDS.]

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Drying Out Submerged Apparatus at Columbus, Ohio

In the floods which swept over portions of Ohio, Indiana, Kentucky and Illinois last March a great many of the cen-



FIG. 1—INCLOSURES FOR DRYING GENERATORS

tral stations suffered loss either in overhead line equipment or in damaged generating apparatus in the power houses many of which were under water. Usually, where the electrical apparatus was damaged by water only, the station attendants set to work to dry it out as soon as the flood



FIG. 2—GAS FURNACES FOR DRYING BOOSTER SET

subsided, and although the conditions at times were very discouraging, service was restored in a remarkably short time. The accompanying illustrations show the means used by the Columbus Railway & Light Company, of Columbus, Ohio, in drying out the generating equipment in its Spring Street station, where on March 26 there was over 1.5 in. of water on the floor of the generator room.

The work the generators were completely inclosed in the manner shown, as hot air obtained from gas furnaces circulated from one housing to the next by motor-driven blowers. Fig. 1 shows two large engine-driven generators being dried out and Fig. 2 shows the gas furnaces in place for drying out a booster set. The ordinary Jewel hot-air furnaces were employed, using gas instead of coal as fuel, and circulation through the housed machines was forced by means of blowers which discharged in one side of the inclosure and sucked from the other side, thus maintaining a positive movement of the heated air.

## Rehabilitation of Combination Electric and Ice-Making Plants at Hampton, Va.

The Newport News & Old Point Railway & Electric Company, of Hampton, Va., which, together with the Citizens' Railway, Light & Power Company, at Newport News, the Hampton Roads Traction Company, and the Newport News Gas Company, was recently taken over by Messrs. Allen & Peck, of Syracuse, N. Y., comprises a combination utility having many interesting features. Its railway lines extend from Newport News to the historic towns of Hampton, Phoebus, Old Point Comfort and Buckroe Beach, localities also supplied by its electric and gas mains.

In addition the company owns 35-ton and 60-ton ice-making outfits at Newport News and 40-ton and 60-ton ice-making installations at Hampton. The first two machines are located in separate buildings in Newport News while the latter pair are under one roof at Hampton. At present the main generating station of the company at Hampton is being rebuilt and steam turbines substituted for the reciprocating engines formerly employed. The ice-making equipment at Hampton is also being overhauled and new equipment and ice houses installed.

### REARRANGEMENT OF ICE-MAKING MACHINERY

When the properties were taken over it was found that the piston type machine was generally discarded and only the Weston York machine was being repaired at Hampton, while both the 35-ton and the 60-ton machine at Newport News were in use. However, it was a matter of time to make the first set out of the three machines. With a change of ownership the ice-making equipment is to be built the ice-making installation at Hampton in the near future the generating station building was being refitted, the idea being to make a good working plant at Hampton by overhauling the compressors, installing new water and oil cooling water systems, etc.

It is expected that the new installation will cost one hundred dollars. The output of the new plant, which is expected to be completed in the near future, is to be used in the ice-making machines at Hampton and may serve the ice-making weather, and to provide for the ice-making machines at Newport News until it can be taken down and installed at Newport News under the same roof as the first machine. The latter is located in a building which is now being used at Newport News, part of which is now used as a substation with rotaries and lighting systems.

The removal of cooling oil from the generating equipment



and the main ice-making equipment at Hampton is apparent. With the substitution of steam turbines for the reciprocating engines in the generating station an unlimited supply of distilled water from the turbines is available for ice-making purposes in the adjoining ice-making plant. Steam for driving the compressors is also obtained from a common boiler room in which coal-conveying equipment and automatic stokers are installed. While the substitution of motor drive for the ammonia compressors might have shown better over-all economy, it was necessary to adopt the cheapest method in obtaining direct results, so the steam-driven compressors were retained. Moreover, it is necessary at times to vary the speed of the ice machines, especially when small amounts of ice are being made, requiring that a direct-current motor or an adjustable-speed alternating-current motor be installed.

#### OVERHAULING AMMONIA COMPRESSORS.

In overhauling the ice-making equipment a Shipley ammonia condenser has been substituted for the old-style condenser, with a consequent reduction in the number of pipes and accumulators in the tank rooms for pre-cooling the water. In the Shipley condenser, marketed by the York Manufacturing Company, York, Pa., the ammonia gas, instead of entering at the top and coming out at the bottom with water trickling over the coils, is put in at the bottom and passes through an ejector which sucks in ammonia liquid with it and in spraying the pipes keeps them wet so that better heat transmission takes place. At Hampton an atmospheric type of condenser on the roof of the building is employed.

The circulating water for the ammonia and steam condensers is taken from a new intake tunnel by motor-driven pumps in the turbine room. One pump is used for the steam condenser and another for the ammonia condenser, but in case of trouble either pump may be employed to supply both condensers. The compressors operate condensing and require from 17 lb. to 18 lb. of steam per hp-hr. The condensate from the compressors flows into the discharge tunnel. The compressors take steam from the main header in the turbine room of the generating station through a 6-in. overhead main so that the ice plant can operate from any boilers under steam. At present superheaters are not installed in the power house, but all piping is of steel with Van Stone joints so that superheated steam can be used when desired.

The boiler-feed pumps and the exciters are turbine-driven and exhaust through an open feed-water heater from which the feed-water supply is taken. About 10 per cent of the condensate from a single turbine unit (there are two 2000-kw units and one 1800-kw unit installed) is sufficient to make 60 tons of ice, so that there will always be an abundant supply of distilled water for ice-making purposes. The condensate from the turbines is collected in a tank from which it is pumped to the reboiler. An elaborate system for conserving the fresh water is employed, so that the quantity of make-up water that must be purchased from the city is kept at a minimum. Such make-up water as is used is first passed through the turbine bearings on its way to the make-up tank located above the feed-water heater. A feature of the turbine room of the company is that all piping is in the turbine room with the exception of the boiler connections feeding the header.

#### CONSTRUCTION OF COLD-STORAGE ROOMS

The company has provided storage facilities for about 500 tons of ice in addition to three small food-storage rooms each about 14 ft. square and one above the other. These rooms are reached by an elevator. Between the tank room for the 40-ton machine and that for the 60-ton machine is a room for handling the ice, and a handling room is also provided for the 60-ton tank.

Tracks for railway freight cars are laid between the sta-

tion and the ice-making plant so that the product from the 40-ton tank can be passed directly into cars for shipment. A flexible connection will also be installed, by which the cars can be chilled before being filled with ice so that the loss from melting will be reduced. From the 60-ton tank the ice is loaded on the carts of the company for wholesale and retail delivery.

In rebuilding the ice-storage room extra insulation was installed in order to avoid melting of the product. The storage building has a 4-in. brick wall lined with  $\frac{7}{8}$ -in. wood. A 6-in. space is provided, which is filled with granulated cork, besides which there is a second 6-in. space filled with re-granulated cork, over which have been placed two thicknesses of paper and one more thickness of board. The ceiling is covered with a 10-in. filling of re-granulated cork and all floors in both the storage and handling rooms are insulated with 3 in. of sheet cork covered with 3 in. of cement. A 2-in. floor on top keeps the ice from touching the cement. The floor is laid on 2-in. by 4-in. studding. Direct expansion is employed in both the storage and handling rooms for keeping them cool, where formerly brine circulation was employed.

#### DISPOSAL OF PRODUCT

The company retails its product at 10 cents for 25 lb., or 40 cents per 100 lb. The wholesale price is \$4.50 a ton delivered, or where the customer uses his own wagon \$4 a ton at the platform. By means of tickets a reduction of 5 per cent in price is available to the retail trade.

A large amount of ice is used by fishing boats and in packing seafood for shipment for the North. It is customary for the fishing boats to follow the schools of fish along the coast from Florida northward and to put into Hampton for ice and also to unload their cargo for shipment. These boats oftentimes require large quantities of ice, and not infrequently 150 tons of ice is used for this purpose in a day.

The ice-making load is fairly steady for eight months of the year and the peak extends over the three hottest months, when the 60-ton plant at Newport News will be pressed into service. The process is steady so that it possesses no diversity factor. By means of the combination there is a saving in labor and in cost of equipment, and also a saving in operation due to the fact that the stokers and automatic coal-handling apparatus installed in the boiler room of the central station also serve the ice-making plant.

#### CONDITIONS OF COMBINATION OPERATION

The effect on the income curve in a combination property depends on conditions. In winter, when the ice-making load is smallest and the railway load is small, the lighting load is highest; while in summer, when the lighting load is smallest, the ice-making load and railway load are highest. A condition could therefore exist where the income curve throughout the year would approximate a straight line.

#### A Clean Mercury-Gage Tube

The glass tube of the mercury gage which we are using in our hydraulic experiments persists in becoming dark along that portion over which the top of the mercury column moves, thereby rendering it most difficult to procure accurate readings. In what way can the oxidation of the mercury be prevented so that the dark oxide will not adhere to the walls of the tube?

E. E. B.

In experiments where great accuracy is required the mercury used to fill the gage tubes is submitted to treatment before entering the instruments. The treatment consists in heating the mercury to the boiling point and maintaining this temperature for a period of about thirty days. Impurities are largely driven out by this process. By placing a small wad of cotton in the open end of the tube to exclude foreign matter the gage glass will remain free from oxide for a long period.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

## Generators, Motors and Transformers

**Standardization Rules.**—The new proposed standardization rules of the German Association of Electrical Engineers for the rating and testing of electrical machines and transformers. In working them out care was taken to get as much uniformity as possible with the American Institute of Electrical Engineers for the sake of export business. *Elek. Zeit.*, April 17, 1913.

*Passage of a Polyphase Induction Machine Through Synchronism.*—G. VALLAURI.—The author reviews the different opinions which have been expressed on the sudden change of power which occurs in a polyphase induction machine when it passes through synchronism. This difference of opinion is due to the fact that with respect to the torque of the induced currents the hysteresis torque has been neglected or that an inaccurate law concerning its variation has been assumed. The author shows that the hysteresis torque is independent of the speed and that consequently the power furnished by the stator by means of this torque is constant. It follows that if the total power of the machine is considered as a function of the speed under different conditions of operation (a constant speed being assumed in each case) this function must show at synchronism a sudden discontinuity equal to double the power of the hysteresis torque. On the contrary, if one considers the gradual passage through synchronism, the hysteresis phenomena in a rotating field would indicate that this variation of power will take place gradually in a finite time beginning at the moment of synchronism. By means of a chronographic method the author has shown that the results of experiments agree with the theory, and he completes his investigation by the analysis and discussion of the losses in this type of machine.—*Att. dell' Ass. Eletrot. Italiana*, March 15, 1913; briefly abstracted in *La Lumin. Elec.*, April 12, 1913.

## Lamps and Lighting

*Standard Specifications of Street Lighting.*—A draft of a standard specification for street lighting drawn up by a joint committee of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers and the Illuminating Engineering Society. When the draft was submitted for approval to the councils of the various societies represented on the committee, it was not adopted by the Institution of Gas Engineers. One important result of the investigation carried out by this committee is that the general effect of street lighting upon the individual, that is whether good or bad, depends on the maximum illumination obtained, and not so much on the ratio of maximum to minimum as has sometimes been thought. Consequently it is possible to classify streets according to minimum illumination, and this has been done for five classes of illumination. In streets with very low minima the measurement is to be by candle power, as the minimum illumination becomes too indefinite to be determined directly with accuracy. Some numerical points of these drafts read as follows:—*Unit of measurement.* This specification is based on illumination the unit of measurement being 1 ft. candle. *Classification of streets.* For convenient reference the streets are classified as having a minimum as follows:—Class A, 0.001 ft. candle; class B, 0.025 ft. candle; class C, 0.04 ft. candle; class D, 0.06 ft. candle; class E, 0.10 ft. candle. *Street lighting at "cross"*

illumination illuminance may then be specified by the height and distance apart of the lighting units and the candle-power as measured in the direction of the thoroughfare at an angle of 15 deg. when the horizontal minimum illumination: The 'minimum illumination' of a street means the minimum illumination on a horizontal plane at a height of 5 ft. 6 in. above the ground level and may be measured by means of (a) any suitable illumination photometer or (b) any suitable photometer adapted for use in the street which will indicate the candle-power of the lamps in those directions which occur at the point of minimum illumination. In this case the minimum illuminance will be calculated by adding together the values of the illumination received from each lamp, the material contributes to the result. Tests: A test of the illumination shall be made under such normal atmospheric conditions as will not appreciably affect the accuracy of the result, and at a fairly selected point not in the shadow of a mantle, lamp, decorative pattern but just free of other obstruction. When a minimum illumination or candle-power of lighting unit is specified it shall be held that such minimum is obtained in the footcandle of the measurements of any three points between two consecutive lighting units at the same type and at the same value of  $h$ . These tests shall be prepared by the Illuminating Engineering Society for the testing and for the use of street photometer and candle

*Street Lighting.* A. B. Rogers, A paper read before the (British) Illuminating Society at the meeting of the committee which prepared the specification for street lighting. This was a joint committee of the Illuminating Institution of Electrical Engineers, the (British) Institution of Civil Engineers, the Institution of Municipal and County Engineers and the Illuminating Engineering Society. There was in the beginning considerable discussion whether the specification should be based on illuminations in foot candles or on the candle power. The author proposed to meet both the objections to the illuminations basis, the horizontal vertical and direct ray measurements, and at the same time to give a maximum and minimum illumination. He gives a review of the present use of the current in foot candles and of the photometric report prepared for the general committee and sums up the final work of the committee. The committee's standard specification for street lighting is now in effect and strictly has been adopted by the majority of the Institution of Electrical Engineers, of the Institution of Municipal and County Engineers and of the Illuminating Engineering Society, while the Institution of Civil Engineers has not done so since it could not agree with the horizontal and beam as the suggested specification—namely, the stipulation of illuminations with a stated horizontal surface measured in the foot candle unit. (See *Engineering*, Vol. 100, p. 101.)

[illegible]

sible to employ a flicker photometer for a study of this nature (*Electrical World*, Feb. 25, 1909). The present investigation carries the study of acuity into the field of the colored background. The following table gives the incident intensities of light, as determined by coefficients of reflection, required to give an equal reflected intensity from various colored cards:

Color	Coefficient of Reflection	Initial Intensity to Produce 4 Ft.-Candles of Reflected Intensity
White cardstock	(Standard of reference)	4.0
Red	0.303	13.2
Green	0.626	6.4
Yellow	0.928	4
Blue	0.288	13.9
Orange	0.525	7.63
Purple	0.380	10

Fechner's law is finally briefly considered.—*Gen. Elec. Rev.*, April, 1913.

**Emergency Miners' Lamp.**—An illustrated description of an electric lamp recently approved by the British Home Office for use in coal mines as shown in Fig. 1. The case

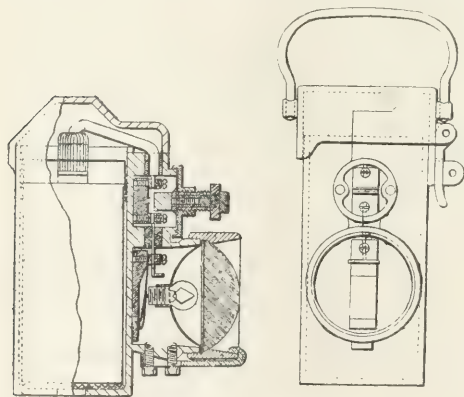


FIG. 1.—EMERGENCY MINERS' LAMP

is of cast aluminum, with a cover secured by a lead rivet lock. The electrical accumulator is so constructed as to prevent escape of the liquid, whatever the position of the lamp, while allowing the escape of gas generated by chemical action in the accumulator. A flame-tight screwed plug of vulcanite incloses the contact made between the insulated lead and the positive terminal of the cell. The switch is contained in a flame-tight inclosure, the cover of which, with its washer, is secured by screws. The screw-heads are pierced so that a wire may be threaded through and the ends sealed with lead seals. The lamp bulb and reflector are contained in a second inclosure, which communicates with the switch inclosure. It is made flame-tight by means of a screwed ring containing the lens and a washer. The ring is prevented from unscrewing by means of a clip secured by screws, the heads of which are pierced as in the case of switch-cover screws. The total weight of the lamp is 4 lb. 8 oz., and it is capable of maintaining 1.5 cp for not less than ten hours. The lamp is only to be used for work of rescue or exploration in the case of an accident or other emergency, or by officials.—*London Elec. Rev.*, April 18, 1913.

## Generation, Transmission and Distribution

**High-Tension Insulator Tests.**—F. F. BRAND.—The commercial testing of insulators resolves itself principally into a determination of the arc-over or puncture voltage under wet and dry conditions of service. The first part of this article comments on the proper manner in which to conduct such tests, attention being called to certain influencing factors and to precautions that are necessary for successful results. The design of insulators is mainly concerned with the question of the distribution of potential, or the potential gradient, over the several parts of the insulator, and data, to be of value in design, should be chiefly of such a character. The greater part of the article is consequently given to a discussion of the potential gradient on two of the common forms of insulators, the pin and suspension types.—*Gen. Elec. Rev.*, April, 1913.

**Trollhättan.**—The first part of a profusely illustrated description of the electric-power plant of the Swedish government at Trollhättan.—*London Elec. Review*, April 18, 1913.

**Cement Mills.**—An illustrated description of some American cement-mill installations with special reference to the method of electric driving.—*London Elec. Review*, April 18, 1913.

## Traction

**Paris.**—An illustrated article on the new lines of the Paris rapid transit railway—*Revue Gén. des Chemins de Fer et des Tramways*, Vol. XXXV, 1912, page 233; abstracted in *Elek. Zeit.*, April 17, 1913.

## Installations, Systems and Appliances

**London.**—F. BAILEY.—A paper read before the Royal Society of Arts in London on electrical supply in London giving a sketch of the historical development and comparisons with Berlin, Paris and Buenos Aires.—*London Electrician*, April 18, 1913.

**Lighting of Small Country Houses.**—J. CALDWELL.—An article giving comparative particulars of two existing typical installations of petrol gas and electric light. Figures of cost are given. While the first cost is higher for the electric light, the cost of operation and upkeep is higher with the petrol-gas plant.—*London Elec. Review*, April 18, 1913.

**Electric Heating and Cooking.**—T. ROLES.—An abstract of his introduction to a discussion held at Leeds and Sheffield on electric heating and cooking. The demand for electric heating and cooking is discussed, and some particulars of the experience at Bradford are given. The influence of rates for energy on the demand is considered, and finally electric heaters and cookers are discussed in some detail.—*London Electrician*, April 18, 1913.

**Electricity in Fire Houses.**—P. LANGOHR.—An illustrated article on the uses of electricity in the new fire house in Cologne-Deutz. The signaling and telegraph system, the apparatus for charging the automobiles and the light and power installation are described.—*Elek. Zeit.*, April 17, 1913.

## Wires, Wiring and Conduits

**Impregnated Wooden Poles.**—BASILIUS MALENKOVIE.—If the "antiseptic force" of an impregnated wooden pole is plotted as abscissa and the mean life as ordinate, the curve is a hyperbola. Not only with tar oil but also with impregnating materials soluble in water a life up to twenty-five years may be obtained if use is made of sufficient quantities of stable antiseptics which do not leach out or evaporate.—*Elek. Zeit.*, April 17, 1913.

## Electrophysics and Magnetism

**Magnetostriction.**—S. R. WILLIAMS.—An abstract of an American Physical Society paper on a comparative study of the Joule and Wiedemann magnetostrictive effects in nickel rods. A photographic method employed in a former work on these effects in iron was applied to a study of the

same effects in two nickel rods. Conditions were found under which nickel behaved as iron for the Joule effect, namely, an initial lengthening for small field strengths and a contraction for strong. Other investigators have found only a decrease in length for all field strengths. Maxwell described the Wiedemann effect as a special case of the Joule effect. One difference seems to have been overlooked by him and others, namely, that in the Wiedemann effect the direction of the resultant magnetization changes as the longitudinal field is increased, whereas in the Joule effect it remains unchanged. This change in direction of the resultant magnetic field in the Wiedemann effect is apparently one of the causes why the maximum twist for iron occurs at lower field strengths than does the maximum elongation for iron in the Joule effect. The behavior of these two nickel rods points to a crystalline aggregation of the elementary magnets which mechanical stresses may alter and so affect the two phenomena studied.—*Phys. Revue*, March, 1913.

Electrochemistry and Batteries

**Furnace Electrodes.**—G. B. BARIHAM.—An article on electrodes for electric furnaces dealing briefly with materials for electrodes, the dimensioning of electrodes, and terminal connections. The best material for electrodes from the point of view of conductivity is graphite. Common coke as obtainable at any gas works is quite suitable for electrodes in the majority of circumstances and has the advantage of costing little. A good material for low-tension work is made of a mixture of 25 per cent of gas coke and 75 per cent of petroleum coke. The only other constituent for the best quality of electrodes is pitch, obtained from the distillation of tar.—*London Elec. Review*, April 8, 1913.

Units, Measurements and Instruments

**Alternating-Current Generator for Telephone Current Tests.**—A. EBLING.—An illustrated description of an improved form of an alternating-current generator designed

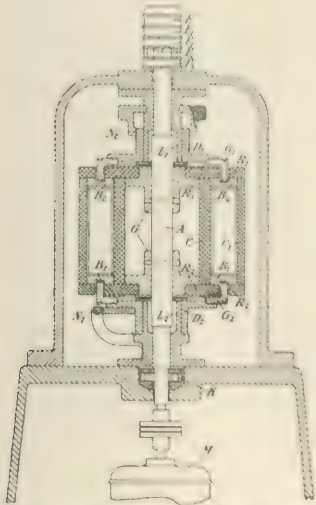


FIG. 2—CROSS SECTION THROUGH THE MACHINE

by A. Franke for use in tests with telephone currents. The generator has two armatures, electrically independent of each other, which contain the windings in which the alternating current is induced. The emf in the two armatures is produced by a rotating periodic magnetic field which is excited from the outside. Fig. 2 shows a section through the generator. The rotor consists of two coaxial cast iron

cylinders  $C, C_1$  which are connected by the bronze disks  $B, B_1$ . There are two pole rings  $R, R_1$  and  $R', R'_1$ , their form being as shown in Fig. 3. Both rings have the same number of teeth (magnetic poles), the outer being exactly opposite the inner ones. The angular hollow space between the two iron cylinders  $C, C_1$  and the bronze disks  $B$  and  $B_1$  contains a solenoid through which passes

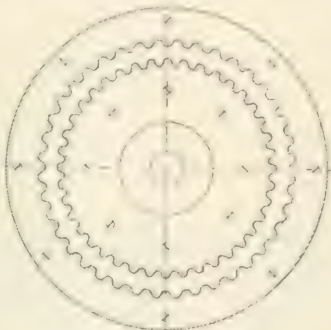


FIG. 3—POLE RINGS

the exciting current which magnetizes the hollow cylinders with the toothed pole rings. The magnetic field thus produced between the pole rings  $R, R_1, R', R'_1$  is not homogeneous and is equivalent to the sum of two magnetic fields, one being constant all around the circumference and the other being periodic, the number of periods corresponding to the number  $n$  of the teeth. Into this rotating magnetic field two stationary armature rings  $G$  and  $G_1$ , made of insulating material, are placed, the form of which is shown in Fig. 4. The armature  $G$  is placed between  $R$  and  $R_1$  while  $G_1$  is placed between  $R'$  and  $R'_1$ . The two armature rings have  $2n$  slots on their inner surfaces. The slots contain the zigzag formed armature windings as shown in Fig. 4. The rotating field acts only on the parts of the windings which are parallel to the axis of rotation. All the two partial magnetic fields into which the total magnetic field can be resolved as shown above, the action of the constant partial field is zero on account of the opposite direction of two parts of the winding in winding slots, while the periodic magnetic field produces in each part of the winding a periodic emf and the emfs produced in two neighbor-

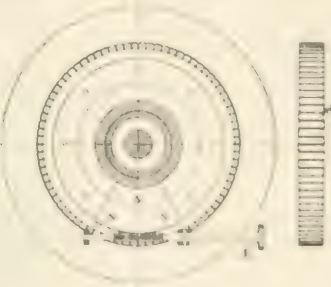


FIG. 4—ARMATURE

ing slots differ in phase by one half period. Since two such parts of the winding have opposite direction, the induced emfs are added together, giving a periodic emf with a frequency  $n$  times that of the speed of the rotor, since during one revolution each part of the winding passes  $n$  times through the maximum of the magnetic field. The armatures are provided with several sliding contact rings



be connected in different ways. The armature  $G_2$  is supported by a bronze piece which is immovable in the direction of the axle of the rotor but may be turned around the axle through an angle which can be measured. If, for instance, the armature  $G_1$  is turned by  $\frac{1}{2}n$  of a total revolution, a phase difference of 180 deg. is produced in the emf induced in  $G_1$  against that in  $G_2$ . In order to be able to produce and measure in this way any phase difference, the bronze piece just mentioned is mounted on the sector of a tooth wheel which can be turned by means of the endless screw as shown in Fig. 4. On the other hand, the armature  $G_1$  cannot be turned around the axle, but can be displaced in the direction of the axle by means of the screw  $D_1$  so that it can be drawn out of the magnetic field whereby the amplitude of the emf induced in it is reduced. The author describes the method of measurement, the testing and calibration of the machine and describes some recent improvements in the design.—*Elek. Zeit.*, April 17, 1913.

### Telegraphy, Telephony and Signals

**Submarine Cable Signaling.**—H. W. MALCOLM.—The conclusion of his illustrated paper dealing with a quantitative test of the relative merits of different methods of signaling in submarine cables in which a standard word is supposed sent through a representative cable and its shape as received is calculated. The methods of signaling considered are: (a) siphon recorder code, (b) ordinary Morse code, (c) the Gott form of Morse, and (d) the Picard form of Morse. The shape of the received word is illustrated graphically, and the effect of various modifications in the sending conditions is discussed. The author concludes that the Gott method is superior to ordinary Morse and to siphon recorder code for the non-cross letters. In the case of the cross letters it offers no advantage over, or is even inferior to, siphon recorder code, and inasmuch as a dash is of greater duration than a dot, it is necessarily slower than siphon recorder code when read by an instrument of variable zero, whether relay or recorder. It appears, moreover, that the method could be improved if each letter were to have its theoretically best shape. Thus, in the case of three successive like signals the first would be slightly shortened and the second lengthened, so as to compensate for the distortion introduced in transmission and make the issuing signals of equal length and of equal spacing. This would probably necessitate automatic transmission, the letters being punched out to their proper shape on the tape and sent through a form of transmitter in which the contacts are under control. These and other modifications which suggest themselves naturally are applicable also to the other methods of signaling.—*London Electrician*, April 18, 1913.

**Telephone Lightning Protectors.**—A note on a recent British patent (No. 16,708, 1912) of the British Thomson-Houston Company and the General Electric Company of this country. "Metal and oxidized non-metal blocks are arranged alternately, separated by spark gaps. Alternately oxidized metal blocks and refractory blocks may be used. Aluminum and graphite are proposed."—*London Elec. Eng'g*, April 17, 1913.

**Electric Transmission of Movement of the Rudder.**—CHR. KRAEMER.—An illustrated description of a new electric transmission system for controlling the movement of the rudder from the bridge. With the aid of a transmitter the excitation of the starting dynamo is changed while the receiver which is connected with the driving motor reduces the excitation again to zero value after a certain number of revolutions.—*Elek. Zeit.*, April 17, 1913.

### Miscellaneous

**Involute Spur Gears.**—A SCHEIN.—An illustrated article giving a comparison of numerical and graphical methods for the design of involute spur gears. The author shows clearly the use of charts in lessening the labor involved in gearing calculations.—*Gen. Elec. Rev.*, April, 1913.

**Testing of Apparatus.**—A continuation of the serial on shop testing of electrical apparatus, outlining general tests of direct-current machines. The present instalment deals with the setting of brushes and brush holders, examination of the commutator, polarity tests, adjustment of the position of the brushes, resistance tests, friction and core losses.—*Elec. Jour.*, April, 1913.

**Protection of Buildings from Lightning.**—E. W. KELLOGG.—An illustrated pamphlet of fifty-five pages on the use of metal conductors to protect buildings from lightning. After a history of the development of the use of lightning rods the author explains some elementary facts of electricity in connection with lightning, discusses lightning rods as insurance and the best arrangement of conductors, and concludes with some notes on other protective methods, and on resuscitation.—*Univ. of Missouri Bulletin*, No. 7. (Eng. Exp. Station, Vol. III, No. 1).

## Book Reviews

**ANNUAIRE POUR L'AN 1913.** Publié par le Bureau des Longitudes. Avec des notices scientifiques. Paris: Gauthier-Villars. Price, 1.5 francs.

This invaluable little pink yearbook of official scientific France is always welcome. Its first issue was in 1796—so that it is over a century old. It has grown with age and experience until it has escaped the limitations of a single volume, and it is now virtually published biennially in two annual parts, the regular calendrical portions running through both parts but the remaining sections appearing in alternate years. This year we have the geographical, statistical and meteorological sections to the exclusion of the physical and chemical. The appendices, which always possess special interest, relate in this case to the solar eclipse of April 17, 1912, the use of wireless telegraphy in disseminating legal time from the Eiffel tower, and the obsequies of M. Radau. There is perhaps no publication which offers so much national scientific information officially at a less cost than the *Annuaire*.

**WECHSELSTROM-ARBEITSDIAGRAMME.** By Emil Waltz. Berlin: Hermann Meusser. 940 pages, 255 illus., 31 tables. Price, 24 marks.

This suggestive work treats in the most thorough and erudite manner of the vector diagrams of alternating-current circuits and devices. The work is replete with exhaustive geometric figures so complex and involved that it will prove an excellent means of testing one's knowledge of alternating-current phenomena to work through these chapters and to endeavor to comprehend the methods employed in this work. It would seem that the author lost sight of the fact, so clearly enunciated by Professor Hertz in his early papers on electric waves, that it does not do to measure in micro-millimeters the distance between chalk marks. Likewise it does not do to apply the utmost fineness and nicety of geometrical analysis to the problem of alternating-current devices, unless this process is used with a distinct and clear understanding that it is rather a sort of mathematical or geometrical rope-dancing than an attempt at a physical understanding of the phenomena. With this clearly in mind, the book will prove useful to those who already know the subject and like to exercise by going through complicated processes, not so much for the sake of understanding the principles as for the sake of the sport gained from difficult geometric analysis. Perhaps the author would have served his readers better if he had kept from becoming too much imbued with the fascination of his diagrams. The book is worth studying by all those who enjoy testing their knowledge.

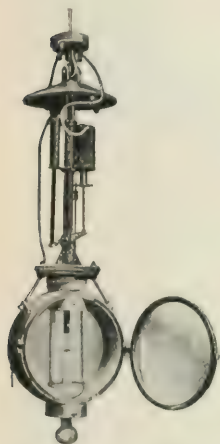
# New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

## High-Efficiency Arc Lamp

The new Jandus arc lamp is characterized by the use of an improved method for preventing a deposit of material from the arc upon the inside of the inclosing glass.

The mechanism of the lamp is quite simple and it uses the familiar washer grip. The electrodes are surrounded by a glass cylinder or chimney, and this in turn is held in an outer part consisting of a metal ring piece with concave glasses on each side, one of which is hinged. The ring piece is made so as to form a hollow or annular chamber, which in connection with the glass chimney at the top and bottom allows the air to circulate between the chimney and the annular chamber. Owing to the differences in temperature the vapors from the arc will circulate through the annular chamber, depositing all suspended matter upon the cold metal walls of this chamber. The latter is protected inside by a non-oxidizing coating so



INTERIOR OF ARC LAMP

that the metal is not attacked by corrosion.

A 375-watt lamp of the new Jandus type is said to give 2000 cp at a 10-deg. angle over the horizontal. With the improved mineral electrodes the consumption is from 0.2 watt to 0.25 watt per candle. The electrodes last from 70 hours to 100 hours. Each time the electrodes are renewed the chimney needs to be cleaned, but in practice this is easily done by fitting in a clean chimney when trimming the lamp, and the old one is afterward cleaned at the shop. For street lighting it is recommended to use the lamp for covering 330 ft. length and 30 ft. width, and in such case it is claimed to be the most economical lamp developed for city use.

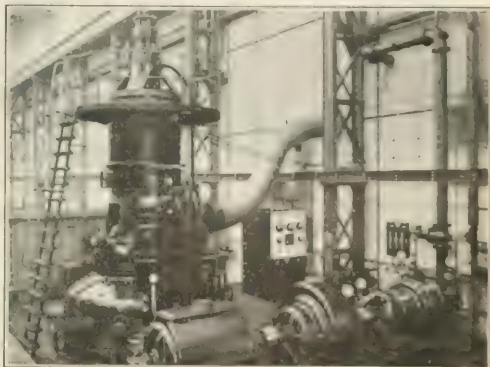
## Internal-Combustion Turbo-Generator

From time to time the question has come up of designing a gas turbine which will utilize internal combustion of gas to produce a direct rotary movement. Recently a turbine has been designed and constructed by a German engineer, H. Holzwarth, of Mannheim, and this unit, which is shown in the illustration, is said to operate very satisfactorily. The unit is a combined gas turbine and generator, of vertical type, with the turbine in the enlarged base portion and the generator at the top.

The principal difficulty with an internal combustion turbine lies in the heating of the gas chambers under the effect of the explosions. Mr. Holzwarth overcomes this difficulty by using a number of explosion chambers which come into action in turn, so that each of them has a certain cooling period. In this way he claims to be able to use the internal-combustion principle with great security and with economical fuel consumption. The efficiency of the turbine

is said to be greater than that one obtained with the gas engine.

To carry out the design the inventor provides a number of explosion chambers around the periphery of the turbine, and these open into the central portion occupied by the rotating wheel with blades. The explosions produce the rotation of the wheel in a manner analogous to that in a



INTERNAL-COMBUSTION TURBO-GENERATOR

steam turbine. The turbine operates with any kind of motor gas or with an oil engine. The unit shown in the illustration is rated at 500 hp and is said to operate in a plant in Germany. The machinery is too large to send to for air delivery and exhaust. The weight of a gas turbine of this kind is said to equal only one-fourth of that of a gas engine of the same rating.

## Large Automatic Controller

Electric Control Limited, of Brighton, Sussex, England, recently made a large automatic controller for starting and stopping a pump. With this pump as motor is twice a minute it is necessary. The pump is driven by two 300-hp induction motors supplied with three phase energy at 440 volts. The motors are driven in series to the ends of the pump shaft with starter and time relays being connected in parallel. The voltage between the terminals is approximately the same as that applied to the motor, the starting current in both circuits being 600 amp and the full-load current 75 amp.

The controller consists of two electromechanical relays, the starter circuit and the stop circuit, which are cutting out the motor resistance time giving the starting current, the time interval between each stop being adjusted by means of vacuum discolor.

The interesting feature of the general design is the fact that each switch out of the pump is connected to the same, although the motor supply, the intermediate motor relays and the distributing main switch are all of different ratings. This results in considerable saving in space in parallel the two poles of a double-pole switch of varying capacity rating. This saving is due to a single pole switch



of 1000 amp. Three of these switches are used to form the triple-pole stator switch and two to form the last rotor switch. The five switches on the top half of the panel thus form one triple-pole and one double-pole, 1000-amp switch, and the remaining switches on the bottom half of panel each form a 500-amp double-pole switch, which is more than ample for the short time they are in circuit. Each

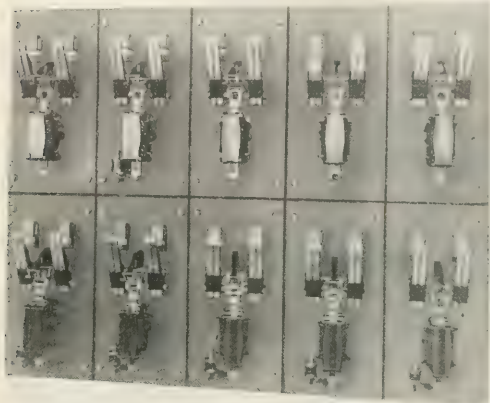


FIG. 1—FRONT VIEW OF AUTOMATIC CONTROL BOARD

switch is assembled on a 2-in. slate panel mounted on a heavy angle-iron frame.

The switch levers are fitted with laminated copper brushes and with auxiliary and main sparking tips. The main sparking tip is a solid copper finger making contact on a large carbon block. The magnets are operated by single-phase current from the main supply. When energized they close the switches through a toggle mechanism, which is so designed that the magnet plunger is free of the mechanism in the "up" position, and thus it is impossible for any vibration to be produced at the switch contacts, which is an essential feature in alternating-current solenoid switches.

The controller itself is governed by means of a tappet switch operated by two tappets on the water reservoir. When the water falls to its lowest level the tappet switch is closed by one of the tappets. This closes the solenoid circuits of the three switches which form the stator switch. These immediately close and thus start up the motors with all the resistance in the rotor circuits, the other switches following in succession with a sufficient interval of time between each. When the short-circuiting rotor switch

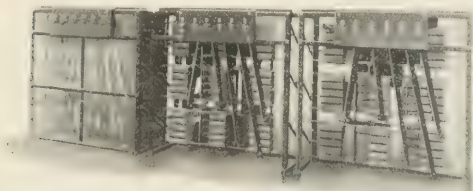


FIG. 2—REAR OF RESISTOR PANELS

closes, the intermediate switches automatically open, and the motor runs at full speed with the stator and the rotor switches closed. When the water rises to its highest level the tappet switch is tripped open and this action opens the controller and thereby stops the motors, the main circuit always being broken on the stator switch.

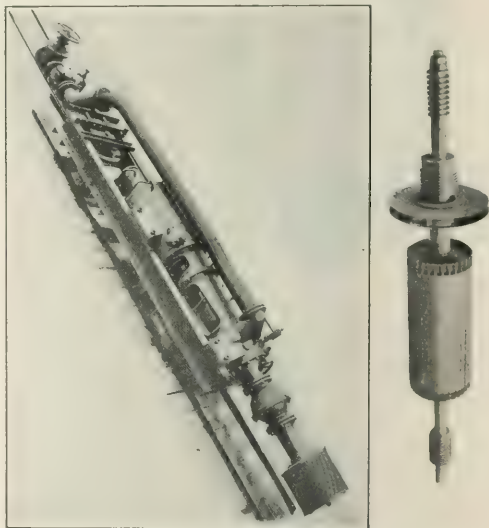
The tappet switch is totally inclosed and weather-proof.

It has no sliding contacts, but is fitted with copper-to-carbon normal contacts with a quick make-and-break action.

A considerable amount of resistance is required for this controller. The resistors are built up on three separate angle-iron frames. Each set is fitted with a slate panel with terminals and cable sockets so that the connections between the resistance terminals and the terminals on the controller panel can be easily and quickly made.

### Alternating-Current Motors for Pumps and Blowers

A new type of non-synchronous motor has been brought out by the Oerlikon company of Switzerland for use on single-phase and polyphase circuits. This type is used for large ratings and at speeds above 1000 r.p.m. and is employed for driving pumps or blowers. For this purpose the diameter of the motor is reduced as much as possible. Such motors are made generally with end-plate bearings and a short-circuited armature for speeds between 1450 r.p.m. and 3000 r.p.m. A partly inclosed motor is shown in Fig. 3. Another similar type has ventilating holes in



FIGS. 1 AND 2—MOTOR WITH SHAFT INCLINED AT 50 DEG. FROM THE HORIZONTAL, AND THE ROTOR

the outer casting. Laminated iron, separated by air spaces, is used in the stator. The winding consists of copper bars or wires, laid in half-inclosed slots and well insulated. The rotor is normally a short-circuited armature for all sizes, base copper bars laid in slots being soldered at each end to a copper ring by silver solder.

Another type of rotor with collector rings is also made, and this is fitted with a device for simultaneously short-circuiting the armature and raising the brushes. The short-circuit is carried out by the use of a collar with projecting contacts which are brought under the collector rings, and the brush-raising device works by the operation of a hand wheel mounted directly on the motor. Generally the outer casting with holes is employed for the motors, but another form is designed for use with pumps, so as to be protected from dropping or splashing of water. Such motors are made in ratings up to 800 hp, above which size they are built with separate upright bearing castings bolted on to a foundation plate.

A type of motor shown in Fig. 1 is designed for vertical shafts and for use in inclined positions and is intended for



pumping plants with direct coupling to the pump. This installation employs a three-phase motor entirely inclosed on an incline of 50 deg. It is rated at 125 hp and operates on a 400-volt circuit at 2920 r.p.m., being coupled directly to a Sulzer rotary pump. In this type of motor the body is entirely closed and a water-jacket is used for cooling. The armature shown in Fig. 2 is provided with a short-

Appliance Company, Sargent Electric Company, Hurley Machine Company, Economy Fuse & Manufacturing Company, Otto Electric Company, Westinghouse Electric Company, Metropolitan Engineering Company, Century Electric Company, Pyralis Electric Company, Chicago Lamp Manufacturing Company, Adams-Bagnall Electric Company, American Electric Manufacturing Company, Hubbard &...



FIG. 3—PARTLY INCLOSED 500-HP. THREE-PHASE MOTOR

circuited bar winding. Grooved bearings are employed in this case, and the oil is raised by the screw thread seen on the end of the shaft and from there forced through the shaft to the bearings.

### Exhibitors at N. E. L. A. Chicago Convention

The exhibition committee of the National Electric Light Association has allotted locations to the various concerns that have thus far completed arrangements with it for space in the Medina Temple in Chicago, where the convention will be held from June 2 to June 6 inclusive. In addition to the regular exhibits the Commercial Section will have an office and reception room in the exhibition hall, the meter committee will have an exhibit on the main floor, and it is hoped that it may be possible to locate the transportation committee also in the exhibition hall.

The exhibit hall has space for sixty-eight booths and the exhibition committee obligates itself to provide signs, railings, decorations, service outlet for electrical connection, telephone, etc., for each booth, and has made arrangements with local firms for labor of all kinds, floral decorations, rugs, furniture, etc. The list of exhibitors thus far includes the following: Thompson Electric Company, Benjamin Electric Company, Hughes Electric Heating Company, G. & W. Electric Specialty Company, Electric Storage Battery Company, Duncan Electric Manufacturing Company, Simplex Electric Heating Company, engineering department National Quality Lamp Division of General Electric Company, Federal Sign System (Electric), Western Electric Company, Economical Electric Lamp Works of General Electric Company, Hotpoint Electric Heating Company, Inc., Tungstolier Works of General Electric Company, Pittsburgh Transformer Company, Weston Electrical Instrument Company, Oshkosh Manufacturing Company, Philadelphia Electrical & Manufacturing Company, Electrical Review Publishing Company, Eureka Vacuum Cleaner Company, *Electrical World*, Mineralac Electric Company, Duplex Metals Company, W. N. Matthews & Brother, Southern Exchange Company, John A. Roebeling's Sons Company, H. W. Johns-Manville Company, Standard Underground Cable Company, Maloney Electric Company, Edison Storage Battery Company, William D. McJunkin Advertising Agency, Electric Vehicle Association of America, Wagner Electric Manufacturing Company, General Electric Company, General Vehicle Company, Electric

### Compact Therapeutic Device

Working on the theory that extremely high oscillations in connection with the generation of ozone are useful therapeutic agents, the Rogers Electric Laboratories Company.



CONTACT VIOLET LIGHT GENERATOR

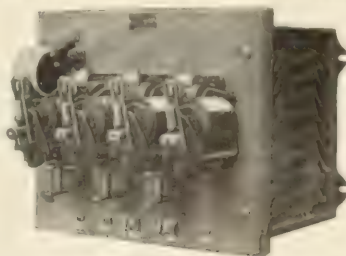
of Cleveland, has developed what it styles a portable violet-ray generator which consumes about 25 watts. The apparatus is very compact, being of about the size of a telephone receiver, and weighs only 2.5 lb. It consists of a plug which will fit any electric lamp socket, a high-frequency generator and a receptacle for holding the electrodes used in treating any affected part of the body.

Electricity at high frequency developed in the generator is delivered through a cord to the hand-holder receptacle which holds the electrode used in treating a patient. By adjusting a screw on the generator the desired amount of energy is developed at the electrode, which is a highly exhausted glass tube.

The generator will operate on either direct or alternating current. The standard sizes are designed for 120 volts, although special sizes are made for other voltages.

### Push-Button-Operated Motor Controllers

The Cutler-Hammer Manufacturing Company, Milwaukee, has added a number of new types to its automatic controller line, one of which is shown in the accompanying illustration. This type of series relay controller can be used with push-button switches placed where convenient to the operator. The resistance in the motor circuit is automatically cut out and the motor accelerated, the starting current being kept at all times below a safe value. The magnetic



SERIES RELAY MAGNETIC SWITCH

switches close the circuit, controlled by the motor current through relays. These relays act to minimize the motor starting water light loss, the water meter being lead the controller to start the motor slowly. In all cases the operator is relieved of stress by the mechanism so that the motor is made to start by means of the push-button.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**New England Telephone & Telegraph Plans New Construction.**—Appropriations for 1913 made by the New England Telephone & Telegraph Company include \$4,500,000 for new construction and real estate and \$5,700,000 for repairs and depreciation.

**More Space for Reading Electric Company.**—The Reading Electric Company, electrical supply jobber, is erecting a four-story building at 503 Penn Street, Reading, Pa. In addition to the latest improvements, the new building will have a large chandelier showroom, 28 ft. x 100 ft.

**Pittsburgh Jobber Adds New Lines.**—The Union Electric Company, Pittsburgh, was recently appointed distributing agent for Sherwin Williams insulating paints and varnishes and is now carrying a complete stock of these. It has also been appointed agent in the Pittsburgh territory for the Erickson Manufacturing Company, Buffalo, N. Y.

**Larger Manufacturing Facilities for Electric Cable Company.**—Work has been finished upon a large four-story addition to the plant of the Electric Cable Company, Bridgeport, Conn. The new building has been laid out with a view to promoting economy and efficiency in manufacturing rubbered-covered wires and cable and will enable the company to double its output.

**Instrument and Meter Trade Not Affected by Tariff Changes.**—Various prominent instrument and meter manufacturers recently interviewed have stated that business in their line continues normal and gives no sign of decreasing. The following statement in a letter from the Bristol Company, of Waterbury, Conn., seems to give a good summary of the general opinion on the question: "Our shipments and orders for recording instruments of various classes are holding up to our usual standard, in spite of the talk of tariff change."

**Many Blower Installations in California.**—The American Blower Company, through its San Francisco office, recently closed a number of contracts covering the installation of its equipment in California. The list includes blowers for high schools in Oakland, several factories and office buildings in San Francisco, the Museum of History, Los Angeles; the Pasadena Bank Building, Pasadena; a pre-cooling plant for the Sebastopol Berry Growers, Inc., Sebastopol; a forced draft plant in the city of Palo Alto for use with an incinerator, and blowers for a large building in Fresno.

**Conditions in Electrical Supply Manufacturing Business Excellent.**—The Trumbull Electric Manufacturing Company, Plainville, Conn., manufacturer of electrical supplies, says that present conditions are excellent in its line of business. The company's sales for the first quarter of this year were materially ahead of those in the corresponding period of 1912, and the factory is being run overtime now and then in various departments. Sales to the Chicago territory and in States along the Mississippi River have been very heavy recently. The company looks for depression in general business if the proposed changes in the tariff are adopted and is not going to take up any plans for building until the outlook becomes more definite.

**Southern Printing Plant to Have Individual Drive.**—One of the most noteworthy installations of electrical equipment for industrial purposes in Memphis, Tenn., is nearing completion. This consists of fifty-one motors and a motor-generator set which are being installed by S. C. Toof & Company in their new printing, binding and lithographing plant. Individual drive will be used throughout the plant, which is to be modern in every respect. The motors will be furnished by the Sprague Electric Works and all will be 200-volts, direct current. F. G. Proutt was consulting engineer to the Toof company in connection with

the new plant and the installation of the electrical equipment is being done by the Electric Novelty Company, contractor, of Memphis. When completed the plant will be the largest using individual motor drive in Memphis or nearby communities.

**Gas-Engine Sales.**—Recent contracts placed with the Bruce-Macbeth Engine Company, Cleveland, include a sixth repeat order from the Willard Storage Battery Company, of the same city, for a 150-hp engine. Other recent orders are as follows: From the Sydenham Glass Company, Wallace, Ont., for a 350-hp four-cylinder vertical-type engine for driving a 60-cycle, three-phase alternator; from the Diamond Flint Glass Company, Redcliffe, Alberta, for two 150-hp engines for a new glass factory. Another order was for a four-cylinder, 100-hp engine to run on producer gas and drive a generator. This unit will be installed in a new factory in Detroit for the Ross & Young Machine Company.

**Electrically Driven Refrigerating Plant Installation.**—A 5-ton electrically driven refrigerating plant is being installed in the restaurant of John Healy at 145th Street and Broadway, New York City, by Halbert P. Hill, Inc., 30 Church Street, New York. The equipment is designed to take care of all the ice boxes and produce in addition 1000 lb. of ice per day. The Hill concern is also supplying a 200-hp motor to drive the 70-ton ice plant of the Brooklyn Hygeia Ice Company at Forty-fifth Street and Rutland Road, Brooklyn. The Brooklyn Edison circuits furnish the energy for this installation, and it is estimated that the energy consumption will be 50 kw-hr. per ton of ice produced, which at the new rates for energy will amount to 90 cents per ton.

**Traffic in Insulators Very Promising.**—The following abstract from a letter written by one of the largest manufacturers of porcelain insulators illustrates the prevalent optimistic view that is taken regarding the impending tariff changes: "The proposed tariff reduction on porcelain may in some minor instances affect our business, but, generally speaking, we consider that it will not influence the major part of the business, for the reason that this part consists of an important product purchased upon quality not price. The development of this product has proceeded to a point where the United States is on an even footing with the best European practice, almost ignoring the tariff. We firmly believe that the United States product will soon far surpass the European. It is an interesting sidelight on the question of European versus American development to note that we are literally 'carrying coals to Newcastle' by sending insulators, in carload lots, for voltages as high as 60,000 to Italy, a stronghold of the finest ceramic product."

**Electric-Heating Appliances in Demand.**—"As far as our company is concerned, demand for electric-heating appliances continues to be very brisk," said Roger Williams, of the Simplex Electric Heating Company, this week. "Our sales thus far in 1913," he continued, "are 27.5 per cent ahead of those in any other year in the history of the company. One interesting feature of the business is the constantly increasing number of inquiries which we are receiving from industrial companies, not only about the devices already on the market, but asking if we can make heating appliances to be used in entirely new fields. At the present time irons and toasters are selling well, and orders for electric ranges are numerous. Two carloads, aggregating 250 ranges, were shipped recently by the factory on one order from the West. Another electric-heating appliance which is attracting attention is the ether stove used in milk analysis, such as those we installed at the Health Department laboratories in the Willard Parker Hospital, New York. As milk-testing lab-







**Will Build New Station in Ohio.**—The United Service Company, of Scranton, Pa., which operates gas and electric properties in Ohio, Indiana and Pennsylvania, is planning to erect a 7000-hp generating station at Coshocton, Ohio.

**Columbus Railway & Light Merger.**—The Ohio Public Service Commission has approved the application of the Columbus Railway, Power & Light Company to issue \$10,184,200 of its stock to exchange for underlying stocks of the Columbus Railway & Light Company.

**Power Equipment Sales.**—Calvin H. Currier, 141 Milk Street, Boston, reports the sale of a complete steam and electrical plant to the Fellsmere Electric Light & Ice Company, and also the sale of two 250-kva direct-connected Kerr turbo-generator sets consisting of one high-pressure and one low-pressure unit.

**Wheeler Manufacturing Company Enlarging Its Plant.**—Owing to the rapid increase in the sale of its products, the C. H. Wheeler Manufacturing Company, Philadelphia, is making extensive enlargements and improvements to its works. The capital stock of this company has been increased from \$200,000 to \$600,000.

**Cornell University to Install Waterwheel.**—The I. P. Morris Company, Philadelphia, has received an order from Cornell University for a 550-hp waterwheel unit. This will operate at 600 r.p.m. under a head of 142 ft. and will be of the cast-iron scroll-case type with single discharge and horizontal shaft. It will be installed at the power station of the university, where it will be available for testing work by the engineering students.

**American Gas & Electric Making Good Showing.**—Although the recent floods in the Middle West caused considerable damage in the districts furnished with electric service by subsidiaries of the American Gas & Electric Company, the latter's earnings last month were far ahead of those in the corresponding period last year. Two contracts aggregating 4500 kw have just been taken by the Canton (Ohio) Electric Company. Both of these are for twenty-four-hour service.

**Changes in Mexican Northern Power Company Plans and Personnel.**—Owing to the unsettled conditions in Mexico, the Mexican Northern Power Company has experienced a number of delays in completing its large hydroelectric station on the Rio Conchos, in the State of Chihuahua, Northern Mexico. According to the original plans, the plant was to have been in operation by the end of 1912, but it was found it would not be able to deliver energy until June of this year. It is now said that it will be October before the plant is placed in operation. Several changes were made recently in the personnel of the company. G. F. Greenwood, former president of the company, and E. B. Greenfield, former vice-president, have retired from the board of directors, and Lawrence McFarland, representing Canadian interests, and W. W. Freeman, vice-president and general manager of the Alabama Traction, Light & Power Company, Ltd., have taken their places. D. E. Thompson, of Toronto, has been made president and A. E. Ames vice-president. The office of the company is at Montreal, Que.

**Large Waterwheel for Pacific Gas & Electric Company.**—The Pacific Gas & Electric Company, San Francisco, in connection with its large hydroelectric developments in California, has contracted with the Pelton Water Wheel Company to build a 20,000-hp single-discharge Pelton-Francis turbine to operate under 493-ft. head and to be direct-connected to a 12,500-kva generator rotating at 360 r.p.m. The turbine unit will probably be the largest of its particular type yet built, because of the fact that the entire water quantity is discharged through a single draft tube. The turbine inlet is 72 in. and the cast-steel spiral casing will weigh about 40 tons. Speed regulation is obtained from a special Pelton direct-motion, oil-pressure governor connected to the wicket gates. The Francis runner will be built of bronze and cast steel and is provided with a special balancing feature which, when the vacuum has been established, practically eliminates all duty of the mechanical thrust bearing. The relief valve, which is attached direct to the turbine casing, is controlled by means of the governor. It is of the mechanically operated type and does not depend upon a pressure rise to render it operative. Because of the

long pipe line and the unfavorable accelerating and retardation conditions, the relief valve is designed to discharge the total water quantity, equivalent to 20,000 hp, but it is also equipped with a slow-closing feature involving some new principles by means of which water economy may be obtained. The cycle of operation involves the opening of the relief valve to discharge the entire water quantity with a load rejection, then slowly closing to effect water economy. This turbine equipment is one of a chain of power houses forming the Pacific company's Drum development, and will work in parallel with a Pelton tangential plant, four units of which are now under course of construction. This tangential plant develops 40,000 kw at 80 per cent power-factor, but the waterwheels are capable of developing 67,500 hp. The south fork of the Yuba River, California, is the source of supply for the tangential plant and the tailwater passes on down to the turbine plant. Additional developments will be made as the power market warrants.

**Dayton Manufacturer Reports Quick Recovery from Floods.**—The Platt Iron Works Company, Dayton, Ohio, manufacturer of waterwheels, air compressors, feed-water heaters, pumps, etc., has issued the following statement regarding the extent of damage to its plant in the recent floods: "As exaggerated reports have been circulated concerning the damage done to our plant by the recent flood, we wish to hand you the following authentic information: While it is true we have suffered considerable damage, our buildings were practically uninjured and we have recovered more quickly than we anticipated. The second day after the water subsided we had steam up and our service and fire pumps were put in operation, and the work of removing the mud and debris was started. Our entire organization responded most loyally toward getting the plant in operation, irrespective of the fact that many of them suffered personal loss due to the flood. A small portion of our plant was put in operation April 7, but owing to the fact that a large number of our machine tools are equipped with individual motor drives we were obliged to bake and clean these motors and did not start up in all departments until April 21. We are now prepared to accept and fill all orders promptly."

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent.	Period	April 30	May 7
Allis-Chalmers, t.r., 4th pd.	\$17,196,000	.....	.....	4½	5
Allis-Chal., pf., t.r., 4th pd.	14,168,000	.....	.....	11½	13
Amalgamated Copper.....	153,887,000	13	Q	71½	75
American Tel. & Tel.....	344,471,400	2	Q	128½	128½
Electric Storage Battery, c.	16,074,425	1	Q	47½	48
General Electric.....	101,307,200	2	Q	137½	138½
MacKay Cos., c.....	41,360,400	1½	Q	83½	82½
Western Union Tel.....	99,747,200	3	Q	64½	65
Westinghouse, E. & M., c.	34,283,550	1	Q	61	61
Westinghouse, E. & M., pf.	3,998,700	1½	Q	117½	114½*

\*Last price quoted.

## NEW YORK METAL MARKET PRICES.

	April 29		May 6	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot .....	14.75	to 15.25	15.00	to 15.50
London, standard, spot.....	62	to 66	69	to 70
Prime Lake .....	15.60	to 15.70	15.65	to 15.75
Electrolytic .....	15.45	to 15.55	15.55	to 15.65
Casting .....	15.30	to 15.40	15.40	to 15.50
Copper wire, base .....	16.75	to 17.00	16.75	to 17.00
Lead .....	4.50	to 4.50	4.35	to 4.50
Nickel .....	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter .....	7.75	to 5.70	7.75	to 5.65
Spelter, spot .....	5.60	to 5.70	5.55	to 5.65
Tin, spot .....	49.50	to 50.10	50.10	to 50.10
Aluminum:				
Prompt delivery .....	26.25	to 26.75	26.25	to 26.75
Future .....	26.25	to 26.75	26.25	to 26.75
OLD METALS.				
Heavy copper and wire .....	14.50	to 14.50	14.50	to 14.50
Brass, heavy .....	9.37½	to 9.37½	9.37½	to 9.37½
Brass, light .....	8.25	to 8.25	8.25	to 8.25
Lead, heavy .....	4.25	to 4.25	4.25	to 4.25
Zinc, scrap .....	4.87½	to 4.87½	4.87½	to 4.87½

## COPPER EXPORTS IN MAY.

Total tons to May 7 .....

8,041

## Personal

**Mr. John C. Greenway** is the new manager of the Calumet and Arizona Mining Company's power plant at Babco, Ariz.

**Mr. W. A. McClellan** has succeeded Mr. W. M. Ayres as superintendent of the Municipal Electric Light Plant at Abbeville, Ala.

**Mr. C. N. Wiley** has been appointed manager and contract agent for the Atlantic & Gulf Portland Cement Company, of Ragland, Ala.

**Mr. A. C. Ramsey** has been appointed contract agent of the Municipal Electric, Water & Light Plant at Carbon Hill, Ala., succeeding Mr. A. P. Smith.

**Mr. Ira Blalock** has resigned as manager of the Gainesville (Fla.) Gas & Electric Power Company. His successor is Mr. J. Wright Reeves, formerly of Atlanta, Ga.

**Dr. A. E. Kennelly**, of Harvard University, has been appointed an honorary corresponding member of the British Association for the Advancement of Science.

**Mr. Ralph W. E. Donges**, Camden, N. J., recently appointed a member of the Board of Public Utility Commissioners, has been elected president of the board.

**Mr. J. M. McNeilly** has been appointed superintendent of the meter department of the Toronto (Ont.) Hydro-Electric System, succeeding Mr. I. M. R. Waldfield, resigned.

**Mr. W. G. Eager** is the new general manager of the Valdosta (Ga.) Lighting Company, of which Mr. H. T. Hartman is the recently elected president, succeeding Mr. G. W. Varn.

**Mr. Bernard Drake**, of Drake & Gorham, Ltd., London, England, is visiting this country in the interests of his company. Mr. Drake is a member of the (British) Institution of Electrical Engineers.

**Mr. J. T. Bateman** has become associated with the Clarendon Electric Light & Ice Company, of Clarendon, Ark., as manager and contract agent, succeeding Mr. Jay Wheelock, who is now vice-president.

**Mr. George Locke**, formerly connected with the Denver (Col.) Gas & Electric Light Company, has signed a contract to act as commercial manager of the Honolulu Gas & Electric Company, of Honolulu, Hawaii.

**Mr. George B. Esterley**, formerly connected with the Edison Electric Illuminating Company of Boston, has been appointed chief engineer of the Rodondo plant of the Pacific Gas & Electric Company at Rodondo Beach, Cal.

**Mr. Frank W. Smith**, vice-president of the United Electric Light & Power Company of New York, is convalescing in his lodge at Beaverkill, N. Y., from a recent operation for appendicitis followed by a few minor ailments brought on by overwork.

**Mr. P. A. Bertrand**, manager of the Jefferson City (Mo.) Light, Heat & Power Company, has been appointed general manager of the Gray's Harbor Railway & Light Company, of Aberdeen, Wash., as successor to Mr. H. B. Zimmerman, who has been transferred to the New York office of the controlling company.

**Mr. S. D. Sprong**, electrical engineer of the Edison Electric Illuminating Company of Brooklyn, was recently appointed a member of the executive committee of the Brooklyn Institute of Arts and Sciences. The general direction of the work of the department of electricity of the Institute is in the hands of this committee.

**Mr. Arthur Williams**, president of the Association of Edison Illuminating Companies, was tendered a testimonial dinner last week at Sherry's, New York, by the trustees and friends of the American Museum of Safety on the occasion of his decoration with the cross of the Royal Order of Isabela la Católica by Señor Don Juan Riano y Gavanges, Envoy Extraordinary and Minister Plenipotentiary of Spain, who was delegated by King Alphonso to make the formal presentation.

**Mr. H. B. Zimmerman**, who has been general manager of the Gray's Harbor Railway & Light Company, Aberdeen, Wash., for the past two years, has been transferred to the New York office of the Federal Light & Traction Company

on special duty. All transactions pertaining to taking charge of the Gray's Harbor property are general matters of the Department of Legislative Affairs, under the control of the Department of the Interior. The chief manager of the Federal Light & Traction Company, of Washington, and the Western & Northern Electric Company, of St. Louis.

**Mr. F. M. Webber**, formerly in charge of the power department of the Erie-Wayne Electric Works, was tendered a farewell dinner April 26, preceding his departure May 1 to become chief of the construction department of the General Electric Company, new factory plant at St. Louis. Shortly after Mr. Webber's departure from the Erie-Wayne organization attended the banquet. Mr. Webber is a graduate of Yale University and has served ten years with the Erie-Wayne works, the last two in charge of the power department.

**Mr. L. B. Wickersham** has been appointed chief electrical engineer of the Oregon Electric Railway and the Federal Railways of Portland, Ore., and of the Columbia & Puget Sound Empire Railway of Everett, Wash. Mr. Wickersham, who is a graduate of Cornell University, Cornell University, served a substantial number of the Western Electric Company in San Francisco and later became chief engineer for the Portland (Ore.) General Electric Company. He was subsequently appointed chief engineer of the Seattle, Tacoma and Oregon syndicate, trained for the purpose of operating and developing water powers in the West, and finally became chief engineer of the Oregon Electric Railway.

**Mr. E. M. Wharf** has resigned as assistant general superintendent and operating engineer of the Catonsville (Md.) Electric Railway & Light Company, where for the past year and a half he had full charge of the operation of the gas, electric railway and steam heat departments. He will become connected with the automatic devices company, which will manufacture the Kautsky spring-operated automobile engine starter. After he was graduated from Syracuse University as a mechanical-electrical engineer, Mr. Wharf was with the so-called Erie-Syracuse at Central New York for five years. He presented to the Board of Syracuse to accept the position with the Catonsville property of the Illinois Traction System.

**Mr. W. Randolph Sweeney**, whose appointment as sales manager of the Toronto (Ont.) Electric Light Company Ltd. was announced in these columns last week, was for many years connected with Stone & Webster, engineering and consulting firm, for years with the Georgia Railway & Electric Company of Atlanta, Ga.

About two years ago Mr. Sweeney became business manager for the Toronto Hydro-Electric System and he had been with the system since the construction period. Much of the work in connection with the negative spring lighting system of Toronto fell on his shoulders and he discussed the lanterns used so extensively on the system and working notes of that city. He also had in the complete sales organization of the Toronto municipal system. On June 1, 1910, Mr. Sweeney was made active general manager of the Toronto Hydro-Electric System and, as mentioned in our columns a week or two ago, was discussed by management of the because of his letter in the Mirror of Toronto asking that for the best interests of the Toronto municipal system Mr. Ellis be not reappointed. Immediately thereafter his connection with the Toronto Hydro-Electric System. Mr. Sweeney was made sales manager of the Toronto Electric Light Company, Ltd., with which the municipal system has been in very active connection for two years. Mr. Sweeney succeeds Mr. Patrick H. Winkler, whose appointment as general sales manager of the Union Gas & Electric Company, of Cincinnati, Ohio, was announced in these columns on Feb. 4, 1913.



W. R. Sweeney



## Construction

### New England

**BROOKLINE, N. H.**—Application has been made by Orville D. Fessenden for authority to operate an electric-utility business in the town of Brookline.

**NEWPORT, N. H.**—The Newport El. Lt. Co. has applied to the Public Service Commission for permission to issue 500 new shares of capital stock (\$50,000 par value).

**SUNAPEE, N. H.**—The Sunapee El. Lt. & Pwr. Co. has applied to the Public Service Commission for authority to issue \$10,000 in capital stock.

**AGAWAM, MASS.**—The Selectmen have granted the Amherst Pwr. Co. a franchise to erect a substation on the Agawam side of Mittineague and to extend its transmission lines to Agawam. The Agawam El. Co. was also granted a franchise by the Selectmen to supply electricity for lamps and motors here. It is expected that the Amherst company will take over the property of the Agawam company.

**ATTLEBORO, MASS.**—The Attleboro Steam & El. Co. is planning to build an addition to its boiler plant, 55 ft. by 80 ft., one story high, to cost about \$15,000. Edgar Tregoning is manager.

**BROOKFIELD, MASS.**—The Selectmen have voted to give the contract for street lighting to the Central Massachusetts El. Co., of Palmer, for a period of one year. The contract calls for 48-cp lamps at \$15.50 each per year.

**BROOKLINE, MASS.**—Bids will be received by the school committee at the office of the Selectmen, Town Hall, until May 15 for the erection complete of a schoolhouse on the Edward Devotion lot, plans and specifications for which may be seen at the office of Kilham & Hopkins, 9 Park Street, Boston, to whom all inquiries must be addressed. Separate proposals will be received for electrical work, heating and ventilating and plumbing. Franklin W. Hobbs is chairman of committee.

**FALL RIVER, MASS.**—The Aldermanic committee on street lamps has recommended the discontinuance of fluid lamps in the First and Second Wards. It is proposed to replace the lamps with boulevard electric and gas lamps, the former predominating.

**WORCESTER, MASS.**—The stockholders of the Worcester El. Lt. Co. have voted to increase the capital stock of the company by an issue of 2000 shares and have authorized the directors to make application to the State Board of Gas and Electric Light Commissioners for approval of such an issue at a price to be fixed by the board.

**GROTON, CONN.**—The town of Groton expects to install within the next four months a 500-kw turbine in the municipal electric-light plant, and also expects to purchase a 25-kw turbo-exciter unit, three generator panels and two distributing panels within the next four months. T. A. Graves is superintendent.

**PUTNAM, CONN.**—The Putnam Lt. & Pwr. Co. is planning to extend its transmission lines to the town of Arlington, a distance of 5 miles, within the next 30 days, and expects to purchase 6 miles of No. 6 wire. The distribution system will require 10 transformers, 256 poles and 500 insulators. R. E. Thurston is general manager.

**SOUTH NORWALK, CONN.**—The electric works of the city of South Norwalk expect to purchase within the next six months considerable weatherproof line wire, various sizes from 4 to 6 B. & S., and possibly some 500,000-circ. mil and 1,000,000-circ. mil, all for direct-current 250-volt distribution. The erection of a 60-ton to 100-ton ice plant to be operated in connection with the municipal plant is contemplated this year if possible. The installation of a public steam or hot-water heating system as an auxiliary is under consideration. A. E. Winchester is general superintendent.

**TERRYVILLE, CONN.**—Plans have been prepared by the Andrew Terry Co. to utilize the water-power of the Pequabuck River by the installation of three power plants at points where the fall of the water can best be taken advantage of. The power houses will be built of concrete, and the first is to be located below the Old Marsh dam at a point where there is a drop of 47 ft. from the dam with a flume to carry the water. The second plant is to be located near the Pequabuck factories of the company and the third still further down the stream near the Allen turning factory. Each will be equipped with turbines and generators and energy will be transmitted by overhead wires. The combined capacity of the three stations will be about 500 hp. Plans were prepared by Sperry & Buell, of Bristol, engineers.

### Middle Atlantic

**AUBURN, N. Y.**—Permission has been granted to Roger B. Williams, Jr., and John W. Dought, receivers, of the New York, Auburn & Lansing R. R. Co., to issue \$120,000 in receivers' certificates for the purpose of purchasing the power plant at the Remington Salt Works and making extensive improvements to same. Of the proceeds of the certificates \$85,000 will be used to purchase the plant and the remainder for improvements.

**BINGHAMTON, N. Y.**—Plans are nearly completed for the construction of the proposed municipal electric-light plant, for which bids will probably be asked the latter part of this month. Douglas Sprague, 39

Cortlandt Street, New York, is consulting engineer. J. A. Giles is city engineer.

**BINGHAMTON, N. Y.**—The Board of Trustees of the Binghamton State Hospital is considering plans for the installation of a new power plant at the hospital, for which an appropriation of \$60,000 was made last fall and plans and specifications prepared by the state architect. The plans call for the installation of three new direct-connected dynamos, two of 150 hp each and one 75 kw. The arc-lamp machine now in use will be installed in the new plant. If the new equipment is installed a complete new system of feed wiring from the power plant to the "Hill" will be required.

**BROOKLYN, N. Y.**—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until May 12 for installing an electric ash hoist in the Boys' High School on Marcy Avenue, between Madison Street and Putnam Avenue, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the above office, and also at the branch office, 131 Livingston Street, borough of Brooklyn.

**HILLBURN, N. Y.**—The Public Service Commission has granted the Rockland El. Co., of Hillburn, permission to exercise franchises for furnishing electricity in the village of Suffern and Hillburn.

**HUDSON, N. Y.**—Bids will be received until May 31 by Miss Mary Hinkley, president board of managers of New York State Training School for Girls, Hudson, N. Y., for wiring work in connection with a school building, also in connection with cottages 13 and 14 at said training school. Drawings and specifications may be consulted and blank forms of proposals obtained at the New York State Training School for Girls, Hudson, and at the office of Charles A. Sussdorf, state architect, Capitol, Albany, where copies of plans and specifications may be obtained.

**LYONS, N. Y.**—The Village Trustees have engaged Horace G. Sweet, of Utica, electrical engineer, to prepare estimates of the cost of installing a municipal lighting-plant for the village. At the special election held a year ago bonds to the amount of \$10,000 were voted to install a municipal plant.

**NEW YORK, N. Y.**—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until May 12, for furnishing materials for the use of mechanics (electrical division, building bureau) in the public schools of the city of New York, in the boroughs of Manhattan, the Bronx, Brooklyn, Queens and Richmond. Bids will also be received until May 12 for installing electric equipment in new Public School 50 on Vyse and Bryant Avenues, borough of the Bronx. Blanks, forms, specifications and further information may be obtained at the above office.

**SYRACUSE, N. Y.**—Bids will soon be asked by the Board of Education for installing heating apparatus and electric wiring in Salina School.

**THIELS, N. Y.**—Bids will be received by Frank A. Vanderlip, president of Board of Managers of the Letchworth Village, Room 215, 55 Wall Street, New York, until May 23, for electric work in cottages A, B, C and D at the Letchworth Village, Thiells. Drawings and specifications may be consulted and blank forms of proposal obtained at Letchworth Village and at the office of the president, Room 215, 55 Wall Street, and at the office of the state architect, Capitol, Albany, where plans and specifications may be obtained. Charles A. Sussdorf is state architect.

**WEST POINT, N. Y.**—Bids will be received at the office of the quartermaster, West Point, N. Y., until May 21, for furnishing the United States Military Academy with building materials, plumbing materials, gas and steam fittings, hardware, paints, electrical goods, stationery and other miscellaneous stores, specified in schedules to be had upon application to this office.

**CHAMBERSBURG, PA.**—A. C. Wood, of Philadelphia, has been engaged as consulting engineer in connection with the proposed improvements to the municipal electric-light plant. J. H. Mowrey is superintendent.

**CHEAT HAVEN, PA.**—Surveys are being made by the West Virginia Devel. Co. for locating an electric transmission line from Cheat Haven to the site of the second power dam on the Big Sandy River. The line is being erected to furnish electricity for lamps and motors in connection with the new dam, work on which will be carried on day and night. Preliminary work has begun on the dam.

**LACKAWANNA TOWNSHIP, PA.**—The Board of Commissioners of Lackawanna Township has passed an ordinance granting the Lackawanna Township El. Co. permission to erect and operate transmission lines for the distribution of electricity on the streets and highways of the township. Lackawanna Township has not a post office.

**LEBANON, PA.**—The large scrap-iron yards of the Lauria Brothers of Lebanon will be equipped with electrically driven machinery. At present steam power is used.

**PINE GROVE, PA.**—The Pine Grove El. Lt. & Pwr. Co. has abandoned the project of purchasing electricity from the Eastern Pennsylvania Lt., Ht. & Pwr. Co., of Pottsville, and will erect a power plant of sufficient output to meet the demands of this locality. A site has been purchased for the plant.

**PITTSBURGH, PA.**—Extensive improvements are being made to the power plant of the West Penn Rys. Co., at Creighton. A 400-kw motor



generator and transformers stepping up the voltage from 2000 volts to 22,000 volts are being installed, the switchboard is also being rebuilt.

WAPWALLOPEN, PA.—Arrangements have been made by the Heber Milling Co. for the installation of a large generator on its mill to furnish electricity in Wapwallopen and nearby territory. The generator will be driven by water-power.

WILLOWOOD CREST, N. J.—The present lighting system on the boardwalk at Willowood Crest will be replaced with new electric lamps erected on ornamental standards.

WILMINGTON, DEL.—The Wilmington & Philadelphia Trac. Co., of Wilmington, has closed contracts to furnish all energy used in the railway, electric lighting and water companies between Wilmington and Delaware City, including New Castle. This will approximate a load of about 700 kw. and the abandonment of these small steam plants. The erection of the transmission line is now under way and is to be done by A. W. Burke, consulting engineer, of Philadelphia, Pa. The new line will serve Springs Park, located near Wilmington, which now has two electric lamps and 100 hp. of motors, is increasing its demand to the extent of 1000 lamps. The transmission line from the power plant of the Wilmington & Philadelphia Trac. Co., which supplies the current, is being redesigned to accommodate the extra load.

RAVENSWOOD, VA.—I. Morton Cottrell, Union Trust Building, Parkersburg, has recently been granted a franchise to install and operate an electric-light plant, waterworks and sewerage system, the whole plans and specifications are being prepared.

STAR CITY, W. VA.—The Monomahc El. Co. has applied to the Town Council for a franchise to construct and operate an electric-light system in Star City. R. W. Smith is president of the company.

ROANOKE, VA.—The contract for furnishing and installing a police alarm system has been awarded to the General El. Co. of New York, N. Y., for \$9,960. A five-turret equipment will be furnished with a sub-circuit office equipment.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until May 20 for 15,000 ft. of submarine cable, type 321, in accordance with specifications 96 C, 427-E and 554-B, to be delivered on three reels of 5000 ft. each. Major W. J. Clarke is disbursing officer.

North Central

BLOOMINGDALE, MICH.—The City Council has granted Lewis Hawk a 25 year franchise to construct and operate an electric-light plant here.

DETROIT, MICH.—Bids are being received by David Starr for electrical equipment for his 12-story hotel building, which he will erect at the corner of Michigan and Wayne Streets. Marshall & Fox, of Chicago, Ill., are the architects.

GLADWIN, MICH.—The State Railroad Commission has granted the Gladwin El. & Pwr. Co. permission to issue \$75,000 in bonds.

ISHPEMING, MICH.—The Marquette County Gas & El. Co., of Ishpeming, contemplates furnishing electricity to the village of Marquette throughout the county for lamps and motors.

MARQUETTE, MICH.—J. S. Wahlman has been awarded contracts for the construction of several minor buildings for the Gladwin Gas & El. Co., on the Marquette and Swartzey ranges, which will be in addition to power house at the Morris mine at North Lake, a power house at the Gardner mine, Swartzey range, and a power house, combination office and warehouse at the Mackinac mine, also on the Swartzey range.

AKRON, OHIO.—Bids will be received at the office of the director of public service, Akron, until May 24 for furnishing machinery for pumping station. Alternate bids will be received as follows: For two vertical triple-expansion pumping engine having a capacity of 1,000,000 gal. per 24 hours; for two turbine-driven centrifugal pumping units, each having a capacity of 15,000,000 gal. per 24 hours. Contract will be awarded for one of the above types of apparatus. Specifications may be obtained from and plans seen at the office of the director of public service or at the office of F. A. Bachner, 1120 Fremont Building, Boston, Mass. R. M. Billmore is director of public service.

ATHENS, OHIO.—The finance committee of the Senate has appropriated \$18,000 for the installation of an incandescent plant for the Ohio University. When the hearing plan was notified same was provided for electric generating equipment.

CANTON, OHIO.—The Canton El. Co. has applied to the Public Service Commission for permission to issue \$125,000 in the proceeds to cover the cost for improvements already made during the past year and also those to be made. The company is now installing a 1000-hp. steam turbine and making extensions to its distributing system. W. C. Anderson is manager.

FINLAY, OHIO.—The proposition to lease bonds for the construction of an electrical distributing system in the city will be submitted to the voters on June 3. J. W. S. Reiche is treasurer of the city. J. C. Edie is city clerk.

NEW CONCORD, OHIO.—The Public Service Commission has granted the New Concord Wtr. & El. Co. permission to issue \$25,000 in capital stock, and also authority to purchase the property of H. M.

Stearns and J. C. Thompson, in this city. The latter is president of the public utility company.

MILFORD, KY.—An independent power plant, owned by the Electric Co. of the American Mfg. Co. of Louisville, Ky., is being constructed at this place near the Adams River.

PRINCETON, ILL.—The Princeton Electric Co., which has recently acquired a large tract of land, has been authorized by the city council to install a power plant. The land is situated on the edge of the city and is about 100 acres in extent.

BLOOMINGTON, ILL.—The Improvement League has appointed a committee to investigate the possibility of installing a power plant in the city. The committee is composed of J. H. Wilson, president of the league, and J. H. Wilson, secretary. The committee will report to the city council on May 20.

PORT WASHINGTON, ILL.—The Port Washington Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

HUNTINGTON, ILL.—The Huntington Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

INDIANAPOLIS, ILL.—The Indianapolis Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

SALISBURY, ILL.—The Salisbury Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

ALTON, ILL.—The Alton Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

BEAVERHEAD, ILL.—The Beaverhead Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

BLOOMINGTON, ILL.—The Improvement League has appointed a committee to investigate the possibility of installing a power plant in the city. The committee is composed of J. H. Wilson, president of the league, and J. H. Wilson, secretary. The committee will report to the city council on May 20.

ELGIN, ILL.—The Elgin Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

HOOVER, ILL.—The Hoover Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

MARSHFIELD, ILL.—The Marshfield Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

MURPHYSBORO, ILL.—The Murphysboro Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

SAVANNAH, ILL.—The Savannah Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

STERLING, ILL.—The Sterling Electric Co. has been authorized by the city council to install a power plant in the city. The company is composed of J. H. Wilson, president, and J. H. Wilson, secretary. The company will report to the city council on May 20.

**LAKE SUPERIOR HYDRO-ELECTRIC CO.** gives the new owners control of a hydroelectric plant with an output of more than 3000 hp and an auxiliary steamboiler plant of 5000 hp, to be used in emergency. A power house will be constructed upon the upper dam which will be connected with the hydroelectric and steam plant on the lower dam. Especial attention will be paid to the development of rural business, to be supplied from transmission lines between towns.

**WARREN, ILL.**—George Loften has been granted a franchise to install and operate an electric light plant here. He has also been given a contract for street-lighting.

**GREEN LAKE, WIS.**—J. R. Stewart, of Ripon, has been granted a franchise to furnish electricity for lighting in this village. Mr. Stewart has entered into a contract with the Ripon Lt. & Wtr. Co. to furnish energy to operate the system.

**LA CROSSE, WIS.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 3 for a new hoistway, an electric elevator, etc., in the United States post office and court house at La Crosse, in accordance with plans and specifications, copies of which may be had at the above office.

**BRAINERD, MINN.**—The City Council has entered into a contract with the Cuyuna Range Pwr. Co., of Deerwood, whereby the latter will supply electricity for operating the municipal electric system and the pumping station. The contract is for a period of 12 years.

**CHISHOLM, MINN.**—Bids will be received by B. R. De Lorimer, clerk of the Independent School District No. 40, at the office of the superintendent, High School Building, Chisholm, until May 28 for furnishing labor and material as follows: (a) For general contract; (b) plumbing contract; (c) heating contract; (d) ventilating-fan equipment; (e) temperature regulation; (f) air washers; (g) vacuum-heating system; (h) electric installation contract; for high school building to be erected by the Independent School District No. 40, Chisholm. Plans and specifications are on file at the office of Bell, Tyrie & Chapman, architects, Auditorium Building, Minneapolis; at the office of the clerk of the district, Chisholm, and at the Builders' Exchanges in Minneapolis, St. Paul and Duluth. Copies of plans and specifications may be obtained from the architects or from clerk of board.

**FULDA, MINN.**—The power plant of the Fulda Lt. & Pwr. Co. was recently destroyed by fire.

**GILBERT, MINN.**—Preparations are being made for improvements to the electric-light system in Gilbert. The village has made arrangements to secure electricity from the Mesaba El. Ry. Co., which will deliver current at 6000 volts. The Oliver Iron Mining Co. now furnishes energy to operate the system at 250 volts, direct current. Most of the material for the change has been purchased. Frank A. Bowman is engineer.

**HENDRICKS, MINN.**—The Hendricks Lt. & Pwr. Co. is contemplating extending its transmission lines from Hendricks to Ivanhoe.

**JACKSON, MINN.**—Preparations are being made for extensions to the municipal electric-light plant, work on which will begin some time in July or August. The equipment will include three waterwheels, one waterwheel governor and one alternating-current generator. L. P. Wolff, of St. Paul, is engineer in charge. J. E. Barrett is superintendent of the municipal electric plant.

**MINNEAPOLIS, MINN.**—The committee on buildings of the Board of Education has decided to install a generator in the new Central High School Building to supply electricity for lighting the building.

**SHAKOPEE, MINN.**—The town of Shakopee has entered into a contract with the Minneapolis General El. Co. to furnish electricity to operate the municipal electric-light system. The company will extend transmission lines out from Minneapolis.

**AMES, IA.**—A proposition has been submitted to the city of Ames by the Cedar Rapids & Iowa Ry. & Lt. Co., of Cedar Rapids, offering to furnish energy to operate the municipal electric system at 2.41 cents per kw for the first 25,000 kw, 1.86 cents for the second 25,000 kw, 1.76 cents for the second 50,000 kw, and 1.71 cents for all in excess of 100,000 kw.

**VAN METER, IA.**—The Adel Mill Co., of Adel, has been granted a franchise to supply electricity for lamps and motors in Van Meter. E. C. Trindle is clerk.

**WHAT CHEER, IA.**—The property of the What Cheer El. Lt. & Pwr. Co. has been sold to a Davenport company. The new owners will make improvements to the plant and extend the service to Keswick and Thornburg. A 24-hour service will be established in What Cheer.

**ALBANY, MO.**—At a special election held April 29 the proposition to issue \$19,000 in bonds for improvements to the municipal electric-light plant was carried. The new equipment will include two generators, one engine, one boiler. The plant will be remodeled throughout and put in first-class condition. W. E. Noonan is superintendent.

**ROLLA, MO.**—Improvements are being made to the municipal electric-light plant, including the erection of a tile stack (85 ft. by 3 ft. 6 in.) and one boiler, 72 in. by 20 ft., 6-in. flue (Wangler type). The work is being done under the supervision of O. W. Chapin, superintendent of the municipal electric-light plant.

**JAMESTOWN, N. D.**—The State Board of Control has engaged Samuel F. Crabbe, of Fargo, to prepare plans for the buildings to be erected at the Jamestown Insane Asylum. The cost of the proposed building is estimated at \$485,000 and will include a heating and power plant, a running ward and a building for tuberculosis patients.

**BLAIR, NEB.**—The town of Blair has accepted the proposition sub-

mitted by the City Council of Altus whereby the municipal plant in Altus will furnish electrical service in Blair. The transmission line will be erected by the city of Altus to Blair, a distance of 10 miles.

**GARDEN CITY, KAN.**—The City Council has engaged Worley & Black, Reliance Building, Kansas City, Mo., consulting engineers, to prepare plans for the proposed municipal electric-light plant, to cost about \$400,000.

**IOLA, KAN.**—J. B. Rohrer, of Chicago, Ill., and several representatives of the Kansas Cement Co. are promoting the construction of a large electric plant to furnish power to the cement plants in the natural-gas belt of Kansas. The plant will probably be located in or near Iola. The company will be known as the Southern Kansas El. Pwr. Co.

## Southern States

**HICKORY, N. C.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 11, for construction complete, including gas piping, electric conduit and wiring, interior lighting fixtures and approaches of the United States post office at Hickory, N. C. Drawings and specifications may be obtained at the above office or from the custodian of site at Hickory. O. Wenderoth is supervising architect.

**RAEFORD, N. C.**—The Raeford Pwr. Co. has located a site for a new dam, to be built on Rockfish Creek. It is proposed to secure a 25-ft. head of water and to develop about 750 hp. The new power plant will furnish power to the cotton mills at Raeford, also to the new oil mill and fertilizer factory. The total cost is estimated at about \$40,000. T. B. Upchurch is president of the Raeford Pwr. Co.

**WINSTON-SALEM, N. C.**—The Southern Pwr. Co., which recently purchased the local street-railway system and the electric-light plant owned by the Fries Mfg. & Pwr. Co., is planning to make improvements to the system, involving an expenditure of about \$50,000. J. B. Duke, 11 Fifth Avenue, New York, N. Y., is president of the Southern Pwr. Co.

**WALTERBORO, S. C.**—The Walterboro Ice & Lt. Co. contemplates installing an electric-light plant this fall. The company has been granted a franchise by the town. G. C. Brown and J. D. Glover, of Walterboro, are interested in the company.

**BARNESVILLE, GA.**—The Collier Mfg. Co. has awarded contract for the erection of a two-story factory building, 50 ft. by 100 ft., to cost \$20,000. The building will be equipped with electrically driven machinery.

**COLUMBUS, GA.**—Additional power equipment will be installed at the power plant of the Eagle & Phoenix Mills, including turbo-generator, transformers, motors, etc., to increase the output of the plant by 1000 hp. The cost of the work is estimated at \$30,000. Lockwood, Greene & Co., 96 Federal Street, Boston, Mass., are engineers.

**CORDELE, GA.**—The plant and holdings of the Citizens' El. Lt. & Pwr. Co., of Cordele, have been taken over by J. G. White & Co., 45 Exchange Place, New York, N. Y. Improvements involving an expenditure of \$25,000 are considered. The new owners will take over the plant about June 1.

**MARSHALLVILLE, GA.**—Plans have been prepared for the construction of a municipal electric-light plant by J. B. McCrary & Co., of Atlanta, Ga. The plant will be equipped with a 50-kw generator (steam-driven). About 14 miles of transmission lines will be erected and 30 arc lamps installed. The machinery has not yet been purchased. An election will be held June 19 to vote on the proposition and bids for construction will be received June 30. E. L. Sammons is chairman.

**DUNNELLON, FLA.**—Bonds to the amount of \$50,000 have been voted for the purchase of the local electric-light plant and waterworks system, owned by the Florida Pwr. Co.

**HIGH SPRINGS, FLA.**—The contract for construction of an electric-light plant and water-works system in High Springs has been awarded to the J. B. McCrary Co., of Atlanta, Ga. The cost of the work is estimated at \$65,000.

**LAKELAND, FLA.**—Improvements are contemplated by the city to the municipal electric-light plant.

**TALLAHASSEE, FLA.**—Extensions will be made to the municipal street-lighting system which will require from 350 to 500 30-ft. 8-in.-top poles, copper transmission wire and petticoat insulators. Most of the work will be done by the city under the supervision of D. W. Swing, manager of the municipal electric-light plant.

**BUTLER, TENN.**—Walker Bros., of Butler, have organized the Butler El. Co. for the purpose of operating a hydroelectric plant here. It is expected to have the plant ready for operation by June 15. D. R. Shearer, of Knoxville, Tenn., is engineer in charge.

**DRESDEN, TENN.**—At an election held April 24 the proposition to issue \$25,000 for the construction of an electric-light plant and water-works system was carried. M. A. Mentz, Randolph Building, Memphis, Tenn., is consulting engineer.

**LONE MOUNTAIN, TENN.**—The Ball Creek El. Co., of Lone Mountain, is planning to build an electric-light plant here to supply electricity for lamps. As yet no engineer has been engaged. Payne Brothers, of Lone Mountain, are interested in the project.

**PARIS, TENN.**—Improvements will be made to the municipal electric-light plant, including the installation of a 300-kw, 125-250-volt, direct-cur-



cent, three wire generator, directly connected, and switchboard. Work will soon begin on the proposed improvements. M. W. Yunker, manager, will have charge of the work.

**ALEXANDER CITY, ALA.**—The city of Alexander City expects to erect a transmission line for alternating current and to purchase new pumps, switching equipment, consisting of switchboards, transformers and protective devices, also transformers, motors and some motors, within the next three months. Electricity for operating the municipal water works will be purchased from the Industrial L. & Pwr. Co. The city has for sale one engine, two generators, three pumps and one air compressor (steam-driven). J. A. Coley is superintendent.

**CARBON HILL, ALA.**—The town of Carbon Hill expects to purchase small quantities of electrical heating apparatus, wiring, lamps, switches, etc., within the next three months. O. P. Fox is superintendent of the municipal electric-light plant.

**CITRONELLE, ALA.**—The Town Council has granted a franchise to Daniel E. Smith and Hubbard Parker and associate to construct and operate an electric-light plant in Citronelle. A company is now being organized to be known as the Citronelle L. & Pwr. Co. to take over the franchise and to construct the electric plant, also an air factory to furnish ice for local consumption. A site has been purchased and all financial arrangements have been made. The cost of the plant is estimated at about \$30,000. Caleb Landsey will have charge of the work.

**CULLMAN, ALA.**—The city of Cullman expects to purchase within the next three months weather-proof wire for the municipal electric-light system. B. Kiel is superintendent.

**ELBA, ALA.**—The Pea River Pwr. Co., of Elba, has awarded contract for construction of power house, to be located near Elba. Arrangements are being made for the erection of a transmission line from Elba to Troy, a distance of 30 miles. Charles Henderson is interested in the company.

**HUNTSVILLE, ALA.**—Plans have been prepared by the Huntsville-Chattanooga & Birmingham Interurban Ry., L. & Pwr. Co. for the installation of an ornamental street-lighting system around the public square and on Washington Street to Clinton. The plans provide for the erection of 24 ornamental standards, carrying five-lamp clusters. The lamps will be maintained by underground wires.

**ARGENTA, ARK.**—The city of Argenta expects to purchase within the next three months one 6.6-kw. series transformer for the municipal electric-light plant. S. J. Chapman is manager.

**ARKADELPHIA, ARK.** The Arkadelphia El. L. Co. is planning a general overhauling of its entire distribution system and expects to purchase poles, wire, line cutouts, etc., within the next two or three months. W. C. Maguire is manager.

**BATESVILLE, ARK.** Plans are being considered for the construction of a hydroelectric plant on the White River. L. C. Fitzgerald, Norman Adler, J. C. Dunn, of Batesville, and Charles A. Foxworth, of the Missouri Engineering Co., of St. Louis, Mo., are interested.

**BOONEVILLE, ARK.**—Greenway & Harvey, owners of the local electric-light plant, expect to purchase one 150-hp. generator, one 250-hp. engine, one switchboard and 4 miles of No. 8 weather-proof wire within the next month; also one 25-hp. three-lamp, one 5-hp. and two 2-hp. motors.

**CONWAY, ARK.**—Improvements will be made to the municipal electric-light plant, including the installation of a new engine, generator and switchboard; also extension to building. The cost of the work is estimated at about \$10,000. Specifications are now ready and bids will be opened about May 15. Copies of specifications may be obtained upon application to E. V. Leverett, of Conway, engineer in charge.

**DANVILLE, ARK.**—The Danville El. Co. expects to purchase within the next 12 months a boiler with a rating of about 100 hp. C. F. Meadows is lessee.

**MARVEL, ARK.**—The Marvel L. & Pwr. Co. will install an electric-light plant in Marvel to furnish electricity for houses and stores. The equipment will include one 100-hp. boiler, one 75-hp. cooling engine and one General Electric 40-kw., 60-cycle, 2300-volt generator. The company will do most of the work and carry practically all the supplies. E. H. Webster, of Marvel, has charge of the work.

**LEHIGH, OKLA.**—At a special election held recently the proposition to sell the municipal electric-light plant to A. Hydro-Elec. of Chicago, Ill., with a franchise for 21 years, was carried.

**SUPPLY, OKLA.**—The Citizens are contemplating the installation of an electric-light plant in connection with the proposed water works system.

**WAKITA, OKLA.**—The Town Board has granted P. F. Woogee & Son a franchise to install and operate an electric-light plant in Wakita. The plans provide for the installation of a plant of sufficient output to maintain 700 lamps, for which contracts have been placed.

**ANGLETON, TEX.**—The Angleton Gas & Pwr. Co. is installing an electric light and power plant here and will also build an ice plant.

**RIG SPRINGS, TEX.**—The West Texas El. Co. is contemplating the installation of additional machinery in its power plant.

**BROWNSVILLE, TEX.**—Extensive improvements are contemplated to the municipal electric-light and water plant, including the installation of new machinery. E. H. Williams is superintendent.

**DALLAS, TEX.**—Plans are being prepared by H. A. Overbeck, of Dallas, for the installation of an electric generating unit and heating

unit, to be located on the site of the old power plant, and which will supply the city with electricity and steam. The new plant will be located on the site of the old power plant, and will be owned by the city.

**HOUSTON, TEX.**—The Houston El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

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**FORT WORTH, TEX.**—The Fort Worth El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**NAVASOTA, TEX.**—The City Council has granted the Navasota L. & Pwr. Co. a 25-year franchise. Under the new franchise the company is to install a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**SAN ANTONIO, TEX.**—We are informed that the city of San Antonio does not contemplate the installation of an ornamental street-lighting system, as proposed in the plan of April 10.

**YORKTOWN, TEX.**—The Yorktown L. & Pwr. Co. contemplates the installation of additional machinery in its plant. A 110-hp. generator and boiler will be installed.

## Pacific States

**ABERDEEN, WASH.**—The Gray's Harbor Ry. & L. Co. contemplates improvement to its water and electric lines, involving an expenditure of about \$30,000.

**ALMIRA, WASH.**—The City Council has granted the Washington Wtr. Pwr. Co., of Spokane, a franchise to sell and operate an electric distribution system in Almira for a period of 10 years. Work will begin immediately on the proposed lines.

**COLVILLE, WASH.**—The Stevens County Pwr. & L. Co. of Colville, will erect a hydroelectric power plant and transmission line, to be located on the site of the old power plant, and will be owned by the city.

**PORT ANGELES, WASH.**—About 1000 tons of material for the construction of a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**TACOMA, WASH.**—The Tacoma El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**TOLLEDO, WASH.**—The Tolleto El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**WALPA WALLY, WASH.**—The Walpa Wally El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**OREGON CITY, ORE.**—The Oregon City El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**STRENGTH, ORE.**—The Strength El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**ALISA, ORE.**—The Alisa El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.

**PASADENA, CAL.**—The Pasadena El. Co. has announced the intention of installing a new power plant, to be located on the site of the old power plant, and will be owned by the city.



for the municipal electric light plant, including two water-tube boilers and an automatic motor-operated induction feeder, 23,000 volts, three-phase, 50 cycles. C. W. Koerner is manager.

**SAN BERNARDINO, CAL.**—The City Council is planning to extend the ornamental street-lighting system about 1½ miles.

**SAN BERNARDINO, CAL.**—The Empire Wtr. Co., of San Bernardino, which proposes to construct a hydroelectric plant near Coyote Creek, is planning to build a submerged dam. About 1500 hp will be developed. W. L. Brown is designing engineer and S. F. Kelley is vice-president, both of San Bernardino.

**SAN FRANCISCO, CAL.**—The Great Western Pwr. Co. has applied to the State Railroad Commission for a modification of its recent order authorizing an issue of \$4,411,000 in bonds. The company asks that money heretofore authorized for new lines, substations and transformer sets to the amount of \$92,562 be made available under a modified order for extensions in the Napa district, the Oakland district, the Petaluma district, the Island district and for minor purposes of general improvements.

**VISALIA, CAL.**—The State Railroad Commission has authorized the Mount Whitney Pwr. & El. Co. to issue bonds to the amount of \$250,000, the proceeds to be used for the construction of hydroelectric projects on the Keweenaw River.

**LEWISTON, IDAHO.**—Specifications have been completed by the Lewiston-Clarkston Valley Ry. Co. for cars, rails, substation equipment, etc., for its proposed railway. Work is to be started at once and completed as far as Clarkston, Wash., by Aug. 1. The railway will eventually be extended to Astoria, Wash. F. L. Sturm is president.

**NEW PLYMOUTH, IDAHO.**—The Beaver River Pwr. Co., of Bliss, has applied to the Village Trustees for a franchise for its transmission line through this village which it proposes to erect through the Payette Valley this year.

**OGDEN, UTAH.**—A deal has been closed between the Utah Pwr. & Lt. Co. and the Union Portland Cement Co. whereby the former will furnish electricity to the amount of 8000 hp to operate the machinery at the cement plants of the latter, located at Devil's Slide. Work will begin at once on the erection of the transmission lines and construction of substation. Energy will be transmitted at 44,000 volts. Material for transmission line and substation has been ordered.

**PHOENIX, ARIZ.**—Bids will be received at the office of the Salt River Valley Users' Association, Phoenix, until June 5 for construction of the cross-cut power plant building. A deposit of \$10 will be required for plans and specifications, which will be refunded upon return of plans.

**HELENA, MONT.**—The Standard Engineering Co., of Seattle, Wash., which has the contract for installing the ornamental lamps in the business district, has submitted a proposition to the City Council offering to install an electric plant to supply electricity to maintain the ornamental street-lighting system. The company has also submitted an offer to place the fire-alarm wires in the business district in separate underground conduits.

**CASPER, WYO.**—A deal has been closed whereby A. M. Hewes & Co., of Chicago, Ill., has purchased the electric-light plants in Casper, Wyo., and Chadron and Crawford, Neb. The headquarters of the company will be located in Casper.

**DENVER, COL.**—An ordinance is being prepared by the Aldermen for the erection of 100 additional arc lamps to be distributed among the 16 wards of the city.

**DENVER, COL.**—An agreement has been reached whereby an ornamental lighting system will be installed on Eighteenth Street. The Denver City Tramway Co. has agreed to furnish the standards, the Eighteenth Improvement Association the ornamental brackets and the city will pay for the current to maintain the lamps. Ornamental lamps will also be placed on West Twenty-seventh Avenue to Zuni Street and on West Lake Place to Boulevard F.

**GREELEY, COL.**—Plans are under way by the Greeley Hydro-Electric Co. to utilize the waters of the Laramie and Poudre Rivers to generate electricity to be distributed for lamps and motors in the northern part of Colorado, and secondarily to furnish water to irrigate 125,000 acres of land in the Greeley-Poudre district. The plans provide for the construction of four reservoirs, the sites for which have been tentatively selected. The company has also secured right-of-way from the government for the transmission line, which will carry 40,000 volts through a forest reserve. The cost of the power end of the project is estimated at about \$1,500,000. D. A. Camfield, of Greeley, is president.

**LAS VEGAS, NEV.**—Ira McFarland and associates are interested in a project to erect a large power plant to furnish electricity for lamps and motors in Las Vegas and adjoining valleys. It is proposed to develop the water from the Charlestown Mountain range above Indian Springs. About \$500,000 will be expended.

**VIRGINIA CITY, NEV.**—The United Comstock Pumping Association is planning to install an electric power plant to furnish electricity for lamps and motors to the deep Comstock mines, near Virginia City. A. F. Coffin is president of the pumping company.

**ARTESIA, N. M.**—It is reported that the General Electric Co. has taken over the proposition of constructing an interurban electric railway between Artesia and Cloudcroft, a distance of 125 miles. It is proposed to build a hydroelectric plant at the falls on the Panaseo

River to furnish power to operate the railway. W. Morgan Hand, representative of the General Electric Co., at Kansas City, Mo., will soon make investigations in connection with the route of the proposed line.

## Canada

**CALGARY, ALTA.**—Bids will be received by the Bowness Improvement Co., of Calgary, until May 31 for the following equipments: (A) For two alternating-current generators; (B) two direct-connected exciters and one motor-driven exciter set; (C) one six-panel switchboard; (D) one series tungsten lighting system; (E) transmission lines and underground cable; (F) two vertical multi-cylinder internal combustion engines. Specifications may be obtained from T. L. Turnbull, consulting engineer, Calgary.

**FERNIE, B. C.**—At an election held recently the proposition to appropriate \$10,000 for extension to the electric-lighting system was carried.

**STRASSBURG, MAN.**—Bids will be received at the office of S. L. A. Smyth, secretary and treasurer of the town of Strassburg, until May 20 for construction of a municipal electric-light plant. Specifications may be obtained upon application to S. L. A. Smyth, secretary and treasurer.

**THE PAS, MAN.**—Bids will be received by H. H. Elliott, M.D., secretary and treasurer of the town of The Pas, until May 20 for machinery and material for power plant and water-works system as follows: (A) For furnishing and erecting two crude-oil engines; (B) for furnishing and installing two generators, exciters, switchboard and other apparatus; (C) for approximately 14,300 ft. of 12-in., 10-in., 8-in. and 6-in. steel or cast-iron pipe and 50 specials; (D) for 10 hydrants, 52 gate valves and boxes; (E) for two pneumatic storage tanks. Plans and specifications may be seen at the office of Murphy & Underwood, Saskatoon, Sask., consulting engineers. A complete set of plans may be secured for any contract upon deposit of \$25; a set covering the entire work can be obtained upon deposit of \$100, which will be refunded upon return of plans.

**SACKVILLE, N. B.**—The Council is considering the question of installing an electric-light plant, to cost about \$70,000.

**LAWRENCETOWN, N. S.**—The ratemakers have voted in favor of the by-law providing for the installation of a small electric-light plant. The equipment will include a 40-kw dynamo to be operated by a steam engine already installed in the mill. Generator, wire, poles, etc., will be required.

**GANANOQUE, ONT.**—The Gananoque El. Lt. & Wtr. Supply Co. contemplates erecting a transmission line to connect with Kingston.

**HAMILTON, ONT.**—Plans are being prepared by E. I. Sifton, of Hamilton, electrical engineer, for the construction of a new substation, work on which will soon begin. New machinery will be installed.

**IROQUOIS FALLS, ONT.**—The Atibit Pulp & Paper Co. proposes to erect a transmission line between Iroquois Falls and Kettle Falls to transmit electricity for its own use as well as for the town of Cochrane, the mills along the line and the Elze Nickel Mine at Iroquois Falls.

**PORTR ARTHUR, ONT.**—Bids will be received by J. J. Hackney until May 19 for three motor-driven centrifugal pumps having a capacity of 2000 gal. per minute, together with pumping valves, meters, switchboard and all necessary apparatus for operating same. Specifications and form of tender may be seen at the office of L. Jones, city clerk, Port Arthur, or T. Aird Murray, Lumsden Building, Toronto, Ont.

**WALLACEBURG, ONT.**—The Premier El. Lt. & Pwr. Co., Ltd., of Wallaceburg, contemplates changing its system from 133 cycles to three-phase, 60 cycles; also to replace the present steam engine with a gas engine. W. R. Waggoner is manager.

**MONTREAL, QUE.**—The board of trustees of the Alexandra Hospital is considering the construction of a power plant and laundry, to cost \$50,000, and a nurses' home at a cost of \$60,000.

**REGINA, SASK.**—Bids will be received by the city commissioners of Regina until May 15 for furnishing one pair of vertical boiler-feed pumps, each to have a capacity of 7500 imperial gal. per hour, and one combined open heater and meter, capable of handling 125,000 lb. of feed water per hour. Copies of specifications may be secured from E. W. Bull, superintendent of the light and power plant.

**YORKTON, SASK.**—Plans have been prepared for the construction of a new power house for the municipal electric-light plant by Munroe & Mead, architects, of Yorkton. It is understood that tenders are being received for erection of same.

**DAWSON, YUKON.**—The power house of the Dawson El. Lt. & Pwr. Co. was recently destroyed by fire, causing a loss of about \$200,000.

## New Industrial Companies

**THE A. A. C. HOLDING CORPORATION**, of New York, N. Y., has been incorporated with a capital stock of \$125,000 to carry on a general electrical engineering business, etc. The incorporators are: M. B. Martin, of New York; R. D. Hawkins, of North East, Pa., and J. C. Bennett, of 831 East Seventeenth Street, Brooklyn, N. Y.

**THE ALTER LIGHT COMPANY**, of Chicago, Ill., has been granted

The incorporators are: Henry S. Blum, Isadore S. Wolfson and Albert M. Blum.

THE ELECTRICAL PRECIPITATION COMPANY, of Pittsburgh, Pa., has been incorporated under the laws of the State of Pennsylvania with a capital stock of \$100,000 by H. E. Latter, W. J. Maloney and O. J. Reichard, of Wilmington, Del. The company will acquire the legal and patent rights of every kind for the prevention of the pollution of air or dust of any deleterious gases.

THE ELECTRICAL SUPPLY COMPANY, of New Orleans, La., has been incorporated with a capital stock of \$50,000. The purpose of conducting a general electrical supply business. The officers are Edward Jumonville, president; L. L. Hirsch, vice-president; Theodore Hirsch, secretary, and James Jumonville, treasurer.

THE INGLE MOTORS COMPANY, of Long Island City, N. Y., has been chartered with a capital stock of \$25,000 to manufacture motors, engines, etc. The incorporators are: J. E. Ingle, Jr., New York, N. Y.; C. E. Reed, of East Orange, and C. K. Murling, of New York.

THE REVIVO DRY STORAGE BATTERY COMPANY, a Los Angeles, Cal., has been incorporated with a capital stock of \$150,000 by A. S. Bradford, J. C. Ripley, S. B. Rosenberg, I. G. Brenner and F. J. Todd.

THE SWARTZ ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of \$150,000 to manufacture, sell or lease individual electric-lighting plants and storage batteries, lamps and systems. The incorporators are: Ira I. Swartz, S. M. Swartz and V. H. Lockwood.

## New Incorporations

PHOENIX, ARIZ.—The Pwr. & Irrigation Co. of Clear Lake has been incorporated with a capital stock of \$1,000,000 by Fred H. Larsen and M. A. Rabbit.

**GOLD SA, CAN**—The Oro Development Co., a subsidiary of the Oro El. Corp., of Oroville, has filed articles of incorporation with a capital stock of \$1,000,000. The officers of the company are the same as those of the Oro El. Co.

**BOULDER CO., Colo.**—The Highland Power line has been authorized to supply electricity to the Black Hawk, Central City and Leadville areas and gold mines of Boulder County. The power plant will be located near the town of Hesse, and contracts will soon be awarded for the construction of a 3000 hp generating plant and for the erection of transmission lines through Boulder and Gilpin Counties. The company is capitalized at \$1,500,000. The officers are: I. H. Barr, president; J. E. Caldwell, treasurer; E. Barr, of Boulder, secretary and treasurer.

**MOMENCE, ILL.** The Momence Utilities Co. has been incorporated with a capital stock of \$1,000 to operate heat, light and power plants. The incorporators are: Howard F. Walker, Harry Eshine and Benson Harpole.

ROANN, IND.—The Roann Wtr. & Lt. Co. has been incorporated with a capital stock of \$15,000 to operate a water and light plant. The incorporators are: B. F. Goltzy, C. M. Cooney and J. M. Wagner.

SCRANTON, PA.—The Scranton Golden El. Co. has been incorporated with a capital stock of \$10,000. The officers of the company are: A. Moorehouse, president; Lee Davis, vice-president; S. M. Lane, secretary; W. W. Anderson, treasurer, and Samuel C. Johnson, manager.

MARSHFIELD, MO.—The Marshfield Fl. Co. has been incorporated with a capital stock of \$10,000 by John F. Hosmer, Lawrence B. James and L. E. Haymes.

CONOVER, N. C.—The Conover Fl. Co. has been organized with a capital stock of \$25,000 by S. C. Coyne, A. L. Shuford and others.

ARLINGTON, TEX.-The Arlington Ice & Power Co. has been chartered with a capital stock of \$200,000. The incorporators are: R. G. Carrell, W. M. Short and S. R. Cantey.

MORGANTOWN, W. VA.—The Monongahela Electric & Light Co. incorporated with a capital stock of \$5,000 by J. Sutton, Elmer W. Webb, H. South, Frank L. Bowman and others.

## Trade Publications

**CONTRIBUTOR:** Catherine A. Grier, University of Tennessee, Knoxville, Tennessee. The author would like to thank an anonymous reviewer for helpful comments.

**PAINTS**—See also the results of the *Survey of Paints* by the *Paint Manufacturers Association*, a not-for-profit, industry-sponsored publication of facts and information regarding paint and associated products, available from the *Paint Manufacturers Association*.

Shaw, R. M. (1982). *Measuring the size of the world's forests*. Cambridge, United Kingdom: Cambridge University Press. 160 pp.

[illegible]

Can make a poster by 14 in., ready for mailing, with no need for a printer. The poster is made by a computer, which is connected to a central computer at the offices of central stations. With the poster is a circular telling why "Simplex" brought it to you, the customer.

**PUMPS.** The pump used in this study is a pump for the use of a concrete pump system located at the corner of the tunnel. Moving along the Concrete Pumping Station (CPS) in the direction of the tunnel, the concrete pump system is a pump system that is used to pump concrete into the tunnel. The concrete pump system is a pump system that is used to pump concrete into the tunnel. The concrete pump system is a pump system that is used to pump concrete into the tunnel.

## Business Notes

MR. CHARLES C. BROWN, insurance company, formerly of 40 Wall Street, is now at 101 East 146th St., New York.

THE UNIVERSITY COMPANY can be purchased from the University of  
Lancaster, Ltd., 15, Great East Street, Lancaster, LA1 4YW

THE KIMBLE TRACTING COMPANY was founded in 1906, when from 117 Washington Boulevard to 144 North West Street.

WESTINGHOUSE, GEORGE, FORMER COMPANY, now under  
their New York office from 30 Bridge Street to 10 Wall Street.

THE FOLLOWING IS A SUMMARY OF THE COMMENTS RECEIVED BY NEW YORK OFFICIALS FROM THE FEDERAL BUREAU OF INVESTIGATION BUILDING, NEW YORK CITY:

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY has moved to the Professional Office Building, Broadway, 37th and Madison Avenues, New York, City, telephone, 690-0100, or 690-0101. Avenue, Brooklyn, N. Y.

HESS BRIGHT MANUFACTURING COMPANY, M. C. Hess, formerly chief engineer of the Alco Company, has been appointed district agent for the New England States, Massachusetts, Connecticut, Rhode Island, and Vermont.

THE METROPOLITAN STEEL INDUSTRIES COMPANY, which manufactures and distributes in America, has formed its New York office in the First National Bank Building, Department Street and Madison Avenue. The company's interest in Metallurgical patents is shown by the Murray patents.

[illegible]

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 11, 1911

[Prepared by Robert Starr Allen, 10 Exchange Place, New York.]

1,059,971. TEMPERATURE CONTROLLED REGULATING DEVICE.  
H. E. Reighley, East Cleveland, Ohio. App. filed Jan. 5, 1933.  
Differential magnet with its coil connected in series with a  
control circuit and a thermoresistive element connected to one of  
said branches.

1,059.988 COMBINED AUTOMATIC SENDER AND TELEGRAPH  
KEY; D. L. Garretson, New York, N. Y. Aug. 11, 1914. 4-3412  
Puts an automatic sending apparatus in the bottom of the telegraph  
key.

1.  $\lim_{t \rightarrow \infty} \frac{1}{t} \log \frac{1}{N_t} = 0$  and  $\lim_{t \rightarrow \infty} \frac{1}{t} \log \frac{1}{N_t} = 0$  for all  $t \in \mathbb{N}$ .

with an average of 1.5% per year.

1984 Nov. 1 (1985). The second time is second reading in British House of Commons, followed by second reading and debate in the



... and into the guide weight plate above the upper part of the, all removably clamped in the body of the iron.

**1,060,082. PROCESS OF MAKING MANGANESE STEEL:** A. E. ...  
... into suitable vessel, pours on top of this enough ...  
... it is to give desired composition of product and com-  
... heating and heating in a reducing atmosphere by means of  
electric heating.

**1,060,082. MOTOR-CONTROL SYSTEM:** J. H. Hall, Cleveland, Ohio.  
App. filed Dec. 6, 1911. Relay and switches forming an interlock  
to prevent closure of main switch or reversing switch when any  
of main contacts of the accelerating switches are closed.

**1,060,117. RAILWAY SIGNALING SYSTEM:** T. H. Patenall, Hollis,  
N. Y. App. filed July 27, 1911. Circuits arranged so that when no  
staff is out of either of the two staff instruments a staff can be  
released from either instrument without sanction or co-operation  
of an operator at the other instrument.

**1,060,118. RAILWAY SIGNALING SYSTEM:** T. H. Patenall, Hollis,  
N. Y., and H. S. Young, Jersey City, N. J. App. filed July 27,  
1911. Special arrangement of pole changes and circuits for "staff  
instruments."

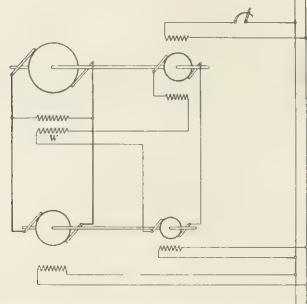
**1,060,207. ELECTRIC SWITCH:** F. C. Newton, West Springfield,  
Mass. App. filed June 30, 1910. Push-button type; a set of circuit  
terminals is engaged by one only of two switch plates when in an  
intermediate position and a second set of terminals engaged by  
other switch plate in its extreme position.

**1,060,208. MEANS FOR REGULATING THE SPEED OF DIRECT-  
CURRENT MOTORS:** H. Osborne, Charlottenburg, Germany. App.  
filed Nov. 8, 1912. Improvement on Ward-Leonard connection;  
uses auxiliary machines which co-operate both with auxiliary regu-  
lating dynamo and the main motor.

**1,060,211. DESK TELEPHONE:** A. C. Reid, Genoa, Ill. App. filed  
Jan. 24, 1911. Has switching springs, one of which is movable,  
a member moving in one direction to establish and maintain a circuit-  
changing operation of the switching springs and guide springs pre-  
venting vibration of the movable spring.

**1,060,212. SELECTIVE SIGNALING SYSTEM:** C. S. Rhoads, Jr.,  
Sandwich, Ill. App. filed April 12, 1910. Polarized magnet controls  
step-up pawl and holding pawl which operate step-by-step element  
of a step-by-step signaling device.

**1,060,214. SIGNALING SYSTEM:** H. O. Rugb, Sandwich, Ill. App.  
filed Feb. 15, 1910. Two call boxes at calling station with means  
controlled by one box to operate indicating means at other call box  
while first box is in active operation and to render indicating means  
inoperative upon completion of call-sending operation.



**1,060,208.—Means for Regulating the Speed of Direct-Current Motors**

**1,060,216. BIFUNCTIONAL STORAGE-BATTERY PLATE:** A. O.  
Tate, Toronto, Canada. App. filed Sept. 16, 1910. Is provided with  
binding bands for holding all parts of plate together and an insulating  
cup held with insulating medium which insulates one end  
of the plate.

**1,060,252. MOTOR CONTROLLER:** J. H. Hall, Cleveland, Ohio. App.  
filed Oct. 16, 1912. Series of magnetically operated resistance cut-  
out switches, each controlled by a relay whose winding is energized  
by current in secondary circuit of the induction motor.

**1,060,263. ELECTRICALLY HEATED UTENSIL:** J. F. Lamb, New  
Britain, Conn. App. filed Feb. 1, 1912. Percolator; two radiating  
members with interposed resistance, vaporizing chamber formed as  
a part of one of the radiating members and the other radiating mem-  
ber in heat-conducting relation to the bowl of the percolator.

**1,060,264. HEATING ELEMENT:** J. F. Lamb, New Britain, Conn.  
App. filed April 12, 1912. Resistance unit having a part in heating  
relation to the utensil, a heat-conducting member against the ex-  
posed part of the unit and a valve plate interposed between said  
unit and said member, the member and valve plate also arranged in  
heating relation to the utensil.

**1,060,265. ELECTRICALLY HEATED DEVICE:** J. F. Lamb, New  
Britain, Conn. App. filed May 31, 1912. Stove or flatiron; mass  
of heat-conducting material comprising heat-receiving and heat-  
yielding sections connected together at different points by webs of de-  
rived heat-conducting material, with an electrical heater in heating  
relation to the heat-yielding section.

**1,060,266. PROTECTIVE DEVICE FOR ELECTRICALLY HEATED  
UTENSILS:** J. F. Lamb, New Britain, Conn. App. filed Dec. 13,  
1912. Pair of spaced terminals in circuit of the heater, a holder  
and a connector of relatively low fusing point clamped between the  
terminals and holder.

**1,060,267. ELECTRICALLY HEATED UTENSIL:** J. F. Lamb, New  
Britain, Conn. App. filed Dec. 16, 1912. Utensil is provided with  
socket and the holder of the electrical heater has a plug closely  
fitting the socket and adapted when heated to swell and establish  
a heat-conductive relation with the wall of the socket.

**1,060,268. ELECTRICALLY HEATED DEVICE:** J. F. Lamb, New  
Britain, Conn. App. filed Dec. 19, 1912. Heater is located in

socket in wall of the receptacle and a plate of heat-conducting ma-  
terial is located in socket against exposed surface of heater with  
its edges in heat-conducting relation to side walls of socket.

**1,060,269. MOTOR CONTROLLER:** E. B. H. Tower, Jr., Milwaukee,  
Wis. App. filed Nov. 26, 1909. Plurality of successively operating  
automatic switches for accelerating the motor and electroresponsive  
means for arresting successive operation while abnormal conditions  
prevail in motor circuit.

**1,060,308. INTERCOMMUNICATING TELEPHONE SYSTEM:** L. D.  
Barrows, New York, N. Y. App. filed March 22, 1912. A relay con-  
trols the holding bridge for the trunk line, and a release relay for  
the holding relay is energized from the local battery of the station.

**1,060,311. RAILWAY SIGNAL:** J. H. Body and F. T. Leftwich,  
Roanoke, Va. App. filed March 26, 1909. Second train entering  
block establishes circuit which lugs by means of a mechanical  
contact at side of track.

**1,060,325. TELEGRAPHY:** P. B. Delany, South Orange, N. J. App.  
filed May 8, 1911. An acknowledging or return signal is given from  
distant end of circuit by means of transmitter and receiver in main  
circuit, a local circuit controlled by receiver in main circuit, and a  
transformer whose primary is controlled by the in-  
terrupter and whose secondary is in the main circuit.

**1,060,341. TROLLEY CATCHER AND RETRIEVER:** E. L. Jewett,  
Brooklyn, N. Y. App. filed, April 22, 1911. An "adapter" of ring-  
like form having a hook and a lug by means of which the retriever  
may be locked to different styles of sockets.

**1,060,361. PROCESS OF MANUFACTURING PLATED GOODS:**  
D. G. Rea, Providence, R. I. App. filed Jan. 6, 1913. Precious  
plated metal article is protected during construction by plating the  
surface with base metal, assembling and finally removing  
or stripping the base metal from the surface of the precious metal.

**1,060,380. ELECTRIC CLOCK:** W. H. Thompson, Memphis, Tenn.  
App. filed April 1, 1912. A free rack meshes with a gear wheel  
on the center post to rotate same by reason of its weight; a rewind-  
ing magnet actuates a lever to engage the gear at a point inter-  
mediate of the rack and center post.

**1,060,382. ELECTRIC-ARC LAMP:** J. Thulin, Chicago, Ill. App. filed  
May 1, 1905. A U-shaped vent tube extends down into the closed  
arc-inclosing bulb, one limb of the tube communicating with the  
outer air and the other limb communicating with the inside of the  
bulb adjacent to the arc but on the side away from it.

**1,060,396. LOCOMOTIVE FRAME:** G. C. Abbe, Lansdowne, Pa. App.  
filed Sept. 20, 1911. For electric locomotives; integral side frame  
has continuous main chord, an interrupted lower chord, pedestals  
connecting sections of lower chord to main chord and a continuous  
upper chord connected by members to the main chord.

**1,060,398. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
MEANS:** A. J. Allard, Richmond, Va. App. filed Oct. 4, 1910.  
Long and short contact rails at each end of block, and contact shoe  
connected with the signaling and controlling means on the car.

**1,060,400. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
MEANS:** A. J. Allard, Richmond, Va. App. filed Oct. 4, 1910.  
Controlling system including siding switches; long and short contact  
rails at end of block engaged by shoe on car.

**1,060,401. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
MEANS:** A. J. Allard, Richmond, Va. App. filed Oct. 4, 1910.  
Train automatically stopped in case of landslide or snowslide; circuit-  
closures on posts near side of track are actuated by pressure of the  
slide.

**1,060,402. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
MEANS:** A. J. Allard, Richmond, Va. App. filed Oct. 10, 1910.  
Breaking devices connected with timbers of a bridge actuate circuit-  
closures and cause train to be stopped in case of bridge being burned  
or carried away.

**1,060,403. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
MEANS:** A. J. Allard, Richmond, Va. App. filed Oct. 4, 1910.  
Contact-rail system of protecting crossings.

**1,060,405. ELECTRIC TRAIN SIGNALING AND CONTROLLING  
SYSTEM:** A. J. Allard, Richmond, Va. App. filed Dec. 4, 1911.  
Contact-rail system with circuit-shifting devices at junctions of  
blocks.

**1,060,406. ELECTRIC SIGNAL:** A. J. Allard, Richmond, Va. App.  
filed Feb. 18, 1911. Semaphore; two solenoids operate a lever  
which is pivotally connected with a longitudinally movable bar hav-  
ing connection with the semaphore arm.

**1,060,407. ELECTRICAL BLOCK-SIGNALING SYSTEM:** A. J. Al-  
lard, Richmond, Va. App. filed Feb. 18, 1911. Two "head-on" and  
two "rear-end" signals at junctions of the blocks with switches  
operable by the rolling equipment.

**1,060,408. ELECTRICAL BLOCK-SIGNALING SYSTEM:** A. J. Al-  
lard, Richmond, Va. App. filed Feb. 15, 1911. Means operable  
mechanically by train entering block causes increase in voltage, and  
this, through relay, etc., effects contact shift train.

**1,060,410. METHOD OF PRODUCING GAS:** J. N. Alsop, Owens-  
boro, Ky. App. filed Nov. 9, 1910. A preservative gas is produced  
by subjecting air to action of electric arc and bringing into contact  
therewith a vapor of an organic substance.

**1,060,451. TROLLEY GUARD:** W. M. Hard, Centerville, Md. App.  
filed April 23, 1910. Guard fingers pivotally mounted on shaft of  
the trolley line.

**1,060,468. PRIMARY BATTERY:** H. E. R. Little, New York, N. Y.  
App. filed July 26, 1912. Zinc and carbon electrodes, electrolyte of  
halogen salt and means for directing chlorine gas to the upper surface  
of the electrolyte.

**1,060,509. PROCESS FOR THE MANUFACTURE OF ALUMINUM  
NITRIDE:** O. Serpek, Paris, France. App. filed May 17, 1912.  
Electrical-resistance heating; nitrogen is suitably to the immediate  
neighborhood of the resistance, thereby forming a cavity between  
the resistance and the nitride produced, into which cavity the  
mixture containing alumina and carbon is supplied.

**1,060,516. BURGLAR ALARM:** F. A. Vanahuter, Lodi, N. J. App.  
filed June 17, 1912. Electric circuit is closed and alarm sounded  
when attempt is made to destroy the device.

**1,060,519. ELECTRIC SIGN:** W. H. Weeks, New York, N. Y. App.  
filed May 29, 1912. Letters of the sign are tumbled about from a  
disorderly position into orderly intelligible relation, with means  
for flashing them in their disorderly and orderly positions.

**1,060,539. ELECTRIC SIGNAL BOX:** J. Derby, New York, N. Y.  
App. filed Sept. 19, 1912. For block-signal systems; firearm is dis-  
charged to give the alarm.



# Electrical World

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## The Money Market and the Industry

It is rather difficult to assign a reason for the condition, but the fact exists that money at the present time is

very tight. That this will act as a deterrent to many promising enterprises in the electrical field is apparent, for if existing utilities can scarcely raise enough money for extensions, where shall the newer and more speculative developments come in? Companies in progressive cities find it necessary to spend a sum equivalent to from 5 per cent to 10 per cent of their capitalization for extensions yearly. In a great many instances this amounts to a million or more of dollars, and considering the very unsatisfactory condition of the security market the world over, that amount of money can be raised only at a high rate of interest. The general public is, of course, not concerned with this end of the business, and public service commissions usually see to it that earnings do not increase beyond a certain reasonable return on the investment without ordering a reduction in rates. Moreover, utilities must serve the communities in which they exist, and although money for extensions may be approved by the public service commissions, if it can be had only at too great a price, retrenchment must ensue and this will react on the manufacturing companies. The number of new developments is becoming less and less yearly, and these must of necessity await a favorable money market or rely on foreign capital. Curtailment along this line affects chiefly the manufacturers of large electrical apparatus, and a pause in this activity need not of necessity be antecedent to any real depression in the industry as a whole.

## A Municipal Hydroelectric Plant

Municipal hydroelectric plants in this country are rare enough to be emphatically worthy of comment. Only a

few such plants are in operation, and the one at Eugene, Ore., described in another column, is therefore somewhat interesting, particularly as the details of cost are given in their entirety. Eugene is in southern Oregon, near the head of the Willamette Valley, and is perhaps best known as the seat of the University of Oregon. The population is about 12,000, so that a fairly considerable demand for electrical energy may properly be counted upon. Power is derived from the McKenzie River, which is a confluent of the Willamette, and the plant itself is 14 miles from the city at the end of a 4-mile canal. The upper hydraulic works are of a kind not uncommon in the West in which the water is deflected from the river supply by a very simple intake, provided merely with suitable protection of the headgates from logs and other drift. Near the power house the water passes through a wooden flume into

the forebay and again from the forebay to the power house through wood-stave pipe, finally uniting with an 8-ft. riveted steel Y leading the water to the two main turbines. The head is a moderate one, 43 ft. in the total, and the present equipment rating of the plant is a little over 1400 kw. for which more than three times as much available water at minimum flow of the stream. The hydraulic details are well recounted in the text of the article. Transmission is at 23,000 volts over a substantial wooden pole line. This municipal plant has been in service for about a year. A thousand customers are served. The average cost of the plant, including the distributing system thus far erected, has been practically \$200 per kw of plant rating. Of this amount \$155 per kw is chargeable to the completed transmission plant aside from all distribution costs. This is certainly not an excessive price for a plant operating in a growing community in the old hater-country. There is the reason why, if administered economically, the plant should not be successful as a practical investment. It is the question of economical administration under ever present political influences which overweighs all other considerations in the operation of municipal plants.

## Idaho and Maine Utility Laws

State legislatures have lately been very active in considering measures for the regulation of public utilities.

Among two of these recently passed are the Maine and Idaho measures, discussed in this issue. In many respects both of these are comparatively well-considered laws, but comparisons between them bring out certain defects or weaknesses which are worth emphasizing to aid in formulating still better laws hereafter. The Maine law is strong in that it recognizes no distinction between utilities under municipal ownership and those under private ownership—an evenly gripped position. Whereas the Idaho law specifically favors municipal plants as corporations. Whether the legislation of Idaho (which uses the term "corporation") should embrace both municipal and non-municipal enterprises we are not sure, but there seems to be some doubt. The variation in position shown from such regulation as applied to utilities with another founded by private capital constitutes an unfair and unjustifiable discrimination against the latter. The question has been discussed before, and we need not dwell upon it now, but considering a fundamental principle, the proper proportion of regulation to encourage the Maine act seems admirable, whereas the Idaho law, insofar as such portion as the commission. Such a principle may be said at once should be amended. The same principle apply to the matter of consolidation of companies and the holding of stock by

one utility in another. Between the two measures there is furthermore a marked difference as to the regulation of rates. Under the Maine law physical valuation is provided for, including the recognition of going-concern value and the allowance of a fair rate of return on the fair valuation or investment, but the Idaho law contains no such provisions. It permits, among other things, an arrangement for a fixed period for the automatic adjustment of rates in relation to dividends, which we interpret to authorize a progressive increase of the dividend rate concurrently with a progressive decrease in service rates. A safeguard against abuse of such a plan, however, is erected in the clause permitting the commission to revoke its approval at any time. The Maine law might be stronger in relation to the matter of establishing service standards and measurements, but the act probably permits of this, although not in perfectly direct language. The Idaho measure is unquestionably the stronger of the two as regards the powers of the commission to safeguard the public and the utility employees from dangers of any description. The provision adopted in Maine consolidating the state railroad and water-storage commissions with the new public utility commission is a commendable measure for economy and centralization of authority. Undoubtedly this will be the general tendency in other states which are preparing to adopt public utility laws or amendments in the near future.

### Annealing Steel in a Magnetic Field

An important article by Messrs. H. Pender and R. L. Jones has recently appeared in the *Physical Review* on the effects produced in the magnetic behavior of ordinary soft steels by annealing them in an alternating magnetic field. They discovered the interesting fact that when such sheet steels are heated to say 800 deg. C. and are then allowed to anneal and cool slowly under the influence of a cyclically alternating magnetic intensity the permeability of the resulting product, to low magnetic intensities, may be 50 per cent greater than when the alternating magnetic field is not applied. The effect of this magnetic annealing is small at higher magnetic fields. It is also small on the hysteretic losses, but it is distinct and these losses are reduced. That is, the remanent flux density is slightly increased and the coercive force is slightly reduced.

It is stated that the most favorable temperature at which to apply the annealing mmf is about 690 deg. C., or that near which pearlite forms. If the temperature at which the annealing mmf is applied was either higher or lower than this, the beneficial results obtained were not so marked. It is easy to understand why this should be the case if the temperature of application falls below 690 deg. C., but it is not easy to understand why the result is not so good if the magnetic process is commenced at say 750 deg. C. In other words, it is difficult to see what harm can be done by applying the mmf during the stage of annealing between 750 deg. C. and 690 deg. C. It is also stated that the benefit obtained in permeability is not proportional to the magnetic intensity used in the process but follows a saturation curve. Apparently there is little to be gained by ex-

ceeding an intensity of 15 gilberts per cm in maximum cyclic intensity, or about 20 mean effective ampere-turns per linear inch.

It seems that the flux densities produced by intensities of 10 or more gilberts per cm are scarcely increased by the magnetic annealing process. The beneficial effects are almost wholly confined to low intensities. Thus, with magnetic annealing, a maximum cyclic flux density of 10.3 kilogausses was produced by a maximum cyclic intensity of 1.25 gilberts per cm; whereas without magnetic annealing 10 kilogausses was the maximum cyclic density at 1.3 gilberts per cm. This means that very distinct advantage may be looked for in closed magnetic circuits, such as those of transformers, by the use of magnetically annealed steel.

The reason suggested for this very interesting effect of alternating magnetic annealing is that near 700 deg. C., in passing from sorbite to pearlite, an irregular blending of ferrite and cementite, the impressed magnetic field assists the grouping of the ferrite and prevents the less powerfully magnetic cementite from setting in an adversely active arrangement. It would be very illuminating to ascertain whether the gain in permeability to low intensities is produced by the magnetic annealing in all directions equally or whether it is produced more effectively in the direction of the impressed magnetic axis than in a direction perpendicular to this axis. A new and usefully promising field of investigation is here opened up by the discovery of the annealing magnetic field.

### Making Drawn-Tungsten Filaments

In the *Digest* this week will be found abstracts of several technical articles which have recently appeared in the German press giving some hitherto unpublished details regarding the manufacture of drawn-wire tungsten lamps. Our readers are fully aware by this time of the advantages of the drawn-wire filament. The preparation of pure tungsten and the method of commercially drawing it into beautifully uniform and homogeneous wire are masterpieces of scientific technology for which our countrymen deserve infinite credit, although the first steps were taken in foreign laboratories. It is a far cry, however, from the experimental preparation of ductile tungsten to its commercial utilization on an enormous scale. The earlier tungsten filaments, produced by sintering, were from the start somewhat granular and crystalline in structure, which accounted for their extreme fragility. As the process became better understood and more thoroughly worked out the sintered filaments were improved very notably in quality. The drawn-wire filament as now prepared has a structure singularly suggestive of the smooth, fibrous character of an iron wire. Like the iron wire, too, it changes character somewhat at high temperatures, but while iron tends to get crystalline at about 600 deg. C. the temperature of tungsten has to be carried to a very much higher point before a change of physical character sets in, and even after it does set in the dense homogeneous wire maintains its form very much better than did the original far less homogeneous sintered filaments.

Some half dozen years ago it was discovered that tungsten, uncompromisingly difficult to work at ordinary temperatures, becomes reasonably ductile at high temperatures. By the exercise of great care in purifying and consolidating the metal it can be prepared in homogeneous rods from which the present admirable wire can be drawn. In the process described in one of our German contemporaries, the original ingots are prepared from the powdery form of tungsten, that in which it is originally obtained, by the chemical part of the process—that is, by sintering in an atmosphere of hydrogen at very high temperature—and on subsequent working, as by rolling or hammering, the comparatively porous mass with which the process started can be reduced to a smooth, homogeneous, somewhat ductile rod which serves as the starting point for the preparation of filaments.

The drawing is the part of the process that requires very special precautions, inasmuch as the extreme hardness of the material prevents the use of ordinary dies, and in order to secure suitable ductility for ready working the temperature must be raised considerably above that of the room. The first requirement is met by the use of a diamond die, and the second by raising the temperature of the die casing and the entering rod to a sufficiently high value by intensive gas flames, the exact temperature depending on the stage of the drawing process. The larger filaments are stated to be drawn at temperatures of 600 deg. to 650 deg. C., and the smaller at temperatures down to about 400 deg. C.

The tungsten wire is remarkably strong, having a tensile strength probably the highest of any known material. Although the physical character of the wire is changed by prolonged heating to its working temperature, the final filament is still much less fragile than that in the earlier tungsten lamps, and it gives a very much longer period of useful service. Perhaps the most important feature of the drawn-wire filament is that it can be produced with such uniformity that the resulting lamps come very accurately to their rating. There is no such serious and costly necessity of sorting as was the case with the carbon lamps, a fact which gives promise of manufacture ultimately greatly cheapened, in spite of the obviously difficult and expensive process of making the lamp filament itself.

### Testing Electric Fans

In warm weather the principal purpose of an electric fan is to increase the flow of circumscribed air in contact with the body so as to promote evaporation of the perspiration, or water of perspiration, exuded through the pores of the skin. This evaporated moisture requires the absorption of heat in order to make it pass into vapor. The heat absorbed by water in passing into steam vapor is called the latent heat of steam. A gramme of water at 37° deg. C.—the blood temperature—absorbs energy when converted into vapor at this temperature to the extent of approximately 580 gramme-calories, or approximately 580 times as much latent heat energy as would be required to raise its temperature 1 deg. C. This vaporization heat is absorbed partly from the skin and partly from the immediately surrounding

air, clothing or adjacent substances. The result is a cooling of the body and a sense of comfort on a hot summer day.

With the understanding that the purpose of an electric fan is to produce motion in the air, its efficiency as a motion producer is naturally determined by the ratio of the motional energy it produces to the electric energy it absorbs in a given time or by that of the motional power it develops in the air to the electric power it absorbs. It is a well-known proposition pertaining to the operation of an ideal fan, producing an assumed uniform velocity of air in a tube, that the power given to the air varies as the cube of the velocity. In the article which we print on page 1009 Prof. H. B. Brooks points out that in view of the above proposition it is unreasonable to compare the output or mechanical efficiency of fans on the basis of the triple air velocities they develop. The cubes of those velocities should be taken into account.

When the power consumed by an ordinary small fan motor is measured as the speed is increased, it is found that deducting the losses in the motor the power increases substantially as the cube of the speed until a certain critical speed is reached, depending on the dimensions and design of the fan, when the power increases only slightly with the speed. This means that up to the critical speed the fan, if of ordinary good design, moves the air forward, so to speak, in direct proportion to the speed of rotation, but with a power necessarily proportional to the speed cube, but when the critical speed is reached the air, instead of passing through the fan, "breaks" and churning commences. At higher rotary speeds the fan simply flaps, flutters but adds little to the critical speed of the critical fan. Air churning is a very wasteful process, as a fan intended to project a column of air to a distance. Some fans in commercial use exceed their critical velocity when driven at full speed.

But the mere net efficiency, or ratio of net power delivered to electric power consumed, is not all of the story. The net efficiency of a fan may be high, and yet the machine may be relatively unsatisfactory for particular kind of service. Some fans are so designed that they can throw a small jet or column of air with considerable velocity to a great distance. Others are so designed that they can throw a large jet or column of air to a short distance. The first type may be compared to a rifle and the latter to a machine gun, both using the same powder charge. Each type has its own advantages in particular cases. The question whether the fan has its full force in throwing its wind far or close, depending on the relative advantage to the two types. The case is like that of an incandescent lamp supplied with different types of reflectors. With a scattering reflector the lamp is enabled to throw a powerful illumination over a small area at considerable distance. With a diffusing reflector it is able to scatter a weaker illumination over a large area. And, for its true great indication, consequently a full measure of the efficiency of a fan, as well as of a lamp, is not its power output, measured from which the air velocity at different distances and positions could be read off directly.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Annual Meeting A. I. E. E.

The annual meeting of the American Institute of Electrical Engineers, at which the result of the election of officers will be announced, will be held in New York on Tuesday, May 20, 1913. Following the business meeting a technical session will be held under the auspices of the railway committee of the Institute, at which two papers will be presented: "Twenty-four-hundred-Volt Railway Electrification," by Mr. H. M. Hobart, and "Trunk-Line Electrification," by Mr. Charles P. Kahler. The usual smoker will be held in the Institute rooms.

### N. E. L. A. Convention Program

The official program of business to be transacted at the annual convention of the National Electric Light Association, which will be held in Medinah Temple, Chicago, June 3 to 6 inclusive, is given below. As far as possible the subjects will be discussed at the time and in the order given. Following the usual custom, on the evening before the convention a reception will be tendered to the president of the association immediately following the opening of the exhibition made by the Class D members. In order to dispose of the business within the prescribed time parallel sessions will be held as heretofore, as many as three being held simultaneously.

#### GENERAL, EXECUTIVE AND PUBLIC POLICY SESSIONS

TUESDAY, JUNE 3, 10 A. M.

(1) Welcome to the city. (2) Address of President Tait. (3) Announcements. (4) Report of the committee on organization of the industry, by Mr. H. H. Scott. (5) Report of secretary, by Mr. T. C. Martin. (6) Report of insurance expert, by Mr. W. H. Blood, Jr. (7) Report of committee on progress, by Mr. T. C. Martin. (8) Report on "Question Box," by Mr. S. A. Sewall. (9) Paper, "Anticipation," by Mr. Paul Lupke.

WEDNESDAY, JUNE 4, 11:45 A. M.

(1) Paper, "Central-Station Power in Coal Mines," by Mr. W. A. Thomas. (2) Paper, "Switching Apparatus for Rural Installations," by Mr. E. B. Merriam. (3) Paper, "Central Stations for Towns of 5000 Population or Less," by Mr. J. Edward Kearns. Executive Session (12:45 p. m.): (1) Action on report of public policy committee, by Mr. Arthur Williams. (2) Presentation of proposed constitutional amendments, by Mr. Frank W. Frueauff. (3) Report of treasurer, by Mr. W. W. Freeman. (4) Election of nominating committee. (5) Appointment of committee on resolutions.

WEDNESDAY, JUNE 4, 8:30 P. M.

Public Policy Session: (1) Reading of report of public policy committee. (2) Address by Mr. Samuel Insull. (3) Report of Commission on Resuscitation from Shock, by Mr. W. C. L. Eglin. (4) Lecture on accident prevention in public utilities, by Mr. J. B. Douglas.

FRIDAY, JUNE 6, 10 A. M.

(1) Report of rate research committee, by Mr. E. W.

Lloyd. (2) Report of street-lighting committee, by Mr. John W. Lieb, Jr. (3) Paper, "Arc Lamps and Recent Developments Thereof," by Mr. W. A. Darrah. (4) Paper, "Advantages of Copper-Clad Wire for Series-Arc Lighting," by Mr. T. K. Stevenson. (5) Report of the committee on underground construction, by Mr. W. L. Abbott. (6) Lecture, "Light and Art," by Mr. M. Luckiesh. (7) Address, "Objects of the Society for Electrical Development," by Mr. Henry L. Doherty.

#### TECHNICAL SESSIONS

TUESDAY, JUNE 3, 2:30 P. M.

(1) Report of meter committee, by Mr. W. H. Fellows. (2) Report of committee on grounding secondaries, by Mr. W. H. Blood, Jr. (3) Report of lamp committee, by Mr. Frank W. Smith. (4) Paper, "New Incandescent-Lamp Development," by Mr. J. E. Randall. (5) Paper, "The Incandescent Lamp and Its Relation to Lighting Service," by Messrs. R. E. Campbell and W. C. Cooper. (6) Report of committee on measurements and values, by Dr. A. E. Kennelly.

THURSDAY, JUNE 5, 10 A. M.

(1) Report of committee on prime movers, by Mr. I. E. Moulthrop. (2) Report of committee on electrical apparatus, by Mr. L. L. Elden. (3) Paper, "Switchboard Instruments," by Mr. Paul MacGahan. (4) Paper, "Latest Developments in Distributing Transformers," by Mr. E. G. Reed. (5) Paper, "The Use of the Telephone in Central Stations," by Mr. Angus Hibbard. (6) Report of overhead-line construction committee, by Mr. Farley Osgood.

FRIDAY, JUNE 6, 2:30 P. M.

(1) Paper, "Transformers and Power Transmission," by Mr. H. H. Rudd. (2) Paper, "Railway Loads for Central Stations," by Mr. E. P. Dillon. (3) Report of committee on award of Doherty gold medal, by Mr. W. F. Wells. (4) Report of committee on memorials, by Mr. T. C. Martin. (5) Report of committee on constitutional amendments, by Mr. Frank W. Frueauff. (6) Vote on constitutional amendments. (7) Report of committee on resolutions. (8) Report of nominating committee. (9) Election of officers.

#### TRANSMISSION SESSIONS

WEDNESDAY, JUNE 4, 10 A. M.

(1) Address of chairman of section, by Mr. W. N. Ryerson. (2) Report of committee on membership, by Mr. R. J. McClelland. (3) Report of committee on progress, by Mr. T. C. Martin. (4) Report on turbines, by Mr. J. F. Vaughan. (5) Paper, "The New Type of Thrust Bearing," by Mr. Albert Kingsbury.

THURSDAY, JUNE 5, 2:30 P. M.

(1) Paper, "Poles and Pole Preservation," by Mr. R. A. Griffin. (2) Paper, "Lightning Arresters," by Mr. E. E. Freighton. (3) Paper, "Developments in Protective Apparatus," by Mr. J. N. Mahoney. (4) Lecture, "The System of the Mississippi River Power Company," by Mr. Hugh L. Cooper.

FRIDAY, JUNE 6, 10 A. M.

(1) Report of committee on receiving apparatus, by Mr. M. R. Bump. (2) Report of committee on distributing lines, by Mr. P. M. Downing. (3) Report of committee on

operation of water-power systems, by Mr. D. B. Rushmore. (4) Paper, "Factors Producing Reliability in the Suspension Insulator," by Mr. A. O. Austin. (5) Paper, "Transmission-Line Construction," by Mr. R. D. Coombs. (6) Address, "Investigation of Life Hazards of High-Tension Lines by the United States Bureau of Standards," by Dr. S. W. Stratton. (7) Election of officers.

#### COMMERCIAL SESSIONS

TUESDAY, JUNE 3, 2:30 P. M.

(1) Address of chairman of the section, by Mr. Edward W. Lloyd. (2) Report of finance committee, by Mr. T. I. Jones. (3) Report of membership committee, by Mr. J. F. Becker. (4) Report of publications committee, by Mr. Douglass Burnett. (5) Address, "How to Protect Business from Disturbance Caused by Panics," by Mr. David R. Forgan. (6) Report of "Electric Salesmen's Handbook" committee, by Mr. E. L. Callahan.

WEDNESDAY, JUNE 4, 10 A. M.

(1) Report of committee on education of salesmen, by Mr. George Williams. (2) Report of committee on electrical merchandising, by Mr. T. I. Jones. (3) Report of advertising committee, by Mr. J. Robert Crouse. (4) Paper, "Advertising for a Small Central Station," by Mr. N. H. Boynton.

THURSDAY, JUNE 5, 10 A. M.

(1) Reports of "electricity on the farm" committees. (a) Eastern States, by Mr. John C. Parker; (b) Middle States, by Mr. C. W. Penbelle. (c) Western States, by Mr. Stanley V. Walton. (2) Report of committee on lighting of existing buildings, by Mr. Robert S. Hale.

THURSDAY, JUNE 5, 2:30 P. M.

(1) Report of committee on ice and refrigeration, by Mr. George H. Jones. (2) Report of committee on efforts in executing customers' orders, by Mr. George C. Holberton. (3) Report of committee on steam heating, by Mr. S. Morgan Bushnell. (4) Report of nominating committee. (5) Election of officers.

#### ACCOUNTING SESSIONS

TUESDAY, JUNE 3, 2:30 P. M.

(1) Report of committee on uniform system of accounts, by Mr. E. J. Bowers. (2) Paper, "Accounting School and Education of Employees," by Mr. A. L. Holme. (3) Paper, "Method of Keeping Prepaid and Accrued Accounts," by Mr. Franklin Heydecke. (4) Paper, "Office and Mechanical Appliances: Their Uses, Economies Effected, etc.," by Mr. H. L. Lohmeyer.

WEDNESDAY, JUNE 4, 10 A. M.

(1) Report of sub-committee on a tentative classification of accounts, including balance sheet and indicant accounts, by Mr. John L. Bailey. (2) Paper, "Handling of Freight Bills," by Mr. Albert S. Scott. (3) Paper, "Accounting for Replacement of Plant Retired from Service," by Mr. Frank A. Birch.

THURSDAY, JUNE 5, 10 A. M.

(1) Report of sub-committee on statistics and forms, by Messrs. C. L. Campbell and H. Spodirer. (2) Paper, "Obligations of the Bookkeeping Department to the Operating Department," by Mr. H. Patterson. (3) Paper, "Handling of Bond Coupons," by Mr. W. J. Kehl.

#### Specials to the N. E. L. A. Convention

Arrangements have been perfected for carrying the delegates to the convention of the National Electric Light Association in Chicago, June 2, 3, 4, 5 and 6. The comfort and convenience of the delegates have been considered, and the result promises to be an even greater success, in point of equipment, service and accommodations, than was attained last year.

The Pacific coast delegates will leave on the special 1913 special train from San Francisco, June 2, at 8 a. m., reaching Oakland at 8:30, Sacramento at 11 a. m. and Ogden at 11:25 a. m. From the latter point a half day later to Salt Lake City will be made, en train arriving there at 11:25 a. m. and leaving at 3 p. m. on the return trip to Chicago. The train will leave Chicago for Omaha at 4 p. m., leaving Omaha for Chicago at 10 p. m. May 31 and arriving at Chicago the next morning, June 1, at 11 p. m. The special train is the "Golden Poppy" special No. 2 from all points between San Francisco and Los Angeles on the "Golden Route" via the Sp. & P. Pacific and south on the coast to the State of New Mexico, and return the same route to San Francisco. In addition to the sleeping cars, there will be parlor and dining cars, day and evening coaches, and baggage cars arranged for collecting gear, mail and other parcels. Car parties from Southern California and the Pacific Northwest are being formed and it is planned to have the former leave on the "Blue" train on May 31, leaving the depot at Oakland 1 p. m. The Northwest group will join the train either at San Francisco or at Chicago. Mr. E. B. Spring, of the Chicago & North Western Co., Chicago, Cal., is chairman of the Western Transportation committee.

An outline of the arrangements for the other special trains was given in page 977 of our issue dated May 2. Since that date certain changes have been made in the departing time of the "Magnolia" and "Purple" specials. The "Magnolia" special from Atlanta, Ga., was at first scheduled to leave at 8:30 a. m. on June 1, arriving at Chicago 6 a. m. on June 2. It has been changed to leave the Southeastern Station at the N. E. L. A. convention auspices this train is being run, to have it leave the Terminal Station, Atlanta, at 10 a. m. on Saturday, June 1, arriving at Chicago at 7 p. m. on June 2.

The "purple" special, which was timed to leave Chicago Station, St. Louis, at 4 p. m. on June 1, arriving at Chicago at 7 p. m. on June 2, has had its departure changed on account of the numerous requests from the managers in and around St. Louis. It will start from St. Louis at 9 a. m. on Monday, June 2, arriving at Chicago 5 p. m. on the same day. It was thought preferable to run the train during the daytime rather than at night in order to afford the delegates a chance to become acquainted en route.

#### Local Committees for Chicago Convention

The general entertainment and convention committee for the forthcoming Chicago convention of the National Electric Light Association is made up of Messrs. Mr. Samuel Insull, chairman; Messrs. E. C. Smyth, H. L. Moore, W. W. Linn, D. D. Allen, H. J. Arnold, Ernest Freeman, E. J. Basci, C. A. Moore, Homer C. Stone, Mary L. Bond, L. A. Bergman, W. Winklerfeld, John F. Williams, Marshall L. Sampell, L. C. Haynes and E. W. Linn. Mr. George B. Foster and Mr. E. C. Smyth are the secretaries of the committee.

Sub-committees have been appointed. Finance: Messrs. Mr. Samuel Insull, chairman; Messrs. E. C. Smyth, W. W. Linn, H. C. Sunny and J. V. Campbell. Reception: Mr. L. A. Bergman, chairman; Messrs. H. C. Sunny, M. L. Bond, H. C. Sunny, T. P. Gaylord, W. P. Sidney, E. W. Allen, Martin L. Bond, J. V. Campbell, H. M. Schell, J. C. Moore, Frederick Sampell and H. J. Waring. Ticket: Mr. H. C. Sunny, chairman; Messrs. H. C. Sunny, T. P. Gaylord, W. P. Sidney, E. W. Allen, Martin L. Bond, J. V. Campbell, H. M. Schell, J. C. Moore, Frederick Sampell and H. J. Waring. Transportation: Messrs. H. C. Sunny, H. R. Hyatt, D. D. Allen, W. W. Linn, H. C. Pinkard, Ernest Freeman, J. C. Moore, James M. Galt, Ernest L. W. Linn, D. D. Allen and Ernest L. Bond. Transportation: Mr. D. D. Allen, chairman; Messrs. George Butler, Ernest Freeman, Ernest Freeman, J. C. Clark, J.

G. Learned, S. P. Wells, Jr., Taliaferro Milton and R. E. S. Geare. Local Industries—H. L. Monroe, chairman, General Electric Company; Messrs. C. W. Regester, F. Von Schlegell, F. A. Ketcham, W. T. Dean, W. L. Abbott, Julian Roe, T. C. Ringgold, E. E. Witherby, Perry R. Boole and Herbert I. Markham.

### Work of the Chicago Central Station Institute

Although the Chicago Central Station Institute has received more than 500 applications for entrance to its courses, the high standard of fitness required of matriculants has limited its present enrolment to sixteen, half of whom are college men, said Mr. F. R. Jenkins, secretary and instructor in charge of the Institute, in discussing the school's aims and plans before the Chicago Jovian Lunch Club on May 12. By Aug. 1 the number will have been increased to about forty, later adding ten others and making up the full quota of fifty.

Enrolment of technical-school graduates has been personally solicited, particularly those with commercial aptitude or tastes. Of the colleges represented in the new class which will enter at the end of the July vacation, Purdue University leads with seven 1913 graduates who have signified their intention of taking the course. Admission is not restricted to college men, of course, but high standards of general fitness for central-station sales work are imposed, regardless of whether the candidate is a graduate or not. Students may enter the eleven-month course at the beginning of any month except July, which is the vacation period. While those who complete the Institute work with good records are practically assured of positions in the companies which defray the cost of the school, no contracts are required of the men debarring them from taking any other position they desire upon graduation. A preliminary account of the plans for the Central Station Institute was given on page 334 of the *Electrical World* of Feb. 15, 1913.

### National City Planning Conference in Chicago

The fifth National Conference on City Planning was held May 5, 6 and 7 at the Hotel La Salle in Chicago. Printed papers dealing with civic improvements which have received the attention of cities in general were distributed to those present and discussed at the different sessions. The presiding officers at each session were men who have taken an active interest in the subjects under consideration at their respective sessions. Mr. Frederick Law Olmsted, chairman of the executive committee, submitted an outline of a program which would serve as a guide in advancing the city planning movement. The hope was expressed that the conference would be instrumental in forming a well-organized staff of city employees, the duty of which would be to record, index and interpret the various changing city plans.

Among the papers discussed at the conference were: "The City Scientific," by Mr. George B. Ford, of New York City; "A Survey of the Legal Status of a Specific City in Relation to City Planning," by Mr. Edward M. Bassett, of New York City; "Organization and Functions of a City Planning Committee," by Mr. William A. Magee, of Pittsburgh; "Some Phases of City Planning with Reference to the Plan of Chicago," by Mr. Edward H. Bennett, of Chicago; "Planning Improved Means for Circulation of Passengers and Freight," by Mr. Milo R. Maltbie, of New York City; "A Survey of European Town Planning with Special Reference to Cost Distribution," by Dr. Werner Hegemann, of Berlin, Germany; "The Actual Distribution of the Cost of Kansas City Parks and Boulevards," by Mr. George E. Kessler, of St. Louis.

Mr. Ford's paper emphasized the need for securing data

on the transportation facilities to ascertain whether they meet the needs of traffic conditions.

Mr. Magee said in his paper that the planning commission should be empowered to suggest to, consult with and advise corporate managers in regard to their improvements. "The municipality is handicapped in dealing with corporations generally by the lack of an appropriate administrative organ." An official representing the city under the guidance of the planning commission, it is believed, would be an invaluable agent on occasions where matters regarding public utilities are discussed.

Mr. Bennett's paper presented some of the aspects embodied in the Chicago plan. There was proposed a method of alleviating the congested conditions in transportation which would provide for considerable future growth in population. Steam railroads have established yards in the heart of Chicago, thereby injuring the esthetic aspect of the city. In several instances warehouses have been built over the tracks, but the establishment of totally covered railway lines can be accomplished best, it was stated, with the advent of electrification. With a proper street system, which is considered by Mr. Bennett the most important subject in the field of the planning commissions, should come rules governing the laying of underground conduits for electricity, telephones, telegraphs, etc.

The method of apportioning the construction charges of new rapid-transit systems in New York City between the companies operating the cars and the city, which builds and owns the lines, was discussed in Mr. Bassett's paper.

The value of straight streets as an aid toward improving rapid-transit facilities was discussed in Mr. Maltbie's paper. The demand for transportation increases as the height of the buildings increases. Considerable care should be taken in locating suburban and urban stations so as to afford convenient means of connection with other transportation facilities. In order that rapid-transit subways may pay, the cars have to be crowded to their limit, as the fixed charges on subway structures are extremely high. In the case of a rapid transit subway extension in New York City, the rate of increase in the value of property in its vicinity is so much above the normal rate that the total construction could have been paid for in six years with the money representing the increase in value of the land. Mr. Maltbie suggested utilizing the cars after midnight and up till morning transporting food supplies into the city from outlying districts as a means toward cutting down living expenses. In conclusion Mr. Maltbie stated that the city should not only control the first schemes of development of a corporation, but should have a body which would keep the varied interests in harmony.

The street-railway situation in San Francisco was explained by Mr. Bion J. Arnold, of Chicago. The municipality is using its own street-railway lines to obtain results from the privately owned system.

### The Society for Electrical Development

The annual meeting of the Society for Electrical Development was called in New York on May 13 and adjourned to reconvene in Chicago on May 31 at the Hotel Sherman, for the greater convenience of the members of the society who will attend the annual convention of the National Electric Light Association and for the convenience of those members of the National Electric Light Association from the West who otherwise would have found it difficult to come East on two occasions.

At the meeting of the board of directors an enormous amount of preparatory work was done to put everything in readiness for the meeting on May 31. The financial statement showed that an amount considerably in excess of \$100,000 has already been pledged to assist in carrying out the work of the society when the active work shall be started, after minimum subscriptions have been made to the



amount of \$200,000. There is still on hand in cash from the advance subscriptions made by the board of directors of the society a sufficient amount to complete the necessary organization work, and the committee approved of an additional expenditure to publish a booklet covering the history of the society, together with the complete plans of the contemplated work, by-laws, etc.

The committee approved the engaging of an editorial or publicity man to begin collecting material and in the meantime be of assistance to the present staff in membership extension and other work. Mr. Stephen L. Coles, formerly managing editor of the *Electrical Review*, will be affiliated with the society in this position.

The board approved the report of the committee on plans, which met on May 6 and from a great mass of ideas and suggestions drew up a definite, concrete plan for the active work of the society, as noted on page 969 of our issue for May 10. The general aims of the society already have the approval of the public policy committee and executive committee of the National Electric Light Association, as well as the approval of the National Electrical Supply Jobbers' Association, the National Electrical Contractors' Association and a number of the representative electrical manufacturers.

The slogan selected for the society, namely, "Do it electrically," was submitted separately by Mr. J. A. Burk, New York; Mr. E. B. Featherstone, San José, Cal.; Mr. Max Lowenthal, New York; Mr. C. B. Briggers, St. Louis,



TRADE MARK OF SOCIETY FOR ELECTRICAL DEVELOPMENT

Mo., and Mr. K. Thornberg, Lynn, Mass. Herewith is reproduced the trade-mark selected, which was submitted by Mr. Philip Dodd, secretary of the society. The prize of \$100 which was offered for a trade-mark has been added by Mr. Dodd to the \$100 offered for a slogan, and \$200 will be divided among the five successful slogan contestants.

Mr. Charles E. Brown, of the Central Electric Company, Chicago, was elected a director to take the place of Mr. R. V. Scudder, deceased, and Mr. John R. Galloway, of Washington, D. C., was elected director in place of Mr. P. N. Thorpe, resigned.

## Oklahoma Utilities Convention

The second annual convention of the Gas, Electric and Street Railway Association of Oklahoma was held in the Skirvin Hotel, Oklahoma City, on May 6, 7 and 8. The delegates were welcomed to the city by Mayor Grant. The annual address of the retiring president was delivered by Mr. F. W. Caldwell, of the Shawnee Gas & Electric Company. A paper by Mr. W. B. Clayton, of the Southwest General Electric Company, on "Lightning Arresters" closed the first session.

### PRESIDENT'S ADDRESS

President Caldwell stated that during the year Oklahoma has passed through an economic crisis, but that the universal feeling is one of optimism and that in view of the abundant crops promised, the outlook is very cheerful. He advocated affiliation with other organizations, both local and national, and favored the selection of an official publication to help the members keep in closer touch with each other. Finally he urged the advisability of cultivating the good will of the public at large and said that courtesy to

the public should be demanded of all employees of service companies at all times.

### LIGHTNING ARRESTERS

Four main types of lightning arresters were described in detail by Mr. Clayton. In the compression-chamber multi-gap arrester the gaps are inclosed in an air-tight chamber, and when the discharge takes place the gases that are formed in the gaps are compressed, which aids the rectifying action in promptly extinguishing the arc. With the graded-shunt multi-gap arrester the temperature of the arc is reduced by selecting metals of low melting point for the splinters and by limiting the value of the current by means of resistance. For systems employing 6600 volts or over the aluminum-cell arresters are best adapted. Horn gaps of various types are useful on very high voltages and may also be used to advantage at times in connection with arresters of the aluminum-cell type. In conclusion, the author made a plea for further co-operation between the power plant engineers and the designers of arresters, in order to enable the latter to cope successfully with increasing demands on such apparatus.

In the afternoon two papers were presented, and a trip was made to the power plant, substation and retail shops of the Oklahoma Railway Company. Supper was served in the evening by the Oklahoma Gas & Electric Company.

### RAILROADS AND SAFETY

In a paper on "Railroads and the Safety First Movement" Mr. George L. Koss, of the Oklahoma Railway Company, gave a brief outline of the growth of the "safety first" movement in the United States, with particular reference to the part played by the railways in its development. The author said that the analysis of reports had proved conclusively that about 80 per cent of the accidents occurring under the old conditions, before the movement had been inaugurated, were due to the carelessness or negligence of the injured. The operating companies were nevertheless obliged to shoulder the public responsibility and in self-protection they were forced to attack the problem from the educational standpoint and try to get the public, as well as their own employees, to study means for avoiding accidents. Some of the measures used for reducing the number of preventable accidents were mentioned. The author said that safety work has certainly been accomplished, comparatively only a start has been made, and that there is need for constantly attracting the public concerning the necessity for caution. The impression conveyed by the paper was that the gain from this safety campaign has been not only compensation for the largely financial loss in reduction of the losses from damages awarded as a result of preventable accidents. Mr. Koss added, during the discussion, that a good deal of help and co-operation had been received from the public and particularly from the school authorities, in promoting the safety movement.

### Low Voltage Lamps

Mr. J. W. Tubb, Jr., of the General Electric Company, made his paper on the advantages of low voltage incandescent lamps an appeal for the use of such lamps in competition with the operation of incandescent flames. His main point was that safety gains by low voltage operation, the central station being in use, Mr. Tubb said, and the consumer tending to get the most satisfaction possible for his money. The issue of low voltage operation is the fact that central station voltages are not as true, very quickly. He said that these could be substituted more often. As a means for properly rating the correct service voltage for best results to the consumer, he advocated the making of extensive "voltage surveys" with resistance coils at the sockets, and furnishing to consumers the most satisfactory lamps to suit their conditions. Two interesting tables were given in connection with the paper, the first of reasons for

the central station by the elimination of under-voltage burning, and the other showing the gain to the customer in candle-power by the same process.

#### SINGLE-PHASE MOTORS

Single-phase motors, especially in the smaller sizes, were held by Mr. F. Johnson, of the Wagner Electric Manufacturing Company, to offer to the central-station man a solution of the problem of the small power user. The subject was treated from two standpoints: (1) minimum tangible and intangible investment, and (2) effect on present investment. The former was covered in a novel manner by a series of questions and answers, with accompanying curves bringing out graphically the superiority of the single-phase motor. As to the latter point figures were given to show that the line disturbance produced by the starting of single-phase motors is materially less than for polyphase machines. It was also claimed by the author that a higher power-factor results from the use of single-phase motors and that this means a big saving. The paper closed with a short explanation of the operating characteristics of the unity-power-factor motor.

In the discussion of the paper a number of the delegates were inclined to disagree with Mr. Johnson as to the superiority of the single-phase motor and as to the extent to which it would be advisable to attempt to regulate the types of motors used by customers. One central-station man put the matter succinctly when he said that he was after the business and was willing to let the customer decide as to his own type of motor.

#### COMPENSATION OF UTILITY COMPANIES

Concerning the perpetual disagreement between the operators of public utilities and the regulating commissions, Mr. W. J. Dibbens, of the Guthrie Gas Light & Improvement Company, offered the following suggestions whereby the operators may obtain a fairer and more impartial consideration of their position by the public and the rate-making bodies: (1) Efforts should be made to keep the public in close touch with the affairs of the companies, by persistent publicity work and by fair treatment of complaints. (2) The facts of the companies' burdens and expenses should be presented in full before the rate-making bodies and an appeal made for adequate rates.

#### ELECTRICITY AND IRRIGATION

A very broad article was read by Prof. H. B. Dwight, of the University of Oklahoma, on the agricultural situation in that State at the present time. He treated particularly of the need for artificial irrigation and the best methods for obtaining it. Certain sections of the State, he said, are particularly adapted to the use of the gravity system, but the greater portion of the farming land is so situated that irrigation by pumping would be most advantageous. The possible methods of pumping and the limitations of each were brought out in detail and a strong appeal was made to the central stations to co-operate in the promotion of more intensive and scientific farming. The author claimed that the extension of service lines to render electrical energy available for the farmers' use would be repaid not only by the sale of energy for pumping but also by its extensive use for numerous electrically operated devices.

#### OIL-ENGINE OPERATION

Some data were given in a paper by Mr. J. W. Dawley, of the Hugo Ice & Light Company, on the operating characteristics and cost of a small oil engine of the Diesel type. The engine in question was of 225-hp rating and was directly connected to a 200-kva generator. It was installed in November, 1911, and had been in operation continuously, except on Sundays, since that date. While exact figures were not available, it was estimated that the fuel cost was from 2.5 mills to 3 mills per kw-hr. The consumption of lubricating oil was about the same as for a steam unit of the same size; that is, approximately 2 gal.

per twenty-four hours, at an expense of 28 cents per gal. About 5 gal. of water per hp-hour were used in the crank case with the oil and about 5000 gal. of cooling water per day were required. Repairs had cost up to that time \$158.33 and the amount of attendance required was small.

#### OPERATION OF A GAS PLANT

The problems facing the operators of a natural-gas plant in a growing Western city were ably covered by Mr. W. H. Bagley, of the Osage & Oklahoma Company.

#### LIABILITY INSURANCE

Mr. Frank H. Ellis, of the Kansas Employers' Inter-Insurance Exchange and Illinois Indemnity Exchange, read a comprehensive paper on the subject of liability insurance. The trouble with the prevailing insurance system in this country, he said, is that the insurance companies have not been forced to keep step with modern business methods. The indifference and ignorance of the insuring public as to what is going on in the insurance field are directly responsible for this state of affairs. That excessive rates are charged for insurance generally is due to the fact that the agents practically control the situation and can demand exorbitant commissions, which of course come out of the policy-holder in the long run. The only hope of reducing the cost of insurance lies in establishing a system whereby the money spent for insurance is used for insurance. This relief may be obtained in one of three ways—self-insurance, state insurance or reciprocal or mutual insurance. There are very few concerns so situated that they are safe in attempting the first plan. State insurance is open to a number of objections, among which might be mentioned the likelihood of dishonesty in its administration and the flavor of paternalism which is apt to attach to it. In the mutual form there is a defect that may cause trouble in that unlimited-partnership liability is incurred by the insurers.

#### PUBLIC-UTILITY LEGISLATION

A lengthy and impartial treatment of legislation affecting public utilities was given by Prof. H. V. Bozell, of the University of Oklahoma. In his paper he presented some of the basic ideas of legislation in general, the power of the State to legislate in connection with the business of public utilities, the causes of some of the recent legislation, the general class of legislation resulting from these causes, subsequent effects upon the utilities and the proper attitude of the utilities regarding this legislation in order to conserve their own best interests. The author was inclined to believe that the gross abuse of privileges by a small number of monopolistic utilities during the early days was responsible for the passing of drastic laws which proved a burden to those utilities which had aimed to be fair. The author pointed out that the present tendency to place the regulation of utilities in the hands of commissions is correct in theory provided sufficient authority is given to such bodies to allow of their protecting the interests of the utilities as well as those of the community. He claimed that where privately owned utilities are subject to state regulation by commission municipally owned utilities should be subject to the same control.

#### OFFICERS

A single session was held on May 8. During the annual business meeting an amendment to the constitution was made providing for company membership instead of individual membership as formerly, a class being reserved, however, for individual members. The election of officers for the ensuing year resulted as follows: President, Mr. F. E. Bowman, manager of the Ada Electric & Gas Company, Ada, Okla.; vice-presidents, Messrs. Lincoln Beerbaum and George W. Knox; secretary-treasurer, Prof. H. V. Bozell, director of the School of Electrical Engineering, University of Oklahoma, Norman, Okla.; directors, Messrs. F. E. Bowman, H. S. Cooper, W. H. Bagley and R. D. Long. The registration at the convention numbered 125.



## Convention of Arkansas Association of Public Utility Operators

The sixth annual convention of the Arkansas Association of Public Utility Operators was held at Little Rock, Ark., May 5 to 7, inclusive. Owing to the late arrival of a number of the members, the first session was not held until Monday afternoon. In the absence of President J. W. McLendon, who has left the State, Second Vice-president J. F. Christie, of Jonesboro, presided. Following an address of welcome by Mayor C. E. Taylor of Little Rock and replies by several members, Acting President Christie addressed the association concerning matters of mutual interest.

### ELECTRIC LIGHT ACCOUNTING APPLIED TO SMALL COMPANIES

In a paper with the above title prepared by Mr. R. B. Fowles, of the Pine Bluff Corporation, only such subjects as would interest the small company with a gross revenue of \$25,000 per annum or less were considered. The classification adopted by the National Electric Light Association for the purpose of obtaining a uniform system of accounting for electric-light companies was discussed, although the company with which the author is connected adopted the classification of the Interstate Commerce Commission in preference to that adopted by the N. E. L. A. The operating accounts as specified in the N. E. L. A. classification were first outlined, account being taken of only such as applied to a steam station, and the general items which fall under the various groups were enumerated.

### Discussion

In the discussion which followed considerable reference was made to the author's mention of the advisability of adopting the Interstate Commerce Commission's form of accounting in preference to that recommended by the National Electric Light Association. Some members thought that the present tendency of merging public utility properties would result in federal supervision. Others contended that it would be well to adopt the commission form of accounting because state commissions would demand some standard method and no doubt specify the system already adopted by the Interstate Commerce Commission. The discussion then turned to the proper method of accounting for going value. Mr. W. L. Wood, Jr., of the Texarkana Gas & Electric Company, said the important item of "going concern" value received too little consideration, particularly with small companies. A careful record should be kept of all items chargeable to this account so that it would enter into rate adjustments and valuations. He said further that many operators of small plants do not appreciate that they are entitled to this additional value.

### OPERATION OF SMALL CENTRAL STATIONS

To operate a small station and get results is one of the biggest things a man can undertake, according to Mr. W. H. Walkup, of the Batesville Water & Light Company. It is not always the station equipped in the most modern manner that "makes good," because such a station may be over-capitalized or badly managed. Sometimes it is the plant with small indebtedness and good management which pays the largest dividends in money and has the good-will of its customers, all of whom expect good service, reasonable rates and courteous treatment. As the necessary essentials for success in the operation of small properties Mr. Walkup specified loyal help, complete and accurate records and competent management. All three topics were expanded by the author.

### Discussion

At the close of the paper Vice-president Christie emphasized the importance of a manager's ability to treat with the public. He must be a good judge of human nature and

always make the complaining customer feel that he is interested and ready to adjust the case fairly.

In explaining the reasons why it is hard to get cost reduction in fuel consumption Mr. Walkup said that previous to taking a large part of the plant in operation the cost of firing was extremely high. However, in the treatment of chambers and auxiliary equipment in the plant also contributed to increase the coal bill. The old boilers and auxiliaries were repaired and a number of measuring instruments added. In closing, he stated that he believed that there was greater economy in firing a small plant than in the large one, owing to having a more efficient management.

Mr. J. W. Gillette, of the Fort Smith Light & Traction Company, described the operation of meter that had had that recently a large amount of mechanical money had been lost at a water plant. One of the things that had happened 125 meters had been broken. Through investigation by someone found in fifteen days and connected with the going. Mr. Gillette also stated that he was experiencing similar trouble in Fort Smith, but the difficulty of obtaining evidence subject to changing conditions made the location of the defective meter hard.

Another subject brought up for discussion was that of adjusting bills. Mr. Gillette stated that the operation of a bill in a way satisfactory to the customer and company was a matter of difficulty. The company may be the rebates and refused to the meters in adjustments, but the matter of getting bills from ten to thirty days are allowed, depending on the financial status of the customer before service is cut off. The type of bill employed by the company is in the form of a card card with a perforated and properly stamped when sent to the company.

### REPORT OF FINANCIAL COMMITTEE

The report of the executive committee was submitted at the opening session on May 6 and among other recommendations of special interest to the association was the nominating Mrs. La Salle Stoops, of the Stuttgart Water, Light & Power Company, as delegate to the Chicago convention of the National Electric Light Association. The report of this committee was adopted unanimously.

### REPORT OF FINANCIAL COMMITTEE CONTINUED

Presenting his paper with the same title, Mr. Gillette made valuable notes to a public utility company in the past bill and confidence of the community which it serves. Mr. J. W. Gillette, of the Fort Smith Light & Traction Company, said that many public utility companies are inclined at times to give too little consideration to financing and suffering the close friendly relationship which should exist between the patrons and the company to make the best return for all concerned. Once a realization must be made at once when understood and realize that their attitude is not only toward the patrons of the company but to the public in general must be courteous, friendly and obliging at all times. Usually street railway companies are more considerate to the community, the largest and most frequent source of the community, and the attitude of the public toward them is more friendly than toward the utility companies. It is the opinion of Mr. Gillette that the public is more friendly toward the utility companies than toward the street railway companies.

### Discussion

In discussing the subject of Mr. W. L. Wood, Jr., of the Texarkana Gas & Electric Company, mentioned the importance of having unity of the managerial personnel. The public utility companies which manage the utility companies but have a lot of time and attention for the kind of their service to customers. Mr. Gillette also mentioned that the utility companies' financial condition was not



consumer. He believed that if this was done there would not be much difficulty in convincing the city council.

Continuing the discussion of relations with the public, it was stated that the strongest efforts should be turned to the complaining customer. If there were any favors to be granted, they should be bestowed on enemies, if the best results were to be obtained. Special stress was laid on the character of the office force handling complaints. Best results have been obtained with men trained for this service. A suggested cure for a number of complaints is that of keeping a record of social entertainments. In many instances it was found that an unusually large bill could be explained by reference to this record.

Mr. A. E. Main, of the Hot Springs Water, Gas & Electric Company, called attention to the publicity policy adopted by the Federal Light & Traction Company and effective in Hot Springs. Cards are posted in cars and other public places which state that courteous treatment is always due the public. Another form of publicity which has had a tendency to reduce complaints has been found in the meter card. This is fastened on the wall near a meter and is a record of the readings and subtractions which form the basis of each month's bill.

#### LEGISLATION AFFECTING PUBLIC UTILITIES

A paper on this subject presented by Mr. C. J. Griffith, of the Little Rock Railway & Electric Company, was devoted exclusively to the trend of legislation directed at street railway companies in various states. Referring to commission control, the author said that much depends on the type of man appointed, but unfortunately many appointments are used to discharge political debts, and where "corporation baiters" are selected much unjust harassing of corporations results. Where a public-utility corporation is composed of practical, level-headed men without bias and with a sense of justice better and more lasting results ensue than where the question of franchises, etc., is left to the mercy of a succession of inexperienced municipal lawmakers more or less subject to political influences.

#### Discussion

The general discussion following the reading of the paper was brief and the points brought out were purely of local interest.

#### SMALL WATER PLANTS

Continuing the regular program on the afternoon of May 6, Mr. E. T. Reynolds, of the Camden Power Company, Camden, Ark., read his paper on "Operation of Small Water Plants," dealing exclusively with problems of public water supply. This was followed by brief discussion. Mrs. La Salle Stoops then presented a paper setting forth the many and varied advantages of the association, entitled "Benefits of Association." At the conclusion of the discussion of her paper a vote of thanks was extended to Mrs. Stoops. A paper presenting the plan of the Utilities Indemnity Exchange of St. Louis, Mo., was read by Mr. B. H. Batte, its representative. The discussion then turned to the benefits to be derived from giving publicity to resuscitation from electric shock through a distribution of the National Electric Light Association charts and books of

instructions, and this plan met with the general approval of the delegates.

#### MODERN PRACTICE OF FEEDER AND VOLTAGE REGULATION

The advantages resulting from obtaining good voltage regulation over an entire distribution system were pointed out in a paper by Mr. V. A. Hain, of the General Electric Company. After discussing what good voltage regulation means and what bad results come from poor regulation, Mr. Hain showed how the condition might be improved and how the improvement is usually fraught with financial gain. Almost all of the paper was devoted to a description of the various types of Tirrill regulators and automatic feeder regulators manufactured by the General Electric Company.

#### Discussion

A brief discussion followed, and in answer to a question relative to the lightning-resisting qualities of the pole-type regulator on a single-phase circuit Mr. Hain replied that it was about the same as a pole-type transformer, the same factors of safety being used in the design. He also said that the two were usually placed near together and tended to act in unison.

#### EFFECT OF TUNGSTEN LAMPS ON REVENUE

For the sake of obtaining information on the effect of tungsten lamps on revenue Mr. A. E. Main, of the Hot Springs Water, Gas & Electric Company, selected fifty residence customers along a certain street and totaled their energy consumption for the year 1909 and for the year 1912. The results show that the energy consumed in 1912 was 4 per cent more than that used by the same consumers in 1909, the average kilowatt-hours per house per month being 22.1. A further comparison covering all of the company's lighting meters on residences and business houses showed that the average per meter per month in 1909 was 67.9 kw-hr. while in 1912 it was 61

kw-hr. This decrease was attributed not to reductions effected by using tungsten lamps but to the fact that the 21 per cent additional meters installed during that time were practically all of the 5-amp size used in small residences and apartments. In the author's estimation, the recent introduction of 110-volt tungsten lamps in 10-watt and 15-watt ratings will not materially affect revenues.

Comments by a number of managers as to the advantages and disadvantages of giving free carbon-filament lamp renewals followed Mr. Main's paper.

#### ELECTION OF OFFICERS

The following officers were elected for the ensuing year: Mr. J. W. Gillette, of the Fort Smith Light & Traction Company, president; Mr. E. C. Bellamy, of Mammoth Springs, first vice-president; Mr. C. M. Richards, of Hope, second vice-president; Mr. A. E. Main, of Hot Springs, third vice-president, and Mr. W. J. Thorp, of Little Rock, secretary-treasurer. The executive committee is composed as follows: Mr. B. C. Fowles, of Pine Bluff, chairman, and Messrs. C. J. Griffith, of Little Rock; A. E. Main, of Hot Springs; W. H. Walkup, of Batesville; W. L. Wood, of Texarkana; S. C. Dowell, of Walnut Ridge; S. C. Stearnes, of Little Rock, and L. S. Hunt, of St. Louis, and Mrs. La Salle Stoops, of Stuttgart.



J. W. GILLETTE

Mr. James Walter Gillette, the newly elected president of the association, was born at Burlington, Mich., June 28, 1871. He was educated at the public schools of Kalamazoo, Mich., and at Wyoming, Ohio. He took a special course in drafting at the Ohio Mechanics' Institute at Cincinnati, after which he spent three years at De Pauw University at Greencastle, Ind., leaving when nineteen years of age. He spent a year as mechanical draftsman in the boiler works of Thomas J. Adams & Company of Cincinnati, and later with the Campbell & Zell Boiler Company of New York, and also with the Electrical Engineering & Construction Company of New York, prior to his connection with the repair and construction department of the United States Navy. His electrical studies were begun in night school, and his first electrical experience as draftsman was with the American Hoisting Derrick Company. After a year of this work he became first assistant to the designing engineer of the California Electrical Works in San Francisco, for which company he later became solicitor on the road, during which time he installed a number of plants, among them the French Camp Hospital, the Hazelton Library plant at Stockton and the plant at Folsom State Prison. He went to southern California and entered the engineering and construction business for himself. In 1895 he rebuilt the lighting system and station equipment at Fond du Lac, Wis., to which city he went after leaving California. The following year he became general superintendent of the Marinette (Wis.) Gas, Electric Light & Street Railway Company, and two years later resigned to go to South America, where he became manager of the West Indies & Colombia Electric Company at Barranquilla. During that time he also acted as resident engineer for the Rio Bogua Mining & Trading Company. He headed an expedition to the interior of Antiqua, in company with two mining engineers, the party covering about 800 miles of travel in canoes and afoot to ascertain the mineral values of a district known as Ramadius. Returning to the United States, he became associated with the electrical department of the Evansville Gas & Electric Light Company as superintendent, where he remained for two years, completely rebuilding the entire station. In 1902 he was made resident engineer of the Phoenix Gas & Electric Company, Phoenixville, Pa., which included the gas works, electric-light station and street railways. He later went with the Fort Smith (Ark.) Light & Traction Company, where he has been manager for a number of years. Mr. Gillette is a member of the American Institute of Electrical Engineers. He was recently appointed representative of the American Automobile Association and is planning to complete as soon as possible the state organization and to make arrangements for automobile trips and for the improvement of highways in the State.

#### ENTERTAINMENT FEATURES

Social entertainment provided during the week included a moving picture show, illustrating the use of Westinghouse Electric & Manufacturing Company's domestic electric appliances; a luncheon given by the Little Rock Chamber of Commerce, and an elaborate banquet and informal dance given by the supply men.

#### MEETING OF SUPPLY MEN

At a meeting of the supply men, or Class B members of the Arkansas association, held on May 7, Mr. L. S. Hunt, of the Commercial Electric Supply Company, St. Louis, Mo., was elected president; Mr. Donald B. Cameron of the Western Electric Company, Chicago, Ill., vice-president, and Mr. W. R. Herstien, of the Electric Supply Company, Memphis, Tenn., secretary-treasurer. Upon request, the president of this division of the association was made a member of the executive committee of the operators' association.

The next convention of the association will be held at Little Rock.

#### Annual Meeting of Chicago Section of E. V. A.

After a year of useful service the Chicago Section of the Electric Vehicle Association of America held its annual meeting on May 6, following a dinner at the Hotel Sherman. Mr. George H. Jones, who presided at the business meeting, told of the efforts of the section in co-operating with the city authorities in the regulation of street traffic, in studying the problem of second-hand cars, the possible establishment of a school for operators and the planning of co-operative advertising. Mr. W. J. McDowell, the secretary-treasurer, presented his annual report. Officers were elected as follows: Chairman, Mr. H. E. Niesz, Cosmopolitan Electric Company; vice-chairman, Mr. D. C. Arlington, Philadelphia Storage Battery Company; secretary-treasurer, Mr. W. J. McDowell, General Vehicle Company; executive committee, officers named and Messrs. W. L. Rudd, garage operator; George H. Jones, Commonwealth Edison Company; Uri B. Grannis, Borden-Grannis Company, and L. E. Wagner, Baker Motor Vehicle Company.

Mr. John F. Gilchrist, of the Commonwealth Edison Company, was toastmaster at the dinner following the business meeting. He commented on the excellent work of the section during the year and read a telegram from Mr. Thomas A. Edison sending regrets. Mr. Arthur Williams, of New York, president of the Electric Vehicle Association of America, who was to have been one of the speakers at the dinner but was unable to be present, sent as his representative Mr. F. C. Henderschott, of the New York Edison Company, who read an address prepared by Mr. Williams.

In his paper Mr. Williams said that there are now about 30,000 electric vehicles in use in the United States. Of these perhaps two-thirds are pleasure cars and one-third commercial vehicles. The business is increasing rapidly and a production of 15,000 electric vehicles is predicted for 1913. The Electric Vehicle Association is fairly entitled to a considerable share of the credit for this advancement. However, the field to be occupied is very great and only an effective start has been made. Mr. Williams reviewed the progress made in the use of electric vehicles in various cities. He said that Chicago is the greatest center in the use of pleasure vehicles, but is behind New York in the number of commercial vehicles in service. The Electric Vehicle Association is very much alive and is planning to raise \$75,000 for the coming advertising campaign.

Mr. E. J. Witherly, district manager in Chicago for the General Vehicle Company, spoke of the "Success of Electric Truck Reorders." He pointed out that the big fleets of power wagons are usually electric vehicles. There are about 300 makers of motor trucks in this country, and about 10 per cent of these make electric vehicles. The long lean years of development for the electric vehicle are over. Confidence in electric trucks is due to their long life; the old cars prove the ease of the electric vehicle. With experience the user knows how to get the most out of his batteries and motor, and perhaps in his pocket out a little bonus system for his driver. Nothing short of a panic can prevent an increase in electric truck sales. Mr. Witherly deprecated the highest idea in electric trucking and spoke of the tendency toward smaller motors and lighter cars. The reorders seem that the electric truck is supreme in its field.

Mr. W. C. Anderson, of Detroit, president of the Edison Electric Light Company, outlined in a paper the reasons declaring that the Commercial Edison Electric Company, for instance, could have more modern advertising electric vehicle operators in Chicago than in New York, and that the electric vehicle manufacturers should not "bunk" one another. He suggested that the hardware "Electric Shop" of the local electric service company might be directed in part to an extensive display of up-to-date electric garage



The lack of proper garage service is constantly hurting the sale of electric cars. The Commonwealth Edison Company might establish a chain of garages where they do not now exist. There are many high-class electric garages in Chicago, but there are not enough of them.

Mr. Anderson advocated a uniform flat garage rate for pleasure vehicles of \$35 or \$40 a month. The Commonwealth Edison Company might establish a school for the instruction of prospective operators of electric vehicles. The electric-vehicle industry and its various branches offer an excellent opportunity for young men. The speaker thought the rates asked by the local central-station company for charging automobile batteries are too high as compared with those of Detroit, which he said are considerably lower. High rates for electricity, the speaker said, force the vehicle manufacturers to pay, indirectly, a premium to the sellers of energy for promoting the business of the latter. The examples of the central-station companies of Boston, New York and Seattle were cited and commended as examples of fostering the electric vehicle. Mr. Anderson closed by making a plea for honest co-operation between manufacturers and gave an amusing recital of the discouragement and bewilderment of the prospective customer in going from one electric-vehicle salesman to another.

Following Mr. Anderson, in a word or two Mr. Gilchrist said that the central-station companies welcome plain speaking. It is probably true that in the past they have not been awake to the possibilities of the electric vehicle. There are, however, two sides to every story. For instance, it may seem to the central-station man that the price of electric vehicles is too high, just as it may seem to the vehicle manufacturer that the price of electrical energy is too high. Furthermore, the electric flatirons, which Mr. Anderson mentioned rather sarcastically in his reference to the "Electric Shop," furnish a very appreciable portion of the central-station company's income. It must be remembered that the number of customers who can buy an electric flatiron is very much greater than the number who can buy an electric vehicle.

Mr. Godfrey H. Atkin, of the Electric Storage Battery Company, offered a resolution extending the sympathy of the section to Mr. F. J. Newman, president of the Chicago Electric Motor Car Company. Mr. Newman, who was the first manufacturer to join the Chicago Section, is lying seriously ill at the Mercy Hospital.

### Principle of State Regulation of Public Utilities Upheld

In an injunction suit brought by the California & Oregon Power Company against the city of Grant's Pass, Ore., the United States District Court has handed down a decision on the respective rights of a city and the State, the Legislature of which has passed a public utilities law. It was held that the Public Utilities Commission, and not the city, had the right to regulate the rate. In granting an injunction restraining the city from enforcing an ordinance reducing the rate for electricity, Judge Bean said: "When a public utility has filed its schedule of rates as required by the law such schedule fixes the only rates which it may lawfully charge or collect until they are changed in the manner provided by the law. If it does charge or receive any greater or less compensation, it is liable under the public utility law to a forfeiture for each offence, and its agents or officers are liable to a fine. It follows, therefore, that after such schedule has been filed the power of a municipal corporation to change or modify the rates therein stated no longer exists, because it is inconsistent with the provision of the utility act and the obligations and liabilities of public-service corporations thereunder. If the rates stated in the schedule filed by the plaintive company are unreasonable

or unjust, the city has a remedy by the proper proceedings before the commission, but it cannot prescribe other rates by ordinance and punish the plaintiff or its officers for a failure to observe them."

### Patent-Law Situation Discussed in Chicago

Since patent laws affect electrical manufacturers and their customers, the present situation should be of interest to electrical men, who may suggest remedies to the Congressional committee which has the subject under consideration. Mr. Lynn A. Williams, a Chicago patent lawyer, in addressing his fellow members of the Electric Club of that city on May 8, said that the present patent laws are essentially a license to commence a lawsuit. By removing clauses which cause doubt and introducing certainty in the phraseology the patent situation can be vastly improved. Although a great many people believe that the government should protect patents, Mr. Williams says that this phase of the subject is for the holders of patents to work out.

Since the patent laws, on account of defects in the system, are subject to abuse and are abused, a committee was appointed at the last session of Congress to look into the matter of reforming them. The Oldfield bill, which has been drafted by this committee, while attempting to remedy the defects has added some serious ones, Mr. Williams believes. Resale price restrictions, compulsory licenses and anti-trust provisions were the main subjects which were considered as not successfully dealt with in the new bill. This bill will probably become law unless some resolutions made by fairly representative bodies from various parts of the country are sent in recommending some changes.

The committee has passed upon the substitution of a nineteen-year term of life for patents, dating from application, in place of the present seventeen-year term. Mr. Williams believes that this feature is undesirable in that many patents can be carried under cover for a considerable period in this way before they are made public.

The Oldfield bill also prohibits a uniform resale price on all commodities. In so doing it was contended that there would be more competition and the public could obtain the article at a less price. But the small dealer cannot sell the article below cost like larger concerns. Manufacturers thus lose the smaller dealers' trade (which is considered in the aggregate), thereby being deprived of the wide distribution of the article and being unable to manufacture at as low a price as formerly.

Little satisfaction can be obtained from lawsuits directed against individual users who infringe on patents. Manufacturers will no longer be able to prosecute the large concerns which may be at the root of a patent infringement under the new bill. Recourse can only be had through courts of equity.

Another provision in the bill which appears unfair in Mr. Williams' view renders it possible for anyone showing that a patented article has not been manufactured for three years to secure a license to manufacture it without giving the patentee a royalty. Whatever time and money may have been expended in the process of evolution of the new article are practically transferred to the holder of the new license without recompense by this new bill.

Any manufacturing company which shall be made to appear as a combination cannot set a price on its commodities under the bill. If a combination violates any of the provisions in the Oldfield bill, anyone holding a contract with it is freed from the contract, according to Mr. Williams' interpretation of the bill.

The Electric Club of Chicago passed a resolution providing for the appointment of a committee which shall look into the patent situation and send suggestions and remedies to the Congressional committee at Washington which has charge of the subject.



### Idaho Public Utilities Act

The new public utilities law recently adopted by the State of Idaho is somewhat similar to the corresponding Missouri act lately adopted and is in many respects a strong and effective measure. It provides a public utilities commission of three members appointed by the Governor for overlapping terms of six years each, at salaries of \$4,000. The commission is provided with a secretary, by its own appointment, and may employ engineers, experts, accountants, inspectors, etc. The Attorney-General of the State is charged with the duty of representing the people and the commission in all actions and proceedings under the new act. The customary restrictions as to interest in public-utility corporations are imposed on the commissioners and furthermore they are enjoined from political activity in behalf of seekers for other public offices, both during their term of office and for two years thereafter.

Under the terms of the act, which applies to both railroads and public utilities, the latter are defined as including every common carrier, pipe-line corporation, gas corporation, electrical corporation, telephone, telegraph and water corporation, wharfinger and warehouseman; they include also those who serve the public indirectly, such as distributing companies. But companies constructing irrigation works are not utilities within the meaning of the act.

All charges made by any public utility, or two or more jointly, must be just and reasonable, without undue preference or discrimination, and every such utility must furnish reasonable, adequate and efficient service, using such means and equipment as will promote the safety, health, comfort and convenience of its patrons, employees and the public. Full powers are conferred upon the commission to fix rates, make investigations, inspect public-utility properties, regulate service, examine books and records, hold hearings, compel attendance of witnesses and enforce obedience of its orders and rules, subject to penalties for infraction.

No public utility may change its rates without thirty days' notice to the commission, nor raise its rates without express permission. Rate schedules must be filed with the commission and kept open to public inspection. Nothing in the act shall be taken as preventing sliding scales of charges, provided they have the commission's approval, nor an arrangement for the automatic adjustment of rates in relation to dividends paid to stockholders, for a fixed period, under like approval. But the commission may revoke such approval at any time for cause. Every telephone and telegraph corporation must handle its business without unreasonable delay and without discrimination, whether tendered by patrons directly or by other companies with whose lines physical connection has been made or ordered by the commission.

No commissioner or employee of the commission may divulge information received from a public utility except such as may be open to public inspection under this act or made public by order of the commission or in the ordinary course of hearings or proceedings. Disobedience of this provision is made a felony and punishable as such. Every public utility is required to file with the commission an annual report, certified to under oath. The commission may order and place in effect rules regulating the standards of service and may compel public utilities to extend or improve their properties when, after due hearing and investigation, such action appears to be justified and necessary.

No street-railroad, gas, electrical, telephone or water corporation may henceforth construct or extend its plant without first securing from the commission a certificate of public convenience and necessity, but exception is made of territory in any city or town heretofore lawfully occupied or contiguous territory not already served, and power companies may without permission enlarge their generating

plants or develop new plants and market the output thereof. No utility of the classes just specified may hereafter exercise any right or privilege in such a territory or place without first securing a certificate.

Provisions of a generally familiar nature are provided for a rehearing on any order of the commission and for appeal to the district and supreme courts of the State. Penalties for disobedience of orders of the commission are fixed by the act, not exceeding \$2,000 for each and every offense, and in case of continuing violation on each day's continuance shall be deemed a separate offense. The last provision is strengthened by a clause subjecting every individual offender, either as an individual or an agent of a public utility, to a fine not exceeding \$1,000 or to jail sentence not exceeding one year or both, for violation of the commission's orders. This act was passed March 13 and takes effect sixty days after final adjournment of this session of the Legislature.

### Public Utilities Law of Maine

The State of Maine has lately adopted a public utilities law containing provisions which cause it to rank among the strongest and most efficient acts of this class in the country, not excluding the law of Wisconsin. Three commissioners are to be appointed by the Governor, with the participation of the Council, for non-overlapping terms of seven years each, with salaries of \$5,000 for the chairman and \$4,500 for each of the others. Salaries and an emolument are also provided. Usual qualifications for service under the commission are stipulated, including an embargo on political activity or any other official or professional activities. Other limitations may be obtained as needed. Customary authority for regulation of the management of public utilities, conduct investigations and require information from them, impose loads and burdens, hold hearings, administer oaths and compel attendance of witnesses and granting of licenses, etc., are provided in the act. Information thus obtained shall be divulged except as to the commission, under penalty of not more than \$500 for or more than one year's imprisonment. Upon request by the commission the attorney-general or the county attorney shall aid in any investigation or hearing and present necessary evidence under the law. Counsel fees may be employed.

#### RATES AND ADJUSTMENTS

Every public utility is required to furnish safe, reasonable and adequate facilities and service, at reasonable and just rates, taking into consideration the fair value of the property and a fair return thereon, including all rights and plant as a going concern, without risk and depreciation. All unjust or unreasonable charges and rates or discriminated discrimination are declared unlawful. Uniform accounts shall be kept in the manner and form ordered by the commission. An annual balance sheet and report on all lines it shall be rendered by each utility. Rate schedules and regulations must be filed with the commission and be disclosed for public inspection. No change of rates may be made by a utility except upon order from the commission, and no utility except those in the act are local. The commission is required to provide for a comprehensive classification of service at least kind, taking into account the quantity and time when used, nature of use and any other reasonable feature.

#### REGULATION AND CONTROL

No corporation or individual, whether or not a natural corporation shall have authority to furnish service without the consent of the commission on the basis of a certificate of public convenience and necessity, and hereafter all public utilities must be incorporated under the laws of Maine. No utility may thereafter come on line for a period longer

than the lawful rate, nor subject any patron to undue prejudice or preference, but a utility may rent necessary facilities from patrons or anyone else upon reasonable terms, separate and distinct from contracts for service. Service contracts in force on Jan. 1, 1913, are held valid until expiration of term, but thereafter, or if terminable upon notice by the utility, the commission may direct that they be canceled.

#### INVESTIGATION OF ACCIDENTS

Accidents resulting in the loss of life and occurring upon the premises of a utility, or resulting directly or indirectly from operation or maintenance of the utility system, shall be investigated forthwith by the commission and the latter may make such orders with respect thereto as seem to it just and reasonable. Accident reports must be filed with the commission as called for, but no such report shall be admitted as evidence in a damage suit resulting from the accident.

#### PHYSICAL VALUATION

The commission shall fix a reasonable value upon the property of a utility whenever it deems the same necessary in respect to fixing rates for service. In such work the records of the State in any other department are made available under the act.

#### APPROVAL OF SECURITIES AND MERGERS

Any utility may issue stocks, bonds, notes or other evidences of indebtedness payable at periods of not more than twelve months after date thereof, when necessary for purchase of property, or construction or improvement of plant, or for refunding lawful obligations, with the consent and approval of the commission. But such permission shall not affect the regulation of rates. No utility shall declare any stock, bond or scrip dividend or divide the proceeds of sales of securities without the consent of the commission.

No utility shall henceforth sell, lease, assign, or mortgage its property, nor merge or consolidate the same, without first securing approval of the commission. However, property not useful or needful in rendering its service may be disposed of in good faith for value. No utility shall hereafter acquire any interest in any other utility without formal consent.

#### PHYSICAL CONNECTIONS

The commission after due hearing and investigation may order physical connections between two or more telephone or telegraph companies for joint through service under joint rates when public convenience and necessity are served thereby, except in the case of points within the same city or town. In like manner and for the same cause the commission may order any utility to rent its facilities to another utility upon reasonable compensation therefor.

#### PENALTIES

The penalties for infractions of the act include a fine not exceeding \$1,000 for each act of disobedience under the commission's orders by any officer or employee of a public utility, or for violation of the act; and when an officer or employee violates an order of the commission the utility itself is liable also to a fine not exceeding \$1,000. Utilities are also made liable to persons, associations or corporations injured by any unlawful act or infringement of the public utilities law.

Any director or officer of a utility who unlawfully issues securities or misapplies the proceeds of sales of securities is punishable by imprisonment for one to ten years, and for wilful false statement in order to secure approval of security issues such official or director shall be fined not less than \$500 or serve one to ten years in prison, or both.

This act becomes effective in respect to public utilities on Sept. 1. The board of railroad commissioners and the State water-storage commission will then be abolished, under the act, and their duties and powers will be conferred upon the public utilities commission.

## Public Service Commission News

### CALIFORNIA COMMISSION.

The California Railroad Commission, which has just completed its first year under the present public utilities act of the State, has issued a résumé of its work. The commission has jurisdiction over fifty-three steam railroads, thirty-four electric railways, three express companies, 168 gas and electric light companies, 237 telephone companies, 342 water companies and 240 other corporations, making a total of 1077 utilities. In the year the commission decided 1277 cases brought before it, and out of 447 formal decisions made, 445 went into effect without court review.

### MASSACHUSETTS COMMISSION

At a public hearing given this week by the Railroad Commission upon service conditions in the city of Lawrence on the lines of the Bay State Street Railway Company, former Chairman James F. Jackson of the commission appeared as counsel for the company and stated that \$88,000 will be expended in double-tracking the Newbury Street trunk line during the present season. It is expected that this improvement will do away with much of the dissatisfaction now expressed with the service. Chairman McLeod of the commission pointed out that it is practically impossible to provide service in any mill town adequate to care for the rush-hour traffic, which has sharper peaks than almost any other class of electric-railway service. The hearing disclosed the willingness of the company to co-operate with the board to better conditions, chiefly along the lines above indicated.

The Railroad Commission has had wide authority along supervisory lines given to it in the recently introduced Washburn bill, which proposes to grant the New York, New Haven & Hartford Railroad the right to purchase the electric-railway systems centering in Springfield and Worcester. Besides determining the reasonable cost of the properties and passing upon the financial fitness of the railroad company to make the purchase, the board is required to determine along what routes the New Haven company shall expend \$5,000,000 in the construction of new trolley lines in the western counties of the State.

### NEW JERSEY COMMISSION

The Board of Public Utility Commissioners has dismissed a petition filed by Mr. Charles G. Justice for approval of an ordinance of the township of Glassboro, Gloucester County, authorizing the construction, laying and maintenance of the necessary pipes and piping, etc., for the supply of water to the inhabitants of that township. This was done on the grounds that the use of the public highways attempted to be authorized by the ordinance is a special or exceptional use not common to all of the citizens of the State; that the right to such use can be acquired only by grant from the State; that the Legislature may grant a right to such use directly or may delegate authority to make such grant to a municipality, and that the application of such power must, however, plainly appear by express grant or by necessary implication. After reviewing the authorities in the State, the board states: "No statute in this State confers directly upon an individual or confers upon the township power to grant to an individual the right to the special or exceptional use of the public highways attempted to be given by the ordinance under consideration, unless Section 32 of the township act (Compiled Statutes, pages 55-86) has the latter effect." The board further states that it is led to the conclusion that the township in granting its consent to the use of the public highway, in supplying water, is limited to the grant of such consent to a corporation organized under the water-company act and is without power to grant such consent either to a corporation organized under the general corporation act or to an individual.

The board has approved two ordinances of the township



of Hanover, Morris County, granting franchises to the Mountain Lakes Gas Company and to the Boonton Electric Company.

On the ground of lack of jurisdiction the board has dismissed a petition filed by the Delaware & Atlantic Telegraph & Telephone Company appealing from an ordinance of the commissioners of the city of Ocean City requiring the removal of the company's poles, etc., from the public highways and the installation of an underground system to replace its overhead system.

The petition of the Monmouth Lighting Company for permission to transfer certain shares of its capital stock to the Eastern Utilities Corporation has been dismissed. Section 49 of the general corporation act, as amended by Chapter 14, P. L. 1913, confines a corporation organized under this act to the purchase of shares of capital stock of a corporation the property of which is cognate in character and use to the property used and contemplated to be used by the purchasing corporation in the direct conduct of its own proper business. The board finds that the Eastern Utilities Corporation is a "holding company" for utility securities. The business of the Monmouth Lighting Company is that of generating and distributing light, etc., its property consisting of a light generating and distribution plant and the franchises under which the same is operated. In the judgment of the board the property owned by the Monmouth Lighting Company is not cognate in character and use to the property used or contemplated to be used by the Eastern Utilities Corporation in the direct conduct of its proper business.

## Current News Notes

**REDUCTION IN RATES IN QUEBEC DUE TO COMPETITION.**—The energetic fight being made for new business by the Quebec Railway, Light & Power Company and the Dorchester Electric Company of Quebec is reflected in the reduction of rates made by the former company from 15 cents to 7 cents per kw-hr. The Dorchester Electric Company announces its intention of meeting the cut by making its base rate for energy 6 cents per kw-hr.

DATA ON "BLUE-SKY" LAWS.—Of the thirty-seven State legislatures which have convened this year eleven have adjourned without passing "blue-sky" laws; twelve are now considering legislation of that character; three states—Iowa, Michigan and Colorado—have passed bills which still await the approval of governors, and twelve states—Arizona, Arkansas, Idaho, Kansas, Maine, Missouri, Montana, North Dakota, Oregon, South Dakota, West Virginia and Vermont—have passed legislation aimed at the fraudulent leader in securities.

**COMMISSION ORDERS GROUNDING OF TRANSFORMER SECONDARIES IN QUEBEC.**—The Quebec Public Utilities Commission, after a thorough investigation of electrical conditions in the city of Quebec and at the solicitation of the Canadian Fire Underwriters' Association, has ordered the Quebec Railway, Light & Power Company and the Dorchester Electric Company to ground all the transformer secondaries or neutrals on their respective systems. Inasmuch as the Underwriters recommended that the grounding be made to the water-piping system of the city, the commission instructed the companies to approach the Quebec City Council and endeavor to secure permission to comply with the recommendation.

**DISASTROUS FIRE IN CHICAGO GARAGE.**—The large establishment of the Robert Bland electric garage in Chicago was destroyed by fire on May 9. Electric automobiles to

the number of about forty were burned, and the total loss was estimated at about \$100,000. The garage occupied three stories of an old building, and fifty electric vehicles were taken from the first floor by firemen and policemen. Most of the cars in the garage were owned by residents of Central Boulevard and vicinity. The garage was supplied with electricity by the Commonwealth Edison Company, and the electrical equipment of that company, located in the basement and protected by a heavy concrete floor above, was not seriously damaged. The origin of the fire is not known.

**PUBLIC SERVICE COMMISSION BILL REPEALS LEGISLATURE.**—A hearing on the public service commission bills pending in the Illinois Legislature was given at a joint meeting of the Senate and House public utility committees in Springfield, Ill., on May 7. Representative public utility companies were present and passed out objection to the Rapp and Glackin bills, which were the ones chiefly considered. The Rapp bill is the one proposed by Governor Dunne. It is modeled to a considerable extent on the California law. The Glackin bill was reported by a minority of the joint legislative committee, which had the subject under consideration for two years. It represents the views on the present city administration of Chicago.

**SAVING FUEL WITH A VERSAILAISSE.** *The Army and Navy Journal* states that there has been a saving of 40 per cent in coal consumption in the State War and Navy Building at Washington, but that the occupants of the building complain that the saving has been made at the expense of their comfort and efficiency. There has not been enough electricity generated properly to run the elevators during the rush hours of the morning and not enough to give the designated candle power to the lobbies when on dark days their use is necessary. Finally some one gave out the information that while the saving of government coal progressed many government employees shivered or wore their overcoats at their desks, some of them caught cold and some were stricken with pneumonia.

—The city attorney and the city electrician at Colorado Springs, Col., have been instructed to draw up an occupation tax ordinance requiring annual payment of a tax, and with refunding basis from all corporations, firms, individuals and partnerships, doing business in that city. The city will be divided into districts and the annual charges for each will vary from \$5.00 to \$100.00, according to business location. The annual tax on every building will vary from \$1.00 to \$50.00, according to size, and smaller to \$10.00, and on every table or large table charge to be uniform in all districts. It is proposed to exempt unincorporated firms from all charges as well as places occupied in part by municipal lines of service.

interference factor. Consequently, the Commissioner's decision is the strongest and the most complete. The Commissioner (Light & Water) Company has made no statement against the Mutual claim that a Power Company is required to restore the latter from being a normal line contributor to the common use of wires at points not paid for by the utility line of the Illuminated Light & Water Company. It is claimed that there is danger to the line and power utility owing to the interference of the Mutual Company as well as the fact that the wires from the Mutual Company and low tension wires of the Illuminated Light & Water Company are connected in some places between the two lines. The other companies in question to some extent are a number of other lines (lines) with a few poles, wires, and equipment between the circuits. The Illuminated Company, however, does not seem to be making the point of the pole line of the Mutual Company.



## SOCIETY MEETINGS

**CONVENTION OF CANADIAN ELECTRICAL ASSOCIATION.**—The annual convention of the Canadian Electrical Association, which was scheduled to be held at Fort William, Ontario, on June 23-25, will be held instead at Toronto, June 25 to 27, inclusive.

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**MEETING OF EMPIRE STATE GAS & ELECTRIC ASSOCIATION.**—The next regular meeting of the Empire State Gas & Electric Association will be held in the rooms of the Business Men's Association at Ithaca, N. Y., May 23 and 24. The topics for discussion will be problems confronting small gas and electric stations.

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**STAGE LIGHTING.**—The effect of colored lights upon stage scenery was strikingly demonstrated by Mr. Bassett Jones at a meeting of the New York Section of the Illuminating Engineering Society held in the Clymer Street Theatre, Brooklyn, on May 8. The lecturer showed to what extent light of one color alters scenery painted in various colors with different materials. He demonstrated the effect of changing the direction of light upon architectural details and illustrated methods of giving unlimited distance effect in stage setting.

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**SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.**—Minneapolis has been selected as the city for the annual convention of the Society for the Promotion of Engineering Education, which is to be held on June 24, 25 and 26. Prof. H. H. Norris, Ithaca, N. Y., is secretary of the society. A partial list of the authors who will present papers is as follows: Messrs. C. F. Cahill, P. P. Claxton, H. W. Hibbard, A. C. Humphreys, I. C. Lee, A. B. McDaniel, H. S. Person, C. R. Richards, E. C. Schmidt, C. E. Sherman, G. F. Swain and D. M. Wright.

\* \* \*

**PLANS FOR JOINT JOVIAN AND ELECTRIC CLUB OF CHICAGO MEETING.**—At the Electric Club luncheon held in Chicago on May 8 it was announced that the Chicago Jovian Lunch Club would be invited to hold a joint luncheon with the Electric Club on May 22. Judge Cutting of the Probate Court is expected to give a talk before the club on that date. Preparatory to the N. E. L. A. convention of June 2-6 the Electric Club has obtained watch fobs bearing the club's monogram which will be worn by the members to distinguish the hosts from the guests. Fobs made of bronze, silver, gold plate and solid gold will be offered as prizes to those securing new members. The committee on by-laws submitted a report suggesting a change in the time of electing new officers. Through this change it is hoped that the new administration will be on a working basis before the preceding officers' terms expire. Mr. Lynn A. Williams, of the Chicago patent bar, discussed the present patent-law situation.

\* \* \*

**ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS TO MEET IN ST. LOUIS.**—The thirty-second annual meeting of the Association of Railway Telegraph Superintendents will be held at the Planters' Hotel in St. Louis on May 20, 21 and 22. On the program there are several papers dealing with telephone subjects, as about 75,000 miles of railroad in America are equipped with telephone dispatching apparatus. Papers are announced as follows: "Main Line Power for Selective Circuits, Including Transmission and Signaling," by Mr. Richard F. Spamer, of New York City; "Some Phases of an Organization for the Maintenance of Lines," by Mr. M. C. Allen, of New York City; "Full Use of Wires," by Mr. H. D. Teed, of Springfield, Mo.; "Protection Against Lightning and High Currents on Telegraph and Telephone Equipment," by Mr. M. H. Clopp, of St. Paul; "Inductive Disturbances as Affecting Telephone and Tele-

graph Lines," by Mr. P. J. Howe, of New York City; "Organization for Wire Chiefs and Telephone Inspectors," by Mr. J. B. Sheldon, of Omaha; "Use of Telephones by Railroads for Dispatching Trains, Handling Messages, etc.," by Mr. J. C. Johnson, of Philadelphia; "Some Facts Concerning Telephone Transmission," by Messrs. E. Miller and C. A. Robinson, of New York City.

\* \* \*

**THE BRITISH COLUMBIA ELECTRICAL INSPECTION SOCIETY.**—An organization with the foregoing name has been formed at Vancouver, B. C., composed of city and municipal electricians and inspectors, superintendents and other officials of electrical contracting firms and representatives of power companies and supply houses. The object of the society is the standardization of inspection work and the co-operation of the various electrical interests. It has been decided to hold bi-monthly meetings, and an address on some interesting electrical subject will be given each month by one of the members. Mr. C. H. Fletcher, city electrician of Vancouver, has been elected president, and the newly elected vice-president and secretary are respectively Messrs. H. Burns and J. W. Cooke, of the city electrician's department. It is the intention to extend the scope of the organization by the addition of members from the cities and municipalities of the interior of British Columbia.

\* \* \*

**INSTITUTE OF RADIO ENGINEERS.**—At a meeting of the Institute of Radio Engineers on May 8, Dr. A. E. Kennelly read a paper on the "Daylight Effect in Radio Telegraphy," covering the general theory of radio transmission between earthed conductors and the probable causes of attenuation and of the rapid variations in signal intensity which occur near times of sunrise and sunset. In the discussion representatives of nearly all radio and wire communication interests took part. The opinion held by all was that great credit was due to Dr. Kennelly for explanations which are so well sustained by observed facts of the absorption phenomena. The next meeting of the institute will be held at Fayerweather Hall, Columbia University, at 8:15 p. m. on Wednesday, June 4. Mr. John L. Hogan, Jr., of the National Signaling Company, will present a paper describing the new "heterodyne" receiver, as used in the Fessenden system during the recent trials of the Arlington naval radio station.

\* \* \*

**AUTOMOBILE ENGINEERS' SUMMER MEETING.**—From June 4 to June 7 the Society of Automobile Engineers will hold its summer meeting en route from Detroit to Sault Ste. Marie. The *City of Detroit III* has been chartered, and the semi-annual meeting of the society will be held on board the vessel. The steamer will leave Detroit on Wednesday afternoon, June 4, landing at Sault Ste. Marie in the afternoon of the following day. A business and professional session will be held on shipboard on Thursday morning, and in the afternoon a professional session, followed by an entertainment in the evening. Professional sessions will also be held Friday and Saturday morning, and at one of these meetings members of the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders of England, who are to visit America upon the invitation of the American society, will present papers and take part in the discussion. Among other subjects that will probably be discussed at the professional sessions are electric motor starters, possibilities and limitations of utilization of electricity in operative motor-car functions, and efficiency in transmission. Mr. A. L. Riker is chairman of the electrical equipment division. The officers of the Society of Automobile Engineers are: President, Mr. Howard Marmon; treasurer, Mr. Hermann F. Cuntz, and secretary, Mr. Coker F. Clarkson, 1786 Broadway, New York.

# Municipal Power Plant of Eugene, Ore.

**Hydroelectric generating station, transmission and distribution systems on the McKenzie River, supplying energy to a municipality containing 12,000 inhabitants**

**T**HE city of Eugene is located at the head of the Willamette Valley, 122 miles south of Portland and 60 miles from the Pacific Coast. It is the county seat of Lane County and the center of a rich agricultural and lumbering district. The University of Oregon is located here and the people of the city have demonstrated a keen interest in the development of both private and public educational institutions.

Electrical energy is supplied to the city at present from three sources—the Chambers Power Company, furnishing water-power by diversion from the Willamette; the Oregon Power Company, with steam-generated electrical power from its plant at Springfield, and the municipal hydroelectric development on the McKenzie River.

There are three large lumber mills about Eugene besides four planing mills. Other industries represented are woolen, excelsior and flour mills, foundries, knife, broom, mattress and incubator factories, fruit and vegetable canneries, concrete tile works, brickyards and soda works.

The present area of the city is 4.2 sq. miles, with a population of approximately 12,000.

The McKenzie River, which supplies power for the Eugene municipal hydroelectric plant, has its origin in Clear Lake, a snow-fed body of water in the Cascade Range, about 70 miles east of Eugene. At its upper end the stream is deep and swift. It gradually becomes broader

and more shallow, however, and for the final 25 miles it runs through a low farming country until it joins with the Willamette at Coburg.

The intake for the city power works is located on the north bank of the river, 18 miles east of Eugene. From the intake water is conducted to the plant through a canal 19,400 ft. long and 650 ft. in wood frame. The water available is more than sufficient to run the plant at its maximum every day in the year; the minimum flow in the river being approximately 1,000 cu. ft. per sec.

The power plant is located 2 miles west of Walpoleville, 14 miles east of Eugene and 1 mile north of the McKenzie River. The intake is on its south side at the mouth and is protected on both sides by breast piling set 8 ft. apart and faced with 2.5-in. plank spiked on horizontally. This sheet-lined piling is cribbed and locked with rock and boulder. Protection for the wood gates from drift, logs, etc., is afforded by a heavy double-log boom extending entirely across the mouth of the canal intake, shown in Fig. 3.

The headgates, 350 ft. below the intake, are of concrete construction on a foundation of hard-pan gravel, there being no rock available. Concrete wing walls extend 20 ft. into the banks on each side at a height of 20 ft. above the mud level. On the lower side of the gate a concrete apron just below the gate openings protects the bed of the canal against the churning action of the water. Each of the four gates is

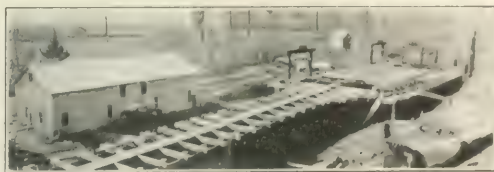


FIG. 1. FOREBAY AND POWER PLANT.



controlled by means of a hand-operated winch and bevel gears.

About 1.5 miles below the headworks is a wasteway, equipped with flashboards. This wasteway is for use in case of emergency only, the regulation of the amount of



FIG. 3—CANAL INTAKE

water in the canal being ordinarily accomplished by suitable adjustment of the headgates.

#### FLUME AND PENSTOCKS

The flume is 650 ft. in length, 10 ft. wide by 7 ft. deep inside, and is constructed of  $2\frac{1}{2}$ -in. tongued and grooved lumber, dressed on both sides. The bed has a slope of 1 ft. per 1000, with the exception of the first 48 ft. at the flume entry, which has a slope of 1 ft. per 100. With the flume running full, the calculated velocity of flow is 8 ft. per second, or a total flow of 560 second-ft.

The forebay is of the same construction as the flume, 74 ft. long by 24 ft. wide, with a depth of 11 ft. The lower end is provided with a waste gate emptying into a plank spillway, through which the waste water is led into the tail-race some 150 ft. below the plant. The main gates are hand-operated by a winch and set of bevel and spur gears. Over the entrance to each penstock is a protective screen of  $1\frac{1}{4}$ -in. wood slats so arranged that it may be conveniently cleaned from above.

Water is conducted from the forebay to the power house through two wood-stave pipes each 100 ft. long with an inside diameter of 8 ft. They are constructed of 4-in. stock dressed to 3.5 in. and are banded every 6 in. with  $\frac{3}{4}$ -in. steel. The forebay end of each penstock is embedded in concrete. The pipes are bedded on heavy timber cradles 12 ft. apart. Just before entering the station the stave pipe



FIG. 4—WASTE GATES IN CANAL

connects to a 96-in. riveted steel "Y" which carries the water to the turbine of each unit.

#### GENERATING STATION

The generators, waterwheels, switchboard and step-up transformers are housed in the main building. The main-line circuit-breakers and the lightning arresters are in a

separate high-tension room back of the switchboard. The foundations are of concrete, 24 ft. deep, in a gravel and rock formation.

The generating equipment consists of two 1200-hp Pelton Francis type turbines directly connected to 2300-volt, 60

TABLE 1—SCHEDULE OF RATES FOR LIGHTING AND MOTOR SERVICE ADOPTED BY THE EUGENE WATER BOARD

LIGHTING SERVICE*		MOTOR SERVICE†	
Kilowatt-hours	Cents per Kw hr	Kilowatt-hours	Cents per Kw-hr.
20	9.0	100	5.00
40	8.0	150	4.50
100	7.0	200	4.00
250	6.0	500	3.50
500	5.0	800	3.00
1,000	3.0	1,300	2.75
		1,900	2.50
		5,000	2.25
		10,000	2.00

\*Minimum monthly bill, \$1.

†Minimum monthly bill, 75 cents per hp of maximum demand

cycle, three-phase Fort Wayne generators having a normal rating of 945 hp (705 kw at 300 r.p.m.).

Two 30-kw exciters are belted to the generator shafts. The hydraulic head on the shaft centers of the wheels is 28 ft. and the draft head is 15 ft., giving a total head of 43 ft.

Each unit is equipped with a Pelton automatic oil-pressure



FIG. 5—CANAL HEADGATES

governor. The speed may also be conveniently regulated by means of a 700 hp, 2300-volt water rheostat installed in the tailrace.

The maximum load on the station in October, 1912, reached 550 hp. In ten months of commercial operation about one-half of the present rated capacity has been used.

#### SWITCHBOARD

The control board consists of seven panels of Vermont marble. All indicating meters are of the vertical edgewise type. The board is also furnished with two recording wattmeters and one graphic voltmeter. The latter instruments are connected to the high-tension side of the step-up transformers through two 22,000/100-volt shunt transformers connected in open delta and three Westinghouse series transformers inserted in the line between the main circuit-breaker and the choke coils. All low-tension oil switches are of Westinghouse make and rated at 200 amp. These are placed in separate concrete cells behind the control board, while the solenoid-operated main-line circuit-breaker is located in a concrete cell in the high-tension room. Relays are of the overload inverse time-limit type. The voltage is regulated by a Tirrill regulator adjusted to compensate for line drop at different loads. A synchroscope is mounted on a swinging bracket at the left-hand end of the switchboard.





every block corner. Thirty miles of streets are now lighted by this system. The lamps are usually mounted on pipe brackets on poles at the street intersection and at a height of about 15 ft. above the curb.

The commercial service is furnished by two 2300-volt, three-phase circuits, carried overhead in poles. The circuit for the north and west and business section of the city is of

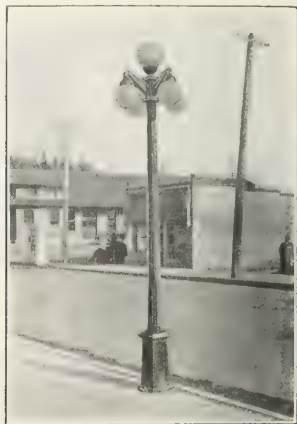


FIG. 10—STREET-LIGHTING UNIT, EUGENE, ORE.

No. 6 copper with a load center at about 3000 ft. from the substation. The circuit for the south and east part of the city is carried underground for a distance of 500 ft. and then changes to overhead construction. The standard secondary emfs are 230 volts for motor service, and 230/115 volts for lighting service.

Customers' service is metered throughout excepting such service as is fixed in regard to the amount and hours use, as in case of sign and window lighting.

TABLE II—COST OF POWER PLANT TO DEC. 10, 1912

	First Cost	Extensions	Total Cost
Supervision	\$2,952.57	\$1,802.58	\$4,755.15
General office	3,027.56	1,389.73	4,417.29
Intake	2,510.23	1,160.85	3,671.08
"Canal"	89,923.64	247.61	90,171.25
Headraces	4,513.57	—	4,513.57
Flume forebay and wasteway	10,199.37	404.44	10,603.81
Hydraulic apparatus and pipe lines	25,547.07	118.52	25,665.59
Electric apparatus	21,913.73	183.47	22,097.20
Station buildings and grounds	7,786.98	1,512.10	9,299.08
Transmission and telephone line	11,269.46	895.03	12,164.49
Substation apparatus	5,058.41	572.30	5,630.71
Substation buildings and grounds	800.00	13.12	813.12
Real estate and rights-of-way	11,723.46	440.72	12,164.18
Miscellaneous	—	112.34	112.34
Meters	—	9,724.17	9,724.17
Transformers and lines	—	22,418.85	22,418.85
Stores	—	8.85	8.85
Ornamental posts	—	7,329.60	7,329.60
Series street lighting	—	17,676.40	17,676.40
Total	\$197,215.95	\$66,305.04	\$263,520.99
Bond expense and interest during construction	20,735.00	—	20,735.00
Grand total	\$217,950.95	\$66,305.04	\$284,255.99

Note: This item includes excessive charges of \$26,257.78, due to excessive construction contract costs.

The lighting of the business section is carried out with ornamental clusters. Five lamp-posts are used with four pendent 60-watt tungsten lamps and one vertical 100-watt lamp. Pendent lamps are inclosed in 12-in. roughed-glass globes and are turned out at midnight. The vertical lamps are inclosed in 14-in. glass and are operated all night. En-

ergy is furnished from the 230/115-volt three-wire commercial system. The wires are carried in steel conduit laid in the cement walk next to the curb.

#### SCHEDULES OF RATES

In the city of Eugene the maximum lighting rates was formerly 15 cents per kw-hr., the maximum rate now being 9 cents per kw-hr., this reduction having been accomplished

TABLE III—SUMMARY OF EXPENDITURES, MARCH 11, 1911, TO DEC. 10, 1912

	Operation and Maintenance	Construction and Extensions	Total
Power plant:			
Supervision and engineering	\$2,483.69	\$526.98	\$3,010.67
General office	877.07	115.25	992.32
Intake	135.84	1,460.85	1,596.69
Head gates	—	247.01	247.01
Canal	21.25	—	21.25
Flume, forebay and wasteway	147.30	404.44	551.74
Hydraulic apparatus and pipe lines	21.60	118.52	140.12
Electric apparatus	150.84	183.47	334.31
Station buildings and grounds	53.45	1,512.40	1,565.85
Transmission and telephone line	583.01	895.03	1,478.04
Substation apparatus	29.98	572.30	602.28
Substation buildings and grounds	22.51	13.12	35.63
Real estate and rights-of-way	1.20	421.03	422.23
Miscellaneous	478.87	112.34	591.21
Operating force	5,375.16	—	5,375.16
Total power plant	\$10,381.77	\$6,583.34	\$16,965.11
Distributing system:			
Supervision and engineering	\$375.13	\$1,275.60	\$1,650.73
General office	2,269.45	1,274.48	3,543.93
Business promotion	691.90	—	691.90
Collecting revenue	143.46	—	143.46
Meters	840.43	9,724.17	10,564.60
Transformers and lines	5,321.20	22,418.85	27,740.05
Lamps	120.42	—	120.42
Stores	130.61	8.85	139.46
Damage	6.40	—	6.40
Real estate and rights-of-way	14.15	19.75	33.90
Miscellaneous	229.13	—	229.13
Ornamental posts	6.60	7,323.60	7,330.20
Series street lighting	77.90	17,676.40	17,754.30
Sub-total	\$10,226.78	\$59,721.70	\$69,948.48
Bond interest	1,500.00	—	1,500.00
Total distributing system	\$11,726.78	\$59,721.70	\$71,448.48
Grand total	\$22,108.55	\$66,305.04	\$88,413.59

in one year since the municipal plant entered the field. The rates for electrical energy mentioned above are the result of careful consideration of all the problems pertaining to rate making.

It may be interesting to note that on Dec. 1, 1911, two customers were served, whereas on Dec. 1, 1912, one year later, no fewer than 1001 customers were being served by the municipal lighting plant, a record of growth that cer-



FIG. 11—STEAM-DRIVEN SAWMILLS

tainly seems to afford ample proof of the extent of the business that the plant is able to secure.

#### COST OF THE POWER PLANT

The record of the engineer in charge of construction submitted to the City Council contains complete data as to cost of construction and operation. These data are contained in Tables II and III.



## Hydroelectric Plant for Sawmill Use at Hartland, Vt.

By M. A. HICKS

Located in a V-shaped gorge, of which one side is an overhanging cliff some 50 ft. high and the other slopes so steeply that access to the bottom is possible only by means of ropes or ladders, there is found in Hartland, Vt., one of the most peculiar hydroelectric plants in New England.

The destruction by fire in October, 1911, of the saw, grist and cider mills which formerly stood upon the bank of the rocky chasm left in place and but slightly injured a 12-in. Rodney Hunt horizontal-shaft turbine waterwheel which had been in service a part of the time since about 1904. This wheel was installed in a cast-iron case connected to headwater by a 24-in. steel penstock, and it discharged to the raceway through a quarter turn and draft tube a vertical distance of 10 ft. It operated under an effective head of 70 ft. or a little over, the static head being 72 ft. The whole structure was in a rocky cave blasted from the sloping ledge near the bottom of the gorge. It was rated by the builders to deliver at the shaft, with full gate opening, under 70 ft. effective head, 85.98 hp when running at 873 r.p.m. No known data were available by which its racing speed, unloaded, could be determined in advance of an actual trial under conditions of practical use.

Owing to the great difficulty formerly experienced in maintaining a satisfactory power transmission system from the high-speed turbine to the main shafting of the mills above by means of belts and countershafts, the owner determined to discard the old system and to substitute for it some form of electric power transmission. A fatal illness, however, prevented him from carrying out his plans, and a brother took over the property and business and has established in his own way a hydroelectric plant which answers his present purpose well, though it is very incomplete in its equipment.

Instead of employing a consulting engineer to specify for and supervise the construction of the generating plant, he invited representatives of the chief manufacturing concerns of electrical apparatus in this country to come to Hartland and submit suggestions, estimates and proposals for furnishing a suitable equipment for his purpose. Meanwhile he had leased some land above and to one side of the gorge that afforded convenient room for a mill yard, and he proceeded, in December, 1911, to put in the foundation for an electric sawmill. Just before this work was begun the writer was invited to go to Hartland for consultation relative to the simplest and most efficient plan for utilizing the power of the high-speed turbine wheel taking into consideration that the plant was to be used for power purposes only, no attempt being made to secure voltage regulation suitable for lighting, and also considering the character of the main load, a circular sawmill—than which no worse load is to be found. It should also be stated that first cost was the touchstone by which all else had to be tried.

The record of service of the waterwheel when driving

the old sawmill, through a long line of countershafts and belts, showed that one about one-third part spinning to make the power was transmitted above. It was proved that the length and capacity of the penstock were such as to permit the use of a good water-wheel governor, there being a pressure relief valve mounted upon the waterwheel case, instead of a surge pipe, to prevent trouble from sudden closing of the draft tube. Representatives of the three largest electrical manufacturing companies in the country had submitted their plans for construction, and a local electrician had also been consulted and had explained to the owner, so that at present the character of the different plans which had been submitted had the approximate comparative costs of installation and care in use. The various plans submitted included the use of both high-voltage and low-voltage alternating-current apparatus and also low to medium voltage direct-current apparatus; but with one or two exceptions all called for some kind of speed regulation of the waterwheel or electric voltage regulator, or a combination of both, even including in one plan a heavy balance wheel between the turbine and generator or smooth out the speed curves or a long spring kind of load. The final decision was in favor of a low direct-current generator connected to the turbine shaft by means of a flexible coupling, this generator to be essentially wound for the situation, to permit fluctuating loads on the various loads and gate openings at the waterwheel, and to maintain an approximate constant voltage at all times.

To accomplish this it is provided with a very small shunt field, calculated just to maintain its volts at the normal value at no load, excepting that of the small currents which the waterwheel racing up to 2,000 r.p.m. and beyond will develop, and by means of a very small potentiometer field winding to vary the excitation on full



FIG. 1.—RAPIDS ON THE CONSUMMATION OF THE GORGE.

load current with the waterwheel running at 873 r.p.m. In other words, with a total gate opening of the unregulated sufficient to cover the resistance had the speed of the waterwheel and the three-ringed generator excited to the load and turbine charges, and so the load current and the speed from racing the wheel had to be cut down to the normal in the series field increase, and were satisfied by it thus maintaining an approximately constant voltage at the generator terminals.

In practice, however, it has been found impossible to secure an even voltage on light loads and intermediate speeds owing to the fact that the speed curve had a sharp curve, do not maintain the better running at high above normal on light loads, thus causing the voltage on the system to rise when entering the no-load region, the power to the generator would increase and had at the maximum moment. Hence such a type of generator was to be limited upon to give normal voltage only at the full gate when the speed and voltage were normal, because in the case of a Sawmill and the other requirements.

The builders of the generator had to provide against both an excessive voltage and an over-excitation of the field instead of large percentage in the penstock and



either a very light load or none at all on the generator. The former required extreme care to secure a perfect running balance of the moving parts, and the latter could in some measure be prevented by use of a variable resistor in series with the shunt field winding.

The following speed tests of the turbine under actual conditions found since the installation of the generator



FIG. 2—THE MILLYARD AND THE MILL

will illustrate this: Runaway speed at three-quarters gate opening and with no load except windage and friction of bearings, 1650 r.p.m. (This was slightly unstable, varying from eight to ten revolutions at different times; cause not known but perhaps due to air in the draft tube.) Speed at same gate opening, and with shunt field excited at about 300 volts, 1550 r.p.m. Speed with both shunt fields of generator and sawmill motor excited, 1480 r.p.m. This latter motor is a 50 hp, 220-volt variable-speed interpole machine with a range of 850 r.p.m. to 1200 r.p.m. by shunt-field control. There is also a 5-hp motor of similar design and voltage rating, with a normal speed of 1050 r.p.m., which is used to drive a board-trimmer saw for squaring up stock as it leaves the mill. The generator and motors were



FIG. 3—CONTROL APPARATUS INSTALLED IN THE SAWMILL

all furnished by the Allis-Chalmers Company and are of extra heavy design in all parts, being rugged, splendidly balanced machines. Owing to the over-voltage on light loads the motors race somewhat, the 5-hp machine running at 1150 r.p.m. instead of 1050 r.p.m., its normal speed, or nearly 10 per cent over-speed. The sawmill motor has a similar speed change owing to over-voltage on light loads.

This at first caused some trouble, but a change of drive pulley on the sawmill arbor and the use of properly hammered saws remedied the trouble somewhat.

Machinery of this class will run more steadily when so driven than if belted to the waterwheel shaft direct, there being, under conditions of sawmill use, a speed change at the waterwheel shaft of approximately 50 per cent between full load and idle load (simply carrying machinery idle). While the resultant over-speed of motors due to over-voltage is approximately 10 per cent, for sawmill use the compound-wound, interpole motor is particularly well suited, the series field being compounded 10 per cent, and the interpoles are so wound that when the saw enters the log and a heavy overload comes on there is very little drop in speed below normal provided the waterwheel gate is opened properly to carry the maximum load at the time.

In their anxiety to make a sale of a generator and motors with auxiliary apparatus, some of the several competing salesmen appear to have suggested to the owner that a switchboard was unnecessary with this kind of generator. a suggestion so attractive to the owner on the score of reduced expense that as a matter of fact the plant was installed and run several weeks with only a main switch and fuses, mounted on a slate base and fastened against the rough boarding of the rude shelter termed a power house to connect the generator to the transmission line. During

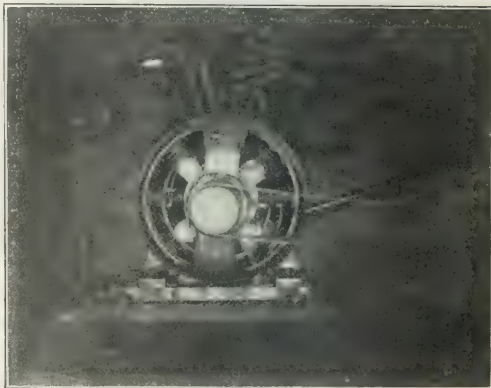


FIG. 4—INTERPOLE MOTOR IN BASEMENT OF MILL

thunderstorms, in place of regular lightning arresters this switch was opened and the line terminals grounded to the waterwheel structure.

After a time it was discovered that the adjustment of the generator field rheostat to control the voltage in some measure could be made with no certainty without a good voltmeter for a guide, and finally, on the suggestion of the writer, the Norton Electrical Instrument Company sent one of its D'Arsonval type of voltmeters for switchboard use on thirty days' trial, and it proved so satisfactory that it was bought and paid for at the close of the trial period. Since its installation a new cider mill has been built, a 15-hp motor installed and a successful season's work done. It was found that by properly opening the waterwheel gate and adjusting the generator field rheostat there was so little change of voltage at the cider mill that 250-volt incandescent lamps could be successfully used to light the mill building and surroundings with the mill doing full work at the same time. The efficiency curve for the waterwheel rises rapidly to two-thirds gate opening and reaches its maximum at three-quarters gate opening, beyond which it drops away rather abruptly to full gate opening, where it is about the same as at the two-thirds point.

The distance of transmission is about 726 ft. and No. 4/0

line wire is used for a calculated drop of 5 per cent at full-load current. The sawmill motor is protected by a circuit-breaker of the sliding metal-contact type, with a rather weak latch-controlling magnet. The latch was very loosely fitted and a sudden jar of the mill building near it would open the circuit and shut down the motor. When the latch was properly fitted to overcome this trouble and a heavy overload came on the circuit-breaker would open but would pull such an arc at the contacts as to blow the main-line fuses at the power house in the gorge.

The writer noticed upon personal inspection that the generator frame was thoroughly grounded to the damp timbering which supported it, and also that there was nothing in way of a ground detector to be found about the plant. As a matter of ordinary prudence, without reference to insurance rules, it would seem best that such a detector be installed to guard against grounds on the line or at the motors. In fact, a small slate switchboard with volt and ammeters, ground detector, main switch and fuses, pilot lamp to light the instruments, and with the field rheostat of the generator mounted upon it, would seem to be an essential part of such a plant and of much practical utility. Aside from the criticisms offered, however, there is probably no similar plant in existence anywhere which, considering cost of installation, is doing more work with less expense for care of the outfit than the one described. Anyone having a high speed turbine of moderate capacity, not much exceeding that of the generator, and in a location difficult of access, will find the plan adopted for getting the power out to a convenient location for the mill or factory one worthy of consideration. However, it should be borne in mind that a first-class circuit-breaker, with carbon break and a well-made controlling magnet, and also a well-made and equipped switchboard, are not luxuries but practical necessities for the proper handling of the energy.

## Testing Electric Fans

By H. B. BROOKS

The testing of electric fans has not been reduced to a standard procedure, although some tendency toward agreement may be seen in comparing the practices of various companies. The over-all efficiency of the fan is the product of the efficiency of the motor multiplied by the efficiency of the blades. The electrical input to the motor may be readily measured, but the measurement of the useful energy imparted to the air presents some difficulties. One basis of comparison which has been used consists in measuring the air velocity at various points on a diameter of the cone of air and calculating the volume of air delivered in unit time. This method also gives the curve of distribution of the air and is a guide in the design of the blades.

The purpose of this article is to point out that the volume of air moved per second or the velocity of the air current through a given channel is not a direct measure of the power required to maintain it. Hence the relative efficiencies of two fans cannot be determined by comparing the volumes or velocities of the air current, with proper regard for the relative amounts of electric power required. A simple approximate relation between the velocity of a uniform air current through a given channel and the power required to maintain it is given below. It is hoped that this will assist workers in this field to make more accurate comparisons of electric fans.

In some preliminary work on electric fan testing a small tightly closed room was used having a circular opening near the floor into which was fitted a short tube whose internal diameter was just large enough to admit the fan guard. The air from the adjoining laboratory blown in at this opening was diffused through the room and passed out through a smaller circular opening near the ceiling. An

anemometer was fitted into this smaller opening, and the time required for a given number of revolutions was determined with a stop watch.

At first, in working up the results, the fan was considered to have an "efficiency" directly proportional to the volume of air moved per second (velocity of air current passing through the anemometer) and inversely proportional to the electric input. It was found that this method was impracticable, as the work done by the air, theoretically, varied as a power of the velocity greater than unity. This view was strengthened by the fact that a comparative test of 8-in., 12-in. and 16-in. alternating-current fans of the same make, which showed 1.00, 0.72 and 0.52, the smallest fan having the highest apparent efficiency. This was apparently not the case, as the velocity of the smallest fan would be the lowest, the thing being possible. It was therefore sought to obtain some other approximate formula which more closely represented the facts.

Assume that the fan delivers air in circular laminas without eddies or other sources of loss. Let the thickness of each lamina be  $t$  feet and its area  $a$  sq. ft. If the velocity of air delivery be  $v$  ft. per sec., then the kinetic energy flowing forward per second and the kinetic energy which each receives from the fan is  $\frac{1}{2}atv^3$ . Then the energy received per second by the air is  $\frac{1}{2}atv^3$  ft.-lb. per sec. Then the power imparted to the air current by the fan varies as the third power of the velocity. Since  $a$  is practically independent of the velocity, it may be disregarded in any test which is to be comparative only, and in which the same unit is used for the anemometer. The comparative efficiency then becomes the cube of the air velocity divided by the power input.

Using this formula instead of the ordinary assumption involving the first power, the relative efficiencies of the 8-in., 12-in. and 16-in. fans were 0.58, 0.72 and 0.90, the smallest fan having the lowest efficiency. This is more nearly what is to be expected for the actual efficiencies of these three fans, taking the efficiency as the power represented by the forward motion of the air current divided by the electric power input.

The assumption that the power required is proportional to the velocity may thus lead to very incorrect conclusions when fans of radically different construction are to be compared. Even the same fan will show marked variations in apparent efficiency (computed from the true power of the velocity) when measured at different speeds, as by changing the voltage. It is evident that the actual moving efficiency of a well designed fan will not be much affected by a variation in its voltage from the normal. Unless the velocity is kept a certain large constant variation in efficiency will be caused.

To test the motor component of a 12-in. and 16-in. fan blades were used, the motor being apparently sound, with a current which was kept constant. The resistance of the armature was measured at the two test and running fan at various speeds. If the sum of the armature losses be deducted from the power input, the remainder is the power delivered by the source to the fan itself. Each fan was operated at various speeds, and the velocity of the air was measured by anemometer and stopwatch. The mechanical power delivered to the fan blades was then considered as equal to a constant times the cube of the velocity of the air, and a comparison was made made. The values thus found for a 12-in. fan were 0.60, 0.72, 0.80, 0.85, 0.88, 0.90, 0.92, 0.94, 0.96, 0.98. This is a good agreement with the values determined by the ordinary assumption given above.

The extremely low efficiency due to electric fans makes the question of testing for testing them of importance not only to the maker but also to the buyer. It seems to be hoped that some simple, reliable method will be devised so the user knows at the start what he purchases and specification.



# Central Station Management

**Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities**

## Educational Illumination

In an endeavor to put before its patrons and the general public comparative data concerning the application of various lamps and reflectors the Indiana General Service Company, of Elwood, Ind., has exhibited in one of its office windows the display shown in the accompanying illustration. In the two compartments on the left an attempt is made to show the difference in the amount of light given by a 60-watt, 16-cp carbon-filament lamp and a 25-watt tungsten lamp, each unit being fitted with an Alba shade. The illumination in the right half of the compartment in which the 25-watt lamp has been placed is even superior to that in the compartment containing the 60-watt lamps.

The two compartments in the center strikingly illustrate the value of properly shading the light source. Both lamps in this portion of the window are 40-watt tungsten units. The shade is a Cora product.

A 16-cp carbon-filament lamp and a 60-watt tungsten lamp are contrasted in the two compartments at the right of the picture. These units were selected for direct contrast as they consume approximately the same amount of



WINDOW DISPLAY IN ELWOOD, IND.

energy per hour. By means of placards in the windows attention was also directed to the percentage of light absorbed by the darker-colored walls.

For the photograph appearing with this article we are indebted to Mr. William A. Beach Smith, district manager of the Indiana General Service Company.

## The Electric Vehicle in Denver

During the last year the Denver Gas & Electric Light Company sold 2,160,000 kw-hr. of energy for charging electric vehicles. This company maintains a vehicle department and has twenty-three electric vehicles in its own service, ranging from a 750-lb. delivery wagon to 4-ton trucks. The company also maintains a department of storage-battery engineering, which gives its service in consultation to all users of electric-vehicle batteries, so that twenty-four-hour service may be had. This department furnishes data on electric-vehicle operation, and its services have proved very valuable in extending the automobile branch of the company's business. The company makes periodical inspection of electric vehicles and batteries on request without expense to the consumer. It co-operates closely with the commercial department, and the result has

been a large expansion of the electric-vehicle business in Denver.

The Denver company believes in judicious advertising, and in addition to using the daily newspapers publishes a monthly magazine, *The Electric Vehicle*, of which 1000 copies are mailed every month to prospective customers, including owners of gasoline machines. In Denver there are 940 electric passenger automobiles, or one to every 200 inhabitants. The field for commercial electric vehicles is promising. The low cost of electrical energy has been an important factor in building up this business.

In private garages there is offered an off-peak rate of \$5 a month and a through-peak rate of \$7.50 a month. In addition a charge of 4 cents per kw-hr. less 10 per cent for energy used in charging the batteries is made. In the case of public garages there is first a readiness-to-serve charge on the Doherty system, and then measured rates which probably work out something like 3 cents, less 50 per cent, less 10 per cent in the case of large garages, say one for fifty vehicles. Taking the two charges into account, the net cost to the large public-garage operator would be possibly a trifle over 2 cents per kw-hr. The garage owners usually make flat rates to their customers, ranging from \$20 to \$45 a month, this price covering everything.

## Energy Consumption of an Electric Truck on Different Street Surfaces

In the following paragraphs are given the results of a number of tests made by Messrs. N. A. Hall and J. M. Hargrave, of the Massachusetts Institute of Technology, in connection with senior thesis work under the direction of Mr. H. F. Thomson, research associate in charge of electric vehicle investigations in the department of electrical engineering. The tests cover runs of a 1000-lb. electric truck owned by the Edison Electric Illuminating Company of Boston upon various highway surfaces, with the object of determining the relative energy consumption of each. The tractive resistance of asphalt was taken as unity. The truck, built by the General Vehicle Company, had an inclosed-panel delivery type of wagon body. Its equipment included a General Electric motor rated at 28 amp and 60 volts, with a battery of sixty Edison cells of 300-amp-hr. rating. The drive was by silent covered chain through a differential gear on a jack-shaft to each rear wheel by a roller chain. The bearings at all important points were of the Timken roller type, and the speed-reduction ratio from the motor to the jack-shaft was 15 to 47 and from jack-shaft to wheel 13 to 62. The normal motor speed was 2000 r.p.m., and a controller was provided giving four forward speeds. The tires were of the Firestone solid-rubber type, 36 in. by 3 in. in dimensions.

For the tests a long stretch of road of uniform grade was marked off, care being taken to have no interruptions from traffic, the machine being driven to attain a uniform speed before passing into the course. As the course was entered readings were begun with a stop watch, ammeter, voltmeter, odometer and a grade-measuring device. The controller position, street surface and weather conditions were also recorded, and, except on heavy grades, tests were



run in both directions and averaged, one test being run on each of the forward controller points for each street surface.

The relative energy consumptions on the various pavements were as follows: Asphalt, 1.00 to 1.05; macadam, 1.15; tarvia, 1.14; glazed brick, 1.34 to 1.36; wooden block, 1.07; granite block, 2.00; snow (fairly hard, with grips), 1.89; snow (fairly hard, no grips), 1.69; hard snow and ice, 1.34; snow (fairly soft), 2.06.

The grips applied were of the Lyon tire type, and these increased the resistance about 12 per cent on fairly hard snow. The tractive resistance of asphalt as determined by calculation from tests was 29.3 lb. per ton. The tractive resistances obtained were for the combination of the four wheels of the truck, although only two of these were driving wheels.

An investigation was also made of the effect of the number of delivery stops upon the energy consumption in watt-hours per trip. With no stops, the energy consumption averaged on a rather hilly course 3.5 miles long 9.20 watt hours total; with five stops per mile, 12.60 watt hours; with ten stops per mile, 14.40 watt hours, the increases in the two latter cases being 34.6 and 57.6 per cent respectively.

The over-all efficiency of the truck from motor input to wheels was found by jacking up and belting each rear wheel to a 3.5-kw generator. The generator shafts were coupled together to prevent relative rotation of the rear wheels and consequent power loss in the differential gears. The over-all efficiency of the truck ranged from a minimum of 72 per cent on the fourth speed, with series-parallel connection of the field coils, to about 66.5 per cent on the third speed, and on the second speed with the field coils in series the efficiency was about 62 per cent.

all-day load factor, and that the efficiency of the bus has been greatly improved as a result of the growth in business. The table shows that made of two years the total energy marketed by the company was more than doubled, its power output was nearly quadrupled, and the connected motor load more than quadrupled. The increase in the average speed of the motor from 2.7 miles per hour to 4.5 miles per hour



after the larger industrial-motor-load business which is bringing in excellent results. The gain in business as a whole has been effected by vigorous solicitation, increased attention to displays of new apparatus, extended company advertising, the reduction of rates and a general effort to get into closer friendly relations with the public.

## The Results of a Progressive Central-Station Commercial Policy

The accompanying load curves comparing the Worcester (Mass.) Electric Light Company's station output on two December days, two years apart, show the influence of an energetic commercial policy on plant operation. The curves were taken on the days of maximum station load for their respective years, the average load on the station being 2350 kw in the former case and 1250 kw in the latter. The respective load-factors were 43 per cent and 41.5 per cent. During the intervening period the company made a vigorous campaign for new business. This growth is also indicated by the accompanying tabular comparisons as of June 30, 1910, and June 30, 1912, the end of the fiscal year.

### GROWTH OF BUSINESS, WORCESTER ELECTRIC LIGHT COMPANY

	1910	1912
Kilowatt hours sold, including street lighting	1,080,000	1,850,000
Motor service sold, in kilowatt hours	1,000,000	1,800,000
Energy sold, exclusive of street lighting, in kilowatt hours	1,000,000	1,800,000
Connected industrial load in kilowatts	1,000	1,800
Connected building load in kilowatts	1,000	1,800
Revenue from sale of energy for motor service	\$100,000	\$180,000
Total revenue	\$100,000	\$180,000
Number motor-service customers	1,000	1,800
Total customers, largest 1,000	1,000	1,800
Number motors of sizes	1,000	1,800
Average house power rating per house	1,000	1,800

The load curves show the general improvement in the demand on the system resulting from increased business, in spite of the fact that each was taken on the day of the heaviest lighting and motor-service peak in its year. The day load in the latter case ran in the vicinity of 2750 kw, compared with about 1250 kw. Examination of other curves in the company's possession clearly shows that the

## Municipally Operated Plants on Same Footing as Privately Owned Plants

A case of some importance, through its bearing on the question of municipal ownership of public utilities, has been recently passed upon by the Supreme Court of Alabama. The details are as follows: The city of Montgomery is authorized by act of the State Legislature to acquire its own water supply and has the option of extending the service to the territories without its corporate limits, but within the limits of its police jurisdiction. A group of residents at Clarendale, a suburb comprising some 1,000 persons, entered into a contract with the municipality for a water supply, made at a fixed rate, with a fixed cost for water used. The water was measured by one meter and the charge was to be paid jointly by the individual consumers. Later trouble arose due to a disagreement as to the amount of excess used; the meter being such that the water was defective, and on the refusal of the municipality to pay the excess charges, the city threatened to cut off the supply entirely. Some months later the city started to extend its lines to Clarendale and at the same time to force its water and sewer meters, as had been the custom in the immediate vicinity, and to reduce the water rates to correspond with those charged for similar service in other communities. In violating the lower water demand in favor of the plaintiff, the court held that unless the municipality is to furnish its water service to the entire city, it is bound to furnish the same service to the entire city, and to reduce the water rates to correspond with those charged for similar service in other communities. The court held that unless the municipality is to furnish its water service to the entire city, it is bound to furnish the same service to the entire city, and to reduce the water rates to correspond with those charged for similar service in other communities. The court held that unless the municipality is to furnish its water service to the entire city, it is bound to furnish the same service to the entire city, and to reduce the water rates to correspond with those charged for similar service in other communities.

### Central-Station Facts and Factors in the State of Iowa

At the convention of the Iowa Electrical Association held at Waterloo, Ia., on April 23 and 24 Mr. Austin Burt presented a report on facts and factors in the central-station industry in Iowa, similar to those compiled and presented annually by Mr. Burt since 1909, when the first investigation of this nature was made. The reports for the years 1909 and 1911, which are referred to in the accompanying table,

were printed in the issues of May 6, 1909, and April 27, 1911.

The present report contains data from thirty-eight stations as compared with twenty-six and thirty-one respectively in previous reports. The central stations are grouped according to population served, the average being given for each group for the present year as well as for the years 1909 and 1911 so as to facilitate comparison and show clearly the growth of central-station business in Iowa.

CENTRAL-STATION STATISTICS FOR THE STATE OF IOWA

STATION NUMBER	Population of District	Number Consumers per 100 Population	Station Rating, Kw	Station Rating per Capita, Watts	Station Rating per Employee, Kw	Ratio Station Rating to Connected Load, per Cent	Average Load During Operation, Kw	Ratio of Average Load to Station Rating, per Cent	Annual Load Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per \$100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio Expense to Gross Income, per Cent	Net Earnings per \$100 Invested	Total Hours of Operation per Year
1	750	14.9	75	100	36	25	68	90.6	34.7	\$100	\$10.00	\$33.33	\$22.33	\$33.33	1.1	60.0	\$22.00	3,200	
2	900	9.4	17	19	17	70.8				400	7.55	139.40	27.88	2.63	34.85		64.5	10.38	
3	1,100	14.5	50	45	25	62.5	8	16.0	32.0	260	11.82	100.00	31.25	4.54	38.46	9.5	65.0	11.46	6,570
4	1,200	12.3	50	42	25	57.5	12.2	24.4	12.0	380	17.04	105.00	35.34	4.37	25.57	12.8	79.8	3.17	2,370
5	1,200	10.2	50	42	25	57.5	13.6	27.2	38.9	360	15.00	71.20	26.37	2.97	19.78	5.3	58.8	6.15	4,300
6	1,500	12.4	60	46	30	59	13.2	21.9	42.5	150	6.92	96.50	35.60	4.44	64.11	11.8	52.0	28.78	3,725
7	1,500	23.3	125	83	25	60	13.3	96.00	31.42	160	13.33	96.00	31.42	8.00	60.00	83.3	8.00		
8	1,500	13.3	60	40	20	60	22.8	38.0	50.8	167	6.67	102.30	35.00	4.66	70.00	11.0	84.0	9.18	2,700
9	1,500	12.5	60	40	20	75	4.4	7.3	13.1	167	6.66	116.67	32.62	4.09	61.32	29.2	74.8	13.45	4,560
10	1,500	11.3	170	113	56	65.4	20	11.6	22.9	260	16.66	133.60	133.60	15.14	91.00	22.7	47.8	45.30	5,000
11	1,600	19.7	115	72	28.7	33.3	25	21.7	37.6	130	9.34	104.00	37.85	7.47	80.27	9.5	25.0	72.09	5,020
12	1,800	12.2	115	64	23	83.3	17	14.8	29.3	200	12.77	72.70	38.00	4.64	36.35	5.9	55.0	14.35	8,240
13	2,000	16.5	150	75	30	30				100	7.50	64.72	29.42	4.85	64.72	9.3	82.8	9.14	
14	2,000	16.1	140	70	35	70	13.3	9.3	19.0	170	11.90	70.60	30.75	4.95	41.65	9.3	99.5	2.28	8,000
Average 1913...	1,416	14.2	88	61	28	56.0	20.2	26.6	30.2	216	10.93	93.28	31.96	5.43	51.51	11.6	66.6	16.51	4,871
Average 1911...	1,415	11.9	82	62	36	94	19.4	26.3	33.8	205	11.03	84.30	48.20	4.33	43.50	10.9	73.4	4.23	4,840
Average 1909...	1,600	10.0	67	42	27	94			36.0	236	10.00	94.00	37.00	4.06	38.00		70.0		
15	2,300	18.3	175	76	44	50	30	17.1	44.6	228	17.36	148.00	61.60	11.26	65.00	9.9	83.3	8.76	8,700
16	2,350	10.5	130	55	26	52.6				230	12.75	85.30	44.80	4.72	37.00		81.6	4.72	8,136
17	2,400	15.2	166	69	50	41	16.8	11.2	12.9	80	5.00	88.90	36.40	5.55	111.00	9.0	53.0	50.25	8,760
18	2,475	20.6	160	65	32	31.8	42.9	26.8	35.8	228	14.75	92.40	29.30	5.98	40.50	3.9	73.8	8.62	8,760
19	2,500	20.0	100	40	20	20	17	17.0	22.1	300	12.00	140.00	28.00	5.60	46.60	9.5	85.7	4.77	8,320
20	2,600	15.2	250	96	42	63.1	29	11.6	21.6	140	15.40	77.80	49.10	7.40	48.50	7.9	75.9	9.63	8,760
Average 1913...	2,437	16.6	163	67	36	43.1	27.1	16.7	27.4	201	12.88	105.40	41.53	6.76	58.10	8.0	75.6	14.46	8,573
Average 1911...	2,650	12.7	157	60	29	55	28.4	25.1	33.0	190	10.61	83.20	37.40	4.52	41.90	5.7	76.1	6.39	7,620
Average 1909...	2,470	10.0	122	44	38	48				221	9.40	95.00	43.00	4.04	41.00		63.0		
21	3,400	18.0	250	74	28.5					127	9.34	80.90	33.00	5.94	63.70		73.5	14.90	3,599
22	3,500	10.1	200	57	25	90				133	7.60							8.260	
23	3,500	14.1	125	36	25	92.5	28	22.4	26.8	320	11.44	120.00	30.25	4.28	37.50	6.2	72.0	8.47	8,260
24	3,500	14.3	300	86	60	50	62.5	20.8	34.8	380	8.57	150.00	90.00	12.85	150.00	8.7	39.4	89.18	8,200
25	5,000	10.5	210	42	26	46.6	37.4	17.8	38.7	288	12.10	92.90	37.10	3.90	32.50	3.3	44.2	16.00	8,472
26	5,000	12.3	450	90	45	58.8	102	22.7	30.9	220	19.80	112.50	73.10	9.90	50.00	5.6	70.9	12.04	8,760
27	5,000	12.2	190	38	19	55	28.9			210	8.60	147.50	45.80	5.60	70.00	5.8	66.0	21.75	8,760
28	7,500	11.7	490	65	38	55.5	115	23.5	33.8	280	24.50	109.30	60.20	7.10	28.60	10.6	77.7	4.35	4,380
Average 1913...	4,550	12.9	277	61	33.3	65.6	36.7	21.4	33.0	222	12.67	116.16	52.78	7.06	61.76	7.7	63.4	23.81	7,379
Average 1911...	4,580	11.5	239	53	33	74	42.1	18.0	26.7	248	12.30	88.50	38.75	4.46	38.25	6.8	67.1	9.95	7,720
Average 1909...	5,670	10.0	285	51	37	50				202	10.00	85.00	42.00	4.40	49.00		56.0		
29	16,200	4.5	750	46	107	62.5	148	19.7	15.8	800	37.05	72.80	76.05	3.43	92.60	4.3	54.0	2.26	8,760
30	17,000	9.8	850	50	85	43.5	176	20.7	27.9	358	17.90	102.30	52.10	5.11	28.50	5.6	46.6	26.00	8,760
31	18,000	7.2	1,650	92	165	62.5	322	19.5	45.4										8,760
Average 1913...	17,060	7.2	1,080	63	119	56.2	215	20.0	29.7	579	27.47	82.55	64.07	4.27	60.55	4.9	50.3	14.13	8,760
Average 1911...	14,500	8.4	1,206	92	128	70	141	14.1	22.6	277	18.70	65.70	52.95	4.27	24.10	5.5	54.7	8.71	8,760
Average 1909...	15,500	5.0	775	50	71	67			22.0	139	8.00	60.00	60.00	3.20	54.00		71.0		
32	25,000	9.5	1,000	40	77.5	24.5	408	40.8	30.4	325	13.00	55.50	23.80	2.24	17.10	1.5	75.4	2.18	8,760
33	26,000	5.8	1,000	38	70	33.3	229	22.9	20.0	365	14.50	121.70	81.10	4.68	33.50	6.1	52.7	13.87	8,760
34	38,000	10.8	2,200	59	78	28.4	061	30.0	31.6	500	29.00	104.70	56.20	6.06	20.95	4.0	47.8	8.91	8,760
35	39,000	6.2	5,000	128	125	90.8	452	9.0	18.1	180	23.10	38.30	79.80	6.01	21.28	4.8	46.1	9.28	8,760
36	43,500	11.2	3,000	69	75	80.8	27.0			517	35.70	67.30	59.60	6.70	18.82	4.1	50.6	7.30	8,760
37	50,000	1.4	900	18	45	33.4	228	25.3	22.0	183	2.79	92.78	116.00	1.67	59.80	4.2	36.0	23.50	8,760
38	90,000	7.7	8,750	95	588	127	136.7	16.1	34.0	223	21.30	59.20	81.20	5.60	26.30	4.2	46.0	12.20	8,760
Average 1913...	44,500	7.5	3,120	64	209	56.2	593	24.4	24.3	326	19.91	81.35	71.10	4.52	28.22	4.1	50.6	11.03	8,760
Average 1911...	55,600	6.2	2,890	51	81	43	653	22.7	31.5	541	27.20	80.50	68.90	4.17	15.27	4.1	48.9	6.26	8,750
Average 1909...	53,000	5.0	2,110	46	262	42			24.0	195	9.00	88.00	79.00	3.50	42.00		51.0		
Grand Av. 1913...	11,100	12.5	778	61	71	35.5	155	23.2	29.3	255	14.23	93.50	49.90	5.74	50.60	8.2	63.6	17.00	6,950
Grand Av. 1911...	14,920	10.6	576	64	51	72	117	22.0	30.1	252	13.85	82.10	47.60	4.36	36.80	7.8	67.5	7.82	6,710
Grand Av. 1909...	9,411	9.0	401	44	63	56			32.0	220	9.60	89.50	46.00	3.93	41.60		64.0		



## Illumination and Wiring

## Ornamental Street Lighting in Los Angeles

At the present time Los Angeles has about 9.5 miles of streets, principally in the downtown section, with special ornamental street lighting. Main and Spring streets, Broadway, Hill, Fourth, Fifth and Pine Streets, Harvard Boulevard and Third Avenue are made more attractive in this manner. The total cost of the existing installation was about \$95,000, and the cost of operating is about \$60,000 a year. In addition, contracts have been awarded for about 5.7 miles of ornamental lighting on Sixth, Seventh, Eighth and Ninth Streets. This system represents 625 ornamental posts and an outlay of \$40,000. Furthermore, proceedings are pending for about 12.8 miles of additional ornamental lighting, which will cost about \$72,000. The cost of installing the special street lighting in Los Angeles is between \$7,000 and \$8,000 a mile.

## Lighting of the Panama-Pacific Exposition

If the Panama-Pacific International Exposition in 1915 at San Francisco shall fittingly celebrate the opening of the Panama Canal, the lighting scheme planned for the Exposition itself will surely be commensurate with the significance and dignity of such an important event. The Exposition is scheduled to open Feb. 20 and continue until Dec. 4, 1915, while the Panama Canal which it commemorates will be officially opened in full running order by the government on Jan. 1 of that year.

At the outset, because the canal will afford a new trade route for the commerce of the Eastern and Western Hemispheres, the question of devising a scheme of decoration and illumination that would not only distinguish the Exposition as unique among its kind but also typify in a measure the traditions of both the Orient and the Occident seemed of utmost importance. That the lighting effects should be designed along entirely new lines appeared imperative. The day of dazzling white expositions was past. Mr. W. D'Arcy Ryan, director of the illuminating laboratory of the General Electric Company, was selected to undertake the work. Mr. Ryan has already acquired invaluable experience through his successful illumination of Niagara Falls and of the Hudson-Fulton celebration. Recently he has also devised the method for lighting the Panama Canal itself. According to the plans he has devised at the Panama-Pacific Exposition there will not be a single piece of lighting that has ever been used before. Everything will be new.

There will be no outlining of buildings with incandescen lamps. While all of the surfaces and lights will be rich with color, there will be no glaring combinations. There will be nothing garish. The highest artistic results will be achieved with a wealth of softened tones that blend readily. The ground tone will be about the color of travertine stone, intensified by lighting to an ivory yellow which will appear almost white from a distance. Distinctive tones, so regular that they will blend in varied harmonies, Pompeian red, strong Italian blues, vermilion and orange tones will be employed in the special color scheme. In certain colonnades the walls behind the ivory-toned pillars will be of Pompeian red. Much of the statuary, particularly the groups, will be warm with color. The walls of many of the arcades will be adorned with huge mural paintings. The lily pools and beds of massed bloom will be enlivened by rising structures which will rival them in the beauty of color display.

The plan of the buildings will be in harmony with the decorative and lighting scheme. There will be no assemblage of individual palaces separated by huge intervening

areas which open up to the sky. There is no parking  
light of the night sky. The large part of the  
related group surrounding the three principal courts. They  
will represent in conception a stupendous Oriental bazaar,  
similar in form to the bazaars of Bagdad or Damascus,  
Damascus or Cairo. All roofs of the buildings will be  
colored a redish pink, like Spanish tile, and will spread out  
over the area along the blue waters of the bay. In the  
thing will be pure gray with color, some appearing  
warmly tinted in the sunlight and others streaked with  
red and blue and orange, and some looking with the pale  
low color of old and weathered stone.

The official colors of the Exposition are vermilion, burnt orange and a very dark green. The color of the latter will be used on the buildings. To make the flags, bunting and decorations in the case of the latter different than any other exposition, the colors have been placed in the design in alternate squares. Although the aim of the illustration will be directed so that colors will have their decorative values.

The Exposition grounds contain many of the historic View section, forming a natural amphitheater overlooking San Francisco Bay and the Golden Gate between the Pacific and the Atlantic Oceans. The Exposition grounds are the United States military reservation, the Presidio, and are used and owned by the city. The grounds are within the city limits of San Francisco, are less than 2 miles from the coast of the business section, extend over 2 miles along the waterfront, and average a half mile in width.

In composition the architectural plan consists of three principal elements: that of the center along the south axis of exhibit palaces and the other two elements, including the either side. In the east are the pavilions of the government, while to the west lies the small city of foreign government pavilions and state buildings. The main exhibit palaces occupy over 100 acres, grouping in two rows, each 15 long by 1200 ft wide. They are flanked by two rows of pavilions to the north and south sides, containing about 100 acres in which the Federal Hall and the International Building will be erected. The foreign government and state buildings spread over about 150 acres of the government grounds.

The majority of the main wings are either directly united into one continuous structure, rising in height to an average six-story city building and ending on the east and west at glass-enclosed pavilions. The nature of exhibits—fine arts, administration, varied industries, museum, etc.—the arts, machinery, mining, transportation and agriculture are appreciated and displayed like the east end of a department store and are identified chiefly by their location, as one passes through them. The main wings are 100 ft. high with exhibits to the right and left.

The court itself is divided in three segments longitudinally north and south, called the Festival Court, or Court of Abundance, the Grand Court of Illness, or the Court of the Sun and Stars, and the Court of the Four Seasons. They are represented there last in west and first in each case to the buildings and water zone. The Grand Court of Illness in the center is the largest, representing 500,000,000, and is dominated by the great tower on the north side, which rises 400 ft. and has on the Administration Building and near the legal offices. Each of the three inner courts, given approximately 100,000 ft.

[illegible]



jewels are not colored bulbs; they are actual jewels. Great quantities are now being made from glass, of a special cutting, cut for different distances and effects, some cut in this country and others necessarily cut abroad. Strangely, glass-cutters and jewelers had never cut anything in these sizes before, and it was so entirely new to them that the illuminating engineers were obliged to figure and measure the index of refraction of the glass. It will cost no more to operate the lighting with jewels than with incandescent lamps.

Not only will jewels be used for the gorgeous lighting on the imposing Tower Gate structure, but also wherever they can add to the beauty of an architectural line or surface or sculptured form they will be suspended upon delicate springs so that the least vibration from the wind or machinery or even the tramping of feet may keep them in constant motion and set them flashing.

In the archways of the tower arcade, 125 ft. in height, through which visitors may enter the court from the south garden, will be set a series of mural paintings expressing the keynote of the Exposition color scheme. In the center of the court will be a sunken garden, 5 ft. below the court level, rich with palms and shrubs and flowers. Two fountains embracing groups of statuary, one signifying the spirit of the East and the other the spirit of the West, brought together through the Panama Canal, will also lie on the main axis within the court. At night the court will be illuminated from these fountains. They will be constructed of dense white glass and in the daytime will in no wise suggest light sources. Within each fountain will be concealed seventy-two luminous arc lamps, a total of 144 lamps for the court. At night when lighted the entire surface of the fountain will become luminous, flooding the court with a softly diffused white light.

Perhaps the most impressive feature of the Court of the Sun and Stars will be found in a classic colonnade, with columns 50 ft. high, extending entirely around the court and surmounted by seraphic figures symbolical of the stars and designed to represent on one side the spirit of the Orient and on the other the spirit of the Occident. These figures, of which there will be 110, will stand 14 ft. high and the head of each will be crowned with a star measuring 4 ft. across. The crowns will be studded with some 10,000 jewels, which will be lighted from the base of the figure opposite, the beams crossing the court. In the court, however, the beams will be invisible, because the white flood light which fills the court will eliminate lines of demarcation and cause the beams to vanish.

Turning west, the Court of the Four Seasons will be entered from the Court of the Sun and Stars through a commemorative arch, larger in size than the Arc de Triomphe at Paris. It will be surmounted by a group symbolical of Western civilization. A prairie schooner drawn by oxen will comprise the center motif of the group, typifying the advance of the Anglo-Saxon civilization across the plains of America to the shores of the Pacific. To the east one will pass through a similar triumphal arch to the Festival Court, which will portray Oriental thought. The grouping on the arch is a colossal piece composed of camels, elephants and Oriental warriors.

All the façades of these palaces, etc., will be made visible by light that will reveal their true colors. In the courts the mural paintings will be lighted by concealed lamps set into the pillars fronting them, a special tubular lamp having been developed for the fluted columns. The lamp and reflectors are made small enough to insert into the flute in the column. For use on smooth columns three lamps will be inserted in each at height of about 10, 20 and 30 ft. and partially concealed by reflectors. The illumination on paintings can be absolutely controlled in intensity and distribution by changing the size of the units and the curvature of the reflecting surfaces, and by introducing colored bulbs any color effect may be obtained.

Throughout the grounds ornamental luminous-arc lamps will be used and fitted with dense globes, which will reduce the intrinsic brilliancy of the lamp to a point where it may be looked at directly without injury to the eye. The inclosed flame-arc lamp is well suited for lighting large inside areas and will be used extensively for indoor lighting, the interior of the buildings being tinted a pearly tone. Both the ornamental luminous and flame-arc lamps with heavy diffusing globes will give nearly four times as much light for an equal amount of power as the older types of carbon-arc lamps used in previous expositions.

Extending along the outside of the walks in front of the main exhibition palaces for a distance of nearly  $2\frac{1}{2}$  miles will be placed singly and in groups standards on which will be suspended large banners representing Spanish heraldry in design. They will be made in the Exposition colors and three shields will be mounted on each standard. Back of them will be concealed five luminous-arc lamps in each case, reflecting on the buildings. The banners are being so constructed that the light glowing through them will present from the court drives the realistic effect of tapestry.

Perhaps the most striking effects of reflection will be realized in the Horticultural Palace at the left when entering through the southern gardens. Composed almost entirely of glass, it will be a veritable crystal palace and at night will appear like a bubble of light 165 ft. above the illuminated blossoms and fountains.

The large electric scintillator, which will be anchored on barges in the bay from 1500 to 2000 ft. from the shore, will project out over the entire grounds powerful beams of colored light. The scintillator will consist of a battery of forty-eight searchlamps having 36-in. parabolic mirrors. Sixty men, who will be required to operate the lamps, will be trained to direct them through many evolutions of color, throwing brilliant auroras into the sky. On clear nights the spread of these colors will be visible in all the bay cities to a distance of 50 or 60 miles. The mists which often come in from the bay at night will heighten the lighting effects by furnishing a background upon which to play the changing colors.

That the Exposition in its entirety will be made not only a beautiful vision but will leave a lasting impression on the many thousands of visitors both from this country and abroad is assured.

## Letters to the Editors

### Fuse Economy

*To the Editors of the Electrical World:*

SIR:—In the issue of the *Electrical World* for April 19 Mr. H. R. Sargent, Schenectady, N. Y., has endeavored to show that the use of the refillable inclosed fuse is uneconomical from the standpoint of the user of fuses. The fallacy of his conclusion is so apparent to those who are actually acquainted with the facts of the case that few will stop to analyze the reasoning and those who do so will not be long in solving the apparent paradox. However, for the benefit of those of the general public who have not given the subject special attention it would seem that a statement so radical as that of Mr. Sargent should be answered and the truth exposed.

As is usual in the case of arguments where the logic and the arithmetic are correct and the conclusion absurd, one must look to the premise to find the error. Mr. Sargent has shown, and correctly, that it is uneconomical to use the refillable fuses costing twice as much as the ordinary cheap fuse on circuits where the annual reloading is 10 per cent or less. He further assumes, and possibly in this case he is also correct, that the average annual blowing of all inclosed fuses in use is 10 per cent. As a consequence, he concludes

that there is no economy in the use of the more expensive type of easily reloadable fuses.

There are, however, two distinct types of service requiring fuse protection. On one good engineering demands the cheaper form of fuse which is in a large part destroyed when blown. On the other hand of service the expense of renewals is excessive and a different type of fuse must, and will, be developed to meet this economic need.

Reloadable fuses are not properly used on circuits blowing to per cent per year—that is, an average of once in ten years. They are used on circuits subject normally to momentary overloads once daily, or once a week, or so. The former situation is found at the entrance service, branch feeders, cut-outs where the size of wire is reduced, motor panel buses, and in general where the different peak loads passing through the fuse are subject to a large diversity factor. These fuses practically never blow except on the infrequent occasion of the breakdown of a cable or the indiscriminate use of a screwdriver or crowbar by a careless employee in the vicinity of busbars. Their chance of blowing is probably much less than to per cent.

A difference exists, however, in that class of service comprising the branch circuits running directly from the branch panel to the energy-consuming device. The fuse on this circuit is not favored by a diversity factor but is subject to the maximum peak that ever occurs. A multitude of unavoidable causes are responsible for momentary overloads of 100 per cent or more on these individual circuits. These overloads are usually very short, do no damage to anything except the fuse, and represent a negligible part of the total time of operation, but they occur just often enough to run up a prohibitive fuse bill. There has not yet been developed a sufficiently small, compact and cheap circuit breaker to take care of this kind of work, and a renewable fuse seems to be the only solution in sight at the present time. The operator has a choice of putting in a large fuse and losing his protection, paying an excessive fuse bill, or using some kind of fuse that may be refilled at nominal cost.

Experience is showing that the consumer will not continue to pay the expense of fuse renewals, which is in some cases enormous and amounts to pure waste. It must be remembered also that most of the arguments hitherto advanced on the subject of fuses have been made by manufacturers eager to direct this waste into channels more advantageous to themselves, and the merits of the case have apparently been considered only incidentally. An economic demand cannot be resisted indefinitely, and there exists at present a real demand for a refillable fuse which still be reliable as to rating, cheaply refillable and reasonably foolproof—that is, one that cannot be improperly refilled by anyone who may undertake to do so.

Chicago, Ill.

HARVEY S. PARSONS.

## High-Frequency Alternator

To the Editors of the Electrical World:

Sirs:—The letters of Prof. J. H. Morecroft and Mr. D. R. Price in your issue of April 26 are of exceptional interest in so far as they bear upon radio transmission by the use of continuous waves. The radiation from "waveless" stations of wave energy in sustained and practically sinusoidal form is rapidly becoming recognized as a method having a number of advantages not possessed by the older use of wave groups.

The "General Electric" or "Alexanderson" or "Fessenden-Alexanderson" or "Fessenden" high-frequency alternator (as the machine is variously called) is an outgrowth of Prof. R. A. Fessenden's early work on continuous wave transmission. In a patent application filed by Professor Fessenden in May, 1901, describing improved methods of generating electromagnetic waves, it was proposed to con-

nect the rotating portions and give a velocity to a series of high frequency alternating current that along with the spark gap and resonant inducting circuits. As an example of a machine known of generating current for such purposes, Professor Fessenden mentioned in considerable detail a generator that could be employed, stating that it should have the following characteristics:

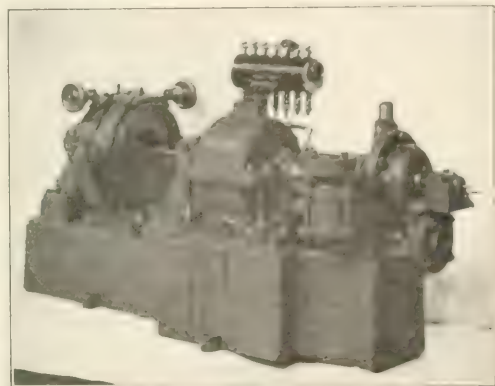
A. The machine type should be used, some in it peripheral speeds of rotor upward of 5 miles per minute are allowable.

B. Very little or no iron should be subjected to the high-frequency magnetic field, in order to minimize hysteresis and post resonance will result.

C. The nature of the armature windings should be arranged to give a true sine wave-form of voltage, as otherwise only noisy resonant potential waves will be secured.

D. The armature should have as few turns as possible, not only to minimize losses but also to insure sharp resonance.

E. The armature windings and circuit should be kept as small as possible, since the armature and secondary are



High-frequency alternator.

connected serially and their distributed constants are therefore small.

Professor Fessenden pointed out that using the entire stationary part of the circuit in common to the machine frequency, the larger amount of inductance and capacity must be in the antenna in order to secure efficient radiation.

The broad method of producing electromagnetic waves as they are produced by these Fessenden sets not provided with spark taken to the leading scientist, mentioned in the art. Professor J. S. Meissner has been so far as to state (in the 19th volume of the "Transactions of the American Wave Society") that the generation of electromagnetic waves was independent from a certain electrical frequency of the alternative between storage type and that therefore the alternating method proposed by Professor Fessenden could not be expected to be of great value.

Meanwhile Professor Fessenden had pursued his own course of high-frequency generation, building first the case of the "General Electric" machine, which was the machine mentioned by Mr. Fessenden and described in the above-mentioned work, but through the recommendation of the Dr. L. L. Lippitt, Stuart Fessenden joined the National Electric Signaling Company, the latter company representing the operating method and other important parts. This machine, as it is known, which has served this field and has numerous applications, and is representative of the design now known as the General Electric Company, the National Electric Signaling Company. The type of the



internal inductor machines manufactured by the General Electric Company was completed some three or four years ago. Mr. E. F. W. Alexanderson, of that company, has done a great deal of extremely valuable work in connection with the development of the motor-driven machine and has produced a lapped winding making possible the direct mechanical generation of frequencies reaching 200,000 per second. It should be made clear that this letter is written with no idea of belittling the results of his ingenuity; I merely wish to urge that in view of Professor Fessenden's basic and pioneer work in this field there should generally be accorded to him the recognition which is conceded to him by the best informed radio engineers and which is undoubtedly due him as inventor of the transmission method now followed by Poulsen, Goldschmidt, Arco and Bethenod.

JOHN L. HOGAN, JR.,

Chief of Operating and Erecting,  
National Electric Signaling Company.

New York, N. Y.

### Light-Distribution Curves

To the Editors of the *Electrical World*:

SIRS:—The letter by Mr. Evan J. Edwards in your issue dated March 15, commenting on my article in your issue dated Feb. 8, serves to emphasize the misunderstanding concerning the purposes for which the curves proposed by the writer were intended which was evident in your comment on my article.

Taking up the editorial comment first, you state that either the Rousseau diagram or the Kennelly diagram gives a graphical representation of the flux distribution zone on zone, and the total flux between any assigned zonal limits including the total flux emitted between zenith and nadir. In a very strict sense this may be true, but for practical purposes it is far from true. It is true that the Rousseau diagram displays in a graphical manner two co-ordinate quantities entering into the light flux, but to obtain a numerical expression for the actual flux in any zone it is necessary to perform either a measurement or a calculation. Inasmuch as this calculation is necessary, why not plot the result at once and use it as the basis for a curve which may be used for actual calculations and as a graphical representation of a far better sort than that furnished by the Rousseau diagram?

It will be noted that the curve proposed by me is simply a plotting of the areas in the Rousseau diagram to polar co-ordinates—clearly the logical system to use in a graphical display of distribution about a point. Obviously the Rousseau diagram is slightly more accurate, but not to an extent significant in engineering calculations.

The Kennelly diagram is open to the same objections as the Rousseau diagram. Both are means of obtaining quantities or performing calculations by geometric constructions and are well suited to this purpose. Neither, however, permits the actual reading of the quantities directly from a convenient scale without the use of measuring devices of some kind, and neither displays graphically the relation between direction of the luminous flux and the point from which it proceeds. They are not suitable as everyday working tools for employment by the practical and busy engineer.

My claim for the curves submitted is simply that they serve practically all the purposes of the Rousseau diagram and the Kennelly diagram (as far as the practising engineer is concerned) with the added advantage of saving time and presenting all spatial relations graphically. Furthermore they serve for point-by-point calculations quite as well as does the ordinary distribution curve.

There is just one function of the ordinary distribution curve that the curves proposed by me do not show, and that is the relative approach of the light distribution characteristic to that required to produce uniform illumination.

This is mainly the affair of the reflector designer and manufacturer. Once the practising engineer is informed concerning the excellence or otherwise of a certain combination from this standpoint (and this information he invariably receives in the form of distribution curves from the manufacturer) he is no longer concerned with anything but point-by-point or flux calculations. For the former the curves proposed are equal to the ordinary distribution curves; for the latter they are infinitely superior to these curves.

I believe that the foregoing covers also most of the objections raised by Mr. Edwards. He evidently overlooked the fact that by placing figures representing actual flux values upon the radical lines denoting 0 deg., 5 deg. and 10 deg., and using a different set of constants, all point-by-point calculations and estimates of illumination at and near the nadir may be made quite as easily as with the ordinary distribution curve. These points were covered in the original paper.

I agree with Mr. Edwards that it is possible to guess at the flux in any zone by estimating, the horizontal distance between the curve and the vertical axis and adding 10 per cent. By repeating this guessing process several times and adding the results one may estimate within 20 or 30 per cent the flux in a given zone. But why go to that trouble for inexact results when the exact data may be obtained from a properly constructed curve which serves (as far as the engineer is concerned) every other purpose of the ordinary distribution curve?

As stated above, I grant that for estimating at a glance the degree of uniformity of illumination to be obtained by the use of a certain unit with a certain spacing the ordinary distribution curve is superior. But, having made this estimate, the engineer usually either accepts or rejects the unit for future use or specification; or, if compelled to use a unit unsatisfactory from this standpoint by reason of other considerations, he is unable to improve its distribution characteristic and can only be interested in calculating by the point-by-point method the degree of uniformity in illumination obtainable, and for this purpose the proposed curve is quite as convenient as the ordinary distribution curve. Even for estimating uniformity of illumination, the ratio between flux in the zone from 0 deg. to 5 deg. and from 40 deg. to 50 deg. (for extensive distribution for example) is an indication sufficiently accurate for all practical purposes, and this may be obtained quite as easily from the proposed curve as the corresponding quantities from the present type.

Even where the ordinary distribution curve may be used to advantage it should at least be purged of its most glaring absurdity—the use of the candle-power as a unit. The measurements from which the curve is constructed are simply determinations of the luminous flux per unit solid angle. Luminous intensity is so defined in the 1912 report of the committee on nomenclature and standards of the Illuminating Engineering Society. In other words, luminous intensity is simply solid-angular flux density, which expresses illumination by dividing by an area. Now, if the candle-power be the unit of intensity, it must also be capable of expressing illumination by the addition of the qualification "per square foot," etc. If the candle-power be not capable of use in this manner, it cannot be anything. Then why use in connection with distribution curves a unit which does not mean anything?

The whole question of photometric quantities is in a most ludicrous position. The obvious remedy is to extirpate the term "candle-power" (and its half-witted sister "foot-candle") root and branch. There are only three units having to do with light distribution that mean anything at all—the lumen, the square foot and the steradian. The sooner the candle-power unit is abandoned the better it will be.

Gloucester, N. J.

R. F. PIERCE.



## Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects Questions and Answers

### Costs of Material for 6600-Volt Line Construction

The following data bearing upon the cost of line-construction material are taken from a tabulation of expenses prepared by the Harvard (Mass.) Gas & Electric Company in connection with the erection last year of 6 miles of 6600-

REPRESENTATIVE LINE CONSTRUCTION COST ITEMS, HEAVY AND  
MASS., CONDITION, 1942

One 11,000-volt disconnecting switch	\$17.00
One 5 amp, 2000-volt single-pole line switch, duplex with extra day clock	27.50
One double-pole horizontal arrester	1.00
Two single-pole, single-throw knife switches	1.44
Two eight-point receptacles and four-point plug, one automatic plug	11.10
One 2.95 kva automatic induction regulator	200.00
Three 15 kva transformers, 11,000 to 2200 volts, 60 cycles	410.00
Sixteen $\frac{5}{16}$ -in. by 5-in. machine bolts	0.83
Sixteen $\frac{1}{2}$ -in. by 3-in. lag bolts	1.00
100 1 $\frac{1}{2}$ B & D single-wire clamps	3.00
500 ft. No. 14 single-brand rubber-covered wire	3.00
90 lb. No. 00 weatherproof wire	12.00
Four 2000-volt primary cutouts with clamps	2.00
524 six-pin crossarms	110.00
Ninety-eight eight-pin crossarms	40.00
254 four-pin crossarms	11.00
Seventy-two $\frac{5}{8}$ -in. C B guy anchor rods	1.00
5000 ft. 5/16-in. seven-strand guy wire	100.00
1200 ft. $\frac{1}{2}$ -in. seven-strand guy wire	6.00
228 guy thimbles	1.11
Thirty-six two-bolt guy clamps	1.11
196 three-bolt guy clamps	10.30
Twelve tree blocks	0.75
90 $\frac{5}{8}$ -in. by 12-in. machine bolts	4.00
102 $\frac{5}{8}$ -in. by 14-in. machine bolts	4.00
Twenty-two $\frac{5}{8}$ -in. by 8-in. eye-bolts	2.00
261 $\frac{5}{8}$ -in. by 16-in. spacing bolts	22.00
Twelve $\frac{5}{8}$ -inch by 22-in. spacing bolts	1.74
Eight 1-in. by 14-in. galvanized rock eye bolts	1.00
4830 2 $\frac{1}{2}$ -in. by 2 $\frac{1}{2}$ -in. by $\frac{1}{2}$ -in. square-cut washers	78.00
1494 $\frac{1}{2}$ -in. round-cut washers	5.00
120 7-ft. alley-arm braces	97.00
244 pairs cross-arm braces	500.00
Four 13,000-volt No. 2 Crown insulators	101.00
Tree No. 14 Electro-steel strain insulators	26.00
Six No. 270 Victor insulators	58.00
5068 least cross-arm pins	1.00
Forty-two No. 14 Pierce steel clamp pins	3.44
Forty-two galvanized iron insulated clamp	1.00
289 30-ft. poles	90.00
338 35-ft. poles	80.00
Twenty-three 40-ft. poles	112.00
Eight 48-ft. poles	72.00
Thirty-five street series brackets	30.00
One pole-line switch	40.00
Twenty-six compression-type multiple arresters	17.00
27,840 lb. No. 6 triple-brand weatherproof wire	8.00
468 lb. No. 8 triple-brand weatherproof wire	8.00
7380 lb. No. 8 duplex metal wire	91.00
6980 lb. No. 6 medium copper wire	100.00
160 lb. No. 6 soft-base wire	40.00
178 ft. two-conductor cable, No. 10	17.00
248 lb. No. 4 bare copper wire	10.00
Three No. 61 Beardsley break arms	1.00
Forty-three No. 220 Pierce brackets	1.47
Twelve copper sleeves for No. 6 to No. 4 wire	4.00
Twenty-seven copper sleeves for No. 1 to No. 4 wire	1.00
Services of construction foreman, seventy hours	33.00
Services of superintendent, ten days at \$5	50.00
Labor cost	100.00

volt line and 12 miles of 2300-volt distributing system, carrying about 75 miles of copper wire on 628 chestnut

materials for the road cost \$10,120.42, and of labor \$5,925.69. Including the cost of a water truck and gravel costs at a charge of 20 cents per cubic yard, the plans and estimates of engineers making plans and contracts, obtaining public and private rights of way for the bulk of the work, with a 18 per cent. concession to the interests in charge of the construction, the total cost

The detailed drawings given herewith were selected as all practical values to small contractors using the method of applying estimates of this construction work system. The three volt lines was built for the purpose of getting the central station of the Massachusetts Public Utility Company at Ayer, Leominster and Clinton to interchange energy and to supply local service to Harvard. The three part work include the construction of a transformer and meter house in Harvard for a small local bus.

### Test of 225-Hp Diesel Engine at Hugo, Okla.

Following are the results of a test recently run on the 245-hp Diesel engine installed at the plant of the Hugo Ice & Light Company of Hugo, Okla., which showed a specific fuel-oil consumption of 6.2 gal. per 100 brake-hp-hr. The engine was run with fuel oil by the Burch-Sulzer Brothers Diesel Engine Company of St. Louis, and the tests were conducted by Dr. A. C. Smith, of Dallas, Tex., with the assistance of the Hugo company, locally.

The prime-mover unit comprises a 225-hp vertical three-

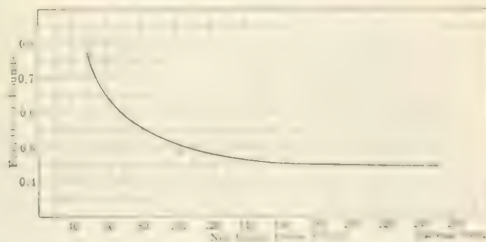


FIG. 1. FUEL CONSUMPTION FOR VARIOUS HP TYPES

cylinder Diesel engine. When connected to drive a 2,000-hp, 2,300-rpm, two-shaft, three-phase Fort Wayne alternator at 104 rpm. A 50-hp motor driving the compressor gas compressor and a 4-mhp, 1,800-rpm fan drive from the output of one of the auxiliary engines.

During this run of 4200 hr the pump and the compressor was suspended from one another. Therefore, in order to obtain the most available power recorded by the turbine, readings were taken of the average torque of the motor driving the compressor and a constant value from the kilowatt-hour output of the generator. The allowance made for the efficiency of the motor is that with the compressor loaded to the extent of the test compressor, per brake-horsepower would have been less than shown in the results given.

The engine had been in operation six months without

adjustment of any sort. Before starting the valve settings were checked and the exhaust valves taken out and examined; but this test itself was undertaken with the purpose of showing what the engine would do in regular running condition and without the refined "tuning up" usually resorted to in attempts to obtain records.

To obtain the amount of fuel oil consumed by the engine, it was only necessary to weigh the oil fed to the fuel pump, where the amount of oil actually fed to the engine cylinders is automatically controlled by the governor and varied according to load requirements. For weighing the oil, a 15-gal. tank and platform scale were used, readings being taken at ten-minute intervals. A funnel of sufficient capacity was installed in order that a small amount of oil might be stored ahead of the governor and the weighing tank properly refilled with oil.

The oil used for these tests was taken from regular stock in ordinary use in this engine. Samples of oil were taken periodically, and an analysis was obtained upon the total combined sample as follows:

Pound Fahr. thermal units, per pound of oil	18.986
Specific gravity, 25.5 deg. C. to 27 deg. C.	0.8531
Viscosity, 33.3 deg. C. (92 deg. Fahr.)	1.63
Flash point, deg. Fahr.	143.6
Burning (fire) point, deg. Fahr.	181.4
Sulphur, per cent.	0.2
Water.	Trace
Free acid.	None

The cost of this oil was \$1.22 per barrel of 42 gal., delivered, or practically 2.9 cents per gallon.

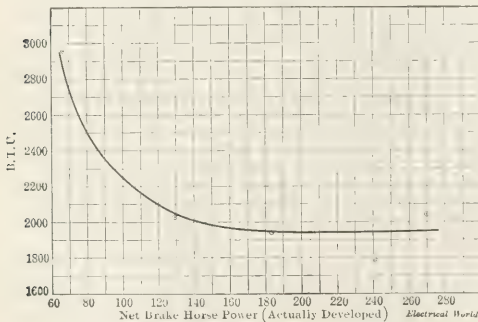


FIG. 2—HEAT UNITS IN COOLING WATER

A water rheostat was used to adjust the load. This rheostat consisted of a wooden box 10 ft. long, 12 ft. wide and 20 in. deep. Each of the three electrodes used could be moved so as to obtain an equilateral triangle. This method permitted the load to be balanced easily and quickly.

The fuel consumption for the various loads was in each instance obtained from an average of the readings taken at ten-minute intervals of the generator and the motor and of the oil used. Fig. 1 is a curve showing in pounds the fuel oil consumed per net brake-hp-hour at various loads.

This curve was plotted by taking the average readings of kilowatt output of the generator at the switchboard, corrected for the previously ascertained generator efficiency at the given load. From this was subtracted the actual kilowatt input to the motor and the resulting figure was reduced to brake-hp-hours. It will be noted from the above curve that the consumption of oil per brake-hp-hour increases very little when output is decreased from full load to about half load. At full load the fuel consumed was 0.441 lb. per brake-hp-hr., or about 6.2 gal. per 100 net brake-hp-hr. When running at practically half load, the fuel consumed was 0.482 lb. per brake-hp-hr., or about 6.8 gal. per 100 net brake-hp-hr. At quarter load the engine consumed 0.8 gal. of oil per 100 net brake-hp-hr.

Several exhaust gas samples were taken while the tests

were being carried on, and these show that there were absolutely no illuminants, no carbon monoxide, no menthane and no hydrogen to be found in the exhaust, thus indicating perfect combustion of the fuel oil.

The quantity of cooling water used during the tests was measured by a water meter read at ten-minute intervals, and an average was taken for each three-hour test. The

#### SUMMARY OF TESTS OF 225-HP DIESEL ENGINE

	NUMBER OF TESTS					
	1	2	3	4	5	6
Duration of test, hours	3.00	3.00	3.00	3.00	3.00	3.00
Switchboard reading, kw	37.42	80.23	117.5	160	180.1	
Compressor motor, gross kw	6.9	9.09	8.93	10	11.4	
Net kw output	30.52	71.14	108.57	150	168.7	
Efficiency of generator, per cent	85	87	90	92	92.5	
Net brake-hp load	2.25	49.7	111.39	162.97	219.63	245.6
Speed, r.p.m.	171.1	169.1	167.4	164.4	164.8	161.9
Cooling water per hour, lb.	3187	3037	4875	6300	4537	5175
Jacket inlet temperature, deg. Fahr.	61.8	62.4	61.9	62.6	61.7	66.7
Jacket outlet temperature, deg. Fahr.	115.3	127.9	115.5	118.9	156.6	173.1
Injection air pressure, atmospheres	39	45.6	56	59	66	77
Fuel oil—pounds per net kw-hr.	1.23	0.7555	0.681	0.646	0.644	
Fuel oil—pounds per net brake-hp-hr.	0.769	0.482	0.454	0.441	0.444	
Fuel oil—gals. per 100 net brake-hp-hr.	10.8	6.8	6.4	6.2	6.2	
Thermo-dynamic efficiency (based upon net useful output), per cent	17.4	27.8	29.5	30.3	30.2	

temperature of both the inlet and outlet water was also read at ten-minute intervals, and from this was obtained the total heat carried away by the cooling water. From these data Fig. 2 was plotted showing the pound Fahr. heat units carried away in the cooling water per brake-hp-hour.

#### Starting Current of Synchronous Motor

A 400-hp, 2200-volt, 60-cycle synchronous motor, separately excited by a 9.5-kw, 125-volt generator, is driving an air compressor capable of delivering 2500 cu. ft. of air per minute. The synchronous motor is rated at 85 amp, but in starting the current values often reach from 275 amp to 300 amp. Will you kindly state whether or not this is an abnormal condition of operation? C. S. E.

The figures given show that the starting current is about three and one-half times the normal rated value. Although this is a fairly large current for the machine, yet it could hardly be called abnormal. It is probable that the designers of the machine expected it to consume about this amount of current during the brief starting period.

#### Transformer Connections

The transformers at the loaded end of a three-phase, 60,000-volt transmission line which is 52 miles in length are star-connected. The transformers at the generating end of the line are connected in delta. Have these connections any effect on the starting torque and initial current of motors at the loaded end of this line? E. C. S.

The current taken by an alternating-current motor connected at the end of a transmission system does not depend upon the types or connections of transformers, except to the extent that the voltage is affected by the types and connections. The starting current of an alternating-current motor depends solely upon the voltage impressed across its terminals and is independent in every respect of the source from which this voltage may be obtained.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Induction Motors with Deep Rotor Slots.**—L. D. JONES.—The author gives the results of some tests that have been made on deep-slot rotors in comparison with rotors having slots of normal depth. The effect of the deep slot is to increase the reactance of the lower portion of the bar at starting and at low speeds, thus causing the greater part of the current to flow in the upper section of the bar, thus being equivalent to increasing the resistance and consequently the starting torque. As the speed increases, the rotor frequency decreases and with it the reactance, and the current distributes itself more nearly uniformly throughout the bar, thus reducing the effective resistance and improving the running characteristics.—*Gen. Elec. Rev.*, April, 1913.

**Armature Reaction of Direct Current Machines.**—C. F. GUILBERT.—An article illustrated by diagrams on the armature reaction in direct-current machines. The author differs from the views expressed by Remick in his recent paper on the predetermination of the excitation of direct-current machines. He thinks that it is not possible to represent in the same way the reactions in alternators and in direct-current machines, since the presence of the commutator changes completely the effect of the transversal reaction.—*La Lumière Elec.*, April 10, 1913.

**Transformation Ratio of the General Transformer.**—F. NIETHAMMER AND E. N. SIEGEL.—The authors show theoretically that in the "general transformer," if the arrangement and the magnetic interconnection of primary and secondary windings differ from that in the ordinary transformer, the transformation ratio of the currents and voltages is not necessarily equal to the ratio of the numbers of effective windings but is influenced to a large degree by the distribution of the primary and the secondary windings. The theoretical results are confirmed by experimental evidence. The authors give formulas which permit a simple calculation of these transformation ratios and simplify these formulas for the case of the induction motors (which is a special case of the general transformer).—*Elek. und Masch.* (Vienna), March 30, 1913.

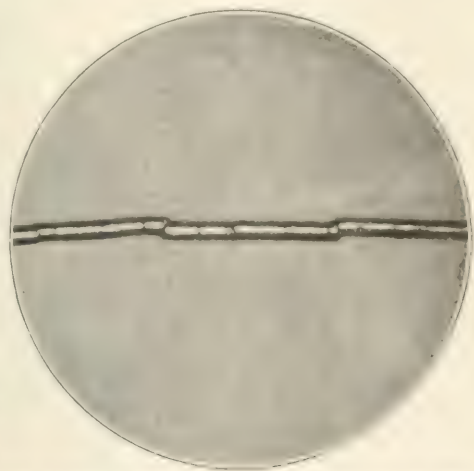
**Self-Synchronizing Machines.**—An account of the discussion of Rosenberg's paper at Manchester and Birmingham.—*London Electrician*, April 28, 1913.

### Lamps and Lighting

**Ductile Tungsten.**—O. KRUH.—A long and profusely illustrated paper in which the author discusses the history of the production of ductile tungsten wire, the original difficulties and their solution, with special reference to the fundamental patents in question.—*Elek. und Masch.* (Vienna), April 13 and 20, 1913.

**Powerful Source of Ultra-Violet Light for Photoelectric Work.**—ALBERT W. HULL AND ANSEL ST. JOHN.—An abstract of an American Physical Society paper. The source of light used is a vacuum discharge tube of the general form used by Lyman in his vacuum ultraviolet source using hydrogen at a low pressure. Experiments were made to find how the photo-electric efficiency depended on (1) the length of the capillary, (2) the diameter of the capillary, (3) the pressure of the gas, (4) the current density in the tube, (5) the potential and frequency applied to the tube. The results may be summarized as follows: (1) The efficiency increased slowly with the length of the capillary (50 per cent increase in efficiency for 300 per cent increase in length) in accordance with the known absorption of ionized hydrogen. (2) The diameter of the capillary, between the limits of 2 mm and 13 mm, makes no difference in the current it contains. (3) Pressure of the gas, between 2 mm and 43 mm, makes no difference in current it contains. (4) A strictly linear relation between current (or discharge area) and photo-electric effect was found. (5) Various forms of interrupters and a powerful Edison and glow comparatively small photo-electric effects, corresponding to the magnitude of current which they furnished. A transformer on a 250-volt alternating current circuit gave current of 1.2 amp through the tube and produced a photo-electric current of  $1.3 \times 10^{-4}$  amp per sq cm on a platinum electrode in a vacuum of  $1/1000$  mm. For comparison a mercury-quartz lamp was set up at a distance of 10 cm from the plate and when running steadily at 2.5 mm gave a photo-current of  $1.5 \times 10^{-4}$  amp per sq cm. The hydrogen tube, with electric window, therefore, gives a photo-electric effect 250 times as large as the mercury arc.—*Phys. Review*, April, 1913.

**Tungsten Lamp.**—H. REMANE.—An illustrated paper presented before the Polytechnical Society of Berlin. The author first outlines the great advantages of the ductile tungsten filament over the tungsten filament made by a paste process. With respect to the use of the tungsten lamp with alternating current, difficulties were originally



THE DUCTILE TUNGSTEN FILAMENT FOR ALTERNATING CURRENT

CONSIDERED WITH REGARD TO THE FACT THAT THE TUNGSTEN FILAMENT IS A SOURCE OF ULTRA-VIOLET LIGHT. THE PHOTOGRAPH SHOWS A TUNGSTEN FILAMENT OF THE TYPE OF ALTERNATING CURRENT, AS COMPARED WITH THE PASTE FILAMENT, BEING USED IN THE TUNGSTEN LAMP. THE PHOTOGRAPH SHOWS THE TUNGSTEN FILAMENT OF THE TYPE OF ALTERNATING CURRENT, AS COMPARED WITH THE PASTE FILAMENT, BEING USED IN THE TUNGSTEN LAMP. THE PHOTOGRAPH SHOWS THE TUNGSTEN FILAMENT OF THE TYPE OF ALTERNATING CURRENT, AS COMPARED WITH THE PASTE FILAMENT, BEING USED IN THE TUNGSTEN LAMP.



unaffected by alternating current. Fig. 2 shows a photograph of an osram with filament after 1000 hours of use with alternating current, the enlargement being 350 to 1. The ductile tungsten lamp has all the good features of the old osram lamp, but has in addition the advantage of being practically unbreakable. The author describes in detail the different steps in making the different parts of the lamp

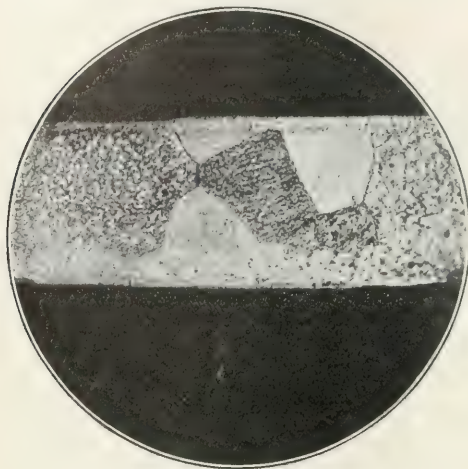


FIG. 2—OSRAM FILAMENT AFTER 2000 HOURS' USE

and assembling them together. The results of life tests and the effect of the change of voltage on the life are shown in curves. Several illustrations are given showing applications of large tungsten lamps for lighting of large inside halls, for outside lighting, etc.—From an enlarged reprint from *Die Welt der Technik*, No. 7, page 130, 1913.

**Tungsten Wire Lamps Operated by Alternating Current.**—O. SCARPA.—An account of comparative tests of tantalum lamps and ductile tungsten lamps when operated with alternating current. He finds that while the tantalum lamp does not behave well with alternating current the ductile tungsten lamp is different, being much less liable to break.—*L'Elettricista*, Vol. XI, page 235 (1912); abstracted in *Elek. Zeit*, April 24, 1913.

**Standard Specification of Street Lighting.**—An account of the extended discussion which followed Trotter's recent paper on standard clauses for inclusion in a specification of street lighting.—*London Electrician*, April 25, 1913.

### Traction

**Single-Phase Commutator Motors for Electric Traction.**—STANLEY PARKER SMITH.—The first part of a paper in abstract presented before the (British) Institution of Civil Engineers. The several factors affecting the use of continuous-current, three-phase and single-phase systems for traction over long distances are summarized and an outline is given of the reasons which have led to the adoption of single-phase. The main problem—from a technical standpoint—then centers around single-phase commutator motors, to which the remainder of the paper is devoted. The paper is to be concluded.—*London Electrician*, April 25, 1913.

**Electrification of Berlin Railways.**—A note stating that the Lower House of the Prussian Diet has passed by 192 votes to 143 a bill which will empower the government to make at a cost of \$6,250,000 preparations for the electrification of the Berlin City Circular and Suburban Railways, with certain temporary restrictions. The traffic has doubled since 1895, and in order to cope with the situation electric

traction must be installed, as it will be \$1,500,000 cheaper a year than steam. With electricity it will be possible to run forty trains an hour instead of twenty-four and to increase accommodation for passengers by possibly as much as 100 per cent. Electric trains are in every way more convenient and economical.—*London Electrician*, April 25, 1913.

### Installations, Systems and Appliances

**Phase-Advancing.**—G. KAPP.—An illustrated paper read before the (British) Institution of Electrical Engineers. Having dealt with the various methods by which phase advancement may be obtained, the author describes the equipment used for this purpose in connection with individual motors, and especially the machine which he has himself designed for use with induction motors. Like Le Blanc's recuperator, the author's vibrator is based on the principle that a leading emf is generated in an alternating-current conductor allowed to swing freely in a continuous-current field. This effect will be seen in Fig. 3, which represents test results obtained with a vibrator. At one-quarter load the power-factor is 0.87 and at half-load it is unity, this value being maintained up to full load and beyond. The diagram gives also the primary and secondary currents and the speed both with and without the vibrator. It will be noticed that the effect of the vibrator is to decrease the

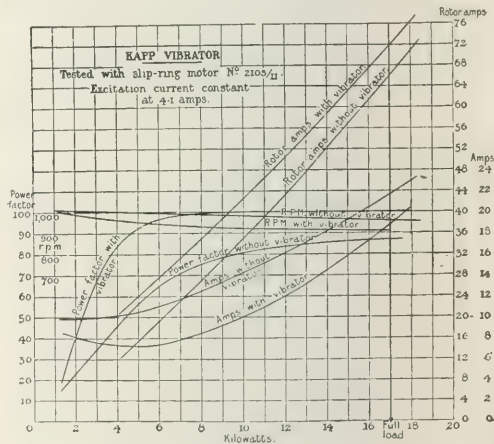


FIG. 3—CURVES SHOWING TEST RESULTS

primary current considerably and to increase the secondary current slightly; this means a smaller copper loss in the motor.—*London Electrician*, April 25, 1913.

### Wires, Wiring and Conduits

**The Temperature Rise and the Deterioration of the Covering Material of Wire by Carrying Current.**—T. HIROBE.—A pamphlet, containing 127 pages of text and a great many diagrams, on an investigation the object of which was to determine the rise of temperature of a wire due to current and the consequent reduction of breakdown strength of different kinds of wire, and also to determine their relations with the nature of insulating material used, the individual thickness as well as the proportion of the thicknesses of successive layers being taken into account. Chapter I gives theoretical formulas for the temperature rise of the wire as a function of the current. Chapter II gives theoretical formulas—general and approximate—for the insulation resistance of wire as a function of the current and the room temperature. Chapter III gives theoretical formulas for the break-down voltage of wire as a function of the current and the room temperature. In Chapter IV

the full experimental investigations of the thermal and the electrical characteristics of different covering materials are recorded. In Chapter V the general formulas for the temperature rise, insulation resistance and breakdown voltage for different kinds of wire, with numerical values of thermal and electrical constants found in Chapter IV, are given with experimental verifications. There are three appendixes in which some examples of applications of the established formulas are given.—Report No. 12 of the Third Section, Electrotechnical Laboratory, Tokyo, Japan, Aug. 24, 1912.

**Single-Phase Conductors in Tubes.**—PAUL H. PERLS.—With reference to the recent article by Bloch on the disadvantages of placing the two conductors of a single-phase system in an iron tube, the present author points out that these disadvantages do not exist when the tube itself is used as a return conductor.—L. Bloch in his reply agrees with Perls.—*Elek. Zeit.*, April 24, 1913.

#### Electrophysics and Magnetism

**Annealing Steel in an Alternating Magnetic Field.**—H. PENDER AND R. L. JONES.—The treatment of steel by a cyclically varying magnetic field during its annealing results in a pronounced alteration of its hysteresis loop. The result is to increase largely the permeability at low and moderate inductions with a corresponding increase of the remanent magnetism. The coercive force and the losses are slightly decreased. The maximum value of the permeability was increased as much as 50 per cent in some cases. The improvement of magnetic quality depends upon the maximum intensity of the force used in the magnetic treatment and shows an approach to a maximum or separation value when the force is large. The best maximum temperature at which to apply the cyclic treatment has been identified with the critical point  $A_{r1}$ , about 690 deg. C., on the iron and steel diagram, and through this fact and the evidence of the micrographic studies it seems very probable that the good results obtained may be ascribed to a preservation of the fineness of the metallographic structure which steel possesses just after it has passed from the non-magnetic to the magnetic condition. The results seem to point the way to a new line of research on the treatment of steels for electrical purposes and possibly of those for other uses as well. None but magnetic qualities have been observed, but doubtless mechanical characteristics were also affected.—*Phys. Review*, April, 1913.

**Origin of the Earth's Magnetic Field.**—L. A. BAUER.—An abstract of an American Physical Society paper. The author confines his attention to the portion of the earth's magnetic field symmetrical about both the axis of rotation and the equator, this portion representing about 90 per cent of the magnetic energy of the earth's total magnetic field, and reaches a number of general conclusions as to the origin of the magnetic field. He assumes that the earth contains two opposite and practically equal charges distributed throughout its interior in such a manner that if the one body is contained within a sphere (or spheroid) bounded by the earth's surface, the opposite body charge is contained within a sphere of slightly smaller radius; in brief, he assumes that if owing to some cause the volume density of the one charge is slightly different from that of the opposite charge, then the rotation with the earth of the opposite charges produces a magnetic field. Applying this hypothesis, it is found that to harmonize with the most obvious fact of the earth's magnetism—that the north-seeking end of a magnetic needle points below the horizon in the Northern Hemisphere—the volume density of the negative charge must be smaller than that of the positive, or, in other words, the earth's total negative charge must be distributed through the larger sphere. In short, to account for the earth's magnetic field as observed on the surface, it is necessary to assume that the positive and negative electrons in the earth and in the atmosphere are distributed in

such a way that, on the average, the negative ones (the more mobile ones) are farther away from the earth's center than are the positive ones.—*Phys. Review*, March, 1913.

**The Field of Two Metal Spherical Electrodes.**—G. R. DEAN.—The third paper of his highly mathematical serial on the potential and electrostatic force in the field of two metal spherical electrodes. This instalment deals with charge and capacity.—*Phys. Review*, April, 1913.

#### Units, Measurements and Instruments

**Wattmeter for Measuring the Power in a High-Tension Circuit While the Load Is an Iron Lossing Circuit.**—CARLOS CAMPOS.—If a wattmeter is inserted in the low-tension circuit in order to measure the power  $W_1$  in the high-tension circuit, it must be taken into consideration that  $W_1$  is not equal to the power  $W_2$  in the low-tension circuit but is equal to  $W_2$  + the transformer losses. These losses consist of iron losses and of copper losses and the former are approximately proportional to the square of the voltage  $V$  and the latter proportional to the square of the current  $I$  so that  $W_1 = W_2 + k_1 V^2 + k_2 I^2$ . If the wattmeter for the low-tension three-phase circuit consists of a double instrument of the electrodynamic type with four ordinary windings (two fixed current coils and two movable voltage coils) the author adds two more supplementary coils, namely, on one side a fixed voltage coil and on the other side a movable current coil (either in shunt or connected by means of a small transformer). The double instrument then gives directly  $W_1 + k_1 V^2 + k_2 I^2$ .—*Atti dell' Assoc. Elettrici. Italiana*, Jan. 31, 1913, abstracted in *La Lumiere Elec.*, April 12, 1913.

**Measurement of Reactance.**—A. F. BURNES.—An illustrated description of the "maximum-power method" for measuring reactance. It is based upon the fact that in an

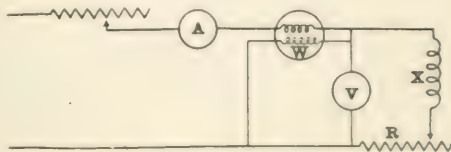


FIG. 4—CIRCUIT DIAGRAM

alternating-current circuit containing a constant reactance the maximum power is obtained by making the total non-inductive resistance equal to the reactance, the effective voltage on the circuit being maintained constant. The method cannot obviously be employed if the reactance of the circuit to be tested is less than its resistance. In other cases, however, all that it is necessary to do is to insert a variable non-inductive resistance (not necessarily of known value) in series with the reactance and the current coil of a wattmeter of suitable range, join the volt coil and also a voltmeter across the circuit as shown in Fig. 4, and vary the resistance until the maximum reading is obtained on the wattmeter, the voltmeter reading being kept constant. The reactance  $X$  is then the square root of the ratio of the square of the resistance  $R$  to the ratio of  $W$  to  $V^2$  and  $W$  and  $V$  are the readings of the voltmeter and wattmeter shown in the illustration. Currents are given showing the procedure in which this method was employed. The diagram for this circuit is also given.—*Technical Review*, April 1, 1913.

**A New Process of Measuring Viscosities.**—WILSON LANGMUIR.—An abstract of an American Physical Society paper. At very low pressures the viscosity of gases is one of their most marked characteristics. This property is made use of in the new apparatus. The apparatus consists of a rotating disk above which is suspended by a quartz fiber another disk carrying a mirror. The viscosity of the gas causes it to be set in motion by the lower disk and this motion produces a torque on the upper disk which can be



measured in the usual beam of light reflected from the mirror. The rotating disk is made of thin aluminum and is attached to a steel or tungsten shaft mounted on jewel bearings and carrying a magnetic needle. The suspended disk is of very thin mica. The lower disk can be rotated easily at a speed of 10,000 r.p.m. by means of a rotating magnetic field produced outside of the bulb containing the two disks. This field is most conveniently obtained by a Gramme ring supplied with current at six points from a commutating device run by a motor. In this way the speed of the motor determines absolutely the speed of the disk, since the two revolve in synchronism. The speed of the disk may thus be varied at will from a few revolutions per minute up to 10,000 or more. The sensitiveness of the gage is extremely great. At 1000 r.p.m. with a scale at about 60 cm distance, 400 mm deflection is obtained for 0.001 mm of air. The deflection is exactly proportional to the pressure, below about 0.01 mm, proportional to the speed of the revolving disk, and practically independent of the distance between the two disks. For different gases at the same pressure the deflections are proportional to the square root of the molecular weight. All these facts are in accord with the kinetic theory of gases. At 10,000 r.p.m. 1 mm deflection corresponds to 0.0000025 mm. There should, therefore, be no difficulty in detecting pressures as low as  $10^{-7}$  mm.—*Phys. Review*, April, 1913.

**Errors in Magnetic Testing Due to Electric Strain.**—A. CAMPBELL AND H. C. BOOTH.—An abstract of a (British) Physical Society paper. In magnetic tests on sheet material considerable errors may occur if the sheets or strips are tested while in bent form. These errors, which are in general agreement with the known effects of compression and tension, were investigated experimentally with one or two forms of magnetic circuit similar to those sometimes occurring in practice. In one method a single length of the strip was bent into ring form with ends clamped together. This was wound with flexible primary and secondary coils and tested for permeability and hysteresis while in the condition of temporary strain. The temporary strain was then annulled by changing the circular form into a square by sharp bends at four places. The magnetic tests were repeated, and usually a considerable alteration was observed. For example, a silicon-iron ring 0.3 mm thick and 50 cm in diameter (the size used in Richter's method of testing hysteresis and eddy-current losses) showed a decrease of 40 per cent in the permeability for  $H=1$  due to the bending. The hysteresis loss was increased by 19 per cent. In another method the ends of two strips were clamped in yokes, and tests were made with different amounts of bending. It was found that temporary strain has considerably greater effect on the permeability than equal permanent strain has.—*London Electrician*, April 25, 1913.

**Vacuum Meter.**—BRUNO THIEME.—An illustrated description of a more robust construction of the MacLeod vacuum meter which permits its use in incandescent lamp factories.—*Elec. Zeit.*, April 24, 1913.

**Electric Instruments in Europe.**—H. B. BROOKS.—A pamphlet of eighty-eight pages giving information on electrical instruments and meters made by thirty-one leading firms in England, France, Germany and Italy.—*Department of Commerce and Labor, Special Agents' Series*, No. 66, 1913.

#### Telegraphy, Telephony and Signals

**Vibration Galvanometer with Unifilar Torsional Control.**—A. CAMPBELL.—An abstract of a (British) Physical Society paper. The author exhibited a moving-coil vibration galvanometer in which a novel principle is used to obtain the fine adjustment of the control torque requisite for accurate tuning. He has found that in a phosphor bronze strip under tension the torsional rigidity is considerably increased as the tension is raised. This anomalous behavior of such

strips has also been noticed by other observers. If unifilar (strip) suspensions are used in a vibration galvanometer (whether of moving-coil or moving-iron type) the tuning can be done in the same way as with bifilar suspension. In the moving-coil instrument minute hooks on the ends of the strips engage in contact hooks at the top and bottom of the coil, which is easily detachable. With a mirror of 15 sq. mm area at 100 cycles per second, a sensitivity of 50 mm at a meter per micro-ampere can be obtained, the effective resistance being about 700 ohms.—*London Electrician*, April 25, 1913.

**Wireless Telegraphy.**—A. H. TAYLOR.—A paper on the most suitable choice of wave-length. Given a definite maximum of available power and a fixed aerial system, the author's experiments seem to show that the shortest wave-length consistent with good coupling gives the best results under all conditions, unless the absorption is very much greater than the value assumed in the paper, in which case a somewhat longer wave will be better.—*Phys. Review*, April, 1913.

**Great Britain.**—W. H. GUNSTON.—A statistical article on the telephonic development of the British Isles in relation to the population.—From the (British) *Post Office Elec. Eng. Journal*; reprinted in *London Electrician*, April 25, 1913.

#### Miscellaneous

**Sterilization of Water by Ultra-Violet Rays.**—A. W. KIPLING.—A general review of the principle of sterilizing water by ultra-violet rays. As it is a sterilization process and not a clarification process, a preliminary filtration of the water is generally necessary. The sterilization is simply obtained by exposing the water to the ultra-violet rays. But it is impracticable to suspend the quartz lamp within the water to be sterilized because if the water contains lime a deposit is formed which reduces the action of the rays. For apparatus of medium size for use in hotels, hospitals, etc., the simplicity and efficiency of the method are particularly advantageous.—*La Lumière Elec.*, April 12, 1913.

**Slaby.**—A photographic sketch, by Wedding, of the life and work of the late Adolf Slaby with his portrait.—*Elek. Zeit.*, April 17, 1913.

## Book Review

**ELECTRICITY FOR EVERYBODY.** By R. Borlase Matthews. London: The Electrical Press, Ltd. Second edition. 312 pages, illus.

As indicated in the title, this little handbook is written for the layman rather than the electrical engineer and as such it is an admirable compilation of useful data on the subjects of domestic and industrial electric lighting, heating and motor service. One section is devoted to each of these subjects. In each instance the author has stated the advantages of electricity above other sources of energy, the cost of service, cost of wiring and in many cases cost of the apparatus required, and there is also given much good advice as to economical operation. This information will be found very useful by the central-station salesmen, and particularly by those who have not had the advantage of a thorough technical education. The author has evidently endeavored to explain all technical matters in a simple way so as to make them easily understood even by the layman. As is often the case, this has brought certain statements very near the danger point where they are either non-understandable or liable to be misunderstood. The greatest merit of the book lies in the large number of cost and operating data, and although these refer mostly to English conditions they will, nevertheless, be found of much interest and usefulness to both the salesman and the consumer in this country.



# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Anchor for Inconvenient Guying Sites

The accompanying illustrations show the method recently used in Decatur, Ill., for overcoming difficulties which presented themselves when the line gang were guying poles in the city streets. The anchor shown in Fig. 1 gives a typical illustration of the manner in which a twist anchor can be installed without the expense of tearing up and relaying a section of cement sidewalk. In this instance an 8-in. hole was chiseled out of the concrete and the anchor twisted into place. A small amount of granitoid quickly repaired the hole and added an effective bit of construction to the plant at an inconsiderable expense compared with that of tearing up the sidewalk.

Fig. 2 shows a scheme used to hold a heavy double buck-arm corner pole in place. The proximity of the sidewalk and the lighting pole would have made it a difficult task to dig a slug hole at this point for burying a large "dead-man," but with two twist anchors driven so that their eyes



FIGS. 1 AND 2—ANCHORS INSTALLED IN RESTRICTED SPACE

stood beside each other the guying problem was made comparatively simple.

The anchors for these installations were furnished by W. H. Matthews & Brother, 3722 Forest Park Boulevard, St. Louis, Mo.

### Motor-Driven Hopper for Boiler Room

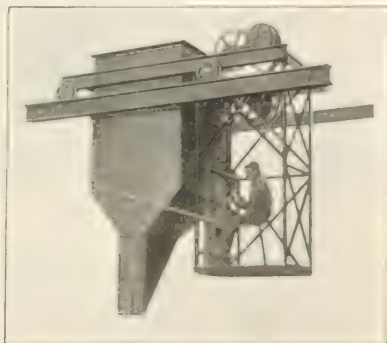
Motor-driven coal hoppers, which can take coal from bunkers located anywhere and deliver it to any boiler in a battery, are coming more and more into vogue. Their use does away with the system of overhead bunkers and individual chutes for each boiler and permits all the coal to be concentrated in one bunker instead of in a series of pockets.

The bunkers can be placed at one end of the boiler room, or outside if necessary, so that the boiler room can be designed with greater freedom and plenty of space can be left above the boilers for light and air.

The hopper runs on a trackway parallel to the front of the boilers and is controlled by an operator in the same manner as an overhead crane. Accurate scales on the hopper make it possible to keep a precise record of the fuel burned by any boiler. If desired, a recording device can

be installed so that a printed record of the weight of every discharge can be made by the operator. The hopper runs under the battery and is filled by the operator, the scales indicating when the hopper is full. It is then run into the boiler room and delivers coal where wanted.

The hopper illustrated herewith is manufactured by the

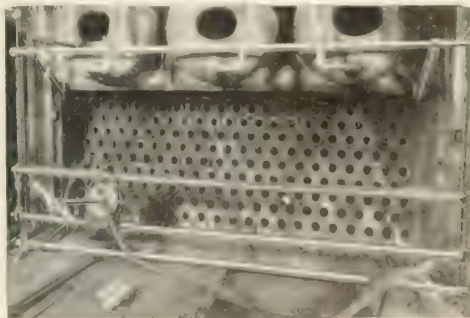


MOTOR-DRIVEN COAL HOPPER

Bergen Point Iron Works, Bayonne, N. J., and is equipped with motors made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh.

### Boiler-Cleaning Arrangement

The Colorado Springs & Interurban Railway Company, Colorado Springs, Col., has recently installed in its boiler



NEW TYPE OF APPARATUS FOR REMOVAL OF SLAG FROM BOILER

rooms a new type of apparatus for removal of slag from the fuel water in the boiler. The fuel water is rapidly removed from the boiler, and a new batch of water is rapidly introduced into the boiler. If this operation is removed this could be done with the use of a vacuum or self-acting air-driven cleaner. Therefore, in order to expedite boiler cleaning operations and to decrease the

time that a given boiler is kept out of commission for cleaning purposes, this company found it advisable to provide a special boiler-cleaning attachment. For this purpose use is made of a cutter head which is driven by a steam motor.

The motor is so designed that the square shaft carrying the cutter head passes directly through it and while revolving at high speed can be worked back and forth in the boiler tubes, the motor remaining stationary upon a supporting frame. The motor is supported between rollers at top and bottom and has a horizontal motion on two supporting bars.

To shift the motor vertically, the two horizontal bars are elevated on vertical racks by means of pinions operated by a crank handle. Both the horizontal and vertical pinions are held in place by pawls, so that after the motor has been adjusted in front of a tube, it remains stationary until the pawls are released.

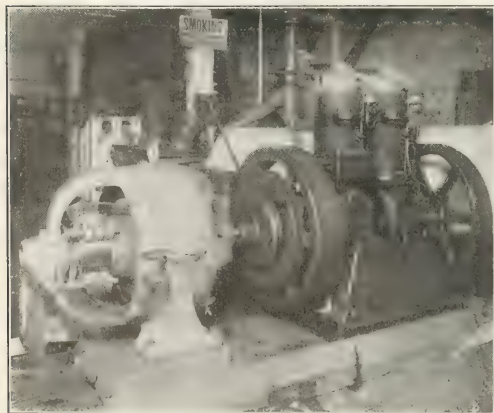
The motor can be driven by either air, steam or water, and with steam at 100 lb. pressure, it will develop 7 hp, which is said to be enough to remove the hardest scale.

The entire equipment was designed and installed by the Laconda Manufacturing Company, Springfield, Ohio.

### Oil-Engine Generator Train-Lighting Set

Mention was made in the issue of May 3 of a new train-lighting set which has been supplied to the Great Northern Railway by the Remington Oil Engine Company, of 120 Broad Street, New York City, and in the accompanying cut the assembly of the outfit is shown. A 20-hp Remington kerosene oil engine appears, directly connected to a Chandeysson direct-current generator of 15-kw rating. The total weight of the set is 6930 lb. It occupies a floor area of 3 ft. by 8 ft. and stands 5 ft. 4 in. above the floor.

A voltage range of between 60 and 80 is obtained from the generator at the usual operating speeds. At the test in St. Louis, where the set was assembled, a delivery of 200 amp at 85 volts was obtained, the speed being 400 r.p.m. After this point was reached the speed of the engine fell off. The engine will develop 20 hp on a fuel consumption



TRAIN-LIGHTING UNIT

of 2 gal. and 2 pints of kerosene oil per hour. Estimating an average continuous load of 12 kw on the generator and 8 cents per gal. for kerosene, the fuel cost will be 1.5 cents per kw-hr. The total operating cost, including repairs, interest and attendance, is estimated to be a little over 2 cents per kw-hr.

It is planned to install this equipment in one end of a

baggage car, so that the apparatus and lighting circuits will be entirely separate from the locomotive. A trial installation has been made at the yards in St. Paul. If it proves satisfactory, it is to be used on express train service between St. Paul and Seattle, Wash.

### Electric Winding at the West Rand Mines, South Africa

The West Rand Consolidated Gold Mines, Ltd., are at present working one shaft, the east shaft, and sinking a



FIG. 1.—ENGINE-ROOM INTERIOR

second on an estate situated around Krugersdorp, about 20 miles from Johannesburg, South Africa. The crushing at the end of 1909 was about 30,000 tons per month, in 1910 about 70,000 tons per month, and with the completion of the new shaft it is expected that this figure will be greatly augmented.

The west shaft of this mine, which is at present in course of sinking, is a seven-compartment shaft and is being driven at an angle of 50 deg. to the horizontal for an estimated distance of 3000 ft. Sinking was commenced by means of a temporary headgear and two small steam sinking engines, and at the same time an order was placed for two double-drum electric winding engines, one suitable for a 6-ton useful load and the other designed for a 3-ton useful load.

By the time the electric winding engines were installed the permanent headgear was completed and the shaft sunk to a sufficient depth to permit of economical hoisting with the electric hoist. The engine room is unusual, being built of brick, and very commodious, whereas the usual engine room on the Rand is of corrugated-iron construction. The interior of the engine room is shown in Fig. 1, indicating the positions of the two hoists and the small compressor for the brakes. The large space in the foreground is reserved for a third electric winder to be installed when the shaft is finished and the mine partly developed.

The two hoists were supplied complete and their erection supervised by the British Westinghouse Electric & Manufacturing Company, Limited. The mechanical equipment of the two hoists is almost identical in spite of the difference in the loads. The services for which these hoists are designed are shown in the accompanying table.

Each hoist is equipped with two drums, 10 ft. in diameter by 3 ft. 9 in. wide between flanges, running loose on the drum shaft and driven by multi-tooth clutches sliding in hexagonal sections of the shaft. The clutches are operated by handwheels on the driver's platform.

Brakes of the segmental type supported in the center and applied by weights are provided on each drum. Compressed-



air engines with "Iversen" valve gear are used for releasing the brakes. Interlocks are provided so that the brakes cannot be released on a drum that is not clutched to the main shaft. Compressed air for operating the brakes is obtained from a small compressor gear-driven by a 10-hp. three-phase, 50-cycle, 450-volt squirrel-cage induction motor, fitted with automatic starting and stopping gear controlled by the air pressure.

The position of either cage in the shaft is indicated by two dial depth indicators, driven one from each drum through gearing. Each indicator has two points, one moving slowly during the entire travel of the skip and the other moving very rapidly during the final part of the wind so as to increase the accuracy of stopping. Automatic devices are provided to bring the skips to a low speed at the tips and stop the hoist dead should the skips pass that level, irrespective of any action on the part of the operator.

The electrical equipment is designed for operation on the Ward-Leonard system. The winding motors are directly coupled to the drum shaft and in each case operate at 60 r.p.m. Hoist No. 1 is provided with a 750-hp, 600-volt direct-current motor with commutating poles, as shown in Fig. 2. Hoist No. 2 is driven by a 450-hp direct-current motor.

Energy for the winding motors is obtained from two



FIG. 2—750-HP, 600-VOLT, DIRECT-CURRENT MOTOR

motor-generator sets arranged so that either hoist may be driven by either motor-generator set, provision also being made for the third equipment in contemplation.

#### DATA ON HOISTS, WEST RAMP MINES

	Hoist No. 1	Hoist No. 2
Incline of shaft to horizontal, deg.	40	40
Length of shaft, ft.	1,400	1,400
Hoisting speed, ft. per minute	1,400	1,400
Weight of rock per wind, lb.	1,400	1,400
Weight of skip, lb.	1,400	1,400
Weight of rope, lb.	1,400	1,400

Each motor-generator set comprises a 200-volt, three-phase, 50-cycle, slip-ring induction motor, directly coupled to a direct-current generator and an exciter. The arrangement of the set for hoist No. 1 may be seen in Fig. 3. The alternating-current energy for driving the motor-generator sets is purchased from the Victoria Falls and Transvaal Power Company, Ltd.

In the Ward-Leonard system the speed and direction of rotation of the winding engines are controlled entirely by altering the strength and direction of the direct-current

voltage of the generator in the motor-generator set. This is carried out by means of a special face-plate controller. By means of this controller any desired speed may be obtained up to the full speed in either direction, the speed corresponding closely to the position of the driver's lever irrespective of the load. These controllers are fitted with stops controlled electrically from the bank so that a safe



FIG. 3—MOTOR-GENERATOR SET AND CONTROLLER

speed cannot be exceeded when men are being hoisted by the hoist.

Each hoist is equipped with an emergency lever, arranged and connected so that the hoist is quickly stopped in case of overwinding, failure of energy supply, failure of exciting current, overloads, failure of air supply or operation of driver's emergency lever. There is thus a safeguard against practically any danger that might arise.

A four-panel switchboard illustrated in Fig. 4 is used for controlling the supply of energy to the two winding motors and is arranged to permit the extension when required. The switchboard is equipped with one alternating-current and one direct-current panel for each hoist; the former for the motor and the latter for the field circuit of the motor direct-current machine.

Although the Ward-Leonard system gives the hoist



FIG. 4—FOUR-PANEL SWITCHBOARD FOR WINDING MOTORS

adapted for use with a dynamo, so that its power can be derived from the mains, no attempt has been made to reproduce the load of the winding engines used for the raising of the Victoria Falls and the Transvaal Power Company, Ltd., are large enough not to be affected even by the heavy loads of the large winding engines which are used in the raising of the Ramp.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Holophane Equipment in Buenos Aires.**—Agar, Cross & Company, exporters, 11 Broadway, New York, have recently equipped their new building in Buenos Aires with Holophane lighting equipment and reflectors. The building is one of the largest in Buenos Aires.

**Trade in Insulating Tapes Good.**—The Hope Webbing Company, of 396 Broadway, New York, stated this week that while exact figures are not available at present, its business in tapes and webbing for electrical work has been good and its looms devoted to that product are busy.

**Kellogg Switchboard & Supply Increases Sales.**—During the first four months of 1913 the Kellogg Switchboard & Supply Company, Chicago, billed \$1,075,000 of merchandise, as compared with \$752,000 in the first quarter of 1912. This is the largest amount invoiced in a like period in the history of the company.

**Record Output of Electric Railway Equipment.**—Ever since last fall the output of The J. G. Brill Company, Philadelphia, has been the largest in the history of the company. As is generally known, the latter is one of the largest builders of electric street-railway cars and trucks in the world. It now has some \$4,000,000 of new orders on hand.

**Three Shifts of Men Employed by General Electric Company.**—So crowded is the General Electric Company with orders that several of its departments are running continuously throughout the twenty-four hours, three shifts of men being employed. This is the first period since 1906 that anything like the present number of men have been working on the day and night shifts.

**Electric Pleasure Vehicles Take in Hilly Country.**—To those who have the impression that the electric vehicle is adapted for use only in level cities, a recent report from Kansas City, Mo., regarding the use of electric vehicles in that city will be enlightening. This report shows that there are 680 electric vehicles in use in that hilly city and that 650 of these are pleasure cars.

**Ceiling Fans in Demand.**—The Hunter Fan & Motor Company, of 114 Liberty Street, New York, issues a statement to the effect that its sales have been exceptionally large. Its type C ceiling fan, it is claimed, has run several thousand ahead of the sales up to this time last year. Some of the larger orders so far have been from electric-light companies throughout the country.

**Receives Large Contract for Automobile Accessories.**—The Heinze Electric Company, Lowell, Mass., which makes automobile accessories, has received a million-dollar contract for coils, magnetos and other accessories from the Ford Automobile Company. In consequence of this the plant of the Heinze company is working day and night and construction of the company's new plant at Walkerville, Ont., is being rushed.

**Lighting Fixture Sales Active.**—One of the companies manufacturing lighting fixtures and various classes of combination sockets says that, in spite of the fact that ordinarily this is a dull season in that line, the recent sales have been more than average. A good deal of this class of material in the local territory—that is, in and about New York—has gone to the railroads for track, yard and train-shed equipment.

**Domestic Machine-Tool Business Brisk.**—When asked concerning the company's export business a representative of Manning, Maxwell & Moore, 35 Liberty Street, New York City, manufacturers of machine tools, said: "I would rather have the State of Pennsylvania as a territory for selling machine tools than the whole continents of Africa and South America." This firm reports that during the last year its domestic business has more than doubled but that

the export trade is so small that little attention can be given to it.

**Japanese Money Stringency and the Export Trade.**—The firm of Mitsui & Company, 25 Madison Avenue, New York City, reports that the recent scarcity of money which has been felt in Japan has left its impress on the electrical export trade. Although business has been fair, the policy of the Japanese government in withholding from purchasing while the money market is high has been reflected by private concerns, with the result that orders have not been coming in with the same regularity as in the past. Recent agitation over the California land bill is not thought to have had any influence upon the business relations of the United States and Japan as far as the electrical industry is concerned.

**Optimistic on Copper Trade Outlook.**—John D. Ryan, president of the Amalgamated Copper Company, spoke optimistically of the outlook for the copper trade in a pamphlet report of that company's operations issued May 14. He said, in part, in his report to the stockholders: "From Jan. 1 to the date of this report your selling agency has sold over six months' production of the mines. We believe the world's consumption of the metal to be fully equal to the present production, and as there is no large new production in sight that can come on the market for several years at least, we feel that the metal market is in a sound and healthy condition and look for satisfactory earnings for some time to come."

**Canadian Lamp Company Receiving Large Orders.**—On account of the large extent to which orders are being placed with the Canadian Tungsten Lamp Company, Ltd., Hamilton, Ont., the latter has found it necessary to double its manufacturing facilities. The product of this company, the Nulite tungsten lamp, was chosen by the Canadian Pacific Railway Company to light its "Made in Canada" train, which recently made a transcontinental trip. The lamps supplied were the regular 60-watt, 115-volt size. A line of 11-volt and 12-volt, 5-watt and 2½-watt sign lamps, placed on the market some time ago by this company, has gained favor and the orders on hand for this type of lamp alone are sufficient, the company says, to keep the sign-lamp department going for fully one month before gaining any headway.

**Jobbing Trade Optimistic.**—According to remarks made this week by the manager of an electrical supply jobbing house in the upper part of New York State, conditions in the electrical manufacturing and supply fields have been much better during the early part of 1913 than it was expected they would be. "Shortly after the first of the year," he said, "electrical manufacturers, jobbers, etc., expressed the opinion quite freely that they might feel very fortunate if results in 1913 equaled those in 1912. So far as Eastern jobbers are concerned, I believe that this opinion has been shown to be unfounded, because, judging from the experience of our company and that of other companies with which we are familiar, conditions for the first four months have been very much better than those in the corresponding period of last year, with the exception of collections. Furthermore, all indications point to the continuance of business upon substantial lines, a condition which should lead all of us to feel optimistic."

**New Jobbing Company in Evansville.**—The Service Electric Company, of 204 Upper First Street, Evansville, Ind., has been incorporated for the purpose of doing a general jobbing business in electrical supplies and construction material. H. A. Robertson, the president and manager, was formerly connected with the Illinois Electric Company of Chicago. R. C. Straight, the vice-president of the new

company, is a former central-station man. B. H. Wood, the secretary, was formerly an electrical contractor in Charlevoix, Mich. The treasurer is M. W. Swift.

**Electrical Equipment for Kansas City Theater.**—The R. W. Hodge Electric Company, Kansas City, Mo., is to furnish all of the electrical equipment for the new Globe Theater to be erected in that city.

**Spring Manufacturer Busy.**—The Dunbar Brothers Company, Bristol, Conn., maker of springs, states that business is very active at present in consequence of which some of its manufacturing departments are being operated twenty-four hours per day.

**More Erecting Space for Automatic Stoker Company.**—The American Engineering Company, Philadelphia machinist and founder and maker of the Taylor stoker, has just completed an additional erecting shop, 150 ft. by 80 ft., to care for the increasing sales of its various lines.

**Automatic Stoker Sales.**—The Sanford-Riley Stoker Company, Ltd., Worcester, Mass., reports the following sales: City of Regina, Sask., 3000 hp; Worcester (Mass.) Electric Light Company, 1538 hp; Glenlyon Dye Works, Phillipsdale, R. I., 500 hp, and B. F. Sturtevant Company, Hyde Park, Mass., 350 hp.

**British Westinghouse Made Decided Improvement in 1912.**—Although the coal strike in England during 1912 greatly retarded general trade in that country last year, the British Westinghouse company's net profits were nearly twice those in 1911, the totals being about \$205,000 and \$103,000 respectively. No dividends were paid upon the preferred stock.

**Wire Manufacturers Find Slim Market in Japan.**—The active manufacture of insulated wire and wiring accessories in Japan has made great inroads in the export trade in those products from this country. A firm which was formerly a large exporter of insulated wires and cables reports that its Japanese export trade in these goods has dwindled to almost nothing.

**Catalogs Requested.**—Henry A. Goode, of the firm of Wonham, Sanger & Bates, 30 Church Street, New York, informs us that he would be pleased to receive catalogs and supplementary information from the manufacturers of electric vacuum-cleaning equipment and of steam-engine-generator sets adaptable for supplying current to fans for railway coach ventilation.

**Exploiting Electrical Devices in Buenos Aires.**—An active advertising campaign is being carried on at the present time in Buenos Aires by the Compañia Anonima Tasatutrica de Electricidad. Household devices, such as irons, toasters, heaters, cookers and the like, which are in daily use in this country, are being exploited with considerable success, although as yet no exhibition room has been opened.

**To Electrify Bombay Textile and Flour Mills.**—Twenty-seven textile and two flour mills in Bombay, India are to be equipped for electrical operation upon central-station service. The connected load in motors will aggregate 36,000 hp. The motors, transformers aggregating 40,000 kva in rating and complete switch gear for each mill will be furnished by the British Westinghouse Company, Ltd. The electrical energy will be supplied by the Tata Hydroelectric Supply Company, of Bombay.

**Eck Dynamo & Motor Company's 1913 Fans.**—No changes have been made by the Eck Dynamo & Motor Company, Belleville, N. J., in the style of its oscillating or universal fan motors for direct current for the 1913 season. An alternating-current, oscillating-type fan, however, in which the oscillating mechanism is similar to that used in the direct-current line, has been placed on the market by the company. In addition to the foregoing lines, the company will manufacture alternating current, universal type desk fans.

**Chicago Jobbers Optimistic on Trade Outlook.** In response to our request for an opinion upon present conditions in its line, the American Electrical Supply Company, Chicago, says: "We are finding business conditions very satisfactory with reference to the demand for electrical goods. Extensions made in our selling organization have produced extremely satisfactory results and the outlook at the present time is causing us to consider still further additions to our sales force and in the territory covered by our representatives."

**E. W. Clark Management & Engineering Company Formed.**—The E. W. Clark Management & Engineering Company has been organized under the laws of Delaware to take over the engineering and management departments of E. W. Clark & Company, Philadelphia. In the past this company, which is one of the oldest in the public-utility field, has maintained operating and engineering departments for managing and making reports of public-utility properties. These departments will now be conducted as a separate corporation.

**Good Business in Lighting Fixtures.**—A representative of the Dale Company, 100 W. West Third Street, New York, manufacturing lighting fixtures, reports that business there for 1912 was very good and fully equal in volume to that of the corresponding period last year. Since moving into its new show room, office building and showroom at the same address, as was noted April 12, the company has broadened its selling plan by entering to the semi-retail as well as to the wholesale trade. A South American office is maintained in Buenos Aires by the company, and the amount of business done is not very large owing to the existence of strong American competition.

**New Electric-Service System Planned for Southeastern Kansas.**—A project is under consideration for the erection of a steam-turbine-driven generating station to be used at about 30,000 kw to supply electrical energy at wholesale to cement mills, public utilities and other users of electricity in the cement-mill district of southeastern Kansas. The cities of Topeka, Independence, Conway and others are in this region. Preliminary plans for the engineering features of the proposed installation have been prepared by The Arnold Company of Chicago. About 40 miles of transmission lines will be required. James H. Grayson, of Chicago, is acting as engineering adviser to the project, which now has the project under consideration.

**Open Engineering Offices in Brooklyn.**—James N. Walton and Frederick M. Beer, formerly chief and assistant electrical engineer respectively of the Bradley Contracting Company, which is doing a great deal of the work on the New York subway system, have opened engineering offices at 1166 Bedford Avenue, Brooklyn, N. Y., under the name of Walton & Beer. They will do a general consulting business, with particular reference to the requirements of large industrial plants. Prior to his connection with the Bradley company, Mr. Walton was associated with the Edison Electric Illuminating Company of Brooklyn as assistant motor service engineer and also with the Industrial Storage Battery Company, Ltd., of London. Mr. Beer has been affiliated with the engineering staffs of the New York Board of Water Supply and the Public Service Commission for the First District.

**Second-Hand Motors in Demand.**—The demand for second-hand motors is increasing rapidly at present, a condition which, he said, indicates great activity among general industrial users. The businesses in the motor line are in order and "companies" he mentioned, are very good clients of the way things are going in the motor industrial field but now we are receiving a very large amount of business consisting of motor or equipment in that generally placed with us at this time of the year. During the past three months our orders and inquiries for electric motors for use in industrial plants have been more than in any other time since the present year. This is due to the fact that manufacturers of all sorts are so busy that they are finding it impossible to supply the large quantities required by us to put on their orders, but that the new equipment or property is becoming in demand with them and they are not able to deliver it until they have been able to get it.

**Increase in Sales of American Machinery Abroad.**—The American Machinery Company, 100 W. West Third Street, New York, reports that business in its line is very good and fully equal in volume to that of the corresponding period last year. Since moving into its new show room, office building and showroom at the same address, as was noted April 12, the company has broadened its selling plan by entering to the semi-retail as well as to the wholesale trade. A South American office is maintained in Buenos Aires by the company, and the amount of business done is not very large owing to the existence of strong American competition.



turers of machine tools, contractors' supplies, agricultural implements, etc. In addition to representing a large number of such manufacturers, it is also selling in Europe the products of the Standard Electric Tool Company, of Cincinnati, and those of an American electric motor manufacturer. A representative of the Allied Machinery company said this week that these electric tools have met with considerable favor and that a number of French railway and industrial companies have placed orders for them. The motors, he added, are not doing as well, on account of the high duty upon them and the strong competition from foreign manufacturers. Captain Godfrey L. Carden, United States Revenue Cutter Service, who is general manager of the Allied Machinery company, and is now on leave, is making a tour of the manufacturing plants of the various American concerns which his company represents abroad. C. N. Thorn, assistant general manager, in charge of the New York office, is in Europe at present visiting the branch offices. The company's business is growing steadily, and in view of the short time that the enterprise has been under way, the extent to which orders are being received abroad is felt to be decidedly encouraging to those associated with it.

**Combination Railway and Lighting Poles Extensively Used.**—"Business has been extremely good in the ornamental lighting pole line and has also been particularly gratifying in the combination railway and lighting pole business." This statement is issued by the Electric Railway Equipment Company, of Cincinnati, Ohio. The company adds that the combination poles are in demand from a number of cities where the expense of installing separate lighting standards would be prohibitive. The Canadian business in this line has been very good during the past year, it says, lighting poles having been supplied in the cities of Moose Jaw and Regina, Sask.; Brandon, Man.; Fort William, Ont.; Nelson, B. C., and Edmonton, Alta.

**Good Call for Electrical Supplies.**—Replying to an inquiry as to present conditions in their line, Hickey & Schneider, 227 Fulton Street, New York, made the following statement: "We are very greatly pleased with present conditions in our business. There are enough orders on hand to keep one factory working overtime for several months. Seamless copper splicing sleeves for transmission-line conductors are in particular demand. Large quantities of them have been shipped to Peru, Brazil, India and Japan, and since the first of the year more than 15,000 have gone to the State of California alone. Large orders for line disconnecting switches, choke coils and horn-gap fuse sets have been received, the heaviest consumers being the J. G. White Engineering Corporation and the Electric Bond & Share Company."

**Automatic Electric Company's New Service Department.**—For some time past the Automatic Electric Company, Chicago, manufacturer of automatic telephone equipment, has detailed members of its engineering staff to act in an advisory capacity to telephone companies installing its apparatus. The object of this practice was to secure the best results from the automatic equipment by helping the telephone companies to arrange their entire plants along the most efficient lines. So valuable has this practice been found to be to both the manufacturer and the purchaser that the Automatic company has now established a special service department to carry on the work. B. C. Groh, formerly chief engineer of the Illinois Telephone & Telegraph Company, has been placed at the head of this department, and his duties, besides embracing those of a plant construction engineer, will include the making of development studies for existing and projected plants and the drawing up of plans and specifications for telephone companies contemplating the enlargement of their present plants or a change from manual to automatic equipment.

**Car-Starting and Lighting Business Good.**—The Willard Storage Battery Company, 136 West Fifty-second Street, New York, reports that during the past year the sales of starting and lighting equipment for gasoline cars have doubled. A number of car manufacturers now put in this equipment as standard, and several of the leading ones have recently taken this step. A large business is also being done in supplying storage batteries for baggage-truck service at large railroad terminals. The Erie, Jersey

Central, Lehigh Valley, New York Central and Pennsylvania lines are among the largest customers. As a culmination of research work here and abroad there is being put out a much improved type of battery for vehicle service, designed to add materially to the ease and efficiency of operation and to the reliability of the service. A local installation of this LBA type of battery which has given particular satisfaction under poor working conditions is that in use by Grant Smith & Company & Locker in electric locomotive haulage service on their section of the Catskill Aqueduct, New York.

**Twenty-five-Carload Shipment of American Electrical Goods for Japan.**—A twenty-five-car train loaded with transformers, switchboards, switchboard appliances and devices has just been shipped from the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company and consigned to the Inawashiro Hydroelectric Power Company of Japan. This shipment of electrical equipment is being exported by Takata & Company, of 50 Church Street, New York City, and Mr. G. A. Harris, chief engineer for Takata & Company, states that the buildings for station No. 1 are to be ready to receive the apparatus in August and that, barring unavoidable delays, the shipment will arrive at the site some time in July. The high-tension apparatus for 50,000 hp of the project is now on order at the Westinghouse plant and will be sent out in three consignments. All low-tension equipment and waterwheels were purchased in Europe. The ultimate development being made by the Inawashiro company will comprise approximately 73,000 hp, and most of the energy will be transmitted over a 145-mile transmission line to the city of Tokyo. The water for the project will be furnished by the Nippashi River, from which a constant flow of 840 cu. ft. is available. However, by regulating the flow of the waters of Lake Inawashiro it will be possible to store the water to meet peak load conditions. The lake itself has an area of 44 sq. miles. For further particulars see the *Electrical World* of March 9, 1912.

**Plan Increase in Capital Stock of Montreal Company.**—Stockholders of the Montreal Light, Heat & Power Company are to hold a special meeting on June 4 to approve an increase of \$5,000,000 in the capital stock of the company. This will bring the total to \$22,000,000.

**Southwestern Utilities Declares Initial Dividend.**—An initial dividend of one-half of 1 per cent, payable June 2 to holders of record May 20, has been declared by the Southwestern Utilities Company, which is the holding corporation for the Texas Power & Light Company, of Dallas, Tex.

**General Electric Directors.**—At the annual meeting of the stockholders of the General Electric Company on May 13 M. F. Westover, of Schenectady, and I. S. Keeler and C. P. Moore, of New York, were elected directors to fill vacancies on the board. Other directors were re-elected.

**Philadelphia Electric Dividend Increased.**—The Philadelphia Electric Company has declared a quarterly dividend of 1¼ per cent, payable June 14 to holders of record May 22. This is an increase of one-quarter of 1 per cent over the previous disbursement, made on Feb. 20, and places the stock on a 7 per cent per annum basis.

**Michigan-Lake Superior Reorganization Progress.**—No dissents having been filed to the plan for reorganizing the Michigan-Lake Superior Power Company, Sault Ste. Marie, Mich., referred to in these columns April 26, the plan has become effective. It will be several months, however, before the reorganization can be fully worked out, as the property must be sold under foreclosure.

**Harwood Electric Company Sold.**—Following negotiations referred to in these columns April 26, the Lehigh Navigation Electric Company, a subsidiary of the Lehigh Coal & Navigation Company, has purchased a controlling interest in the Harwood Electric Company, of Philadelphia. This was obtained from Alfred D. Pardee, who, having disposed of his holdings, has resigned the presidency of the company. Operation of the latter will be continued under the direction of A. W. Drake, its vice-president and general manager.

**Allis-Chalmers Bookings Continue at Satisfactory Rate.**—Payment of the final assessments upon the preferred and common stocks of the Allis-Chalmers Company in accord-



ance with the plan through which that company has been reorganized took place on May 15. All legal matters connected with the reorganization have been completed and the business is now being carried on by the Allis-Chalmers Manufacturing Company, which, as mentioned in these columns March 22, was incorporated under Delaware laws on March 15 as successor to the Allis-Chalmers Company. The rate at which orders are being placed with the new company continues to be satisfactory.

**Extending San Joaquin Light & Power System.**—As was mentioned in these columns April 19, the San Joaquin Light & Power Corporation, Fresno, Cal., has arranged with the J. G. White Engineering Corporation for extensions and improvements to its system. This work includes the design and construction of a 6000-kva hydroelectric plant on the Tule River near Springville, Cal., the installation of a 3000-kva generator in the San Joaquin power house No. 2, a 3750-kva generator and waterwheel at the Kern River Canyon plant, a 6250 kw steam turbine, boilers, auxiliaries and buildings at the Bakersfield steam plant, and the installation of four 666 kva transformers, together with the necessary revision of switching arrangements, in the No. 3 plant of the San Joaquin Light & Power Corporation.

**Central Illinois Light Company Expanding.**—The recently organized Central Illinois Light Company, of Peoria, has acquired the properties of the Peoria Gas & Electric Company, Citizens' Gas & Electric Company, Pekin Light, Heat & Power Company, Washington Light & Power Company, Electric Service System, Farmington Light & Power Company and Elmwood Electric Light Company. The new company is capitalized at \$7,500,000 and will operate electric, gas and other utilities in Peoria, East Peoria, Pekin, Washington, Eureka, Metamora, Farmington, Elmwood and other cities and towns in Peoria and Tazewell Counties and vicinity in central Illinois. In all about twenty-four communities will be served. R. S. Wallace, of Peoria, is the vice-president and general manager of the Central Illinois Light Company.

**Brazilian Traction, Light & Power to Increase Capitalization.**—A special meeting of stockholders of the Brazilian Traction, Light & Power Company, Ltd., whose head office is at Toronto, Can., has been called for May 21, 1913, to approve an increase in the capitalization by the issue of \$10,000,000 of 6 per cent convertible preferred stock and also an increase in the common stock to provide for the conversion of this preferred stock. The new preferred stock is convertible into the common stock at 120, the new stock to be paid for 50 per cent on May 31 and 50 per cent on June 30. It has been underwritten in London at 97 and will be offered at par. This company was formed last year as a merger of the Rio de Janeiro Tramway, Light & Power Company, Ltd., the Sao Paulo Tramway, Light & Power Company, Ltd., and the Sao Paulo Electric Company Ltd. all of Brazil.

**Electric Properties Company Readjustment Plan.** John F. Wallace, Henry R. Hayes and Albert M. Chambers have been appointed a committee to carry out a plan for the reduction and readjustment of the capital stock of the Electric Properties Company, which, as noted in these columns July 6, 1912, was taken over last year by a syndicate composed of the Westinghouse Electric & Manufacturing Company, the Equitable Trust Company and William Morris Imbrie & Company, of New York, as a medium for dealing in the securities of public service corporations. The plan provides for reduction of the present outstanding common stock of the company from \$6,000,000 to \$4,000,000, the amount of outstanding preferred stock remaining at \$3,020,200. Provision will also be made for the funding of back dividends on the preferred stock from Feb. 1, 1910. The entire capital stock of Westinghouse, Church, Kerr & Company is owned by the Electric Properties Company.

## April Statement of Copper Producers' Association

The April statement of the Copper Producers' Association, issued May 8, showed a decrease in the stocks of marketable copper of 28,520,162 lb., as compared with a reduction of 18,032,028 lb. during March. Stocks on hand May 1

were 75,599,908 lb., as compared with 104,120,070 lb. on April 1. The April and March statements were as follows:

Stocks on hand on May 1, 1913	April 1, 1913	March 1, 1913
United States	41,150,000	41,150,000
Foreign	34,449,908	62,970,070
<b>Total</b>	<b>75,599,908</b>	<b>104,120,070</b>
Domestic deliveries	75,599,908	75,599,908
Export deliveries	75,599,908	75,599,908
<b>Total</b>	<b>151,199,816</b>	<b>151,199,816</b>

## NEW YORK METAL MARKET PRICES.

	May 16	May 15	May 14	May 13	May 12
Copper	11.10	11.10	11.10	11.10	11.10
Standard	11.10	11.10	11.10	11.10	11.10
Electrolytic	11.10	11.10	11.10	11.10	11.10
Frame Electro	11.10	11.10	11.10	11.10	11.10
Electrolytic	11.10	11.10	11.10	11.10	11.10
Casting	11.10	11.10	11.10	11.10	11.10
Copper wire	11.10	11.10	11.10	11.10	11.10
Lead	4.35	4.35	4.35	4.35	4.35
Silver	5.65	5.65	5.65	5.65	5.65
Snell	5.65	5.65	5.65	5.65	5.65
Aluminum	50.10	50.10	50.10	50.10	50.10
Brass	11.10	11.10	11.10	11.10	11.10
Future	11.10	11.10	11.10	11.10	11.10

## OLD METALS.

Heavy mixed metal	18.50	18.50
Brass	8.25	8.25
Lead	4.35	4.35
Zinc	5.65	5.65

## COPPER EXPORTS IN MAY.

Total value in May	16,475
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## Industrial Securities

	Dividend	Price	Yield
Allis-Chalmers	\$1.15	11.10	10.81
Allis-Chalmers, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81
Armstrong, pt. 1st, 4th pt.	1.15	11.10	10.81

## Personal

**Mr. Manly Morrison** has been appointed manager of the Central Maine Power Company's plant at Calais.

**Mr. M. B. Herron** has been appointed superintendent of the Rockwell White Power Company at Dayton, Ohio.

**Mr. C. W. McKillip** is the new district manager for the Pacific Gas & Electric Company's plant at Sacramento, Cal.

**Mr. Tom Edwards** has been appointed manager and purchasing agent for the Malone (Ariz.) Electric Company.

**Mr. C. E. Sedgwick** is the new district manager at the Dixon, Cal., plant of the Pacific Gas & Electric Company.

**Mr. E. R. Candor** has succeeded Mr. L. O. Becking as manager of the municipal electric plant at San Francisco.

**Mr. E. W. Florence** has been appointed district manager of the Redwood District of the Pacific Gas & Electric Company.

**Mr. D. L. Gould** has succeeded Mr. H. W. Foot as manager of the Municipal Light & Water Plant at Springfield, Mo.

**Mr. Don C. Ray** has recently been appointed district manager of the Pacific Gas & Electric Company's plant at Martinez.

**Mr. Charles B. Riddle, Jr.**, has recently succeeded Mr. J. W. Enboms as superintendent of the College Park (Ga.) Electric Light Company.

**Mr. Frank Hertz** has become associated with the Municipal Electric Light Plant at Quitman, Ga., succeeding Mr. J. M. Curtwright, resigned.

**Mr. F. H. Williams** has been appointed superintendent of the Brownsville (Tex.) Municipal Water & Light Plant, as successor to Mr. E. A. Stobart.

**Mr. H. L. Heffner** has succeeded Mr. A. W. Lindgren as manager and superintendent of the Huntington Beach (Cal.) Electric Light & Power Company.

**Mr. J. V. Smeaton** is now occupying the position of manager of the Bay Point (Cal.) Light & Water Company, having succeeded Mr. Robert A. Johnson.

**Mr. Glenn D. Smith**, formerly vice-president and manager of the Ontario (Cal.) Power Company, is now general manager and contract agent for the company.

**Mr. L. H. Hartsock** has been appointed district manager of the Colusa (Cal.) office of the Pacific Gas & Electric Company, succeeding Mr. William H. Henderson.

**Mr. F. D. Brown**, manager of the Aberdeen (S. D.) Railway Company, has resigned his position to accept the management of the Huron (S. D.) Light & Power Company.

**Mr. James Veitch**, formerly of the Bruce, Peebles Electric Company, Edinburgh, has joined the engineering staff of Mr. Charles F. Gray, consulting electrical engineer, Winnipeg, Manitoba.

**Mr. E. A. Graham**, who was recently appointed electrical engineer of the Winnipeg (Manitoba) Electric Railway Company, has resigned that position and gone South on personal business matters.

**Mr. W. H. Fraser**, who has been connected with the electrical staff of the British Columbia Electric Railway, has been appointed electrical superintendent of the company as successor to Mr. D. R. Kennedy.

**Mr. A. H. Mann** has resigned as general superintendent of the New Jersey Central Traction Company, Keyport, N. J., which supplies electricity for all purposes in Keyport, Matawan, South Amboy and vicinity.

**Mr. W. G. Murrin**, who was formerly connected with the staff of the London (Eng.) United Railway, has been appointed mechanical superintendent of the British Columbia Electric Railway, of Vancouver, B. C.

**Mr. B. J. Denman**, chief engineer of power plants of the Detroit (Mich.) Edison Company, has joined the staff of the United Light & Railways Company as assistant general manager with headquarters at Davenport, Ia.

**Mr. Walter S. Wyman**, who manages the Central Maine Power Company's plants at Augusta and Waterville, has assumed also the management of the company's plant at Clinton, from which Mr. Manly Morrison recently resigned.

**Mr. William B. Dickson** has resigned as president of the International Steam Pump Company, New York. Mr. William Guggenheim, chairman of the board, will direct the affairs of the company until another president can be chosen.

**Mr. C. E. Horn** has been appointed superintendent of the operating department of the Toronto (Ont.) Electric Light Company, Ltd., as successor to Mr. Thomas P. Marshall, whose retirement is announced elsewhere in this column.

**Mr. Philip Gregg** has resigned as district superintendent of the Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., and on severing his connection with the company was presented by his associates with a gold chain, locket and fob.

**Mr. J. W. McCrosky**, general South American representative of J. G. White & Company, Ltd., London, arrived in New York May 16, on the *Mauretania*. While in this country the address of Mr. McCrosky will be 43 Exchange Place, New York.

**Mr. D. R. Kennedy**, electrical superintendent of the British Columbia Electric Railway, Vancouver, B. C., has resigned his position and will spend the next few months traveling through the United States and the Dominion of Canada inspecting numerous electrical plants.

**Mr. V. E. Bird**, of the Stone & Webster Management Association, has been transferred from Fall River to assume the position of general manager of the New London Gas & Electric Division of the Connecticut Power Company, with headquarters at New London, Conn.

**Mr. Thomas P. Marshall**, after twenty years of service, has retired as superintendent of the operating department of the Toronto (Ont.) Electric Light Company, Ltd. In token of the esteem with which he was held by the members of the operating department he was presented with a leather couch.

**Mr. Homer E. Niesz**, manager of the Cosmopolitan Electric Company, Chicago, Ill., was elected chairman of the Chicago Section of the Electric Vehicle Association of America on May 6. Mr. Niesz was for several years connected with the Commonwealth Edison Company and the Chicago Edison Company, and is well known among central-station men.

**Mr. James Bennett**, whose retirement from the position of chief electrical inspector of the Canadian Fire Underwriters' Association, Montreal, Quebec, was announced in these columns some time ago, was presented with a diamond watch charm by the staff in Montreal, Quebec City and Sherbrooke when he finally severed his connection with the association.

**Mr. C. H. Howell**, of the Coshocton (Ohio) Light & Heating Company, has been appointed vice-president and manager of the County Electric Company of New Philadelphia and Canal Dover, the Twin City Traction Company of Dennison, and the New Midland Power & Traction Company of Cambridge, Ohio. Mr. Howell will continue to act as manager of the Coshocton plant.

**Mr. Charles H. Hubbell**, who has been secretary and assistant treasurer of the Texas Power & Light Company since its organization, has resigned to accept the position of vice-president and treasurer of the Southern States Audit Corporation. Upon the date that he left the service of the Texas Power & Light Company he was presented with a diamond watch fob by the employees of the treasury department.

**Mr. Fred J. Newman**, president of the Chicago Electric Motor Car Company and formerly chief engineer of the Woods Motor Vehicle Company, is seriously ill. Mr. Newman recently submitted to a surgical operation at Mercy Hospital, Chicago, and his condition arouses anxiety. He is a member of the American Institute of Electrical Engineers and has been prominent in the affairs of the Society of Automobile Engineers.

**Mr. H. C. Gilbert, Jr.**, has resigned as superintendent of construction of the Sanitary District of Chicago to accept a position with the W. A. Jackson Company, constructing engineers, Chicago. Mr. Gilbert is a Rose Polytechnic graduate and before his connection with the Sanitary District was engaged in engineering work at the St. Louis World's Fair, the Jamestown Exposition and the Union Electric Light & Power Company at St. Louis.

**Mr. C. Nesbitt Duffy**, vice-president of The Milwaukee Electric Railway & Light Company, has been appointed arbitrator for the company to pass on the questions at issue between the city of Cleveland and the Cleveland Railway Company in relation to allowances for maintenance, etc., under the Taylor ordinance. Mr. A. B. DuPont has been named as the city's representative on the board of arbitration. The third arbitrator is Judge Killits.

**Mr. P. D. Kline** has been promoted from general superintendent to general manager of the Ogden (Utah) Rapid Transit Company. Mr. Kline has been connected with the Ogden Rapid Transit Company since Feb. 1, 1913, previous to which time he was general superintendent of the Falkenau Electrical Construction Company, of Chicago, where he was in full charge of all field construction, having carried on the installation of several large railway systems, lighting systems and a number of large power stations. Mr. J. M. Read succeeds Mr. Kline as superintendent.

**Mr. Edward N. Lake**, formerly of Chicago, has been transferred from the Boston to the Chicago office of the Stone & Webster Engineering Corporation. During the last year he has had charge of installation work for the Boston Elevated Railway Company, the contract for which was



held by the Stone & Webster corporation. Two 15,000-kw generating units were installed and six substations erected. Ever since Mr. Lake first went to Chicago in 1833 he has been associated with some electrical interest, including the Chicago Edison Company, the Arnold Company and the Board of Supervising Engineers.

**Mr. Frank W. Stevens**, of Jamestown, N. Y., has resigned as chairman of the New York Public Service Commission, Second District. Mr. Stevens' term expired on Feb. 1, but in deference to the wishes of the Governor and many of the utility companies of the State, he continued to act until the important matters coming under his personal charge were disposed of. Mr. Stevens has been chairman of the commission since its organization on July 1, 1907, and it is generally conceded that the labors of the commission have fallen most heavily upon him and that he has personally developed the greater part of the system under which it performs its duties.

**Mr. L. S. Hunt**, general sales manager of the Commercial Electric Supply Company, St. Louis, Mo., was elected president of the supply men's division of the Arkansas Association of Public Utility Operators at its annual convention held at Little Rock, Ark., recently. Mr. Hunt was born at Delphos, Ohio, in 1874 and served three years in the electrical department of the Fort Smith (Ark.) Light & Traction Company. In 1891 he joined the sales organization of the Western Electric Company, remaining with that concern seven years. He became the Central States representative of the Commercial Electric Supply Company in 1899 and two years afterward was made general sales manager, which position he still holds.

**Mr. James E. Allison** has resigned as commissioner and chief engineer of the St. Louis Public Service Commission to engage in general consulting practice, making a specialty of public-service valuation work and the examination of securities. Mr. Allison was graduated from Harvard University. Before going to St. Louis he operated gas works and managed and designed for manufacturers of street-railway equipment. In 1908 he was appointed chairman of the board of engineers of St. Louis and was consulting engineer in one of the departments of the World's Fair. In 1909 he was appointed commissioner and chief engineer of the St. Louis Public Service Commission, and he was reappointed in 1911. As chief engineer of the commission he made detailed valuations of public service property for the city of St. Louis, including the Union Electric Light & Power Company, the Bell Telephone Company, the St. Louis water works, etc., representing a capitalization of about \$170,000,000.

**Mr. J. D. Andrew** has been appointed superintendent of the station engineering department of the Edison Electric Illuminating Company of Boston, Mass., succeeding Mr. Moulthrop, whose promotion to be assistant superintendent of the construction bureau was noted in these columns last week. Mr. Andrew has had a wide experience in the engineering field. After his graduation from Columbia University he was for four years in the erecting and testing department of the Edward W. Alis Company, of Milwaukee, Wis. He left that company to become mechanical engineer of the Metropolitan Street Railway Company, New York City, and resigned after two years' service to be chief engineer of the New York Edison Company. Three years later Mr. Andrew joined the Alherene Stone Company as general manager, and in December, 1907, he went to Boston to be superintendent of power of the Boston Elevated Railways, which position he held until a few months previous to the time he became connected with the Boston Edison company.

**Mr. Arthur N. Dutton**, who since June, 1909, has been vice-president and general manager of the Peerless Motor Car Company, New York, N. Y., has been appointed general manager of the West Virginia Traction & Electric Company, which operates in Wheeling and Morgantown, W. Va., and is controlled by the Eastern Power & Light Corporation, of which Mr. W. S. Barstow is president. Mr. Dutton was born in Milwaukee in 1873 and served for many years in railroad work in the West. In 1903 he entered the employ of the Brooklyn (N. Y.) Rapid Transit Company with the elevated division. Three months later he was made assistant superintendent of the elevated system of

the company, and when Mr. George R. Folds resigned as assistant general manager of the company Mr. Dutton was appointed successor to Mr. J. F. Calderwood, vice-president and general manager and subsequently had command of the operation of the entire system. He resigned from the Brooklyn Rapid Transit Company to become connected with the Peerless Motor Car Company.

**Mr. James C. DeLong**, who for the past six years has been vice-president and general manager of the Syracuse (N. Y.) Lighting Company, has been elected president of the company in accordance to Mr. Walter Cook, secretary-president of the United Gas Improvement Company, of Philadelphia, Pa., who has been president of the Syracuse subsidiary ever since it was taken over by the P. U. G. I. C. corporation about twelve years ago, with the exception of two or three years when Mr. F. F. Collins was president. The office of general manager has been qualified by Mr. DeLong, who is a native of Utica, N. Y., after having been connected with the lighting business in that city and afterward held responsible positions with other similar corporations in several other cities. He went to Syracuse from Philadelphia, where he was connected with the United Gas Improvement Company. Mr. DeLong is first vice-president of the Empire State Gas & Electric Association, a member of the National Electric Light Association, the National Association of Gas Engineers, and the American Gas Institute and its associate member of the American Institute of Electrical Engineers.

**Sir William Henry Preece**, the well-known English electrical engineer, is retiring at 70 with the United States again this fall. It has been several years since he was last in this country.



to which he has made periodic visits during the last thirty or forty years, with the object of studying the electrical developments and for which he has always had a great deal of admiration. Sir William Henry Preece is a native son of the British and valued co-workers. He is a past-president of the Institute of Civil Engineers and a past-president of the Institute of Electrical Engineers, a fellow of the Royal Society, a member of the Physical Society, the Astronomical Society, the Royal Institution,

the British Association and the Society of Arts. His remarkable gifts as a scientific and practical engineer have prominently been to the general public at England, which crowns the honor of the Society of Arts and the Royal Institution whereby he is functioning as one of the principal topics of the hour in respect to the scientific and inventive marvel. Through his exertions the scientific branch of the telegraph department in the British Post Office has become more and more broad in its commercial enterprise in that kind. His inventions which are many, deal with the telephone, Wheatstone apparatus, duplex, quadruplex and automatic telegraphy, wireless telegraphy and electrical devices for increasing the range of telegraph travel. His contribution to wireless telegraphy and telephony and in one of the most practical branches of scientific progress in the British Empire. A detailed examination of these papers is looked for in the near future, as many of the different inventions show the developing character of wireless telegraphy and telephony and which, through his great ability as a scientist, he has been able to put into the practical world. Sir William Henry Preece was born in 1843 near Warrington, in North Wales. He completed a technical course at Warrington Grammar School and then went on to study at the Royal Institution and the Royal Society, where he was actively engaged in telegraph work.

He was one of the first to be employed in the telegraph department in 1862 when he was then only the age of twenty. On April 1, 1864, he was elected an honorary member of the New York Electrical Association.



## Construction

### New England

**BELGRADE LAKES, MAINE.**—The Belgrade Pwr. Co. contemplates the purchase of a controller for its waterwheels and expects to purchase within the next six months some transformers and some tungsten lamps. Ernest E. Hurd is general manager.

**CLARKS MILL, MAINE.**—The Clark Pwr. Co. is to build a transmission line into the village of Bar Mills, a distance of about 3 miles, this spring. Cecil F. Clark is president and manager.

**MILO, MAINE.**—The Milo El. Lt. & Pwr. Co. expects to purchase within the next three months one 100-kw, three-phase, alternating-current generator, five lightning arresters and a new street-lighting system. Julian d'Este, 26 Canal Street, Boston, Mass., is purchasing agent. W. S. Owen, Milo, is treasurer.

**ROCKLAND, MAINE.**—The City Council has granted Hollis M. Shaw a franchise to erect and operate electric transmission lines in Rockland.

**LEE, MASS.**—The Berkshire St. Ry. Co., of Pittsfield, contemplates the construction of a new substation to furnish energy to operate the new electric railway between Lee and Huntington.

**PAXTON, MASS.**—At a special town meeting held recently it was voted to install an electric-light system. It is proposed to erect purchased energy from the Worcester El. Lt. Co. A committee, consisting of Edward E. Eames and Arthur W. Dwyer, has been appointed to act with the Selectmen to secure estimates of cost of same.

**DANIELSON, CONN.**—The People's Lt. & Pwr. Co., of Danielson, expects to extend its transmission lines to Brooklyn, a distance of 5 miles, within the next few weeks and will use 210 poles, 10 miles of No. 6 wire, several transformers and 500 insulators. The company also expects to change its arc-lamp street-lighting system to 40-cp and 80-cp incandescent lamps. J. H. Burdick is superintendent.

**EAST NORWALK, CONN.**—The town of East Norwalk expects to purchase within the next six months new equipment and apparatus for the municipal electric-light plant as follows: One motor generator set, consisting of one 37½-kw alternating-current generator and exciter, and one 75-hp direct-current motor; one switchboard panel with necessary instruments to operate the above motor generator set; five 1-kw and two 3-kw transformers, 2 miles of No. 8 copper wire, 300 glass insulators and 25 5-amp alternating-current wattmeters. About 1½ miles of transmission lines will be erected within the next six months for both street-lighting and commercial purposes. Fred H. Bergren is superintendent.

**GREENWICH, CONN.**—The United El. Lt. & Wtr. Co., Greenwich division, has recently entered into a contract with the borough of Greenwich, whereby all the present direct-current inclosed-arc lamps will be removed and 200-cp incandescent lamps substituted. It is proposed to standardize the street-lighting system and operate the entire street system at 6.6 amp. G. F. Atwater is superintendent.

### Middle Atlantic

**BROOKLYN, N. Y.**—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 3 for furnishing five radio sets at the Navy Yard, Brooklyn, N. Y., as per schedule 5440. Applications for proposals should give the schedule desired by number. T. J. Cowie is paymaster general, U. S. A.

**COHOES, N. Y.**—Plans have been prepared for the Cohoes Co. for the construction of a large power house, 67 ft. by 170 ft., to be located in the bed of the Mohawk River, about 700 ft. below Cohoes Falls. The cost of the building and equipment is estimated at about \$1,100,000. The initial installation will provide for three 10,000-hp units. Provision will be made for the installation of two additional units. The company will receive bids for the work at its New York office, 2 Rector Street.

**CORRY, PA.**—The Corry City El. Lt. Co. has been awarded the contract for street lighting in Corry. The contract is for a period of five years and provides for 25 4-amp magnetite arc lamps, 250 60-cp series Mazda lamps and 20 series Mazda lamps of 100 cp. The City Council is also considering the installation of an ornamental street-lighting system. B. E. Waltz is secretary and treasurer of the company.

**HARRISBURG, PA.**—Application has been made to Governor John K. Tener to charter for the following companies to furnish electricity for lamps, heaters and motors: The Stoneboro Pwr. Co., the Sandy Lake Suburban Pwr. Co., the Fairview Pwr. Co., the Sandy Lake Pwr. Co. and the Lake Pwr. Co. The incorporators are: William A. Alexander, A. R. Carrier and James George, all of Greenville.

**PHILADELPHIA, PA.**—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 14 for furnishing and installing three electrically driven capstans at the navy yard, Philadelphia, to cost approximately \$9,000. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. William M. Smith is acting chief of bureau.

**READING, PA.**—The Metropolitan El. Co., of Reading, has entered into a three-year contract with the city of Reading to furnish electricity to operate the city sewage disposal plant. The equipment consists of

one 150-hp and one 100-hp centrifugal pump, which will be driven by 2300-volt Westinghouse motors. K. A. Fichtorn is treasurer.

**LAKEWOOD, N. J.**—The Commonwealth Wtr., Lt. & Pwr. Co., of Summit, which controls the Lakewood Wtr., Lt. & Pwr. Co., has purchased the property of the Point Pleasant El. Lt. & Pwr. Co., which furnishes electrical service in Point Pleasant, Bay Head, Spring Lake and vicinity. Electricity for operating the system of the Point Pleasant system will be furnished by the Lakewood plant. Supplies for the transmission line will be needed later. H. M. Whitehead is superintendent of the Lakewood company.

**NEWARK, N. J.**—Bids will be received by the committee on public buildings of the Common Council of the city of Newark, N. J., until May 26 for the construction of a public market building in Newark, to be known as the Centre Market, to be erected on the Market Plaza. Bids will be received for the entire work under general contract and separate proposals will be received as follows: (1) To include mason work, tile and marble, iron and steel and chimney; (2) to include carpenter, roofing, sheet metal, painting and hardware; (3) electrical work, elevators and elevator doors; (4) plumbing, refrigerating and heating; (5) well, air compressor and receiver; (6) boilers and incinerator. Plans and specifications may be obtained from Hooper & Co., architects and engineers, 118 Market Street, Newark, upon deposit of \$100, which will be refunded upon return of plans. C. J. Harrington is chairman of committee.

**NEW PROVIDENCE, N. J.**—The Tri-County Trackless Trolley Co. has applied to the township committee for permission to erect a pole line and install feeder lines for operation on Springfield Avenue.

**PATERSON, N. J.**—Bids will be received by the board of chosen freeholders of the county of Passaic, addressed to William H. Mason, chairman of road committee, until May 21 for furnishing 200 or more 2000-cp arc lamps. Bids are to be submitted on one, three and five-year contracts.

**BROOKLYN, MD.**—Bids will be received by Otto Zentgraf, chairman of fire-alarm system, until May 24 for installing a fire-alarm system.

**FROSTBURG, MD.**—The Frostburg Ilg. & Mfg. Co. expects to install within the next two months a gravity system for handling coal. C. H. Leatham is general manager.

**CHARLOTTESVILLE, VA.**—The Redland Pwr. Co., recently incorporated, contemplates the construction of a hydroelectric plant to develop 2000 hp, at a cost of about \$100,000. Neff & Thompson, of Norfolk, Va., are engineers in charge. F. C. Todd is president.

**NATIONAL SOLDIERS' HOME, VA.**—Bids will be received at the office of the superintendent of post fund, Southern Branch, National Home for Disabled Volunteer Soldiers, National Soldiers' Home, Virginia, until May 27 for remodeling old power house building No. 17, plans and specifications for which, with blank proposals, may be obtained upon application to Everett B. White, superintendent of post fund.

**RADIO, VA.**—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 14 for furnishing and installing three electric hoists at the United States naval radio station at Radio, Va. Plans and specifications can be obtained on application to the bureau. William M. Smith is acting chief of bureau.

### North Central

**CADILLAC, MICH.**—The Consumers' Pwr. Co., of Jackson, contemplates extensions to its system in this locality.

**INGALLS, MICH.**—The power dam owned by Ira Carley, of Ingalls, which furnished power to operate two turbines and an electric generator in his sawmill, was recently washed away, carrying the turbines and generator into the river. The dam will be rebuilt as soon as possible.

**LAPEER, MICH.**—The power plant of the Lapeer Gas & El. Co. was wrecked by an explosion on May 7, causing a loss of about \$60,000.

**MILFORD, MICH.**—The Milford El. Co. expects to purchase one 150-kva, three-phase, 60-cycle, 2300-volt generator, with directly connected exciter, 600 r.p.m., one 200-hp waterwheel, vertical, open penstock type, one waterwheel governor, two triple-pole, single-throw oil switches, switchboard, instruments, etc., within the next six months. C. C. Sherk is superintendent.

**MUSKEGON, MICH.**—The contract for the installation of an ornamental street-lighting system has been awarded to the Rodgers Electrical Co., of Muskegon, for \$4,000. The contract provides for 62 standards each carrying five-lamp clusters, maintained by underground three-conductor armored cable, two No. 8 wire and one No. 6 wire. This is the initial installation and will be followed by several others of at least as many lamps. Louis H. Conger, secretary of Chamber of Commerce, is interested in the project.

**NORTHVILLE, MICH.**—Preparations are being made by the town officials to build a concrete dam 60 ft. long and 15 ft. high within the next two months. The purchase of one car load of 30-ft., 35-ft. and 25-ft. poles is contemplated within the next two months; also the purchase of a new switchboard for three generators and exciters within the next six months. Samuel Wilkinson is superintendent.

**PETOSKEY, MICH.**—The purchase of two Jones underfeed stokers and a polyphase curve drawing wattmeter is contemplated for the municipal electric-light plant. J. W. Lovelace is manager.

**SAGINAW, MICH.**—The power plant recently installed by Saginaw Wood Products was completely destroyed by fire on May 3.

**SAGINAW, MICH.**—A committee has been appointed to investigate the proposition of providing a new lighting system for South Saginaw between Fifth Street and Second Avenue.

**BARBERTON, OHIO.**—At an election to be held May 20, the proposition to issue \$110,000 in bond for the improvement of a municipal electric light plant will be submitted to the voters. W. S. Mitchell is Mayor.

**CLEVELAND, OHIO.**—Bids will be received in the office of the secretary to the director of public service, Room 104, City Hall, Cleveland, Ohio, until May 27, for steam-driven and motor-driven electric generators and rotary converters for the municipal electric light plant. Plans and specifications may be obtained at the office of the engineer of construction, Room 319, City Hall. W. J. Spangham is in charge of public service and W. H. Kirby secretary.

**CLEVELAND, OHIO.**—Bids will be received at the office of the secretary to the director of public service, Room 104, City Hall, Cleveland, Ohio, until May 27 for one 40-ton motor electric traction crane, with one 5-ton auxiliary crane, for the municipal electric light plant. Plans and specifications may be obtained in the office of the engineer of construction, Room 319, City Hall. W. J. Spangham is director of public service and W. H. Kirby secretary.

**CORTLAND, OHIO.**—The Village Council has engaged B. F. Hewitt, a Jefferson, consulting engineer, to prepare plans for an electric light plant and water works system.

**COSHINGTON, OHIO.**—The United States Co., of Springfield, Pa., has decided to locate in Coshtown its central power plant to furnish energy in Newcomerstown, Coshtown, New Philadelphia, Grant Township and Cambridge. Work will soon begin on the installation of a 2,000-hp. steam turbine with additional boiler capacity. The company has a contract to furnish electricity for the Newcomerstown plant of James B. Clow & Son. Work will also be started on this development at once.

**DETROITE, OHIO.**—The Public Service Commission has granted permission to the Detroit Gas & E. Co. to issue \$2,000,000 in capital stock and bonds to the amount of \$257,000, of which \$200,000 is to be used for retarding purposes, \$57,000 will be expended on improvements to the plant in Detroit and will include the rebuilding of the electric line and extensions to the gas service. Another steam generating unit will be installed in the central station in Detroit to provide emergency service in case of breakdown in the Angliate Pwr. Co.'s service.

**HICKMAN, KY.**—The Fulton E. L. & Pwr. Co., of Hickman, has increased its capital stock from \$10,000 to \$50,000.

**HICKMAN, KY.**—The name of the Hickman Ice & Coal Co. has been changed to the Hickman E. L. & Wre. Co. and its capital stock increased from \$20,000 to \$80,000.

**WINCHESTER, KY.**—The City Council has decided to accept the proposition of the Main Street property owners to erect underground lamp standards, provided the city would equip them and maintain the lamps. The Council also voted to accept any similar proposition made by property owners on other streets.

**PLYMOUTH, IND.**—The Plymouth E. L. & Pwr. Co. has been granted a franchise and a contract for lighting the town of Cassin and its surrounding electricity to the cottages around the lake. The street-lighting contract calls for about 40 series Mazda lamps. A high-tension transmission line will be erected from Plymouth to Oliver. C. D. Seaburger is president.

**VINCENNES, IND.**—The City E. L. & Pwr. Co., of Vincennes, has increased its capital stock from \$75,000 to \$300,000.

**ALFED, ILL.**—The Consumers' E. L. & Pwr. Co. contemplates improvements to its local electric-light system, costing from \$50,000 to \$200,000, if granted a new franchise.

**AURORA, ILL.**—The Mayor has recommended to the City Council the installation of a new police and fire-alarm system in the business district to cost approximately \$10,000.

**BLANDSVILLE, ILL.**—C. R. Hunter, president of the local electric light plant, expects to purchase 1000 B. & O. cars during the next three months.

**BLOOMINGTON, ILL.**—The Chicago & North Ry. Co. has expended \$937,000 for improvements to its shops and yards in Bloomington. The estimates provide for boiler and machine shops, boiler room extension and possibly additional generating capacity, one electric plant including crane, hoist and hoists, wiring, truck and other machinery and other extensions and improvements.

**CLINTON, ILL.**—The Board of Local Improvements has awarded a contract to the Clinton Gas & E. Co. for the erection of standard electric lamp standards at \$53.25 each, and for improvements, lighting, etc., \$1.00.

**CLIFTON, ILL.**—The Public Service Co. of Northern Illinois, at Chicago, is contemplating extending its transmission lines to Clifton and thereby to supply electricity for lamps and motors. The service will probably be furnished from the Kankakee plant.

**DALLAS CITY, ILL.**—The capital stock of the Dallas City E. L. Co. has been increased from \$10,000 to \$30,000.

**GALESBURG, ILL.**—The Galesburg American, Inc., is contemplating installing about 1½ miles of underground conduit for electric wires in the same amount of steam-heating mains during the coming summer. J. Weinberg is treasurer.

**GENESEO, ILL.**—The Illinois Northern Electric Co. of Chicago, has applied to the City Council for a street system of 14,000 ft. franchise

which covered Main St. The franchise would connect the existing 4-ft. wire franchise with the new line of 10,000 ft. of the old cable to provide for the new system and for the old system.

**GERARD, ILL.**—The City Council has decided to accept the proposition of the local electric light plant to issue \$10,000 in bond for the improvement of the plant. The proposition will be submitted to the voters at the next election to be held May 20.

**PARIS, ILL.**—The Council of the City of Paris has decided to accept the proposition of the local electric light plant to issue \$10,000 in bond for the improvement of the plant.

**PIERCE, ILL.**—The City Council of the City of Pierce has decided to accept the proposition of the local electric light plant to issue \$10,000 in bond for the improvement of the plant.

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to will erect a transmission line (to be owned by the city of Van Meter) to Van Meter, a distance of 7 3/4 miles.

ALTON, IA.—The town of Alton has granted Mason & Mason a franchise to operate an electric-light plant here. The company agrees to furnish 40 lamps of 80 cp for street lighting at \$25 each per year, for a period of five years.

ATLANTIC, IA.—The managers of the municipal electric-light plant expect to purchase within the next six months 15 electrolamps for five-lamp clusters and underground wiring for same. T. E. Nichols is superintendent of the municipal plant.

CAMBRIDGE, IA.—W. A. Curtis, owner of the Cambridge electric-light plant, expects to erect within the next two months a transmission line between Huxley and Maxwell, Ia., to operate at 6600 volts primary and 110 volts secondary, and also expects to purchase transformers and line equipment within the next two months.

FAIRFIELD, IA.—The City Council has engaged J. B. Hill, of Iowa City, as consulting engineer in connection with equipping the pumping station of the water-works system for electrical operation.

RUSSELL, IA.—A special election has been called for May 19 to vote on the proposition to establish a municipal electric-light plant in Russell.

SABULA, IA.—At an election held recently the proposition to install an electric-light system was carried.

KANSAS CITY, MO.—The Kansas City El. Lt. Co. is planning to remodel the Metropolitan power plant at Ninth Street and Blue River, which was dismantled two years, to be used as a substation. Equipment costing about \$50,000 will be installed. Louis H. Egan is general manager.

BISMARCK, N. D.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 9, for the installation of an electric passenger elevator in the United States post office and court house at Bismarck, in accordance with drawings and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

DUNSEITH, N. D.—Bids will be received by the trustees of the North Dakota Tuberculosis Sanitarium at the office of Dr. J. G. Lamont, medical superintendent, Dunseith, until June 6 for the construction of a cottage building for patients, also two smaller cottages for homes for servants, the bids to include general contract work, heating, wall wiring for lamps and plumbing work, in accordance with plans and specifications, copies of which may be obtained upon application to the Board of Trustees, Dunseith. Bids will be received collectively or separately. William Gottbreit is president of board of trustees.

GRAND FORKS, N. D.—Bids will be received by Clarence A. Hale, secretary of board of trustees, until May 27 for construction of a Masonic Temple building. The steam-heating and ventilating system and plumbing will be let under a separate contract, also electric wiring, painting and decorating and vacuum cleaners. Plans and specifications were prepared by De Remer and Wallis, architects, Title Insurance Building, Los Angeles, Cal., and may be seen at the Builders' Exchange in St. Paul and Minneapolis, Minn., and Grand Forks, and also at the office of the secretary.

ST. THOMAS, N. D.—At a special election held April 28 the proposition to issue bonds for the installation of a municipal electric-light plant was carried. An engineer has not yet been engaged. C. Ganssle is Mayor.

VELVA, N. D.—O. S. Kaufmann, of Hillsboro, Wis., has applied for a franchise to construct and operate an electric-light plant in Velva.

KIMBALL, S. D.—The El. Lt. & Pwr. Co., recently organized with a capital stock of \$15,000, will construct an electric-light plant here, to cost about \$12,000. Garret Ashley, of Kimball, is engineer in charge. C. E. Smith is secretary of the company.

WAGNER, S. D.—The Interstate Pwr. Co., Wagner, contemplates the construction of a central power plant to furnish electricity for the Dakota division, but neither the installation or location has yet been decided upon. J. F. Cameron is manager.

AURORA, NEB.—The Aurora El. Co. has instructed J. B. Harvey, general manager, to prepare plans for improvements to the electric-light plant.

NIORARA, NEB.—The Niorara & Sioux City Ry. & Pwr. Co. has increased its capital stock from \$1,000,000 to \$7,000,000. The company proposes to build a power plant on the Niorara River near Valentine and operate an electric railway from the power plant to Sioux City. The head office of the company is in Omaha.

OMAHA, NEB.—The State Legislature has appropriated \$100,000 for the Nebraska School for the Deaf at Omaha, of which \$60,000 will be used for new buildings, \$35,000 for a power house and equipment and \$5,000 for improvements to present buildings.

SPRINGFIELD, NEB.—The Platte El. Lt. & Pwr. Co. has applied to the State Railway Commission for permission to issue \$250,000 in stocks and bonds. The company proposes to build a hydroelectric power plant on the Platte River for the purpose of furnishing electricity in Omaha and neighboring cities.

ARGONNA, KAN.—The proposition to issue \$25,000 in bonds for the installation of an electric-light plant and water-works system will soon be submitted to the voters. Rollins & Westover, Midland Building, Kansas City, Mo., are consulting engineers.

HOWARD, KAN.—The question of calling an election to vote on the proposition to issue bonds to the amount of \$11,000 to \$14,000 to build an electric light and power plant is under consideration.

SCANDIA, KAN.—The City Council is considering a proposition submitted by the Concordia El. Lt. Co., of Concordia, to furnish electricity for lamps and motors in Scandia. The company asks for a 20-year franchise.

## Southern States

MURPHY, N. C.—Bonds to the amount of \$70,000 have been voted to build a hydroelectric plant. The plans provide for the construction of a dam, about 20 ft. high and 400 ft. long, across Hiwassee River, 6 miles from Murphy; construction of power house, 20 ft. by 40 ft., and installation of electric generating equipment to develop about 800 hp. Plans were prepared by the J. B. McCrary Co., of Atlanta, Ga. D. W. Dewese is Mayor.

ORANGEBURG, S. C.—At an election held recently the proposition to issue \$60,000 in bonds for rebuilding the municipal electric-light plant and water-works system was carried. L. H. Wanmaker is city clerk.

COLLEGE PARK, GA.—The College Park El. Lt. Co. expects to extend its service within the next five months and will either purchase hydroelectric power or install a 60-kw electric generating unit; it also expects to purchase within the next six months 25 5-kw transformers, 50 10-amp meters and \$500 worth of lamps and to expend \$500 for electrical appliances. Charles B. Biddle, Jr., is superintendent.

MADISON, GA.—The town of Madison expects to purchase within the next 12 months a motor-driven pump, with a capacity of 500 gal. per minute under 100 ft. head, and 1000 ft. No. 8 weatherproof wire. George W. Hubbard is superintendent of the municipal plant.

MONROE, GA.—The town of Monroe expects to purchase within the next eight months one five-panel switchboard with all instruments, motors, heating devices and other electrical appliances which will be utilized in connection with the installation of a day service. J. W. Butts is superintendent.

QUITMAN, GA.—The city of Quitman expects to install an additional electric generating unit, consisting of a generator and engine (directly connected), and to overhaul the equipment now in service in the municipal electric-light plant within the next few months. G. B. Garwood is purchasing agent.

STATESBORO, GA.—Plans are being considered for the purchase of one 250-hp boiler or two 125-hp boilers for the municipal electric-light plant soon. D. L. Gould is manager.

THOMSON, GA.—The town of Thomson expects to establish a day service within the next six months. Additional equipment, including a 50-hp engine and 35-kw generator, will be installed in the municipal electric-light plant to provide for the service. L. J. Porter is superintendent.

WAYNESBORO, GA.—The managers of the municipal electric-light plant expect within the next 10 months to purchase one boiler-feed pump, 100 meters, 10 lightning arresters, three 10-kw transformers, 18,000 ft. weatherproof wire, 500 60-watt, 100 100-watt and 100 60-watt lamps. J. C. Andrews is superintendent.

CLEARWATER, FLA.—The Clearwater Ice Factory contemplates the purchase of a 250-hp engine or turbine connected to a 175-kw, three-phase, 60-cycle, 2300-volt alternator, with exciter, a three-phase switchboard, synchroscope, etc., within the next six months. J. N. McClurg is manager.

DADE CITY, FLA.—The Dade City Ice, Lt. & Pwr. Co. expects to purchase within the next six months one second-hand 40-kw to 50-kw, three-phase, 60-cycle, 2300-volt belted alternator, with exciter and switchboard. E. W. Muller is president and general manager.

GAINESVILLE, FLA.—The lighting committee is contemplating the installation of an ornamental street-lighting system in the business district, contracts for which will be let in about 60 days. The plans provide for the erection of 80 standards, carrying five-lamp clusters. J. E. Goodwin is chairman of lighting committee.

JACKSONVILLE, FLA.—The city of Jacksonville expects to purchase within the next three months one new battery of boilers (Babcock & Wilcox type) with a rating of approximately 1040 hp. The purchase of three 1000-kw stepdown transformers running from 6600 to 2300 volts has been authorized. Bids are being asked for two 50-lamp tub transformers to operate 100 additional 4-amp magnetite-arc lamps, and it is very probable that within the next year four more tub transformers and 200 additional lamps will be purchased. The new power-house having an output of 10,000 kw was completed in November, 1912. W. H. Tucker is superintendent.

LEESBORO, FLA.—The Leesboro Ice Co. expects to double the output of its electric plant within the next six months and also expects to purchase a 100-kw generating unit, consisting of an engine and generator and single-panel switchboard. The company has installed a 200-hp Babcock & Wilcox boiler, an oil-burning outfit and a 250-hp Cookson heater. J. Y. Clark is president.

PANAMA CITY, FLA.—The proposition to issue bonds for the installation of an electric-light plant will be submitted to the voters.



**ST. PETERSBURG, FLA.**—The City Council has adopted a resolution providing for submitting the proposition for a municipal electric-light plant to a vote at the same time the city commissioners are elected.

**ELIZABETHTON, TENN.**—The property of the Watonga Pwr. Co., of Elizabethton, has been purchased by the Lumber merchants of New York, N. Y. It is understood that the new owners propose to harness the Watonga River at other points and develop about 7500 hp to serve this entire territory.

**MONTEREY, TENN.**—The City Council has granted a franchise to George N. Welch, T. E. Goff and J. T. Price to construct and operate an electric-light plant in Monterey. The cost of the plant is estimated at from \$3,500 to \$4,000.

**ATTALA, ALA.**—At an election held recently the proposition to lease the municipal electric-light plant and water-works system to the Alabama Pwr. Co. for a period of 30 years was carried. The Alabama company will make improvements to the plant involving an expenditure of about \$20,000. Electricity for operating the electric system will be obtained from the East Gadsden station, which will be completed early in June.

**COTTER, ARK.**—Preparations are being made by Walker W. Powell, of Little Rock, president of the Dixie Pwr. Co., and Col. John A. Laird, of St. Louis, Mo., for the construction of the proposed hydroelectric plant just as soon as Congress grants the necessary rights. The State rights having already been obtained. This development will be located on the White River, near Cotter, where it is estimated that about 15,000 hp can be developed. The plans call for the construction of the following: For dam, length of spillway 800 ft., length of core walls 120 ft., height of spillway 100 ft., height of core walls 125 ft. (hollow construction). Electricity generated at this plant will be transmitted to cities and towns in central and northwestern Arkansas. The cost of the entire plant is estimated at about \$2,000,000.

**RAYVILLE, LA.**—Senator George Wesley Smith, Jr., has granted a franchise to operate an electric-light system in Rayville. C. A. Smith is secretary of the Rayville Progressive League.

**ST. BERNARD, LA.**—The New Orleans Ry. & L. Co. is considering the acceptance of the franchise granted by the St. Bernard Parish jury some time ago. Under the terms of the franchise the company is required to furnish the parish with ten arc lamps free of charge.

**ALINE, OKLA.**—Contracts have been awarded by Paul Schenckel and James Thomas for the installation of an electric-light plant and ice factory. The cost of the plant is estimated at about \$6,000.

**WATONGA, OKLA.**—The City Council has engaged the Benham Engineering Co., National Bank Building, Oklahoma City, to prepare plans for extensions to the municipal electric-light plant and water-works system.

**BELTON, TEX.**—The City El. Co. recently has taken over the Belton L. & Pwr. Co. and the Belton Ice & L. Co. The company is capitalized at \$60,000 and the incorporators are John D. Robinson, A. J. Denny, W. W. Thornton, Thomas Fairweather and M. V. Smith. The plant uses steam and the other water-power) will be consolidated with these power houses kept intact.

**BURLESON, TEX.**—The Burleson Wtr. Wks. Co. is constructing an electric light plant in Burleson.

**TEAGUE, TEX.**—The plant of the Teague El. L. & Pwr. Co. is nearly completed and will be put into operation within a short time. The equipment consists of a 150-hp Herne boiler, one 100-hp fuel engine and a 100-kva generator. J. Y. Guygal is manager.

**WEST, TEX.**—The Southern Trac. Co., of Dallas, has purchased the local electric-light plant. The new owner, it is said, will extend and improve the service.

## Pacific States

**ANACORTES, WASH.**—The Anacortes L. & Wtr. Co., recently organized, will make extensive improvements to the local light and water systems. C. M. Bliven, J. C. Corbin and others are interested in the new company.

**BATONVILLE, WASH.**—The City Council has granted a franchise to Hudson, of Tacoma, electrical engineer, to locate a power plant on the Mashell River for the proposed municipal electric-light plant. About 150 hp will be developed.

**OLYMPIA, WASH.**—Application has been made to the City Council by Millard Lemon and Wilbur B. Burdick for a franchise to construct and operate an electric light and power plant in this city. The proposition will be submitted to the voters on May 24.

**KENO, ORE.**—D. F. Kems, of Clatsop, Ore., is installing a large distributing system in and around Keno, consisting of 2000 ft. of transmission lines from his power plant at Keno.

**OSWEGO, ORE.**—The Portland, Eugene & Astoria Ry. Co. has awarded the contract for the construction of a substation to the Portland Engineering & Contracting Co., of Portland.

**PORTLAND, ORE.**—Bids will soon be asked for the executive board of the City Council for the installation of a lighting system on Grand Avenue.

**PORTLAND, ORE.**—The Portland Ry. L. & Pwr. Co. will begin work immediately on the extension of the South Mount Taylor-Hawthorne Avenue car line to East Seventy-fourth Street and Twenty-ninth Avenue. The Woodstock car line will be extended from East Forty-ninth Street to

East Forty-seventh Street and will also be extended to East Seventy-fourth Street on the Mount Taylor car line.

**ROSLIE, ORE.**—The Rosalie Power Co. is active in building a new hydroelectric power plant on the Malheur River near Rosalie, which will be used to generate about 10,000 hp of electricity.

**SHERIDAN, ORE.**—The new electric light plant, owned by the Yamhill Milling, L. & Pwr. Co., of Sheridan, has been purchased by J. P. Thompson, of Portland, Ore. The plant, which has been constructed for the Yamhill mill and is located in Astoria, Ore., will have a generating plant in Waldport. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**TOLEDO, ORE.**—The Independent El. Co., of Portland, has been granted a franchise by the County Commissioners to build a transmission line from Wagoner to Toledo and a branch line to Lakeview and to Klamath.

**BOULDER CREEK, CAL.**—The Boulder Creek El. L. & Pwr. Co. is rapidly building a new electric light plant in Boulder Creek, Cal. The plant, which will be located on the Boulder River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**COACHELLA, CAL.**—The Coachella El. L. & Pwr. Co. is rapidly building a new electric light plant in Coachella, Cal. The plant, which will be located on the Coachella River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**FRISCO, CAL.**—The Frisco El. L. & Pwr. Co. is rapidly building a new electric light plant in Frisco, Cal. The plant, which will be located on the Frisco River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**HERNOSA, CAL.**—The Hernosa El. L. & Pwr. Co. is rapidly building a new electric light plant in Hernosa, Cal. The plant, which will be located on the Hernosa River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

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**LOS ANGELES, CAL.**—Plans have been submitted by the Pacific L. & Pwr. Co. for the construction of a new electric transmission line from Los Angeles to San Bernardino, a distance of about 100 miles.

**LOVELAND, CAL.**—The Loveland Electric Co. will begin work on construction of the Loveland and Loveland Electric Co. station about June 15. The plant will be the operation of 1000 hp of electricity and will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**PASADENA, CAL.**—The Pasadena El. L. & Pwr. Co. is rapidly building a new electric light plant in Pasadena, Cal. The plant, which will be located on the Pasadena River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

**SAN FRANCISCO, CAL.**—The San Francisco El. L. & Pwr. Co. is rapidly building a new electric light plant in San Francisco, Cal. The plant, which will be located on the San Francisco River, will have a generating plant of 1000 hp. The plant is being managed by J. H. Mack, president; G. G. Bushman, vice-president, and J. P. Thompson, secretary, treasurer and general manager.

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electricity for lamps and motors. Franchises have been granted the company in Downey, McCammon, Bancroft and Soda Springs to furnish electricity for lamps and motors. The company has taken over the power plant of the Telluride Pwr. Co., on the Bear River, and will construct a power plant at The Narrows.

**TWIN FALLS, IDAHO.**—The City Council has granted the Beaver River Pwr. Co., of Boise, a franchise to furnish electricity for lamps and motors in Twin Falls.

**PHOENIX, ARIZ.**—The Smith's Milling Co. is planning for the installation of an electrically operated gold-recovery plant on the Hassayampa to recover gold from the Vulture tailings there.

**ST. JOHNS, ARIZ.**—Plans are being considered by the St. Johns El. & Pwr. Co. and the Nebo Lt. & Pwr. Co. for the construction of hydro-electric plants near St. Johns for the purpose of supplying electricity for lamps and motors in St. Johns and for operating irrigation pumping plants and other industrial plants in this vicinity.

**LIBBY, MONT.**—The Libby Wtr., El. Lt. & Pwr. Co. proposes to make improvements to its system this year, to cost about \$7,000.

**BOULDER, COL.**—The Northern Colorado Pwr. Co., of Boulder, has submitted a proposition to the City Council offering to install nearly 900 tungsten lamps, at practically the same cost per annum as the present street-lighting system, under a ten-year contract. The plans provide for the erection of ornamental lamp standards. The cost of the system is estimated at \$20,000. H. U. Wallace is vice-president and general manager.

**GRAND JUNCTION, COL.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 24 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Grand Junction, Col. Drawings and specifications may be obtained at the above office or from the custodian of site at Grand Junction. O. Wenderoth is supervising architect.

**LA JARA, COL.**—The La Jara Creamery & El. Co. expects to purchase within the next three months several small transformers and about 50 wattmeters. G. E. Miles is manager.

**LEADVILLE, COL.**—The property of the Leadville Lt. & Pwr. Co. was purchased and the operation of the plant taken over by the Colorado Pwr. Co. on April 2, 1913. D. E. Houston is treasurer.

**ELKO, NEV.**—The Elko-Lamoille Pwr. Co. has purchased the property of the Elko Lt. & Wtr. Corp. and will take possession of the plant about July 1. The Elko-Lamoille Pwr. Co. is building a 400-kw hydroelectric power plant at Lamoille, utilizing the water-power of Lamoille Creek. Both plants will be operated together to supply electricity in Elko County. The new company also plans to develop irrigation projects along its lines. B. G. McBride is manager of the company. Prof. J. G. Scrugham, of the State University, and F. O. Brolli, of Reno, are engineers in charge of constructing the new plant and remodeling the old plant at Elko.

**SANTA ROSA, N. M.**—The construction of an electric-light plant near Santa Rosa is being promoted by C. R. Jones, who holds options on the Santa Rosa Rio River near here. The plans provide for a power transmission system.

## Canada

**KAMLOOPS, B. C.**—Bids will be received by J. J. Carment, city clerk, until June 12 for furnishing hydroelectric machinery for the new municipal power plant in Kamloops. Plans may be obtained from the city clerk or from Dutter, Du Cane & Co., consulting engineers, Rogers Building, Vancouver.

**MIRROR LAKE, B. C.**—The Mirror Lake El. Lt. Co. has applied to the provincial authorities for a license to use 100 miners' in. of water of Bjerkness Creek, which empties into Kootenay Lake near Mirror Lake. The water will be diverted about 1500 ft. from the mouth of the creek above the falls and will be utilized to generate electricity to be distributed in the adjacent district.

**PORT ALBERNI, B. C.**—Preliminary surveys are being made for the proposed power plant at Stamp Falls, near Port Alberni. The initial installation will provide for the development of 750 hp. R. C. McNaught, engineer of the Ritchie-Agnew Pwr. Co., has charge of the work.

**LINDEN, N. S.**—An electric plant, it is reported, will be installed at this place. Parties interested in the proposition own coal mines in this district.

**NIAGARA FALLS, ONT.**—The Canadian Pwr. Co. contemplates extending its transmission lines to Ridgeway and Crystal Beach.

**TORONTO, ONT.**—Bids will be received by the Department of Public Works of Ontario, Toronto, until May 23, for electric wiring of the new government house at Rosedale, Toronto; for alterations to boiler house and steam plant at the institution for the deaf and dumb, Belleville, and the institution for the blind, Brantford; also for steam heating and plumbing in the Field Husbandry Building, Ontario Agricultural College, Guelph. Plans and specifications can be seen at the above institutions and at the above department. H. F. McNaughton is secretary.

**MONTREAL, QUE.**—The Board of Control has accepted the tender of G. M. Gest, of New York, N. Y., and Montreal, for construction of underground conduits on St. Catherine Street, from Papineau to Guy Street, at \$271,000.

## Miscellaneous

**PEARL HARBOR, HAWAII.**—Bids will be received at the Bureau of Supplies and Accounts, Washington, D. C., until June 3 for furnishing at the naval station at Pearl Harbor, Hawaii, the following supplies: Schedule 5426—One pillar electric crane. Schedule 5413—Electroplating plant, one hydraulic forging press. Schedule 5423—One wall crane, etc. Applications for proposals should give the schedule desired by number. T. J. C. Cowie is paymaster-general.

**PANAMA.**—The Panama Tramway Co. contemplates the construction of a new power plant with an output of 1200 kw, which probably will be equipped with Diesel oil engines. The Canal Commission is erecting a transmission line from the Miraflores power plant to Panama. The tramway company will sell electricity for commercial purposes.

## New Industrial Companies

**THE AMERICAN GAS ENGINE COMPANY** has filed articles of incorporation under the laws of the State of Delaware with a capital stock of \$500,000. The incorporators are: J. E. Burmeister, A. Clifford and C. A. McCune, of Davenport, Ia.

**THE BROWN-GATES COMPANY**, of Springfield, Mass., has been incorporated by H. C. Brown, M. A. Drennan, of Springfield, and P. S. Gates, of Longmeadow. The company is capitalized at \$50,000 and proposes to manufacture and deal in electrical appliances.

**THE ELECTRIC NAIL COMPANY**, of Battle Creek, Mich., has been incorporated with a capital stock of \$31,000 by T. N. Vaughn, Howard Wattles, W. T. Truax and E. C. Lewis. The company proposes to manufacture an electrically welded roofing nail. Plans have been prepared for construction of a factory, to cost about \$20,000.

**THE ELECTRIC VEHICLE SERVICE COMPANY**, of Chicago, Ill., has been incorporated by George C. Tripp, Francis E. Ingalls and H. J. Murphy. The company is capitalized at \$20,000 and proposes to manufacture, repair and rent automobiles.

**THE ELECTRIC WATER HEATER COMPANY**, of Los Angeles, Cal., has been incorporated with a capital stock of \$10,000 by C. S. McLaury, A. R. Carney and C. B. Morganthaler.

**THE GARRETT-TILLEY COMPANY**, of New York, N. Y., has been incorporated with a capital stock of \$10,000 to deal in furnaces, oil, gas and electrical appliances. The incorporators are: Frank S. Garrett, Edwin F. Tilley, Jr., and W. Williams, 37 Liberty Street, New York, N. Y.

**THE LA SALLE LIGHT COMPANY**, of Chicago, Ill., has been incorporated with a capital stock of \$10,000 by Andrew G. Anderson, G. S. Anderson and Karl C. Loeher. The company proposes to manufacture and deal in electrical supplies.

**THE LINEBERGER ELECTRICAL APPLIANCE COMPANY**, of Gastonia, N. C., has been incorporated by L. T. Lineberger, J. W. Wilkins and R. L. Babington. The company is capitalized at \$10,000 and proposes to manufacture and deal in electrical appliances.

**THE LONG DISTANCE TELEPHONE EQUIPMENT COMPANY**, of Seattle, Wash., has been incorporated with a capital stock of \$300,000 by Oscar Mercer, J. Linn Criswell and others.

**THE MCKERVEY-EWING ELECTRICAL COMPANY**, of Wheeling, W. Va., has been chartered with a capital stock of \$5,000 to deal in electrical supplies. The incorporators are: Robert L. McKervery, Robert B. Ewing, Edmond P. Hunter and others.

**THE S. & K. MANUFACTURING COMPANY, INC.**, of Brooklyn, N. Y., has been incorporated with a capital stock of \$10,000 to manufacture motors, engines and machines. The incorporators are: Harry Stauder, Francis J. Hill and Stephen Koefie, all of 253 Starr Street, Brooklyn.

**THE PAGE ELECTRIC STARTER COMPANY**, of Indianapolis, Ind., has been incorporated with a capital stock of \$10,000 to manufacture starting means for internal combustion engines. The directors are: Carl M. Page, Leon T. Leach and A. C. Wells.

**THE SPECIALTY INSULATION MANUFACTURING COMPANY**, of Hoosick Falls, N. Y., has been chartered with a capital stock of \$30,000 to manufacture insulation material, etc. The incorporators are: M. Casey, W. P. Wood, of Pittsfield, Mass., and C. Bacholts, of Hoosick Falls.

**THE TAMPA ELECTRICAL SUPPLY COMPANY**, of Tampa, Fla., has been incorporated with a capital stock of \$10,000. The officers are: William Hunter, president; W. S. Monroe, vice-president; C. F. McCullum, secretary, and Joseph A. Saverese, treasurer.

## New Incorporations

**LOS ANGELES, CAL.**—The Pacific States El. Co. has been incorporated with a capital stock of \$500,000 by W. L. Goodwin, J. C. Gibson, J. S. Eells and Frank Fodden.

**DENVER, COL.**—The National El. Co. has been incorporated with a capital stock of \$1,000,000 by H. C. Allen, S. D. Crump and A. E. Chapman. The company proposes to engage in a general electric business in Denver.



**SPRINGFIELD, ILL.**—The Logan County Gas Co. has filed articles of incorporation with a capital stock of \$266,000 for the purpose of furnishing gas and electricity. The incorporators are: C. E. Smith, C. S. Morgan and H. S. Martin.

**INDIANAPOLIS, IND.**—The West Indiana Utilities Co. has been granted a charter with a capital stock of \$125,000 to supply water, light, heat and power to a number of small towns. The directors are: James H. Drew, Edward G. Hendrickson, Edgar L. Kline, John W. Twitley and Frank M. Thompson.

**WABASH, IND.**—The Wabash Valley Utilities Co. has been incorporated with a capital stock of \$10,000 to do a general utilities business. The incorporators are: H. E. Vordermark, Frederick H. Schmidt, O. H. Lindenberg, Leland Wilkins and W. H. Snyder.

**WEST BADEN, IND.**—The West Baden Wtr., Lt. & Pwr. Co. has been incorporated with a capital stock of \$75,000 to furnish water, light and power by H. Ballard, N. Ballard and M. B. Ballard.

**WEST LEBANON, IND.**—The West Lebanon El. Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of \$10,000. The directors are: William A. Hunter, Frank Burger, Charles Ames, Ross Ruppel and Isaac Hall.

**PORTLAND, MAINE.**—The Dallas El. Co. has been incorporated under the laws of the State of Maine with a capital stock of \$1,000,000 to do a general lighting, heating, steamboiling business, etc. The officers are: William E. Tucker, of Chelsea, Mass., president; John H. Brown, of Portland, treasurer; and David W. Snow, of Portland, clerk.

**PORTALES, N. M.** The Portales Pwr. & Irrigation Co. and the Portales Utilities Co. have been organized by A. A. Rogers, S. F. Ward and M. V. Peaslee, the former with a capital stock of \$100,000 and the latter with capital stock of \$717,000. The Portales Pwr. & Irrigation Co. owns the large central power station and system of transmission lines which furnish electricity for operating many irrigation pumping plants in this section. The Portales Utilities Co. has taken over the public utility plants and system in this town. The transmission system will be extended and improvements made to the local plants.

**BINGHAMTON, N. Y.**—The Afton-Windsor Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of \$5,000 by C. Fred Wright, of Susquehanna, W. E. Bennett and Frank J. Mangum, both of Lanesboro, Pa.

**MCCURTAIN, OKLA.** The Twin City Tr. Lt. & Pwr. Co. has been incorporated with a capital stock of \$5,000 by W. W. Bessley, Jr., of Bokoshe, J. M. Bessley, B. A. Little and J. N. Fasler, of Cham-Mo, Okla.

**HARRISBURG, PA.**—The State Department has granted licenses to 14 electric companies to operate in Bucks County. Each company is capitalized at \$5,000 and takes its name from the place in which it is to operate, as follows: Borough of Bristol Lt. Co., Doylestown Lt. Co., Buckingham Lt. Co., Borough of Bristol Lt. Co., Doylestown Lt. Co., Falls Lt. Co., Lower Makefield Lt. Co., Upper Makefield Lt. Co., Morrisville Lt. Co., Newtown Lt. Co., New Hope Lt. Co., Solebury Lt. Co., Taylorsville Lt. Co., Wrightstown Lt. Co. and Yardley Lt. Co. The incorporators are: W. Fred Wright, John Barbee, S. L. Wright, W. I. Babin, and W. Roywood Wright, all of Philadelphia, and Frank Battles, of Newtown Square. The offices of the companies will be in Philadelphia.

**VELASCO, TEX.**—The Velasco Pwr. Co. has been organized with a capital stock of \$20,000 for the purpose of installing a coal-burning plant, cotton gin and electric light and ice plants.

## Trade Publications

**GRAPHITE.**—A booklet entitled "Graphite for the Boiler" has been issued by the Joseph Dixon Crucible Company, Jersey City, N. J., which tells briefly how Dixon's boiler graphite does its work.

**TELEPHONE ACCESSORIES.**—Telephone holders and accessories made by the K & B Company, Eighth and Chestnut Streets, Philadelphia, Pa., are illustrated in a booklet recently distributed by the company.

**SPRINKLERS.**—The Grinnell Automatic Sprinkler Bulletin for April is replete with information and statistics referring to fires. A number of striking illustrations add to the effective text. A record of fires in buildings where the Grinnell sprinklers were installed shows a remarkably low fire loss where this apparatus was in operation. Many machines and other industries are represented in the list. The bulletin is issued by the General Fire Extinguisher Company, 1 Liberty Street, New York.

**FANS.**—The President Electric Company, with its plant and office at 125 Avenue of the Arts, an extensive manufacturer of electric fans, the most different types of fans made for the domestic and industrial use, described.

**SIX-TAMPERS.**—The most recent model of the Six-Tampers Electric Company, 116 Avenue Street, New York, the "Six-Tampers" electric fan, and which are described, has been described with its characteristic of local distributing curves secured during recent tests.

**THE INDUSTRIAL FAN.**—The new industrial "Six-Tampers" electric fan, described in the Electrical Engineering and Maintenance, the Industrial Fan, has been described with its characteristic of local distributing curves. The fan is described with its characteristic of local distributing curves secured during recent tests.

**INSULATING VARNISHES.**—The new insulating varnishes, described in the Electrical Engineering and Maintenance, the Industrial Fan, has been described with its characteristic of local distributing curves. The fan is described with its characteristic of local distributing curves secured during recent tests.

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## Business Notes

**THE PHILADELPHIA JOURNAL OF ELECTRICITY.**—The Philadelphia Journal of Electricity, published by the Philadelphia Electric Company, is a monthly publication. It contains a list of the companies and their products, and a list of the companies and their products. It is a valuable source of information for the electrical industry.

**THE CONTINENTAL ELECTRIC COMPANY.**—The Continental Electric Company, of New York, is a manufacturer of electrical equipment. It has a large stock of electrical equipment, and is a valuable source of information for the electrical industry.

**THE LARSEN ELECTRIC COMPANY.**—The Larsen Electric Company, of New York, is a manufacturer of electrical equipment. It has a large stock of electrical equipment, and is a valuable source of information for the electrical industry.

# Weekly Record of Electrical Patents

UNITED STATES PATENT OFFICE, ISSUED MAY 6, 1913

[Prepared by Robert Starr Allen, 16 Exchange Place, New York.]  
1,060,576. KEY CONSTRUCTION AND SUPPORT FOR TELEPHONIC APPARATUS. W. P. Anderson, J. Low, and H. W. Hall, Jamaica, N. Y. App. filed March 15, 1912. One-piece frame of channel form with a ledge, pivoted keys projecting down into the channel below the ledge and spring blades supported on the ledge and engaged by the keys.

1,060,577. APPARATUS FOR TRANSMITTING TELEPHONIC SIGNALS. P. J. Allen, New York. App. filed March 15, 1912. One-piece frame of channel form with a ledge, pivoted keys projecting down into the channel below the ledge and spring blades supported on the ledge and engaged by the keys.



- engaged by armature and a ground contact plate engaged by armature when it is attracted by magnet.
- 1,060,400. **CONDUCTOR**; B. G. Jamieson and C. A. Keller, Chicago, Ill. App. filed June 28, 1910. For "concentric cables;" outer conductor is held between movable clamping members which are concentric to the inner conductor.
- 1,060,617. **FUSE-HOLDING DEVICE**; T. E. Murray, New York, N. Y. App. filed Jan. 6, 1913. Block of insulating material having a projection of reduced thickness on one side and a recess on the opposite side, with a fuse strip doubled over the edge of the projection and having its ends entering the recess.
- 1,060,628. **ELECTRIC BELL**; C. M. Proctor, Detroit, Mich. App. filed April 29, 1912. Binding posts on opposite faces of the base of the bell so that circuit wires may be led to the front or the back of the bell.
- 1,060,651. **OZONE GENERATOR**; A. L. Van Patten, Los Angeles, Cal. App. filed Aug. 21, 1912. High-tension sparks are produced between the electrodes within a pump chamber.
- 1,060,700. **SWITCH**; G. E. Palmer, Hartford, Conn. App. filed July 6, 1911. Upon closing controlling circuit switch is closed and mechanically locked.
- 1,060,718. **ELECTRIC HEATER**; W. Stanley, Great Barrington, Mass. App. filed Sept. 7, 1912. Heat storage; mass of iron or other material of high thermal conductivity surrounded by heat insulation material on all but one side.
- 1,060,722. **COMMUTATOR**; W. G. Viall, Bridgeport, Conn. App. filed Aug. 12, 1912. Series of sheet-metal segments having their ends secured in slots in two end insulating disks.
- 1,060,724. **REVERSE-CURRENT RELAY**; E. B. Wedmore and W. P. Hamlyn, Rugby, Eng. App. filed June 6, 1910. Differentiating wound series and potential coils having common magnetic flux and two independent armatures controlling the circuit, responsive to the flux and one arranged to shunt the flux from the other.
- 1,060,731. **ALTERNATING-CURRENT MOTOR**; E. F. W. Alexander-Schenectady, N. Y. App. filed Oct. 19, 1911. With a single-phase source of supply uses a polyphase motor, a phase converter having its rotor loosely mounted on the motor shaft and a clutch for connecting the rotor to the shaft.
- 1,060,734. **LOCOMOTIVE TRUCK**; A. F. Batchelder, Schenectady, N. Y. App. filed Dec. 13, 1912. Armature fast on axles and the motor frames are integrally connected together so as to form a complete truck frame.
- 1,060,754. **PROJECTOR CONTROL**; J. L. Hall, Schenectady, N. Y. App. filed Sept. 19, 1912. Electric motor for training a searchlight projector; a controller for the motor operated by a synchronous pilot motor; manually operated commutating device controlling current in rotor of pilot motor and a commutating device operated by training motor and controlling current in stator of pilot motor.
- 1,060,757. **THERMAL CUT-OUT**; C. D. Haskins, Schenectady, N. Y. App. filed Sept. 19, 1912. Sheet of thin leaf-like metal rolled up with the convolutions out of contact and its ends connected in circuit.
- 1,060,760. **ELECTRIC SIGNALING APPARATUS AND CIRCUITS**; F. B. Herzog (deceased), New York, N. Y. App. filed July 5, 1889. Individualizer elements with electrically controllable responding signal-transmitting elements at two or more individualizable stations and connecting devices organized to control the signal transmission through the individualizer.
- 1,060,781. **AUTOMATIC ALARM AND SIGNAL DEVICE**; J. D. Nelson, Cincinnati, Ohio. App. filed Feb. 11, 1911. An oscillating switch delivers current to a relay circuit from a direct-current supply first in one direction and then the other.
- 1,060,822. **METHOD OF CONNECTING ELECTRIC WIRES TO LAMP HOLDERS, PLUGS AND THE LIKE**; A. T. Crosher, Te Aroha, New Zealand. App. filed Jan. 18, 1911. Strain-relief; wires passed through a central hole, then doubled back upward and brought down to the circuit terminals.
- 1,060,832. **STORAGE-BATTERY COMPOUND**; N. Fallek, Denver, Col. App. filed June 17, 1912. Sulphuric acid, asbestos, sodium silicate and water.
- 1,060,836. **BRAKE CONTROL FOR ELEVATORS**; E. L. Gale, Sr., Yonkers, N. Y. App. filed Dec. 23, 1909. By a system of reversing switches, discharge resistance, etc., brakes are first applied lightly and thereafter with full braking power and are applied extra hard when stop motion switch or automatic switch is opened.
- 1,060,839. **ELECTRIC FURNACE**; D. J. Hauss, Aurora, Ind. App. filed Sept. 8, 1911. Utilizes alternating current and direct current to fuse the material and the direct current between the anode and cathode to electrolyze the material and deposit one of its components at the cathode, and also to transfer the anode material to the cathode alloy it with the cathode deposit.
- 1,060,851. **PASSENGER-DRIVER TELEPHONE SIGNAL SYSTEM FOR VEHICLES**; H. G. Fape, Buffalo, N. Y. App. filed July 1, 1910. Telephone system in combination with a direct acoustical communication between passenger compartment and the driver's seat.
- 1,060,868. **ELECTRIC RESISTANCE FURNACE**; L. Ubbelohde, Karlsruhe, Germany. App. filed Dec. 22, 1911. Spiral wire surrounds central tubular non-conducting member; a layer of carbon surrounds the wire and tubular member, and a porous insulator consisting of ash, kaolin, alumina and water glass is interposed between central member and carbon in which the wire is embedded.
- 1,060,869. **PROCESS FOR THE EXTRACTION OF TARTARIC SALTS FROM WASTE TARTAROUS MATERIALS**; G. Vigneaux, Paris, France. App. filed May 31, 1912. Materials are treated with dilute mineral acid; solution so obtained is subjected to electrolysis, using electrodes of a metal which reacts to decompose the free acid of the solution, and the deposit of tartaric salts formed thereby is removed by filtration or decantation.
- 1,060,886. **INSULATOR**; J. E. Bicknell, Findlay, Ohio. App. filed Oct. 30, 1911. Consists of a plurality of duplicate sections having self-centering telescoping parts with a groove at the inner end of each section to co-operate with the telescoping part of the adjacent section to clamp a wire therebetween.
- 1,060,894. **DYNAMOMETER-WATTMETER**; M. Delivo-Dobrowsky, Wittenberg, Germany. App. filed Aug. 18, 1910. Two concentric magnetic cores, a movable coil between the cores, a stationary short-circuited coil in inductive relation to the movable coil and cores and a third coil in inductive relation to the short-circuited coil.
- 1,060,895. **MOTOR-STARTING AND PROTECTIVE DEVICE**; G. T. Egar and C. H. Williams, Ballston Spa and Schenectady, N. Y. App. filed July 9, 1910. Electromagnetic switches first connect the motor directly to the supply circuit and then to the supply circuit through fuses after a predetermined interval, and connections whereby opening of a fuse in one phase opens the circuit of another phase.
- 1,060,939. **AUTOMATIC TELEGRAPH TRANSMITTER**; L. M. Potts, Baltimore, Md. App. filed June 17, 1909. Uses prepared sending form with predetermined perforations, and the sending mechanism for effecting movement of the form is controlled automatically by the perforations in the form itself.
- 1,060,940. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; J. C. Reed, Steelton, Pa. App. filed June 4, 1912. Motor with series winding; a resistance is automatically connected in parallel with the armature when armature reaches a predetermined speed.
- 1,060,941. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; J. C. Reed, Steelton, Pa. App. filed Jan. 4, 1913. Means to supply current to rotor and stator series and means dependent upon speed of rotor to connect automatically the rotor and stator in parallel.
- 1,060,953. **ADAPTER FOR ELECTRIC LAMP SOCKETS**; G. I. Silbert, Chicago, Ill. App. filed August 25, 1910. Full-operated switch located in the body of the adapter.
- 1,060,957. **APPARATUS FOR PRODUCING ELECTRICAL DISCHARGES**; R. Spaulding, Chicago, Ill. App. filed June 27, 1910. Electrodes form independent transverse passages through which passages the air is forced.
- 1,060,978. **APPARATUS FOR IGNITING MINERS' SAFETY LAMPS**; E. A. Hailwood, Morley, England. App. filed Sept. 3, 1909. Generator or coil chamber to receive the lamp; the outer door may be closed and fastened and the igniting circuit be completed only when an inner circular door has been entirely closed.
- 1,060,989. **ELECTRIC TERMINAL**; F. W. Lyle, Lynn, Mass. App. filed Oct. 30, 1911. For an electrical resistance consisting largely of elemental boron, said terminal consisting of a metal of the chromium group in intimate conducting relation to the resistance.
- 1,060,991. **VARIABLE-RESISTANCE ELECTRIC-LAMP SWITCH**; F. C. Mapes and W. M. Owen, Chelsea, Mich. App. filed Aug. 21, 1912. A spiral switch element rotatable within a groove engages the turns of a coil wrapped about the insulating body and overlying the groove.
- 1,060,992. **HEATER FOR AUTOMOBILE RADIATORS**; L. H. Mayer, Johnston, Pa. App. filed July 29, 1912. Heater is secured directly to the front of the radiator; obliquely disposed ribs conduct heat from the electric heating element to the radiator.
- 1,061,016. **PROCESS OF MELTING FERRO-ALLOYS AND KEEPING THEM IN LIQUID STATE**; W. Schemmann and J. Bronn, Rombach, Germany. App. filed Dec. 30, 1912. Melts alloys by contact-resistance heating in contact with a secondary resistor heating, using a voltage drop between each of the movable block electrodes and the bath of molten material which is less than 30 volts.
- 1,061,055. **CONTROLLER REGULATOR**; C. P. Ebersole, Philadelphia, Pa. App. filed Dec. 30, 1911. Bolt is moved by cams into position for engaging stops to prevent the controller being turned on too rapidly and to permit it being cut off quickly.
- 1,061,089. **ELECTROLYTIC SOLUTION FOR CLEANING METALLIC ARTICLES**; A. Levy, Paris, France. App. filed Dec. 4, 1912. Prussiate of potash, caustic soda and chalk.
- 1,061,170. **ELECTRIC SOLDERING IRON**; F. M. Giffen, San Antonio, Tex. App. filed July 17, 1912. Has a receptacle for a bar of solder; electric heating element melts forward end of the bar and by moving contact member in contact with the solder out through an opening in the end of the copper-soldering point.
- 1,061,191. **ELECTRICAL CONTROLLING DEVICE**; H. W. Leonard, Bronxville, N. Y. App. filed June 25, 1904. Winding in a permanently closed circuit subjected to currents in opposite directions and controlled by variation in emf at terminals of translating device automatically controls rheostat to maintain desired constant emf on translating device.
- 1,061,192. **MEANS FOR CONTROLLING ELECTROMOTIVE FORCE**; H. W. Leonard, Bronxville, N. Y. App. filed Dec. 23, 1905. Two opposing electric motors in series across source control device for varying emf applied to a translating independently of change in emf of the source.
- 1,061,195. **METERING PANELBOARD**; A. C. McWilliams, Chicago, Ill. App. filed May 8, 1910. Parallel meter bars, a circuit bar, a bushing sliding in contact with the circuit bar, and a contact on the meter bars and a fuse plug screening into the bushing for connecting it to the connector.
- 1,061,225. **THERAPEUTIC DEVICE FOR UTILIZING RADIANT ENERGY**; S. A. Cunningham, New York, N. Y. App. filed Nov. 14, 1912. Transparent screen supported in a ventilated reflector is connected with the surface to be treated and the source of light is surrounded by a colored medium through which the light rays pass.
- 1,061,226. **SAFETY FUSE**; A. F. Daum, Pittsburgh, Pa. App. filed July 7, 1911. Ends of fuse wire are clamped between the heads and caps of the casing and at the same time the terminals are clamped to the caps.
- 1,061,227. **CARTRIDGE FUSE**; A. F. Daum, Pittsburgh, Pa. App. filed Jan. 26, 1912. Fuse strips extends about a screw stem and is clamped to the casing by the head of the screw.
- 1,061,228. **CARTRIDGE FUSE**; A. F. Daum, Pittsburgh, Pa. App. filed March 1, 1912. Ends of fuse strips clamped by interior movable washers against the end caps.
- 1,061,238. **TELEPHONE SIGNAL**; A. U. Gerber, Chicago, Ill. App. filed Feb. 19, 1912. Switch-operating means is locked against movement after a certain limited number of calls is registered.
- 1,061,251. **COMMUTATOR**; J. Burke, Erie, Pa. App. filed Dec. 21, 1906. A segment having an inner main portion containing iron and an outer part of copper serving as the trailing part of the segment, the trailing part enveloping the inner main part.

# Electrical World

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## Ignoring the Electric Vehicle

That the healthy co-operation between central stations and electric vehicle manufacturers during the past few years is bearing fruit in the accelerated use of not only the electric truck but also the electric pleasure vehicle was fully shown at the convention in Boston on May 20 and 21, as reported elsewhere in this issue. It is not too much to claim that a large part of the activity now found in the electric vehicle industry is attributable to the influence exerted by wide-awake central stations in making known to prospective vehicle users the convenience and reliability of the electric car, both by using this type of vehicle in their own service and in giving low rates for vehicle-battery charging. It is indeed unfortunate that this highly important branch of central-station activity is to be ignored at the forthcoming convention of the National Electric Light Association, the program of which contains no paper dealing with the electric vehicle, the storage battery or the attitude of central stations toward the vehicle-battery charging load, admitted to be of the most highly desirable character.

## Decreased Manufacturing Profits

The annual reports of the two great electrical manufacturing companies show that in so far as the sale of electrical apparatus is concerned the business secured during 1912 was larger than that of any other year in the history of either company. Nevertheless, the profits from the sales show a diminishing percentage, which the General Electric Company attributes to increased competition, but in what particular branch the company does not state. Suffice it to say that although the sales billed by this company in 1912 aggregated \$80,182,185, the profit from the sales was less than 10 per cent, or \$8,107,093; whereas in 1910, when the sales billed were a trifle over \$71,000,000, the profit was \$8,343,956, showing that although the sales increased more than \$18,000,000 in two years, the profits decreased approximately 2.5 per cent. In the case of the Westinghouse company, the sales billed last year were \$39,077,505, as compared with \$38,110,312 two years previously, and the profits were \$4,571,272 and \$4,608,701, respectively—an increase in sales of \$1,888,000 and a decrease in profits of approximately 3 per cent. Both of these companies do such a large proportion of the entire electrical business of the country that what is true of them is necessarily true of the industry as a whole. New developments requiring large machinery in which the percentage of profit might be larger than ordinary have not been many during the past few years, so that the business of both companies has been confined chiefly to the manufacture of smaller and standard machines, apparatus and general supplies. There is, of course, competition in these lines, but

we are of the opinion that the industry is probably attracted to a certain sort of production in its larger sort of labor and machinery rather than to something new. Moreover, it is more than likely that in future the percentage of profit will not show an increase, for in many other industries, the manufacturers of electrical apparatus will have to contend themselves with narrowed sales or smaller margins of profit.

## Preservation of Silvered Mirrors

In every photographic laboratory and in some of scientific researches or industrial plants, and the use of such mirrors requires regular attention in the routine of their use. In his article on page 154 for June, Will discuss the preservation of mirrors very thoroughly. A mirror is not generally known as being a not usually that the reflecting power of the silvering on the back of the glass is subject to some slight depreciation with time. It is a very commonly known and much resented characteristic of silvering exposed to air on the top of a glass surface to become tarnished with time, but that after the ordinary mirror has been carefully cleaned up, the glass surface there should be depreciation in the coated silver surface beneath seems an unreasonable handling. It would be interesting to know whether this is due to an additional coating by chemical oxygen or whether the effect is physical rather than chemical. The tarnishing of specula, for the better preservation of their reflective qualities, seems to be a simple and effective process.

## "White-Way" Lighting

It is impossible to consider the philosophy of the so-called "White-Way" lighting as a rather interesting situation disclosed itself. Such lighting was used in the main thorough thorough the initiative of the merchants in the principal business streets of the city, in connection with the purpose of obtaining such illumination as well as to make their business. This simply means that streets that figured in previous newspaper are not possibly limited by the municipality. If it is necessary to comprehend the point lighting as an important street scene, so to bring the illumination to the point of maximum efficiency for the money spent, then it is self-evident that as far as municipal effect is concerned the city has not done its duty in the economy in that particular region. Looking back a little farther, one comes upon upon the point which we have often mentioned in these columns, that the tastes of Americans in manipulating street lighting are too much inclined to a way of showing off or uniformity on the part of the municipal authorities. There is a fact associated that some street is as good as every other street, and as the latest street the city will do it.



able to afford are distributed with a wholly indiscriminate and moderately impartial hand over the entire territory to be lighted. The idea of uniformity, too, has often in the past, and frequently in the present, led to the adoption of a single type of lamp, generally the arc, all over the territory to be lighted. This necessitates spacing altogether too great for the illuminants used, with the result of producing dark holes all over the city, to be relieved only by private enterprise when suitable lighting becomes necessary in certain sections.

"White-way" lighting is admittedly expensive and is sometimes carried to an extent which would not ordinarily be justified in lighting at public expense. Notwithstanding this, it is certainly true that in many places the merchants have felt themselves driven to private lighting under circumstances that plainly demand an increase of public effort as well. Municipal authorities certainly owe it to their mercantile interests to provide proper illumination on business streets. Aside from general considerations, the merchants on such streets are important taxpayers, and on their activity the prosperity of the municipality as a whole largely depends. Fear of unwonted expense is undoubtedly the chief reason for hesitancy in public lighting on a brilliant scale, yet a few simple considerations, if followed out, would lead to a great betterment of present conditions and would provide good lighting without greater expense than a city owes its important streets.

In the first place, it is neither necessary nor desirable to use the same kind of lamps all over a city; both the spacing and the kind of illuminant should be adjusted to the requirements of the streets to be lighted. Secondly, it is unnecessary and sometimes undesirable to operate all the lamps all the time. Many business streets of great importance from the traffic standpoint in the early evening are practically deserted a few hours later and require only adequate lighting for police purposes. This condition is met in the ordinary "white-way" lighting by the extinguishment of the bright lights late in the evening, leaving only the municipal system in operation. There is not the slightest reason why, if economy is necessary, the public lighting suited to a busy street should not be reduced by using, say, only one-half of the lamps after midnight, when business is over and pedestrians few.

In many of the Continental cities the half-light half-night illumination scheme is now in use with highly satisfactory results. Indeed, frequently arc and incandescent lamps are installed on the same pole, the former for use during the period of bright illumination, the latter for the ordinary illumination of the deserted street. Efforts to economize in this country have usually been in the direction of the so-called moonlight schedule, which is neither one thing nor another, and is frequently inadequate. It would seem that the ultimate solution of the problem of good lighting would be to throw upon the municipality the whole burden of suitable lighting of the streets for the purposes of their use, and that even now under ordinary circumstances the city and merchants should join hands for proper illumination, instead of leaving the whole burden, as is too often the case at present, on enterprising merchants or civic organizations.

## The Theoretical Basis of the Multiple-Rate System

The basis of rates for supplying electrical energy to consumers in electric service systems is of great practical importance to the corporation producing the energy, to the consumers utilizing it and to the whole community in which the service is rendered. If the rate is unfair in the direction of insufficiency the corporation is the first to suffer, but ultimately all parties suffer, because the community which has saved the capital invested in the plant cannot receive adequate compensation for this service. The plant languishes and renders inadequate service. The ill effects are shared by the public at large. If the rate is unfair in the direction of excess the consumers are the first to suffer, but ultimately all parties suffer by reason of non-expansion and discontent. Only when the rates are fair to all parties can all parties share in the benefits of the industry. A rate may be admitted to be substantially fair and yet be open to other objections. It may be unnecessarily complicated, it may be crude and unscientific, or it may be open to ambiguity and dispute. An ideal rate would be fair to all parties, easy to understand and to reckon, rationally and logically constructed, and reasonably free from misunderstanding.

In the earliest days of electric public service many contracts were made on a monthly rate per lamp installed, and no meters were used. This method of establishing rates has generally met with disfavor. It encourages extravagance and tends to tax the more thrifty consumers for the carelessness of the less thrifty. The next step was to introduce the electric meter and to make a constant rate of so much per kilowatt-hour consumed. This was a simple arrangement, but it was unfair to large users as well as to off-peak users. The next step was a multiple rate effected by a discount, or series of increasing discounts, on extended consumption. Another step in the direction of equity was the constant charge, or the minimum monthly bill. Yet another step was the introduction of the maximum-demand meter in addition to the total-energy meter.

It is well recognized that a rate should depend both on the energy consumption and on the maximum demand, since energy produced and sold during peak hours costs the producer much more than energy sold during off-peak hours. Opinions differ, however, as to the best method of establishing a rate with respect both to energy and maximum demand. Various ways have been suggested or tried for combining these two measurable quantities into the rate for direct-current service. In alternating-current service a further complexity is introduced by the consumption of reactive power.

In the case of direct-current service Mr. Hugo E. Eisenmenger has shown that the monthly bill of a consumer may always be referred to a point on the surface of a three-dimensional model, consisting of a truncated rectangular prism, resting on a horizontal rectangular base, the generating lines of which may be taken as the Y and Z axes. Distances along the Y axis correspond to maximum demand. Distances along the Z axis correspond to the monthly consumption of energy, and heights above the basis, or along the X co-ordinate, correspond to the monthly bill. The shape of the broken or truncated upper surface of the prism



shows at a glance, in a comprehensive manner, how the monthly bill depends on the rate established. In general, the broken surface will not be smooth but will contain a number of sharp ridges and furrows, which mark the points at which a discontinuity or discount occurs in the rate. It is by means of a comparison of such models, properly prepared to represent different rates, that the relative effects of such rates can be most easily apprehended. Mr. Eisenmenger's article in this number is a plea for solid rates and an interesting interpretation of rate bills expressed in terms of solid geometry. Propositions which are by no means self-evident when discussing the mere arithmetic of rates become salient when translated into solid geometry. In the absence of three dimensional models, perhaps the next best presentation of bill amounts in terms of Y and Z would be in two dimensions, on a chart of squared paper, ruled to Y and Z, with contour lines in X marked thereon in another color. Some of the advantages of Mr. Eisenmenger's models would, however, be missing in such charts.

### Progress of High-Tension Cables

A paper by Dr. Lichtenstein, briefly referred to in the *Digest* this week, gives an account of recent advances in the manufacture of high-tension cables abroad, and in particular presents some details of recent work in producing and testing cables for extremely high tension. In this country practice in this direction is limited not by the skill of the manufacturer but by the demand, since we consistently shun the use of high-tension cables whenever it can be avoided. Dr. Lichtenstein declines to play the rôle of a prophet in saying what may be done in the manufacture of cables for extremely high pressures. He does, however, after noting the fact that three phase cables up to 30,000 volts and single-phase cables up to 60,000 volts are regularly in successful use, unhesitatingly venture the opinion that the three-phase construction can be comfortably carried up to at least 40,000 volts and the single phase construction up to 80,000 without difficulty, although such cables are not now manufactured, and inferentially leaves a very strong impression that much higher pressures even than these are entirely within the range of probability.

The *Elektrotechnische Zeitschrift* and *La Revue Electrique* have both published recent articles on some successful trials of very high-tension underground cable in Germany, at Dessau-Bitterfeld. The cables referred to are each 4.3 km long and are operated at an effective single-phase pressure of 60 kv between wires, or 30 kv between the conductor and grounded sheath of each cable. The frequency is low, being only 17 cycles per second. It is stated that these cables have been in steady operation since April, 1911. They are of the lead-covered Siemens-Schuckert subterranean type, in side by side conduits, 0.8 m below the ground surface. The insulator is impregnated paper, ungraded, and 13 mm in radial wall thickness. The nominal gradient of potential in the dielectric is thus  $30/13 = 2.3$  kv per mm; but the curvature of the wall makes the actual maximum gradient 4.2 kv per mm at the surface of the conductor. Of course, a frequency so low as 17 cycles per second is very helpful in reducing

the charging current and reactive power absorbed by the cable. On the other hand, it is not new for fluorescent lighting and for the poor output of transformers. It becomes increasingly evident that, whatever success can be and has been obtained with very high voltages in buried lines in sparsely settled districts, buried cables are necessary in suburban and thickly settled districts. Energy transmission is then limited in range by the economic voltage which the cables will withstand.

The tests made on three phase cables certainly indicate that the art of insulation has some visible advances. For example, a three-phase cable with ground insulation between wire and wire, and wire and sheath, was recently tested at 200,000 volts with no failure or burn for fifteen minutes without a pause. The same cable was also held for a minute at 270,000 volts and for a few minutes even at 310,000 volts without pause. The cable being nominally for use at 30,000 volts, it would be fair to set the factor of safety at about seven, which is exactly all that anybody could reasonably ask. The ordinary engineering requirements for factor of safety in the insulation do not exceed three. A thorough test at double the working voltage gives a fairly satisfactory trial of the cable for all ordinary purposes. Of course, the real question in prescribing a test is to try out the cable under conditions nearly the maximum voltage to which it is likely to be subjected, including such proper allowances for resonance and surges as the conditions of use would indicate. One must therefore admit that the severity of a test should depend not only on the working voltage but the nature of the service for which the cable is to be employed.

In this connection Dr. Lichtenstein refers to the very beautiful direct current high voltage testing equipment which is practically an enormously high-tension commutator synchronized with the current stepped up from its connected generator. By means of this apparatus it is possible to obtain direct current for testing at 50,000 to 100,000 volts. The obvious advantage of such a testing set is that it enables cables to be tested at close by a conveniently portable apparatus without having to deal with the very formidable charging-current phenomena connected with high voltage. It also makes possible, without leaving the voltage anywhere near its limit, to put the insulation of cable to place at somewhere near the working pressure. It is altogether probable that some time will elapse before such more valuable information regarding the condition of the cable than the ordinary tests now have a few per cent of the sort of voltage. Of course, the latter-day test apparatus involves the unknown resistance between the endurance of a cable under alternating and under direct current. That the latter is most exact on the cable than the former is well known. The difference between the two is sometimes as high as three to one, which is probably in excess of the truth. There is a liability, we think, in the use of very high insurmountable values in producing graded quasi-electrostatic effects on the insulation which have not yet been sufficiently given account of in the comparison. At all events, the electrostatic paper makes it perfectly clear that more consideration is now well in demand of the present requirements of American practice.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### N. E. L. A. Convention Preparations

Advance registrations for the annual convention of the National Electric Light Association to be held in Medinah Temple, Cass and Ohio Streets, Chicago, June 2-6, are coming in rapidly and a very large attendance is assured. Present indications are that the number attending the convention will be about 6000.

Nearly all the space in the basement of the Temple has been sold to Class D members for exhibits of electrical apparatus. Original and beautiful illuminating effects are planned for the exhibit hall. The Commercial Section will hold its meetings in a large tent in the rear of the Temple, and this will be handsomely decorated and effectively illuminated. The tent will cover a ground area of 50 ft. by 80 ft. and will provide sittings for about 700 persons.

Subject to change, the general program of entertainments has been planned by the local convention committee, of which Mr. Samuel Insull is chairman. The opening of the exhibition will take place at 8 p.m. on Monday, June 2. There will be a reception in the main auditorium of Medinah Temple followed by dancing. On Tuesday afternoon, beginning at 3 p.m., there will be a musicale in the ballroom of the Blackstone Hall, at Michigan Avenue and Hubbard Place. Grand-opera artists will provide the singing and instrumental music on this occasion. This feature is for visiting ladies only. A vaudeville entertainment will be provided for all convention visitors on Tuesday evening in the main auditorium of Medinah Temple.

For Wednesday afternoon a number of industrial excursions are planned. One will be to the Hawthorne works of the Western Electric Company and another to the North-west generating station of the Commonwealth Edison Company. At the latter place there are extensive recreation grounds, and one of the features of the convention will be a baseball game between the "East" and the "West" on these grounds on Wednesday afternoon. For the ladies' entertainment on Wednesday afternoon there will be a matinee party at the Auditorium Theater to witness the pageant entitled "Darkness and Light." In connection with this the ladies will be given an opportunity to witness the spectacle and exposition in the Coliseum known as "The World in Chicago."

Other optional industrial excursions are planned for Wednesday afternoon. One is a visit to the Chicago Drainage Canal, with its hydroelectric development, at the invitation of the Sanitary District of Chicago. Another is a trip to Gary, Ind., to inspect the great steel works of the Indiana Steel Company with their interesting gas-engine and electrical equipment. A third available trip is to the Union Stock Yards, and still another is to "Underground Chicago," the unique network of tunnels underlying the central portion of Chicago and provided with electrically operated freight tramways.

For visiting ladies only there is provided on Thursday what should prove to be a very enjoyable outing. Leaving the Art Institute at Michigan Avenue and East Adams Street at 10:30 a.m., the ladies will be taken for a 50-mile automobile trip. The party will proceed through Lincoln Park, Sheridan Road and the beautiful North Shore suburbs to Highland Park. Here, at the Moraine Hotel, a luncheon will be served. The return will be made in the

same manner in the afternoon, the ladies being taken by automobiles to their respective hotels, which will be reached about 5:30 p.m.

On Thursday evening will take place the great Jovian rejuvenation in the ballroom at White City, a large amusement park at East Sixty-third Street and South Park Avenue. A joviation will follow the rejuvenation, and it is expected that about 1500 Jovians will be present.

### Pittsburgh Convention I. E. S.

At a meeting of the convention committee of the Illuminating Engineering Society held in Pittsburgh on May 16 it was decided to hold the next annual convention of the society in that city during the week beginning Sept. 22. In addition to the regular technical sessions there will be a reception and dance and several excursions to points of interest in Pittsburgh. Prof. H. S. Hower, of the Carnegie Technical Schools, is chairman of the Pittsburgh Section, I. E. S. The chairman of the local committee on arrangements is Mr. W. A. Donkin, of the Duquesne Light Company; Mr. J. C. McQuiston, of the Westinghouse Electric & Manufacturing Company, is chairman of the publicity committee. The president of the society is Mr. P. S. Millar, Electrical Testing Laboratories, New York, and the secretary is Mr. Joseph D. Israel, of the Philadelphia Electric Company.

### National Committee on Electrolysis

The joint national committee on electrolysis will meet for the first time at the headquarters of the American Institute of Electrical Engineers in the Engineering Societies Building, New York, on Tuesday, May 27, at 3 p.m. The committee will consider the subject of electrolysis broadly and if possible agree upon some basic principles or method of procedure to be followed in the case of electrolytic dispute. The American Electric Railway Association, the American Railway Engineering Association, the National Electric Light Association, the American Telephone & Telegraph Company and the American Institute of Electrical Engineers have each appointed three representatives, and it is expected that the representatives of the American Water Works Association, the Natural Gas Association of America and the American Gas Institute will be announced shortly. It is the purpose to organize the committee at the first meeting and to outline some definite plan of action. The delegates appointed by each of the national bodies invited to participate in the conference are as follows: American Electric Railway Association—Mr. R. P. Stevens, Lehigh Valley Transit Company, Allentown, Pa.; Prof. A. S. Richey, Worcester Polytechnic Institute, Worcester, Mass.; Mr. Calvert Townley, Westinghouse Electric & Manufacturing Company, New York. American Railway Engineering Association—Mr. E. B. Katté, New York Central & Hudson River Railroad Company, New York; Mr. D. J. Brumley, Illinois Central Railroad Company, Chicago, Ill.; Mr. W. I. Trench, Baltimore & Ohio Railroad Company, Baltimore, Md. National Electric Light Association—Mr. Philip Torchio, New York Edison Company; Mr. L. L. Elden, Edison Electric Illuminating Company of







a poorer grade of coal can be economically used by the central station than by the steam locomotive and that this circumstance favors electric operation.

#### TRUNK-LINE ELECTRIFICATION

Mr. Kahler introduced his paper with the statement that it had as far as possible been arranged so as to be intelligible to railway men, as it was to that class he wished particularly to appeal. The extremely large initial investment necessary for the electrification of steam roads has been one of the obstacles in the path of a general movement in that direction. Most of the work that has been done along that line so far has been due to the fact that on the sections in question there are conditions to be met that absolutely preclude steam operation. Nevertheless, observation and comparison of these electrically operated sections with known characteristics of steam operation have revealed many advantages for the former system. Mr. Kahler's paper was a detailed investigation of these factors. The effects of physical (or topographical) characteristics and class of locomotive on the operating expenses were first discussed, and following that the process by which certain classes of passenger and freight traffic have already been largely taken from the steam roads by electric lines. A proposed railway system was then laid out, traffic conditions and physical characteristics were indicated, and a comparison was made of estimates as to the relative equipment and operating costs of electric and steam locomotive haulage. Single-phase operation was assumed, energy being supplied from parallel 60-cycle and 15-cycle transmission lines with frequency changers interposed. The comparison was made on the basis of the standard account items required by the Interstate Commerce Commission and was supplemented by numerous tables of operating costs. Assuming that energy was purchased from a central station at an attractive rate, the summation and comparison of these estimated costs showed that, while the initial expense of electrifying the hypothetical system would be large, the annual saving over steam operation accomplished thereby would be from 9 to 11 per cent of the necessary investment. Another conclusion reached was that by reason of the better overload characteristics of the electric locomotives they can be operated to advantage over heavier and longer grades than can steam locomotives, so that the expense of grade reduction can be eliminated. Finally, Mr. Kahler thought that by proper co-operation between railroads and central stations in the building of transmission lines along railway rights-of-way mutual advantages would accrue, because it would allow of the development of hydroelectric sites that would not be otherwise commercially possible and would at the same time afford a ready source of supply when the time comes that electrification is necessary.

#### Discussion

In opening the discussion Mr. Sprague said that it was a significant fact that two investigators, working independently and advocating different systems of operation, should arrive at practically the same conclusions as to the economy of electrification of steam roads and under conditions hitherto held to prohibit economical electric operation. He thought it also worthy of note that both papers advocated the purchase, rather than the generation, of electrical energy. The system advocated and assumptions made in Mr. Hobart's paper he considered the safer and more practical, and in his opinion the operation of parallel 60-cycle and 15-cycle transmission lines, with frequency changers interposed, was impracticable and would introduce sufficient extra running equipment to rob the single-phase operation of one of its principal claims, that of simplicity. He closed by saying that the optimism shown in the two papers was justified by his own observation and experience.

Mr. A. H. Armstrong, of the General Electric Company, expressed the opinion that in planning the electrification of

steam roads the requirements of the future should receive careful consideration and the system installed should be able to expand to meet the future demands. He admitted that on traffic of low density the single-phase alternating-current operation possesses some advantages, but thought that for heavy or medium traffic conditions direct-current operation is essentially better. However, he said that, whichever system is adopted, it will probably have little effect on the type of motor used, since the development of the steel-container mercury-arc rectifier has advanced to a stage where it is capable of handling heavy loads. By installing such rectifiers, either directly on the electric locomotives or in substations, he thought that at an early date the advantages of alternating-current transmission and of direct-current drive can be combined so as to make electrification still more attractive. In closing he said that the General Electric Company had recently made tests on a locomotive using a 1000-kw mercury-arc rectifier with very satisfactory results. Moreover, the 2400-volt system proposed by Mr. Hobart does not represent the practical limit of direct-current operation, because 5000 volts has been used satisfactorily.

Mr. F. E. Wynne, of the Westinghouse Electric & Manufacturing Company, championed Mr. Kahler's solution of the problem. He introduced several charts showing in graphic form the results obtained in the second paper, and he expressed the opinion that the paper's chief value lay in the fact that it pointed the correct way to attack the problem of comparing costs of electric versus steam operation. After discussing several of the tables in Mr. Kahler's paper he turned to the question of direct-current operation. Mr. Hobart's paper, he thought, was an excellent academic treatment of the subject, but in his estimation the assumptions made in it were not in line with actual practice in steam or electric railway operation. In particular, he thought, an operating voltage of 2400 much too low for handling heavy traffic effectively.

Mr. W. S. Murray expressed the opinion that future improvements in steam-locomotive operation might have a large bearing on the subject and might make electrification seem less advisable than at present. He thought that the limitations of steam operation had not yet been reached, and that oil-burning or automatic stoking might be developed in the future to keep pace with electric locomotive progress.

#### Boston Edison Service Annuities

Extending a carefully planned welfare program begun about a year ago, the Edison Electric Illuminating Company of Boston placed in effect on May 1 a system of service annuities which represents an advanced method of dealing with the retirement problem and insures unusually liberal compensation to employees of long standing and good records. The plan comprises several distinct improvements over any known pension system in use at present by a public-service corporation. Retirement under the provisions of the system is not compulsory; the rates of payment are exceptionally high; close articulation is provided with the existing system of disability payments in the company; no maximum limit is placed on the amount of the annuity; the payments are non-contributory from the employee's standpoint, and death benefits are protected. Another notable feature is the inclusion of service in public-service corporations acquired by the company in figuring the duration of employment upon which the pension is based.

With the establishment of the company's welfare bureau in 1912, three important provisions were put in force, classified as industrial accident benefits, sick benefits and death benefits. These provisions not only include all the provisions formulated under the Massachusetts workmen's compensation act, but in addition provide that a man shall receive sick benefits for one-quarter of his length of service.

Another advantage over the provisions of the Massachusetts act is that the company goes farther than the so-called ten-dollar maximum. The act provides that a man shall receive one-half his weekly wage in case of disability, not to exceed \$10 weekly. The company does not limit itself to this, but applies the proportional rates of payment directly to the man's full salary, regardless of what the maximum disability payment figures out. The new pension system provides for three classifications, as follows: (a) Providing for the retirement of male employees at sixty-five years of age, with fifteen years of continuous service, and for the retirement of female employees at sixty years, to be retired upon individual request or at the discretion of the committee in charge of the plan; (b) the retirement of male employees of sixty years of age with twenty years' service and of female employees of fifty-five with twenty years of service, to be retired at the discretion of the committee; (c) employees completing thirty years' continuous service, irrespective of age, also at the discretion of the committee. These terms of service include faithful service in the same land of a company in the electrical business whose business has been acquired by the Edison company, or specifically in the electric-lighting department of any public utility operating in the public streets of the State, which has been added to the company's system.

The amount of the service annuity to be paid yearly to an employee retired under this plan is 1 per cent of the average annual pay of that employee during the last ten years of active service multiplied by the number of years of service, provided, however, that no service annuity shall be less than \$300 per year. All service annuities are payable monthly and are not assignable. In case an attempt is made to assign an annuity, or if it is attached, or if the annuitant becomes bankrupt or insolvent, the right to the annuity ceases, and the annuity may be either suspended or withdrawn, or paid to the annuitant or his dependents, all at the discretion of the committee in charge. Overtime pay is excluded in determining the average annual pay. Leave of absence for special reasons or absence on account of illness does not constitute a break in the continuity of an employee's service, but if such absence exceeds three months, the excess is deducted in computing the length of service. Service annuities continue from the date of retirement to the end of the calendar month in which occurs the decease of the annuitant.

The plan is distinctive in that no employee loses the advantage of the death-benefit provision of the welfare program. If an employee is on the disability payroll at the time he becomes eligible to a service annuity, he may nevertheless be retired upon an annuity and when so retired is no longer entitled to the benefits of the disability payroll. The death benefit conditions, however, provide for the payment to the employee's heirs at the time of his or her death of twenty-six times the weekly wage, the maximum payment to be \$500 and the minimum not less than \$100. With out special provision, it might happen that an employee would die just at the time of passing from the regular payroll to the annuity pension class or within a short time after having been transferred, and thus his family would be deprived of the regular death benefit allowance. This cannot happen under the provisions of the Boston Edison plan, because any differences between the death benefit and the amount received in pension up to the time of death are made up by the company. An employee who has been retired with a service annuity will continue to receive it so long as he does not, in the judgment of the committee, engage in any business which is in competition with the company or act in an unfriendly manner toward it, or become undeserving through misconduct or otherwise.

At present there are over 1000 employees in the Boston Edison payroll, and at least twenty-five employees are eligible for retirement at once, it being desirable. Among

the employees are men whose ages range from sixty-five to seventy-seven years and whose terms of continuous service range from eighteen years eight months to thirty-two years one month. The administration of the plan for retirement with service annuities is in charge of the following committee: President Charles L. Edgar and Messrs. Walter C. Baylies, Thomas K. Cummins, Frederick Manby Fox and Herbert W. Adams.

## Terminal Electrification in Chicago

The question of the possible electrification of the trunk-line railroad terminals at Chicago is being agitated by the sorely needed relocation and modernization of several of the terminals of the twenty-one railroads that enter Chicago. The whole subject is under consideration by the railway terminals committee of the City Council; and, for perhaps the first time, the railroads are showing a willingness to cooperate with the city authorities. At a meeting of the committee on May 17 Mr. Robert Redfield, a lawyer, appeared for several of the railroad companies. He introduced Mr. A. J. Earling, president of the Chicago, Milwaukee & St. Paul Railway Company, who said that five roads use the so-called Union Station on Union Street. Plans have been prepared for a large and handsome station to supersede this old "head and tail" one in the place bounded by West Adams, South Canal, West Jackson and South Clinton Streets, fronting on Canal Street. Architect E. R. Graham, of D. H. Burnham & Company, produced drawings and described briefly the handsome and imposing structure proposed. Apparently the station is designed for electrically operated trains. Mr. Earling said that the Jarvis Hunt plan for one great railroad terminal in Chicago operating on the terminal-loop principle are entirely impracticable.

Mr. Darus Miller, president of the Chicago, Burlington & Quincy Railroad Company, another trunk line using the Union Station, where 250 passenger trains are handled daily, also expressed the opinion that the Hunt plan are impracticable.

Mr. J. J. Turner, of Pittsburgh, second vice-president of the Pennsylvania Lines West of Pittsburgh, declared that the proposal of the Chicago Plan Commission to move railroad terminals on Twelfth Street is impracticable. He said that the railroad traffic of Chicago is so large that one union station is impracticable. The railroads are unanimous in opposing the Hunt plan, according to Mr. Turner.

Mr. A. A. Deane, president and one of the partners of the Wabash Railroad, disagreed with the preceding speakers. He thinks the Hunt plan a valuable contribution to the study of the subject, although he feels a better plan can be worked out. Mr. Deane has given much attention to the Chicago terminal problem. Several years ago he recommended the grouping of terminals on Twelfth Street, although still open to conviction on this subject. Mr. Deane gave an interesting exposition of railroad terminal conditions in Chicago, where there are no passenger terminals, each serving but four or five trains. He mentioned the suggestion that the New York Central terminal in New York has a greater capacity for handling trains than all the passenger terminals of Chicago put together. He stated that a similar concentration might be possible to build the structure, at least, using and covering the surrounding area owned by the railroads.

Mr. A. H. Smith, of New York, superintendent and general manager of the New York Central Company, made an interesting contribution to the discussion. He said that his company is satisfied with the South Street Station and is not compelled to move its terminal, although it is possible it will have to move, on account of the cost of repairs. He would not support the removal of the passenger cars of the Hunt plan, because it is possible that the New York Central could not move its cars and that there would be a serious



disadvantage compared with the other railroads. He does not think it practicable to house the New York Central and Pennsylvania lines in one station in Chicago. The terminal electrification in New York was brought about by the tunnel conditions in that city. It is practicable but very expensive. The electrification question is up everywhere, but the railroads think the cost is very heavy. Steam locomotives are perfected to a greater degree than electric locomotives, for they have been in use much longer. The trouble with the electric locomotive is to make it capable of pulling a heavy load at high speed, although the railroads do not ask it to do anything a steam locomotive cannot do. However, improvements are being made constantly, and Mr. Smith thinks the desired electric locomotive will be available before long. But while these experiments are going on somebody must pay the expense in the shape of overhead charges. In answer to a question, the speaker said that he did not know of any practicable means of hauling heavy railroad trains save steam and electricity.

The committee adjourned to consider the subject further at its next meeting.

### Electric Vehicle Convention at Boston

A special convention of central-station men, electric-vehicle and accessory manufacturers was held in the Engineers' Club auditorium, Boston, on May 20 and 21 under the auspices of the New England Section of the Electric Vehicle Association of America and the Electric Motor Club of Boston, about 100 persons being in attendance, including registrations from New York, Philadelphia and points in the Middle West. The first session began with a paper by Mr. Fred M. Kimball, of the General Electric Company, on "New England as an Electric-Vehicle Field."

#### THE ELECTRIC VEHICLE IN NEW ENGLAND

Mr. Kimball reviewed the history of electric-vehicle development in New England and emphasized the improvements in the last few years leading to the popularization of both pleasure cars and trucks. The author defined the possibilities of present designs and showed that as a general proposition a given number of commercial electric vehicles can perform fully twice the service that an equal number of horse-drawn vehicles of equal carrying capacity can perform in the same period of time, while the cost of operation will be from two-thirds to one-half that of the horse-drawn apparatus. The commercial truck occupies on the streets not over half the space of a horse-drawn truck of equal capacity, and its service reliability is independent of climatic conditions. Other well-known advantages were cited and the author pointed out the attractions of the New England highways and the highly developed roadways of the Boston district as incentives toward a greater electric-vehicle development. The registration of electric vehicles in Massachusetts in 1913 is thus far 30 per cent ahead of last year's record. The estimated present income of central stations from electric vehicles is about \$900,000 per year, figured on the basis of 4 cents per kw-hr. It is estimated that about 40,000 of these machines will be in service by the end of the year. In closing, the author outlined several fields peculiarly adapted to electric-vehicle service, including the delivery of milk and ice in the early morning hours in suburban residential districts.

#### Discussion

Among those discussing the paper were Messrs. Harvey Robinson, New York; P. E. Whiting, Boston; F. D. Stidham, Boston; L. A. Tirrell, Boston, and Colonel E. M. W. Bailey, Boston. The point was brought out that 10 per cent is a liberal allowance for replacements in connection with electric vehicles. Rolling country was shown to be no disadvantage in maintaining battery-driven car schedules.

#### CRITICISMS ON ELECTRIC VEHICLES

Mr. E. R. Davenport, sales manager of the Narragansett Electric Lighting Company, Providence, R. I., presented a trenchant paper discussing with the utmost frankness some of the weak points in electric-vehicle salesmanship and service which retard the logical development of the industry. He contended that the time has arrived for a reduction in the prices charged for electric pleasure cars and urged the adoption of methods of marketing and distribution along the lines practised by the largest manufacturer of modern low-priced gasoline automobiles, who is building no less than 200,000 cars this year and securing a small unit profit on each with a correspondingly large total. Mr. Davenport said that it should be possible to retail a good electric pleasure car for \$1,250, figuring battery cost at \$350 to \$400, motors at \$115 each, and using assembled frames, axles and bodies. The tendency toward increased prices was deprecated, and the author said that in his territory people will not invest \$2,250 for a runabout which could not be expected to go over 75 miles on a charge. There are many people who would like to own an electric runabout for city service, but the present high first cost is a serious obstacle. There is no question that any agent with an electric roadster selling for \$1,250 could sell the car without any form of catalog and any central station could afford to buy such cars and use them for purposes for which large and expensive electric roadsters are not adapted.

Prices charged for commercial electric vehicles are high, but not as exorbitant as those for pleasure cars. A great future lies ahead of the commercial car, but the practice of showing what can be done with a demonstrating car is a vital necessity and one which remains to be appreciated in the electric-truck field as it now is in the gasoline-car industry. The author affirmed that an agent who is covering the entire New England territory should at least own a demonstrating car and be willing to do the customer's work in case he is in the market for either an electric or a gasoline truck. Many electric-truck salesmen are at a disadvantage through their previous familiarity with the gasoline machine. Salesmen should be better posted on such matters as the actual weights of their cars complete and the mileage which can be handled by both gasoline and electric delivery wagons including stops.

Regarding the question of service after purchase, Mr. Davenport made several telling points indicating the great importance of following up the customer's use of his equipment and seeing to it that he secures the best possible results. Insufficient care is at present taken to provide for inspection of individual cars at regular intervals. The manufacturer of the vehicle should be more willing to bear some share in the replacement of small parts proving defective, rather than leave this burden upon the central station, which often secures a gross income of only \$60 or \$70 a year from the vehicle owner, compared with an agent's profit of say \$500 on the sale of a pleasure car. The customer should not be left to his own resources after the car is delivered and has had an initial charge under the direction of the sales representative. A number of actual cases were then cited where the central station was called upon to do more than its fair share of the service work, considering the moderate revenue involved. In one of these the Narragansett electric-vehicle man had to make ten calls while supervising the installation of a charging set which was sold at cost, to insist on the use of distilled water and to instruct the coachman in the handling of a battery-testing hydrometer. In another a leaky cell was removed by an incompetent man owing to the lack of any method of having the distant agent attend to the problem or advise upon it, and the central-station man had to devote an entire morning to rectifying matters. The car owner had never received the signed guarantee that should have accompanied the battery. In another instance the



vehicle representative failed to inform the customer of the value and uses of the hydrometer, syringe, distilled water and a thermometer suitable for use in such a battery when being charged. The author in closing reiterated the need of closer co-operation between the battery and vehicle makers and the central station and advocated "getting together" to adjust more equitably the costs of rendering the service upon which the largest success of the electric vehicle depends.

#### SELLING ELECTRIC CARS

Mr. Louis E. Burr, president of the Woods Motor Vehicle Company, Chicago, in a paper on the proper selling of electric cars, touched upon the improved conditions regarding local charging facilities now being inaugurated in many parts of the country and set forth the importance of the use of electric cars by central stations in carrying on effective selling campaigns. Low prices for energy are vital. Service guarantees should be definite, as in many cases the car owner's ideas of service guarantee and maintenance become mixed and he gets the notion that he can operate his car at no cost except the garage charges. The Electric Automobile Manufacturers' Association is now considering a standard service along the following lines: Free inspection monthly at a specified time; gratuitous examination of the wiring, motor, controller, gearing, brakes and battery; free oiling exclusive of repacking bearings or gears in grease; notification of owner when repairs are needed. This service will in no way eliminate the responsibility of the garage, but will do much to insure better operation and determine the limits of free repairs and adjustments.

Mr. Burr's paper concluded with a discussion of the need of closer co-operation between electric-vehicle salesmen and manufacturers, leading to more permanent employment and service of greater loyalty.

#### ADVERTISING THE ELECTRIC VEHICLE

Mr. F. Nelson Carle, advertising manager General Vehicle Company, Long Island City, N. Y., presented a paper urging that sound design, sane speeds and other fundamentals of long-lived construction are characteristic of the electric truck industry, and that sound selling methods are a striking feature of its work. How to make the turn-over and how to expand at the same time is the problem of the manufacturer rather than what shall be next year's model. The author advocated conservative expansion and the gradual establishment of district offices and selling representatives as the growth of the business warrants. He favored the wide use of localized electric-truck advertising in good press mediums. The local advertising must be adapted to road and traffic conditions and the status of the electric truck and delivery contractor. The use of advertising copy on the news pages was recommended and the value of selective trade paper advertising emphasized. Commendation was given to the Electric Vehicle Association of America's magazine advertising, and the author said that central station advertising in the interest of the electric vehicle is increasing yearly.

Too much importance, Mr. Carle said, cannot be attached to understanding local conditions. In a typical case a well-planned advertising campaign fell flat because the preparation of the copy did not take account of the fact that 90 per cent of the local deliveries were handled by three contractors. The advertiser had been talking to merchants about the high cost of horses when some of them had owned a horse for five years. In this work the cooperation of the central station is of supreme importance. Electric truck advertising has won men to see that the machines of this type are superior in their own field, and the problem now is to educate the public to see the size of the field. Impress upon the prospective buyer the importance of adaptability as a factor in operating efficiency and the value of simplicity of construction and operation as factors in life

labor problem. This is the true advertisement, not a hand-slinger but a seller of transportation machinery.

#### CONCLUSIONS OF THE MEETING

Mr. E. J. W. Proffitt, of the Proffitt-Lanham Advertising Corporation, Providence, R. I., emphasized the need of co-operation between seller, purchaser and advertising man in the securing of the best results from the electric vehicle. He commended the voluntary association of buyers within a territory as in the Electric Vehicle Association of America in a publicity campaign and voiced the improvement in vehicle construction which have made a thoroughly practical basis. He contended that so the greater representation and personal concern of the local owner is the best field for maximum electric-vehicle application, appropriate advertising should be made with the idea of concentrating advertising work in this territory, especially in the case of great local people. The electric-vehicle movement, after five to ten years, failed to take as much advantage of the outlet as has the automobile builder. The central station and vehicle manufacturer should augment the advertising of the national association by publicity generated within their own communities and cooperation.

The author suggested that the vehicle manufacturer should maintain a central station in the section of following the latter a certain sum for every vehicle sold in the territory, say from \$50 to \$100, depending on the size of the car. The amount of time could then be divided between arrangement and it would prove a very valuable selling feature, making a possible for the central station to agree to give the business to the company and the manufacturer gain.

#### DISCUSSION

The papers by Messrs. Carle and Proffitt were discussed by Messrs. William Lee Thomas, Mr. E. J. W. Proffitt, Providence, R. I.; Gilbert H. W. M. Bailey, Amherst, Mass.; J. C. Bartlett, Philadelphia; H. W. Holmes, Long Island City, N. Y.; Henry Gorman, Buffalo, N. Y.; Parker, Baltimore, New York; Ben Baker, Detroit; J. S. Gorman, Boston; A. D. Hartman, Worcester, Mass.; C. D. Marsh, New York; and W. C. Anderson, Detroit, Mich.

The point was made that the electric vehicle must be made to appeal to the masses of lower income, that it is unnecessary as yet to attract to produce a new class car, and that concentrated advertising is of the greatest value. The rich man is the natural purchaser of the thousand-dollar electric vehicle. The electric vehicle is characterized by the electric vehicle in relation to cost upon the station were emphasized. The success of the car is closely due to the local service which is given and to the service of the best satisfaction and service stations. The support of a proportion of central station electric vehicle advertising is recommended as a means of increasing the sale of the electric vehicle companies to the value of the electric vehicle but not necessarily having a percentage from manufacturers to meet the part of central station business which would be in cooperation in local territory.

An hour session will discuss advertising of electric power by Messrs. H. M. Shaw, J. H. Wain, and W. C. Anderson in the publicity of the electric vehicle and the proper methods of securing without financial sacrifice the results.

#### ENTERTAINMENT MATTERS

At the close of the meetings there were some 1500 River Water of the General Electric Company at Long Beach, and in the West Coast, with field men and a large number of visitors. An electric-vehicle exhibition, and truck show, was given at the Fairgrounds, Long Beach, California.

### West Virginia Public Utility Act

The act of the last legislature of West Virginia creating a public service commission goes into effect this month, and it is expected that the Governor will announce the names of the commissioners in a few days. There are to be four commissioners, whose term of service will be eight years, and the salary attached to the office is \$6,000. The jurisdiction of the commission extends over common carriers, railroads, street railroads, express companies, freight lines, car companies, toll bridges and ferries; telegraph and telephone companies and pipe-line companies for the transportation of oil, gas or water; gas companies, electric-lighting companies and municipalities furnishing gas or electricity for lighting, heating or industrial purposes; hydroelectric companies for the generation and transmission of electricity, water companies, and all persons, associations, corporations and agencies employed or engaged in any of the businesses enumerated. The commission will also perform such duties as may be imposed upon it by law in connection with any workmen's compensation law or fund which may be established. It is empowered to change any intrastate rate, charge or toll which is unjust or unreasonable and may prescribe such rate, charge or toll as would be just or reasonable and change or prohibit any practice, device or method of service in order to prevent discrimination; provided that it shall not reduce any rate, toll or charge within ten years after the completion of the railroad or plant to be used in the public service below a point which would prevent such public service corporation from making a net earning of 8 per cent on the cost of construction and equipment of such railroad or plant. The commission is to collect full and complete information on the value of all property owned and controlled by a public service corporation once a year, and to furnish the same to the board of public works for use in assessing taxes. A new tax is laid on public-service corporations in the shape of a special license fee, the amount of which is to be apportioned to the value of the corporation's property, and the tax in the aggregate must produce a revenue of \$60,000 a year, which is appropriated for the support of the commission. The orders of the commission are reviewable by the Supreme Court of Appeals.

### Going Value in the Buffalo Rate Cases

In the recent rate cases brought by the city of Buffalo against the Cataract Power & Conduit Company and the Buffalo General Electric Company before the New York Public Service Commission for the Second District, the proper method of arriving at going value or going-concern value was discussed at length.

The Cataract company made several claims for going-concern value, according to the differing views of its own experts. These claims were severally as follows: \$350,400, or 10 per cent of reproduction cost of physical property; \$996,000, on the value of the created or existing income theory, and \$300,000, on the basis of 0.75 cent per watt of connected load. In the other case the Buffalo General Electric Company claimed a going-concern value amounting to \$1,200,000. In neither of the cases was any of these claims approved or conceded by the commission, for the reason that under any of the admissible theories it was found that the stockholders have already been more than amply compensated through profits and dividends hitherto paid and equities in the properties accumulated out of surplus earnings.

The opinion held that there is a fundamental distinction, upon principle, as to going-concern value, between rate cases and appraisals for purchase or sale. It was held that going-concern value is inherent in the method of appraising a plant at its reproduction cost, for such a value could not exist without reasonable net earnings to support it; in the

opposite event it would be worth much less than the reproduction cost and in the extreme case of no earnings would be worth no more than the scrap value realized by dismantling the property. The earnings themselves were held to have no bearing whatever upon going-concern value in a rate case, since the earnings are directly in question and their amount remains to be fixed by the decision of the regulating board.

Upon applying the other rules sometimes used to determine the so-called going value, such as early losses, cost of building up the business to a basis of reasonable profit, deferred dividends, etc., the commission found that the cost of attaching business had been charged to operating expenses and the net earnings throughout the company's existence had been as a whole so large as more than to offset any claims for allowances of this character. The opinion also held that such losses do not in any case constitute a property right and therefore are no part of the property value, although they may in some cases form the basis of claims which have a reasonable foundation. The arguments given in the opinion are supported by citations from a number of well-known rate cases decided by state and federal courts.

### Public Service Commission News

#### WISCONSIN COMMISSION

In a decision recently announced the Wisconsin Railroad Commission has ordered a physical connection to be made between the toll lines of the Wisconsin Telephone Company and the La Crosse Telephone Company at La Crosse. The matter was brought before the commission upon petition of certain subscribers of the La Crosse Telephone Company who alleged that public convenience required the physical connection between the exchange systems of each company and the toll lines of the other. The case has attracted considerable attention among telephone men, as it is the first contested case of any importance to come before the commission under the recent legislative enactment providing for physical connection between telephone systems, and for the further reason that is in the nature of a test case for other cities in the State where similar conditions exist. There are two competing telephone companies operating in the city of La Crosse—the Wisconsin Telephone Company, a branch of the American Telephone & Telegraph system, and the La Crosse Telephone Company, the latter being owned and controlled by local capital. Because it is a local company and because of the conditions which gave rise to its installation the La Crosse Telephone Company has enjoyed a constantly increasing patronage and the Bell company has had a corresponding decrease in number of subscribers. Although the local company has more than twice the number of subscribers, its toll facilities are much inferior to those of the Bell system. The petition for a physical connection was vigorously contested by the Wisconsin Telephone Company on the ground that its local exchange would be deprived of its patronage and that irreparable injury would result if its extensive toll-line facilities were made available to the patrons of the competing company. In commenting upon the respondent's contention that the statute transgresses certain constitutional guarantees of property rights, the commission considered that the law was framed with the "view of protecting the utilities in the enjoyment of all of their legal rights and privileges, while at the same time compelling an involuntary enlargement of the use of their facilities when necessary and required for public welfare." In connection with this case it is remembered that at the time the physical connection bill was passed by the Legislature another law was enacted which had for its purpose the non-duplication of telephone exchanges in cities and incorporated villages. The two laws represent a compromise between the Bell and the independent interests.



FIFTEEN THOUSAND AMERICAN FLUORIDE LAMP RECOMMENDED FOR CHICAGO STREET LIGHTING. Following a contract with the SUMMIT District of Chicago, installing 15,000 additional fluorescent lamps on Chicago equivalent was recommended by the Chicago City Council finance committee on May 26. The installation would save a large sum of money and there is a movement among the city officials to do so. In the meantime, which took place at a meeting of all members of the committee, the SUMMIT District had submitted something more to benefit energy to all of the city's street lamps. The plan is to have the lamps installed and have them lighted from a system which may be used in other districts. If the proposed plan gives the city a good deal of money in the form of interest and alley interests, the city would have to pay for the cost of the lighting in the street, and the city would have to pay for the lamps will be installed by private citizens instead of the city.



**UNDERGROUND STRUCTURES IN CHICAGO.**—Alderman Fisher has introduced in the City Council of Chicago a resolution authorizing the Mayor to name a commission to investigate "underground Chicago" and report a comprehensive plan for caring for the pipes, wires, conduits, tunnels and other public and private utilities which are operated underneath the surface of the streets.

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**SELECTION OF EXPLOSIVES.**—Mr. Clarence Hall and Mr. Spencer P. Howell are the authors of a bulletin, No. 48, issued by the United States Department of the Interior, Bureau of Mines, referring to the selection of explosives used in engineering and mining operations. The bulletin deals with the characteristic features of the principal explosives and is one of a series dealing with tests of explosives and methods of reducing the risks involved in their use in mining work.

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**ELECTRICITY'S PART IN WEST VIRGINIA'S GOLDEN JUBILEE.**—A unique ceremony in connection with the celebration of West Virginia's golden jubilee at Wheeling, June 15 to 21, will be the commemorative service at 12 o'clock on June 20, the State's natal day. The lines of all the transportation, telegraphic and telephone corporations will be turned over to the State at that hour. These wires are to be connected with a mammoth receiving board, into which the President of the United States, the Governor of the State, the speakers of the day, the poet who composed the ode, and others participating in the program, will speak. Their voices will be carried over these wires to every city and village of the State, where similar appliances are to be installed which will reproduce the entire program.

\* \* \*

**HUGE ELECTRIC CRANE.**—At the shipbuilding yard of Blohm & Voss at Hamburg, Germany, a huge crane has been erected for use in fitting out the *Vaterland*, sister ship of the *Imperator*. It has a lifting capacity of 250 tons. The forward arm of the jib, which has a total length of over 315 ft., can be raised to a height of 330 ft. above water level. There are two independent lifting appliances, a crab, which can lift 250 tons at a radius of 113 ft. or 110 tons at 175 ft., and a revolving traveling crane, which can run the entire length of the top of the main jib. This auxiliary crane can lift 10 tons at a distance of 240 ft. from the turning center of the main crane, an area of practically 182,920 sq. ft. being served by it. Only two men are required for controlling the crane, which is driven entirely by electricity.

\* \* \*

**ELECTRICAL EXHIBITION AT UNIVERSITY OF MICHIGAN.**—An electrical exhibit was given by the students and faculty of the engineering department of the University of Michigan at Ann Arbor on May 15 and 16. The illumination display consisted of several types of electric-arc and incandescent lamps, equipped with various reflectors. Comparisons were shown between the light distribution of direct and indirect fixtures in the photometric exhibit. Through the courtesy of the Eastern Michigan Edison Company, a modern electric kitchen was equipped with improved heating and cooking utensils. A miniature three-phase electric locomotive designed by Prof. C. L. De Muralt and built by students in the engineering shops operated on a track 100 ft. long near the engineering building. An automobile equipped with an electric starter, the patents on which are held by Prof. Benjamin F. Bailey, was also on exhibition. One of the features of the exhibit was a combined miniature water-power generating station and irrigation system which was constructed under the supervision of Prof. H. W. King. On a space about 14 ft. square was an imitation mountain with streams running down the valleys, the water from which was dammed up behind masonry structures corresponding to the famous Roosevelt Dam. The water was

conveyed through a miniature generating station and then allowed to spread itself over the plains below, through irrigation ditches. Automatic and manual telephone systems and telegraphic instruments for communicating messages with and without wires were also shown.

\* \* \*

## SOCIETY MEETINGS

**MEETING OF EFFICIENCY SOCIETY.**—The next monthly meeting of the Efficiency Society will be held on Tuesday, May 27, at the Aldine Club, 200 Fifth Avenue, New York. The general topic will be "Office Efficiency."

\* \* \*

**ANNUAL DINNER OF COLORADO ELECTRIC CLUB.**—The annual dinner of the Colorado Electric Club was held on May 8 at the Albany Hotel, Denver, Col. Over 500 members, including ladies and guests, were in attendance, and Messrs. J. Monroe Markley, of the Redpath Lecture Bureau, and Willis V. Elliott, district attorney, were the speakers.

\* \* \*

**ELECTRIC VEHICLE ASSOCIATION.**—At the regular monthly meeting of the Electric Vehicle Association to be held in the Engineering Societies Building, New York, on May 27, Mr. H. M. Martin, of the H. C. & A. I. Piercy Contracting Company, will present a paper entitled "The Ideal Electric Garage." The meeting will be called at 8 p.m.

\* \* \*

**DEMONSTRATION OF "LIGHT AND ART."**—Mr. M. Luckiesh, of the Physical Laboratories of the National Electric Lamp Association, Cleveland, Ohio, presented his "show," as he calls it, entitled "Light and Art," before the Chicago Section of the Illuminating Engineering Society on May 14. The chairman of the society, Mr. F. A. Vaughn, of Milwaukee, drew an analogy between art and music, saying that the composer of music depends on the technique and skill of the player to secure the proper effect from the music, just as the artist, sculptor, etc., depend on the illuminating engineer for the proper impression being conveyed by their work. Mr. P. S. Millar, of New York, president of the society, said that the effects produced by Mr. Luckiesh's "show" suggested the possibilities in the evolution of illumination.

\* \* \*

**NEW YORK COMPANIES SECTION, N. E. L. A.**—At the meeting of the New York Companies Section of the N. E. L. A. Mr. Arthur Williams, general inspector of the New York Edison Company, spoke on "Welfare Work." Commenting on the present wave of social unrest, striking proofs of which are afforded in the recent disturbances in Lynn, Mass., and Paterson, N. J., Mr. Williams explained that the solution of the problem caused by this state of mind among the workers was the making of partners out of them. He said that "about twenty years ago a painter in France came to the conclusion that it was eminently unfair for him to take a large part of the earnings of his twenty employees from week to week. No matter what wages he paid, there was always something at the end of each week that these men left with him. Thereupon he conceived the brilliant idea of taking the men into partnership with him, and from that has come the idea of profit-sharing among employees, service annuities and other kindred plans." Mr. Williams then enumerated some of the advantages to be derived from membership in the New York Edison Savings and Loan Association, which is conducted under the auspices of the company and has all expenses paid by the company and not from the savings of the association. Although just about a year old, the association now has a membership of about 900, with a total surplus of about \$38,000 invested in mortgages.

# Electrical Equipment of Industrial Plants

**Illumination, motor requirements and telephone-call system of the Continental Motor Manufacturing Company, Detroit, Mich. By Harry C. Spillman**

**I**N designing electrical equipment for factories little attention is given to future growth, and very soon the owner finds that the feeders are too small and must be reinforced. This leads to other complications, and a little later the wiring is in such a tangle that an expert must be employed to straighten matters out, and usually he recommends an entirely new electrical installation. All of these matters can be avoided by a little foresight in the original layout. The rule-of-thumb principle cannot be made use of in this work if satisfactory results are desired; moreover, when an installation is carefully laid out there need be no changes and alterations during the installation, as mistakes can easily be corrected on the drawing board.

A great amount of thought and foresight was exercised in the planning of the new Detroit plant of the Continental Motor Manufacturing Company, which has resulted in its being a model installation and affording an excellent example of modern electrical work.

Three-phase, 60-cycle current at 220 volts is used for motors and 110-volt, single-phase current is used for the lighting. The low voltage was adopted in preference to a higher value because of the

fact that the power house is located in a central position in respect to the factory buildings and the greatest transmission distance, taking in consideration the future extensions of the buildings, is less than 200 ft. A higher voltage would be more or less dangerous for an industrial plant, and there would be a great deal more trouble from grounds.

The switchboard at the power house has separate panels for lighting and motor service, and each building has its separate circuits for each purpose. This arrangement has many advantages, as each building is electrically independent and trouble in any one circuit does not affect the others. Tests can easily be made, and measurements of energy consumption are simplified. Small plug switches on the switchboard connect the power-factor meter and indicating wattmeter to any circuit to show the actual load condition for any building. All the buildings are connected to the power house by means of a large tunnel, one side of which is used exclusively for the electrical feeders, each circuit being placed in a steel conduit which protects the wires from rough usage such as they generally receive in manufacturing plants.

The wire used for the entire installation is double braid with 20 per cent. There and was furnished by the American Steel & Wire Company. Soon after the wiring was installed there was a heavy flood and on the ground in one corner were submerged for many days. After the flood passed it was discovered that the steel conduits were filled with water. After having been carefully drained the conduits were found for ground, but not a single ground in case of trouble developed. Double joints are used for every connection. This plan is of great assistance in case of any trouble. A line can be easily disconnected and replaced without having the system making splices or remodeling.

The means for motor service in the machine shop consists of two systems, one for safety and each of the circuits connected through a switch and a F. C. circuit-breaker. From the large distribution board control is obtained, the operator has a full view of the entire room. This board is made up of ten panels containing besides the emergency circuit breaker, eight open double-throw, three-pole oil switches with the handles on the front of the board. Each motor is controlled by one of these switches with a low-voltage release and a mechanical overload



FIG. 1.—ILLUMINATION OVER SPECIAL GRINDING MACHINES

coils so arranged that a bell rings in case the switch opens by overload. Each one of these oil switches can be opened from a distance by the use of a push-button placed near the motor, which can be moved immediately in case of accident. This scheme allows all the motors in the machine shop to be started at a central point and gives the operator control of the motors under one hand.

The ground-fault arrangement is used in the machine shop, each department having its independent line shafting and motors. All branches of motors are run in one ground, and the entire system is made safe and operating by the use of a fuse.

A separate line carries current from the power house to each of the connecting buildings. These circuits are connected to a central switch, which is located near the entrance of the buildings, and the motor current is obtained from these switches to the motor operating different groups of machines. These circuits are made of No. 10 gauge steel and are slotted; the specific are mounted on steel and have enclosed boxes to protect the wire.

As a rule, the selection of the proper size motor is a matter of guesswork, which results in using motors entirely



too large for the requirements. This leads to more or less trouble for manufacturers operating their own power plant and using polyphase alternating current. The greatest trouble in using too large motors is poor regulation and a low power-factor, which reduces the efficiency of the generators and causes excessive line loss. By careful planning the motors in this plant were selected so as to operate be-

conditions are known and a smaller or larger size motor can be installed as needed so that each motor may be correctly loaded as nearly as possible.

Much thought was given to the illumination of the factory so that each department would have sufficient light of the right kind. Each building has its own three-phase feeder, supplying energy at 220 volts to the building, where

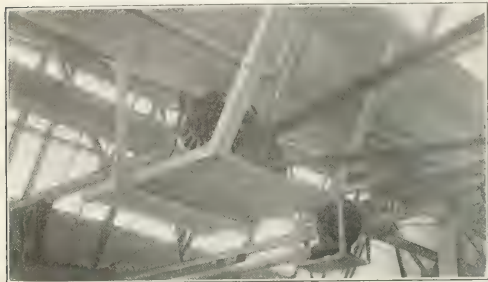


FIG. 2—MOTOR STANDS IN BUILDINGS WITH SAW-TOOTH ROOFS



FIG. 4—STARTING SWITCHES FOR MACHINE-SHOP MOTORS

tween three-quarters and full-load rating. On this account the power-factor for the entire plant is 84 per cent, which is unusually good for an industrial establishment. Investigations have shown that in most industrial plants using induction motors the power-factor is about 60 per cent. Use is made of Wagner motors covered by a guarantee of a continuous overload capacity of 25 per cent. Small motors are controlled by a special switch made by the Detroit Fuse Company, and the large ones by General Electric controllers with adjustable overload relays and no voltage release, which eliminates fuses at the motors. All the motors are mounted on a suitable platform, supported either from the concrete columns or the roof trusses. The platforms are

it is transformed to single-phase and 110 volts by means of balance coils. It was found that the saving in first cost over 220-volt tungsten lamps would more than pay for the balance coils. Moreover, the 110-volt lamp is more rugged than the 220-volt unit.

The lighting panels are for 110-220-volt, three-wire single-phase system controlled by knife switches with inclosed fuses. The cabinet boxes are made of No. 10 gage sheet metal with reinforced corners provided with a 3-in. gutter. The panels are made of 0.5-in. Monson black slate with the valleys of 0.5-in. slate strips properly drilled for branch wires and slotted for the main feeders. The switches are of double-pole, single-throw type with 30-amp rating and



FIG. 3—SUB-ASSEMBLY ROOM LIGHTED BY TUNGSTEN LAMPS



FIG. 5—LATHE-ROOM ILLUMINATION BY TUNGSTEN LAMPS

made in one piece so that motors can be lifted off and the platforms removed from the metal bracket, which allows the motor to be lowered. In case a motor is working unsatisfactorily it can be removed and a new one installed in less than fifteen minutes. In order to make quick electrical connections Dossert joints are used at the motors. Careful tests are made of the motors every month so that the load

250-volt spacing and provided with rubber handles. These cabinets are distributed along the side walls of the buildings so that the length of the branch circuits do not exceed 100 ft. Three-quarter-inch conduit leads from these cabinets, each containing three double-braid duplex wires. Condulets are used at each outlet so that future extensions can be made in any direction at each conduit. The conduit is fastened



at 6-ft. intervals in the concrete ceilings by means of pipe straps and lead anchors.

One-hundred-watt tungsten lamps with enameled steel reflector with a green exterior are used in the offices, assembly room, stock room, receiving room and tool room. These rooms have 13-ft. white ceilings with which a tungsten lamp proves most satisfactory. The lamps were spaced

The machine-shop roof is of saw-tooth construction having the columns spaced on 20-ft. centers; the bottom of the roof trusses is 14 ft. from the floor. Cooper Hewitt lamps with white reflectors are used in this room. Each lamp consists of a 50-in. tube placed 12 ft. from the floor; the spacing is 40 ft. It is 20 ft. between each row of lamps, which are staggered with reference to the next row.

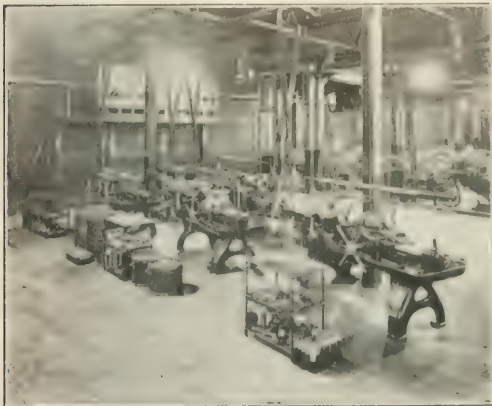


FIG. 6—ILLUMINATION IN MACHINE SHOP

on 10-ft. centers in the office and assembly rooms and were suspended 9 ft. from the ceiling. With the lamps at this spacing operating at the middle voltage, photometric readings show an average of 5.4 ft.-candle at the working plane, which is 30 in. from the floor. The illumination is very uniform and varies only 0.4 ft.-candle throughout the factory.

Special attention was given to the spacing of the lamps in the tool room over the machines, so that the operator would have strong light without shadows. This plan has



FIG. 8—ILLUMINATION IN GRINDING DEPARTMENT

arrangement gives 6.3 ft.-candle at the working plane with a consumption of only 0.45 watt per sq. ft. floor area. The entire machine shop is operated without the use of extension cords. The mercury-vapor lamps provide an excellent light for reading blueprints. These lamps have been operating for nearly a year, and not a single tube has been replaced.

The power house is illuminated with Cooper Hewitt lamps with red reflectors which give nearly white light.



FIG. 7—MOTOR PLATFORMS ON CONCRETE COLUMNS

been carried out so perfectly that the operator has 7 ft.-candle at the working plane, and the workmen in this room have not requested a single extension cord or desired to have any of the lamps changed. In the stock room use is made of three lamps between each steel bin, each lamp being controlled by a pendant switch. In the remainder of the stock room the lamps are spaced on 10-ft. centers.



FIG. 9—QUARTZ-HALIDE ARC MERCURY SWITCHBOARD

These lamps are suspended from the roof trusses 20 ft. from the floor, thereby affording a very strong illumination.

Owing to the large amount of smoke and the great distance to the roof trusses, starting arc lamps are installed in the motorist room and heat treatment building. A glow electrode is used in these lamps, as the glow light possesses the property of penetrating the smoke. These lamps

are placed on 20-ft. centers and are staggered so that a fairly uniform distribution of light is obtained. Extension plugs are also installed for the inspection of motors. Careful records show that the electrodes in these lamps burn 107 hours per trim.

The entire telephone system throughout the plant is connected to the Bell system, which allows every telephone an outside connection. The telephone system passes through the private branch exchange board, which is under the control of the operator. In case the person called is not at his desk an "auto-call" system in charge of the telephone operator rings a signal throughout the plant and yards until this person answers the nearest telephone. With this arrangement it is possible to locate a person within an average time of three minutes. Formerly this work was done by a messenger boy at an average of seven-téén minutes. There is also connected to the same call system a program clock which rings at starting and quitting time. This auto-call is also connected to the telephone system at night and on Sunday to notify the watchman in case of a telephone call. Thus the department heads can get in touch with the factory at any time.

### Silvered Mirrors and Their Preservation

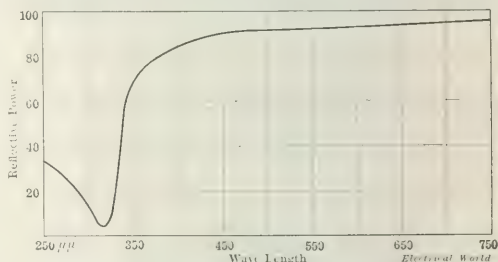
By DR. LOUIS BELL

For most technical laboratory work requiring the use of reflecting surfaces one is fortunately able to use glass mirrors silvered on the back, like the ordinary commercial product, and hence giving very little trouble from depreciation of the reflecting power. One is not justified in assuming, however, that a mirror constant once determined will remain indefinitely the same, and changes of small amount—an amount greater, however, than is to be accounted for by the condition of the outer glass surface on the mirror front—are quite possible. There is a necessary loss by reflection at this free surface of the order of magnitude of 4 or 5 per cent, an amount which will vary materially with the thoroughness of the cleaning to which the mirrors are subjected prior to use. With thorough cleaning, however, the variation at the front surface is practically negligible. Frequently the variation at the rear silvered surface is also practically negligible, but it cannot be taken for granted that it will remain absolutely uniform through months or years of use. In a very thorough investigation of reflecting powers Chant<sup>1</sup> found a variation of 2.6 per cent, which is too large to be accounted for simply by observational errors, in the coefficient of a mirror silvered on the back after three months. Just what the cause of such a change may be is not fully determined. It may be due to deterioration of the film by reason of imperfect cleaning of the surface on which it was deposited, or possibly it may be the effect of lack of backing or improper backing of the film causing a change in its reflecting properties.

For certain purposes, however, it is desirable to use the actual metallic reflecting surface of a mirror silvered on the front; for instance, in some reflecting instruments the added sharpness of such a reflection is a material advantage and in experiments in radiation the absorption of the glass when a mirror is silvered on the back is highly objectionable. Ordinary plate glass, for instance, absorbs most of the radiation up to a wave-length of about 320  $\mu$ , and also produces some strong absorption in the infra-red part of the spectrum where the silvered film itself has enormously high reflecting power.

For silvering mirrors a considerable number of processes have been tried, a very good résumé of which has been given by Curtis<sup>2</sup>. Any of these can be made in careful hands to give good results, the two most popular in this

country being those of Brashear and Lundin. In the writer's judgment the success of any of the methods depends chiefly upon the perfection of the cleaning of the glass. If the cleaning is done with extreme care, almost any of the silvering solutions and reducing agents will give a good coating, although all the processes are sensitive to temperature in ways not yet clearly understood. For most purposes it is best to work for a fairly thick coating in order that the surface may stand polishing. Thin coats of silver transmit a very material amount of light, which lowers the intensity of the reflected beam; for example, one very beautiful coating tested by the writer, a coating too thin to burnish, showed a reflecting power of only 73.8 per cent from the silvered face. It showed a transmitted beam of 10.2 per cent, uncorrected for the very slight reflection at the free glass surface after the beam had been transmitted through the silver coating. The color of the film in this case was pale violet gray when the film was held against the sky, and the apparent transparency was very striking. To stand polishing, the films should be thick enough to transmit the light from an incandescent filament only very faintly, when the loss by transmission becomes negligibly small. Unless the mirror surface is highly polished there is an unmistakable loss from scattering, the silver film being to a certain extent granular in surface. Polishing seems to smear down the soft silver surface into metallic luster and on the success of the polishing depends



REFLECTING POWER OF A SILVER SURFACE

the ultimate coefficient of reflection. Polishing is usually done with a very soft bit of leather made up into a loose ball over cotton and touched with a barely perceptible amount of the very finest rouge. Fresh silvered surfaces thus polished may have reflection coefficients as high as 94 or 95 per cent at normal incidence in the visible spectrum, as has been shown by Hagen and Rubens and also by Chant. It is extremely difficult to get so perfect a polish as to give such results.

Various mirrors tested by the writer, polished by various skilful hands, have generally shown coefficients of from 84 to 87 per cent, with the tungsten lamp as the light source. Chant's high results were obtained with a Hefner lamp, which from the predominance of the reddish rays would necessarily give a slightly higher reflecting power. The difference due to this cause could, however, hardly exceed 1 per cent, so that it is clear that care in polishing is a very essential matter if a high coefficient is to be obtained.

Incidentally, it should be mentioned that in a particular region of the ultra-violet, between the wave-lengths of 330 and 300  $\mu$ , silver is a uniquely bad reflector, as the sub-joined curve shows. At its minimum it is scarcely as good as black paper would be. For obtaining a surface good in reflecting the extreme ultra-violet one does better to abandon silver and use either a silvered mirror nickel-plated according to a process suggested by Wood<sup>3</sup> or a metallic mirror wholly of, or surfaced with, nickel. At the

<sup>1</sup> *Philosophical Journal*, Vol. XXI, page 211

<sup>2</sup> *Popular Astronomy*, Vol. XIX, pages 327, 398

<sup>3</sup> *Astrophysical Journal*, December, 1911.



point where silver utterly fails nickel has a coefficient of about 45 per cent. Metallic nickel polishes very badly in the rolled or cast state, and a better surface can undoubtedly be obtained by an electrolytic deposit on metal to which is subsequently given as high a polish as possible. When fresh, Mach's alloy gives a much higher coefficient but is difficult to preserve from deterioration. Silvered surfaces deteriorate under ordinary laboratory conditions with exasperating rapidity and may in a few weeks fall in reflecting power by 20 or 30 per cent or more. The following test recently made by the writer is more in point.

A certain silvered mirror gave initially a coefficient of 84.5 per cent. After fifteen weeks' exposure during the first month being merely laid away unprotected from dust and the rest of the time placed on edge in a somewhat damp and dusty cellar—the coefficient had fallen to 39.8 per cent and the mirror had acquired a golden-brown tinge of very considerable intensity. To prevent this deterioration, often even more rapid and destructive than that heretofore, the writer has recently been trying the process suggested by Perot\* for coating the silver surface with an extremely thin film of collodion. Collodion is easily obtainable in amyl-acetate solution, and lacquers of very similar character are used commercially for the preservation of the polish on fine silverware.

A mirror similar to the one just mentioned, which initially gave a coefficient of 86.3 per cent, was flooded with such a solution, the thing actually used being one part "Lastina" lacquer, extra clear, diluted with two parts of the "thinner" provided for commercial use with it. This leaves faint and broad color interference bands due to the film, probably in this case, as in Perot's experiments, somewhere nearly 1 wave-length in thickness. After the film was dry, which consumed only an hour or so, the mirror was again tested for reflective coefficient, and the value obtained was 82.6, so that the actual loss of light due to the film was in the vicinity of only 4 per cent. The mirror was then exposed alongside its mate for fifteen weeks and on testing at the end of the period showed a coefficient of 79.2 per cent in spite of the results of some accidental handling. It exhibited no change in color, the film being as white as it was at the start. Some experiments were later tried with the same lacquer, diluted this time with six times its volume of "thinner," on one of the large diagonal flats used on a 2-ft. reflector at the Harvard Observatory, and the series of tests made there by Mr. E. S. King showed that there was no perceptible injury to the definition. The photographic star images through the film were apparently as sharp as without it. Finally the same process was applied to the 2-ft. parabolic speculum itself. The definition was apparently unimpaired, and after three months of regular service the lacquered silver film has not changed color nor lost a material amount of its brilliancy, while an unprotected coating usually is quite unfit for service in a decidedly shorter time than this. The lacquer coating is easily washed off with the "thinner," and if the film underneath has deteriorated there is no reason why it should not be repolished and a fresh coating then applied. At all events, the Perot process carried out by means of the commercial lacquer seems thoroughly successful. It is altogether probable that the same process applied to a mirror of Mach's alloy would keep its surface in condition for a long period, and so that a film would produce scarcely perceptible absorption except in the region approaching 200  $\mu$ , beyond which the most extraordinary precautions have to be taken. The solution is applied by pouring a liberal quantity quickly upon the mirror surface, tilting it about to make sure the surface is fully covered, and then tipping the mirror quickly on edge to drain and dry. The process is best carried out in a fairly warm and dry room as free from floating dust as possible.

## The Theoretical Basis of the Multiple-Rate System

By HENRI L. LAMBERTSON

I. A SUMMARY OF THE THEORETICAL ASSUMPTIONS

It is now generally recognized that a rational and equitable system of rates for electric service should not only take into account the physical factors involved by the customer but also the capital investment which the customer causes to the central station. This latter value is largely determined by the duration of the existence of the time of the central station's peak load, which is called hereafter the customer's continuous peak, and upon which is made to measure the individual customer's continuous peak in a commercially practicable way, usually the customer's maximum demand is taken account, regardless of the time when it occurs, the assumption being that for a certain class of customers the ratio of maximum demand divided by demand during peak generally does not vary much for the individual customer from the average pertaining ratio for that class.

This means that the demand  $x$  of the customer's bill under this system of rates is composed of two parts: the first one,  $Y$ , the demand charge, being proportional to the customer's demand  $d$ , and the second,  $Z$ , the energy charge, being proportional to the energy consumed,  $e$ . Thus:

$$x = Y + Z, \quad Y = yd, \quad Z = ze \quad (1)$$

where  $y$  is the demand charge per kilowatt of maximum demand (to be called specific demand charge hereafter)

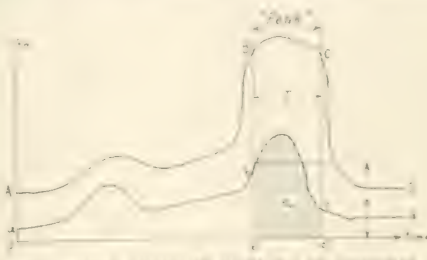


FIG. 1—LOAD CURVE OF STATION AND CUSTOMER

and  $z$  is the energy charge per kilowatt-hour (expressed in energy charge  $\epsilon$ ,  $z$  is given in terms per kilowatt of maximum demand and  $\epsilon$  in cents per kilowatt-hour).

According to the usual assumptions,  $y$  and  $z$  are constants for a certain class of business (the customer's continuous peak) and that would be correct if the central station's peak load were assumed to last only for one season, but not differential of time. In practice, however, the maximum demand is determined not only by the instantaneous maximum but also at least as far as the necessary size of the central station is concerned—by the average maximum demand over a longer period, for instance, one or two years, or otherwise, length of time the load curve shows an adequate portion equal to the maximum ordinate. After that point is passed this period comes to an end. The customer's continuous peak, therefore, is more properly his average demand during the period of the central station's peak load and when over the force is lost thereafter, the latter shall be in the sense of this paper, indefinite. In other words, the customer's continuous peak means the number of kilowatt-hours used in the customer during the central station's peak-load period divided by the duration of the latter in hours.

If now a portion (duration) of the central station's peak load is assumed, it will be shown in the following that it is no longer theoretically correct to use a constant for the specific demand charge. In order to get close to the fundamental of the problem, assume first that it is possible to determine a customer's continuous peak  $d$ , and to find

\*Complex Relations, N. A. S. 1910.



the specific demand charge  $y'$  thereon, instead of basing it on the absolute maximum demand. In the new case,

$$a \quad y'r + c \quad (2)$$

That part  $y'r$  of the total bill which represents the demand charge is proportional to the customer's simultaneous peak, and if the specific demand charge  $y'$  is based thereon, it will be a constant. In practice, however, as explained

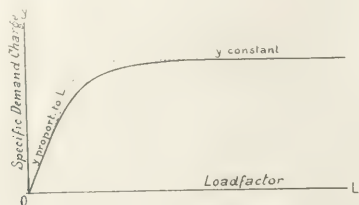


FIG. 2—SPECIFIC DEMAND CHARGE PLOTTED AGAINST LOAD FACTOR

above, it is necessary to base the specific demand charge on the maximum demand, and if the total demand charge shall be the same in both cases,  $dy = y'r$ , where  $y' = \text{constant}$ , or

$$y = \frac{r y'}{d} \quad (3)$$

If  $ABCD$  (Fig. 1) is the central station's load curve and  $abcd$  be the load curve of an individual consumer, and if, further,  $b'c'$  be assumed as the duration  $T$  of the central station's peak load, then the consumer's simultaneous peak  $r$  is given by the height of the rectangle into which the area  $b'bc'$  can be converted over the basis  $b'c'$ . Then it will be possible to write

$$r = \frac{c_o}{T} \quad (4)$$

where  $T$  is the duration of the central station's peak load  $b'c'$  in hours and  $c_o$  is the area  $b'bc'$  or the energy consumed in kilowatt-hours by the customer during the period  $T$ .

Equation (4) can be written in the following form:

$$r = \frac{c}{d} \times d \times \frac{c_o}{e} \times \frac{1}{T}$$

or

$$= L \times d \times \frac{c_o}{e} \times \frac{1}{T}$$

where  $L$  is the load-factor expressed as equivalent number of hours' use of the maximum demand per month (or per day, according to the period over which  $e$  is taken) and

$$r = L \cdot \frac{c_o}{e} \times \frac{1}{T}$$

Substituting this in equation (3),

$$y = L \cdot \frac{c_o}{e} \times \frac{y'}{T} \quad (5)$$

where  $\frac{y'}{T}$  is a constant for a given central station with a given shape of load curve.

The specific demand charge  $y$  will therefore be not constant but directly proportional to the load-factor  $L$ , provided

$\frac{c_o}{e}$  does not change with changing  $L$ . It is easy to see,

however, that  $\frac{c_o}{e}$  does change with changing use of the demand, and a little investigation is necessary to ascertain how the ratio  $\frac{c_o}{e}$  is likely to vary under such conditions.

If the load-factor is very small—for example, thirty minutes' use, or less, per day—it is hardly likely that the whole installation is in use but a few minutes per day and completely idle the remainder of the time. The reason for the small load-factor will rather be found, in the majority

of cases, in a large maximum demand of very short average daily duration—probably not an everyday maximum and perhaps occurring only once or twice a month. This short peak will be superposed on a load curve more or less of the character of the typical load curve for that class of consumers; in other words, the customer will have a number of lamps which are infrequently used, but which increase the maximum demand very decidedly. For instance, if a residence customer uses his maximum demand an average of fifteen minutes daily, it seems obvious not that he is really using his full installation for fifteen minutes day after day, but rather that he is using certain lamps in his house from day to day in the same manner as other residence customers, and at comparatively infrequent intervals uses a number of additional lamps, for some special occasion, which otherwise never are in use simultaneously. In other cases the explanation might be that the house is not constantly occupied, day by day. In both cases, however,

it would seem that the ratio  $\frac{c_o}{e}$  will not be materially

changed from its average value for that class of business (residence) and may for a rough approximation be assumed constant and the same as with normal load-factors of that class.

On the other hand, an abnormally large load-factor is possible only by long hours of use. Residence loads, which as a class have a peak later than the central station's peak, are likely to have their load-factors increased, not by additional hours of use during the central station's peak load, but almost exclusively by additional use during the later hours of the evening. Such classes of business, on the other hand, as have their peaks during the central station's peak—such as offices, stores, etc.—can improve their load-factors *eo ipso* only by increased off-peak use. Therefore

the ratio  $\frac{c_o}{e}$  will, apparently, decrease with increasing

load-factors, if the load-factor is large.

It seems evident, therefore, that for small load-factors  $\frac{c_o}{e}$  is roughly constant, and consequently from equation

(5) the specific demand charge  $y$  is approximately proportional to the load-factor, whereas with large load-fac-

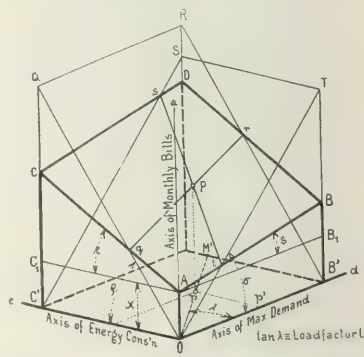


FIG. 3—GEOMETRICAL METHOD OF REPRESENTING CHARGES IN A RATE SCHEDULE

tors  $\frac{c_o}{e}$  is decreasing as the load-factor increases, thereby leaving the product  $L \cdot \frac{c_o}{e}$  more or less constant, and there-

fore  $y$ , according to equation (5), does not change materially for larger load-factors. If the specific demand charge  $y$  is plotted against the load-factor, the result, therefore, should be a curve somewhat like Fig. 2.

#### III. THE EXPRESSION OF VARIABLE SPECIFIC DEMAND CHARGES IN THE RATE SCHEDULE

The problem of how to express these variable specific demand charges in a rate schedule is most conveniently treated graphically along the lines described in the author's article, "Space Representation of Central-Station Rates," in the *Electrical World*, Nov. 4, 1911. A system of rectilinear solid co-ordinates will accordingly be chosen, representing the customer's maximum demand  $d$  and his kilowatt-hour consumption  $e$  as horizontal co-ordinates and the amount of his bill  $a$  as the vertical co-ordinate.

In order to deal with more general conditions, assume a system of charges of which the above is only a special case, namely, the three-charge system, which charges each customer, besides the energy and demand charges, a certain fixed amount  $x$  equal to the customer or connection charge. Equation (1) then becomes

$$a = x + yd + ze \quad (1a)$$

where  $x$  is a fixed amount, expressed in cents per month.

If now  $x$ ,  $y$  and  $z$  are taken as constants, the geometrical representation of equation (1a) is a plane in space in the general position  $ABCD$  (Fig. 3). The distance  $OA$  equals the customer charge  $x$ ;  $y$  and  $z$  are given by the tangents of the angles  $s$  and  $r$  respectively. The proof for this is given in the above article, but for those not familiar with that treatment, it may be briefly pointed out here that by placing in equation (1a) first  $d$  and then  $e$ , equal to zero, the equations of the traces  $AC$  and  $AB$  are at once obtained and these equations,  $a' = x + ez$  and  $a'' = x + dy$ , demonstrate the correctness of the above statements about the geometrical representations of  $x$ ,  $y$  and  $z$ .

Each customer's load is represented by a point on the bottom plane (Fig. 3), for instance  $p$ , where  $Op'$  is the maximum demand and  $p'p$  is the kilowatt-hour consumption. The load-factor  $\frac{e}{d}$  is proportional to the tangent of the angle  $B'OM'$ .

Let it now be assumed that smaller specific demand charges are wanted for smaller load-factors, and vice versa, as already developed. If all customers with a load-factor below a certain value,  $\tan B'OM'$  (Fig. 4), are charged a constant demand charge  $y_1 = \tan \alpha_1$ , and if for larger load-factors the demand charge is increased to  $y_2 = \tan \alpha_2$ , and furthermore, if the customer charge  $x$  and the specific kilo-

watt-hour charge  $z$  remain constant, the surface of the bill  $a$  will be a plane  $ABCD$  in the case of the steps, a continuous curved surface, of conical character like Fig. 6, will replace the original series of planes. The nature of the directrix  $BB'$ , or  $mn$  of this surface depends entirely on the functional relation between the specific demand charge and the load-factor.

Now let the number of the demand charge steps be three.

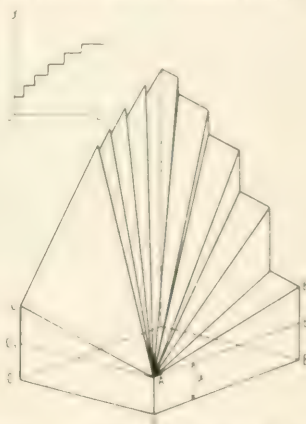


FIG. 3.—GRAPHIC REPRESENTATION OF DEMAND CHARGE SHOWING RESULT OF INCREASE IN NUMBER OF STEPS

tion  $t$  of the load-factor, or  $y = r(L)$ , whereas the customer and kilowatt-hour charges are the constants  $x_1$  and  $z_1$  respectively; then

$$a = x_1 + y_1(L) + z_1 e \quad (6)$$

If now, for instance,  $y = r(L)$  be chosen proportional to  $L$ , or

$$y = r(L) = k \cdot L \quad (7)$$

it follows that

$$a = x_1 + d \cdot k \cdot L + z_1 e$$

or, since

$$L = \frac{e}{d}$$

$$a = x_1 + (k + z_1) e \quad (8)$$

The variable demand charge in this case therefore is simply reduced to an additional kilowatt-hour charge; the total bill is independent of either load-factor or demand and under the assumption made in this instance it follows that a demand charge can be expressed by an energy charge and vice versa.

For example, it might be specified in a rate schedule that a kilowatt-hour charge of 5 cents would be made and in addition a variable demand charge equaling (in cents per kilowatt of demand per month) twice the load-factor (in hours' use per month); this would simply mean a straight rate of 7 cents per kw-hr., as can be verified from equation (8). When  $a = 0$ , a customer, for instance, having a 10 kw demand and using 10 hr. of equipment, would have a load-factor of one hour's monthly use and consequently pay a demand charge of 20 per kilowatt. His bill would therefore be

$$\begin{aligned} 10 \text{ kw} \times 20 &= 200 \\ 100 \text{ kw-hr} \times 5 &= 500 \\ \text{Total} &= 700 \end{aligned} \quad \begin{array}{r} \text{cents} \\ \text{per month} \\ \text{per month} \end{array}$$

This would be equivalent to a straight rate of 7 cents per kw-hr.

If  $y$  be chosen as

$$y = r_1 + r_2 L \quad (9)$$

then

$$a = x_1 + r_1 e + r_2 L e + z_1 e \quad (10)$$

That means that if the demand charge is a straight line

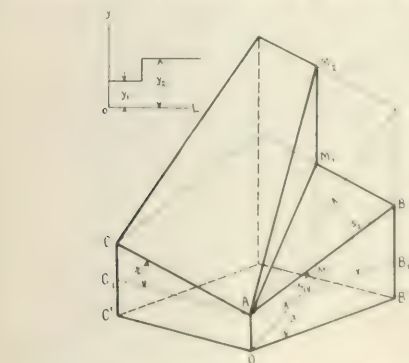


FIG. 4.—GRAPHIC REPRESENTATION SHOWING LOCUS OF CUSTOMERS' BILLS

watt-hour charge  $z$  remain constant for any size of the load-factor, then the locus of customers' bills under all conditions of consumption, demand and load-factor is shown in Fig. 4 in heavy outlines.

If now, instead of using only two steps in the demand charge, the number is increased the result will be typified by Fig. 5, and it is easy to see that by a continual increase





kilowatt-hour is represented similarly by the angle  $\sigma$ . It is evident from this that if the customer charge  $x = OA$  is zero or if only that part of the bill is considered which is formed by the two other charges, then all customers with the same load-factor will have to pay under a rate like Fig. 3 or Fig. 6 the same average price per kilowatt as well as the same average price per kilowatt as well as the same

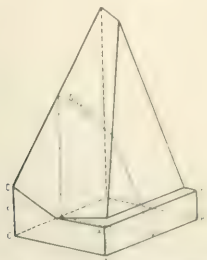


FIG. 8—SOLID REPRESENTING CUSTOMER CHARGE

average price per kilowatt-hour, no matter whether they are large or small consumers. The second and third methods can then be expressed as follows:

**Second Method.**—The customer will be charged 50 cents per month plus the amounts given in the third column of the table for each kilowatt of maximum demand. Each value in that column has been found from the preceding column by adding the number of kilowatt-hours per kilowatt at 2 cents each (or hours used at 2 cents each) to the corresponding figure of the second column; for instance, in the range forty-five to fifty hours the figure \$4.37 is the sum of  $\$3.37 + \$0.02 \times 50$ . This type of schedule, with a few minor variations and different figures, is used, for example, among other schedules at Spokane, Wash.

**Third Method.**—The customer will be charged 50 cents per month plus the amounts given in the fourth column of the table for each kilowatt-hour consumed. Thus, for instance, if his load exists for from forty-five to fifty hours per month he will be charged 8.74 cents per kw-hr. in addition to the customer charge where 8.74 has been found as the quotient of the corresponding figures in the third and first columns, that is,  $437 \div 50$ . This general principle of expressing rates in a schedule for the customer is made use of by the municipal lighting department of Seattle, Wash.

**Fourth Method.**—The curve given in Fig. 9 is approximated by a series of straight lines  $BPQ$ . The curved surface of Fig. 6 then changes into a pyramid as shown in Fig. 8, with its vertex at the same point  $A$ , and superposed on the same flat slab,  $A'B'C'B,C$ , the latter being caused

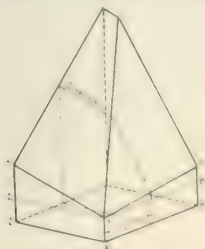


FIG. 8a—SOLID ILLUSTRATING EFFECT OF MINIMUM BILL

by the constant customer charge, which disappears if that charge becomes zero. The shape of this pyramid shows at once that we have arrived at an ordinary multiple-rate system with a given primary charge per kilowatt-hour and a lower secondary charge, the ranges of the two charges being divided from each other by load-factor lines; such multiple rates are shown and explained, for instance, in

Fig. 10 of the above-mentioned article in the *Electrical World* of Nov. 1, 1911.

By the term "multiple rate" shall be understood a rate with the following features: The kilowatt-hour consumption is divided into a number of "blocks" progressing either with the number of kilowatt-hours used or with the load-factors (for example, blocks of 100 kw-hr. each, or 5 per cent load-factor each) or by combinations of the two methods. The primary consumption for each block is charged at a certain rate per kilowatt-hour, which decreases by steps from one block to the next. The "primary" rate is charged for the first block, the "secondary" for the second, the "tertiary" for the third, etc. The characteristic of the multiple-rate system is that each one of these rates applies only to its own block and has no influence on what is charged for the other blocks, in counter-distinction to the method in the fourth column of the table, where every reduction in the kilowatt-hour charge applies to all kilowatt-hours, beginning with the first one.

This same multiple, or "cumulative block," rate system may also be made to apply to kilowatt charges, and finally both the kilowatt and kilowatt-hour multiple systems may be combined, as, for instance, in the Boston "Schedule C" (see *Electrical World*, Nov. 4, 1911, page 1124), which charges 5 cents per kw-hr. up to 1500 kw-hr. per month, 3 cents for each kilowatt-hour between 1500 kw-hr. and 5500 kw-hr. and 2.5 cents for each kilowatt-hour above

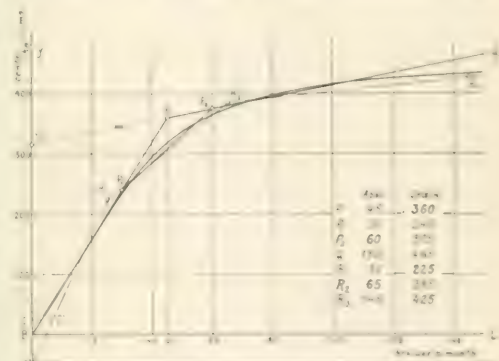


FIG. 9—CURVE SHOWING SPECIFIC DEMAND CHARGE VARYING WITH LOAD-FACTOR

5500, besides the following monthly demand charges: \$2 for each kilowatt below 15 kw, \$3 between 15 kw and 55 kw and \$2.50 above 55 kw.

The primary charge or primary rate applies as long as the corresponding straight line  $BP$  in Fig. 9 applies; that is, until the load-factor of forty-five hours per month is reached. After this the secondary rate applies. We can also, with the aid of equation (10), find what the actual figures of the schedule will be if the directrix  $BPQ$  is used. It appears from Fig. 9 that up to forty-five hours we

$$Y = \frac{100}{100} \times 2 = \frac{100}{45} \quad Y = 2.22$$

and for more than forty-five hours we

$$Y = 100 + 4 \left( \frac{100 - 100}{100 - 45} \right) = 115 + 4$$

Now, assuming again that  $a_1 = 50$  cents and  $a_2 = 2$  cents per kw-hr., and furthermore that

$$\begin{aligned} 3 \quad Y &= 0 & \text{if } L &= 45 \text{ hours} \\ Y &= 5 & \text{if } L &= 45 \text{ hours} \\ Y &= 115 & \text{if } L &= 45 \text{ hours} \\ Y &= 119 & \text{if } L &= 45 \text{ hours} \end{aligned}$$

equation (10) reduces to

$$a = 1 + (8 + 2) \times 2 = 10 \quad (10a)$$

or,  $a = 1 + 115 \times 2 = 231 \quad (10b)$

The schedule would read, therefore: a constant connection charge of 50 cents per month, and for each kilowatt-hour up to forty-five hours' use, 10 cents per kw-hr.; such kilowatt-hours as are used in excess of forty-five hours' use will be charged at the secondary rate of 3 cents per kw-hr.

According to the rate analysis given in the author's previous article, the equation for this rate for load-factors of more than forty-five hours' use (secondary range) would be:

$$u = x_0 + 10 \times 45d + 3(e - 45d) = x_0 + 315d + 3e$$

This shows that the demand charge 315 cents per kw of demand in the secondary range checks with the demand charge in equation (10b) as it should do. The customer charge  $x_0$  is of course unchanged and equals 50 cents.

Instead of using but two straight lines  $BP$  and  $PQ$  to approximate the curve of the demand charge in Fig. 9, the curve can be approximated, of course, by any number of broken straight lines as closely as desired. This will result in tertiary, quaternary, etc., charges. For instance, the directrix  $BP, P, Q$  would be represented by the following rate: 10 cents per kw-hr. up to thirty hours' use; 6½ cents for all kilowatt-hours between thirty and sixty hours' use

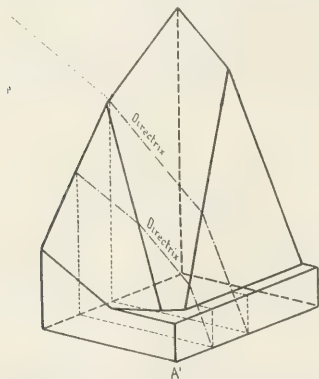


FIG. 10—REPRESENTATION OF MULTIPLE-RATE SYSTEM HAVING PRIMARY, SECONDARY AND TERTIARY CHARGES WITH MINIMUM BILL

per month, and 3 cents for all kilowatt-hours beyond sixty hours' use, besides a customer charge of 50 cents.

### III. SUBSTITUTION OF A MINIMUM BILL FOR THE CUSTOMER CHARGE

In order to simplify the rates, it is often considered desirable to replace the customer charge by a minimum bill. This changes the solid shown in Fig. 8 to the type illustrated in Fig. 8a, and the vertex of the pyramid is lowered by the amount of the customer charge, from  $A$  in Fig. 8 to  $A'$  in Fig. 8a; and accordingly it is necessary to lower  $B$  in Fig. 9 to  $B'$ .  $B'R_1R_2$  may then be assumed as a fair approximation to the curve, with a minimum, for instance, of 75 cents, thus changing the directrix to  $CC'R_1R_2$ . This would correspond to a primary rate of

$50 + \frac{225}{25} + 2 = 13$  cents per kw-hr. up to twenty-five hours' use, and

$\frac{385 - 225}{65 - 25} + 2 = 6$  cents per kw-hr. for all kilowatt-hours used between twenty-five and sixty-five hours' use, and

$\frac{425 - 385}{145 - 65} + 2 = 2\frac{1}{2}$  cents for all kilowatt-hours beyond sixty-five hours' use; minimum charge, 75 cents per month.

Of course, a minimum bill can never replace a customer charge exactly, for although a pyramid with a sufficient number of sides can approximate a given cone with any

desired degree of accuracy if the vertices of pyramid and cone coincide, yet it is absolutely impossible to make them exact substitutes for each other if the vertices do not coincide. The best plan, therefore, if it is decided to use a minimum bill instead of a customer charge, would be to choose the position of the directrix  $mn$  not at unity distance from the origin, as in Fig. 6, but at a distance repre-

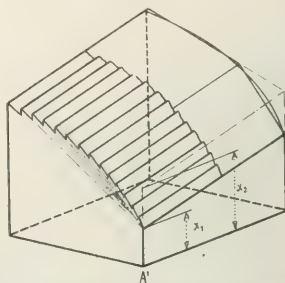


FIG. 11—CURVED SURFACE PRODUCED BY INTRODUCING DECREASING RATES WITH INCREASING ENERGY CONSUMPTION

senting that demand  $d_m$  for which a maximum revenue is obtained (which in residence service is about 0.75 kw of maximum demand). Fig. 10 shows a multiple-rate system with primary, secondary and tertiary charges and a minimum bill instead of a customer charge. If compared with Fig. 6 or Fig. 8, it shows at a glance the difference produced by the substitution of the minimum charge.

### IV. INTERCHANGEABILITY OF THE THREE FUNDAMENTAL CHARGES IN GENERAL

It has been shown in this article how a variation of the demand charge in terms of the load-factor can be expressed, under certain assumptions, by changing both demand and energy charges from their respective original values. Thus a demand charge proportionate to the load-factor can be expressed by placing the demand charge equal to zero and increasing the energy charge to a constant amount above its true value. In other cases the demand charge may be reduced, without reaching zero, and the energy charge correspondingly increased. The energy charge, therefore, under certain conditions, can take the place either of the whole demand charge or at least some part of it, according to circumstances. A similar inter-

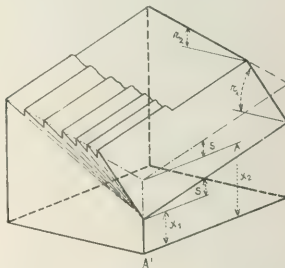


FIG. 12—SOLID SHOWING EFFECT OF REDUCING SPECIFIC ENERGY CHARGE BELOW TRUE VALUE AND INCREASING CUSTOMER CHARGE

changeability between all three fundamental charges may occur in other instances. We might assume, for example, on the value-of-service principle, that large energy users ought to receive smaller specific energy charges in such a way that those charges are gradually lessened as the consumption of energy increases. Then by lines of reasoning analogous to the case treated above in Figs. 4, 5 and 6, it

is evident that the plane shown in Fig. 3, which holds only for constant charges, is changed into a curved cylindrical surface as indicated in Fig. 11.

Without going into details it may be pointed out here that under certain conditions, viz., if  $x$  varies inversely with the energy consumption, this cylinder changes back into a plane as illustrated in Fig. 12, where the specific energy

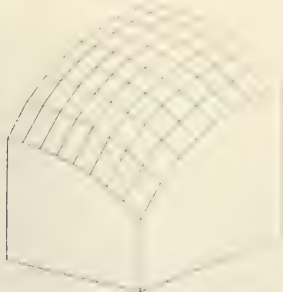


FIG. 13—NUMEROUS PLANES APPROXIMATING A CURVED SURFACE

charge is reduced below its true value and the customer charge increased, while the specific demand charge is unchanged. In this case each succeeding plane, passing toward larger consumption, has a smaller specific energy charge and implies a larger customer charge than its predecessor. In this case the customer charge takes, as it were, the place of the energy charge. The same applies finally to the demand charges, since they also may be decreased for large customers, under the value-of-service theory.

These principles of reducing certain specific charges for consumers having large demands or long hours of use may also be combined with each other, as in the Boston "Schedule C," for example, previously mentioned.

It appears, then, that the specific demand charge may decrease with increasing demands and the specific energy charge may decrease with increasing energy consumption, whereas the customer charge increases with both increasing demand and energy consumption. Another method to the same end, at least as far as the energy consumption is concerned, has been chosen in Portland, Ore., where the light

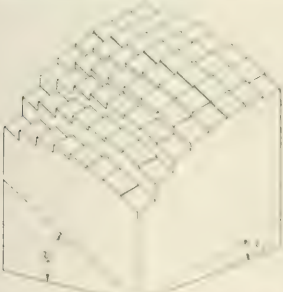


FIG. 14—SOLID REPRESENTING TYPE OF RATE IN WHICH SPECIFIC DEMAND AND ENERGY CHARGES ARE BOTH CONSTANT

ing schedule is a multiple-rate system with primary, secondary and tertiary ranges divided from each other by steps in the load-factor. For that part of the energy consumption which reaches beyond 1000 kw-hr. a discount is made of 1 cent per kw-hr., and for all energy consumed beyond 3000 kw-hr. another cent is discounted. This also raises the customer charges while reducing the kilowatt-hour charges

by revolving the planes around the 1000-kw-hr. and 3000-kw-hr. lines into positions which are more nearly horizontal.

If one or more of the three specific charges are changed without any simultaneous opposite change in one of the other specific charges, it can be easily seen from the solid models that this will always cause the surface to become discontinuous, as shown for instance in Fig. 4 or Fig. 5, or in the table. In such cases there are certain customers who, by very slight changes in demand or consumption, will experience sudden or abrupt changes in their bills, caused by passing over discontinuities of the surface, as for instance near  $AM, M_2$  in Fig. 4.

Fig. 13 illustrates the fact that by means of a rate system which is represented by a series of small planes a close approximation can be had to a curved surface, and as the planes become smaller the approximation becomes closer, approaching the curved surface as a limit. Fig. 14 shows the same type of rate where the specific demand and energy charges are both constant, and only the customer charge is subject to variation; this model exhibits a surface which approaches the surface in Fig. 13 as the steps become smaller.

Fig. 15 shows the same surface composed of differential particles of such planes as have a common constant customer charge  $x_0 = OA$  and also a constant specific-demand



FIG. 15—SOLID COMPOSED OF DIFFERENTIAL PARTICLES OF PLANES HAVING COMMON CUSTOMER CHARGE AND SPECIFIC DEMAND CHARGE

charge is also expressed for instance in the fourth column of the table, with the provision that the steps are not infinitesimally small there.

Thus the same result can be obtained in a series of an infinite variety of other combinations of constant and variable specific charges.

## Financial Statistics of Cities

The department of commerce and labor, bureau of the census, has published a special report entitled "Financial Statistics of Cities Having a Population of Over 25,000," which presents under the supervision of Mr. L. C. Gray, Powers, and statistics for income and municipal expenses. These tables give in detail the financial statement of the municipal governments. Their indebtedness and taxes and the assumed collection of local property. The statistics are arranged so as to present as in some the various of conducting the city business, together with the revenue collected and the methods of payment for meeting these costs. In Table 10 which contains the income from public-service corporations we find a total income of \$22,057,904. It shows the income from gas, water, power and charges.



# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Bright Lining of the Flood Cloud

In some of the cities of the Middle West lately afflicted by floods the central stations have been able to find consolation for their losses in the gains that have been made in other directions. With scores of houses and stores yet uninhabitable the Dayton Light & Power Company is carrying more than its normal load. This is due to two main causes, the first of which is that the company has taken on the load carried before the flood by the independent plants of a department store, an office building and the largest laundry in the city, and has installed many small motors—amounting to at least 1000 hp in all—for work formerly done by gas and steam engines. Every motor the company had or could obtain from outside the city was put to work in short order to take the place of units disabled by the flood. The second factor in raising the Dayton company's load is the increased and new lighting installations in houses and stores that are being rehabilitated. Stores that might have got along for years with twenty lamps in their windows and shops have increased the number as an incident to the general overhauling. House wiring has been easier to get since the flood than formerly.

The attitude of the company was not that of forcing its service upon those sorely in need; it simply asked, "Can we do anything for you?" The intangible benefit from the flood has been the demonstration of the enterprise of the central station, its powers of quick recuperation, and in general the showing that the central station is a good thing to tie up to.

This was shown in many ways, and incidentally the adaptability of electricity for all kinds of work was made plain to power users and the public at large. While the disconsolate shop owner whose basement was full of water was wondering how he was going to get rid of his own particular share of the flood the company's men would set up a small motor-driven pump on the sidewalk, connect up the suction hose and have the cellar free of water in short order and free of charge. Dayton's finest newspaper plant was put out of business by water in the boiler and press rooms. As it would have taken too long to set up the emergency press in the *News* building, the press was placed on the street, where it still stands, its motor connected up to the company's mains, and a board fence built around it. A big sign of the Dayton Light & Power Company on this fence is a constant reminder to the passer-by that it was central-station power that made it possible for the newspaper to run off its editions in spite of the flood.

In any number of cases central-station service was the savior of situations that appeared hopeless to the operators of small plants, with gas or other engines below the street level. One of these was a coffee mill where the machines were driven by gas engines. The mill was one of the concerns to which the company put the query whether it could do anything to help out. The answer was the rather despairing one that the only thing that would help would be to get the machines working. When told that this could be easily accomplished the mill people wanted to know when, and they were incredulous when the reply came, "This afternoon." With the co-operation of manufacturers' salesmen, who were also early at work, one 50-hp motor was installed in a few hours, and the other 100 hp needed was ready the next day.

In Columbus the Railway & Light Company had its system in operation long before the municipal plant was in service. The company, in fact, carried the municipal plant's commercial load for a month, lighted the city hall, and offered to light the streets, but for some reason the offer was declined, and in consequence the larger part of the city remained in darkness much longer than was necessary. Several good motor users that formerly operated independent plants have become customers of the company since the flood, and its load is now better than normal. The quick restoration of the Columbus company's service was due to the prompt and effective means taken to dry out its machines, which with one exception had been 6 ft. under water. These were boarded up, and the inclosures were connected with flues from a number of large heaters. In this way all were ready for operation in less than a week.

## Transmission Lines Along Country Roads

A peculiar case of alleged negligence came before the Supreme Court of Washington recently. The defendant, the Yakima Power Company, operates a high-tension transmission line running along a public highway in the Yakima Valley, the wires being supported by ordinary wooden poles at about 40 ft. above the ground. The plaintiff, a farm hand, was riding in a loop of wire cable that hung from the 18-ft. boom of a 45-ft. portable derrick used in hay stacking. While passing along the road, this boom swung to one side and allowed the wire cable to make contact with the bare wires of the transmission line and a circuit to the ground was completed through the person of the plaintiff, resulting in shock and burns. Action for damages was lost in the Superior Court and, in supporting its opinion, the Supreme Court held that a company owning a high-tension line is bound to put its wires high enough to leave the road safe, not for any and all travel, but for usual and ordinary travel. There was no worthy evidence tending to prove that at the time the defendant company erected its transmission line hay derricks 45 ft. high, including the projection of the arm above the mast, were so generally hauled over the road as to constitute ordinary and usual travel.

## Securing Small Motor-Load Customers in Duluth

Mr. C. E. Van Bergen, general manager of the Duluth Edison Electric Company, prepared a short but interesting paper entitled "Securing Small Power Customers," which was read by Mr. George W. Gibeau of the same company at the recent St. Paul convention of the Minnesota Electrical Association. Mr. Van Bergen said:

"Duluth is not a manufacturing center, and the motor load obtained has been secured only by hard work and being continually on the job. We work in conjunction with the different commercial clubs of the city and endeavor to encourage in every way possible this class of service.

"Our business is confined to supplying motors of 50 hp and smaller ones according to our contract with the Great Northern Power Company. However, we have now installed about 4600 hp of motors distributed among 671 customers, an increase of 40 per cent in three years.

"Prospective customers for small motors usually make themselves known by inquiries regarding the voltage, cycle and phase of the service supplied. Some inquire first as to rates. As soon as an inquiry is received, a representative calls on the prospective customer, getting details as to the size of motor desired, informing him what firms are agents for motors, and in general getting acquainted.

"If the 'prospect' is already a lighting customer, we point out our policy of allowing the lighting and power loads to be placed on the same meter at the minimum power rate, 6 cents per kw-hr. If he is not a lighting customer, this point appeals to him and thus aids in securing his contract for both services. A minimum charge of 80 cents net per hp per month is made in connection with this 6-cent rate. The class of business usually secured by this method includes grocery stores, meat markets, dentists and others. In the case of a customer who wishes to add to his equipment, we gladly make any tests he desires in order to determine the energy consumed by any or all of his machines.

"We believe in the value of newspaper advertising and run an advertisement at least twice a month in the principal newspapers of the city, making the motor business the feature. We also encourage the small motor customer by either renting him a motor for a few months in order to enable him to make a start in business or selling him one on monthly instalments, the company retaining the ownership of the motor until it is fully paid for. This method gains for us on an average several customers each month. We also take back from customers who wish to increase their motor capacity their old motors and furnish them with larger motors at as near cost price as possible.

"We find it good policy to call on our small motor customers at times and perhaps make suggestions as to rearrangement of shafting or motors or learn if they have any electrical trouble needing attention. These visits are surely appreciated by customers, often leading to increased load. Indirectly they are also of benefit since a satisfied customer is always ready to 'boost' for the concern which shows itself interested in his welfare."

## Sales Organization of the Commercial Department

By HARVEY B. MANN

Viewing broadly the sale of central-station industrial motor service, one cannot fail to note how highly developed it has become in some cities for so new a business, not how in certain respects it might be improved in other places. The rapid development of such a large selling field has resulted in building up sales organizations from the best material at hand and has precluded, in a considerable measure, the attainment of well-rounded, cohesive organizations and policies such as mark our older industries. While a great deal of real sales work has been done it is apparent that considerable of this business has simply come itself, following a wider general knowledge of electrical power possibilities. In other words, this has been non-competitive business which required little more than exploitation and advertising. Under these conditions high efficiency in motor-service selling was not required and hence not often developed.

The business now enters another phase where its further increase meets competition from isolated plants, installed or projected. To get the central station's share of this business the art of selling service will have to be further developed, and it is the object of this article to outline briefly some features which to a competitor appear worthy of attention.

Foremost among these is that of pure salesmanship. That a higher standard of salesmanship is not apparent in many central-station organizations is probably due to the

fact that men have been selected too much on the basis of their electrical-engineering knowledge. While desirable that central-station salesmen have technical educations and necessary that the same engineering experience those qualifications are of no value unless the men are, fundamentally, salesmen.

Good salesmanship will be of unusual value in overcoming the popular prejudice against the central station. It is not necessary to prove that the prejudice exists or that it has been justified in many instances by the conduct of the utilities corporation. The psychological basis for such a feeling against the large corporation, and especially the monopoly, is well understood. The enlightened policies of many public-utility corporations are doing much to allay this feeling, but it is bound to exist to some extent and is therefore a handicap in selling service which calls for salesmanship.

A vital point in commercial work, and probably the key to the entire situation, is the management of the business department. This position should not be filled by a first-class engineer but by a sales manager. He should have a wide experience in factory power plants, especially steam stations. He should be an experienced salesman and, of course, have the necessary grasp, broadness and executive ability.

Having found no place for the purely electrical engineer in the position of manager or solicitor, let us place him where he will be of most service—in the office as engineer to the power sales department. Any large city office of the electrical manufacturing companies serves as an example of this plan of organization. In one of them we find a sales manager, a motor salesman, a lamp salesman, a mining-machinery salesman, a turbine and condenser salesman and a district engineer. The salesmen's engineering problems are handled by this engineer. The latter holds his position by virtue of his technical ability and is not expected to sell.

Following this plan for the motor sales department, we would have salesmen who sell, a sales manager who directs and assists salesmen and a power engineer who estimates, tests and advises. This type of organization has already justified itself in several instances where it has been only partly perfected.

The power engineer should be competent in both steam and electrical engineering. Practical experience in steam work, preferably in selling steam equipment, is very desirable. This training in steam apparatus sales is secured because it implies a practical knowledge of the various lines and types of equipment in isolated plants. In the selling end, again, the technical graduate will in a shorter time gain a broader experience based on many different industries than he will in the engineering office of the same concern. The inside man devotes more of his time to the problems of his own line and has less time to travel and observe general plant equipment than has the salesman. Motor-service engineers can be had with this training, for there are plenty of men now selling who are better fitted to do engineering.

If selling training is of value for the motor-service engineer, it is doubly so for the motor-service salesman. Men so trained could avoid very many of the mistakes of getting a job after an inspection of the equipment and an hour's talk with the chief engineer. Unnecessary trips to plants could be largely eliminated, saving expense and thus waste the million attention now being put a lot of time on a job which an afternoon's engineering could try to improve. A great deal of the necessity of visiting to purchase of energy.

With this steam training the central-station engineer or salesman could successfully meet the steam equipment man on isolated plant possibilities. To prove that this knowledge is necessary it may be well to examine a field where competition is at the least—that is, where exhaust steam from the isolated plant can be used for heating or drying



If the central-station salesman knows what can be done with this steam, how much is required, the cost of the equipment, its efficiency and economy, then, and then only, can he present a good case. The motor-service engineer analyzes the situation and prepares a comparative statement, but cold facts and figures are far from infallible in getting a contract signed. It takes the salesman to put life into it, to drive home the points, and especially to secure weight for such items as "personal attention," "fear of shut-downs," "explosions" and "injury to workmen," which cannot be expressed in black and white. To do this effectively the salesman needs to have steam experience.

One just-out-of-college central-station salesman reported a test of an isolated plant showing an evaporation of 62 lb. of water per lb. of coal. Failure to know at sight that such a result was wrong showed a lack of practical knowledge quite too general. Slips like that cause other statements of the central-station's men to be discounted, and such blunders are used to the full by the competent and experienced steam men who are boosting the isolated plant. While this is an exaggerated example, it serves to emphasize the necessity of having in the motor-sales department men who are not lost the moment they get beyond the magnetic field of their textbooks.

It is very essential that comparisons made by the motor-sales department between central-station service and the isolated plant be on a conservative basis. The major portion of such a comparison is in working up the costs of the isolated plant, and this cannot be done properly without a practical knowledge of such plants. It is advisable that such a report show somewhat better economy than can actually be maintained. Give one's competitor the benefit of the doubt and it helps one's cause, provided the customer is shown how liberally the costs have been figured. Underestimate a competitor's position and the observant customer discounts one's statements in a greater proportion.

A thorough knowledge of isolated plants, aside from its value in making reports, is also desirable in discussing the proposition with owners or engineers. The motor salesman's competitor is the customer himself who proposes to make for his own use that which the central-station wishes to sell him. That competing isolated plant must be argued against, analyzed, pulled apart and every element properly tagged. Such analysis must be done fairly, cleverly, tactfully and without "knocking." Of course, no salesman can expect to do this without thoroughly knowing his subject. He must know the cost of fuel available and its heat value, the cost of water and its quality, the probable efficiency of the boilers and engines to be used, and more especially the heating requirements.

An organization of salesmen, engineers and sales manager selected as above suggested would go far toward improving the situation and decreasing idle investments in plant and equipment.

### Extension of Central-Station Service in St. Louis

About thirty isolated plants in St. Louis, supplying electricity and heat to buildings ranging in size from 1,000,000 cu. ft. to 8,000,000 cu. ft., have been displaced by the service of the Union Electric Light & Power Company during the last year. In several cases the contract for supplying electricity from the central station is accompanied by the agreement to furnish the entire engineering service required in the building. The operation of the generating units has been discontinued in each case, and the boilers are used only for supplying heat to the building in which they are located and to some others in its locality. Where the boilers cannot pass an inspection for high-pressure steam they are utilized by connecting them to a low-pressure heating system. As many as ten buildings are heated from some of the steam installations. Some of the buildings require steam for seven months during the year.

One economy effected by central-station service is the operation of several heating installations by one fireman. Two foremen are employed to supervise the buildings. The main inducements offered to the owners of private plants are the elimination of heat in the summer, freedom from supporting an engineering corps and reliability of service.

### Public Service Company's Booklet on Refrigeration

Encouraging reports from central-station companies that have a refrigerating auxiliary have been referred to in these columns. The Public Service Electric Company, of Newark, N. J., is sending out a booklet entitled "Mechanical Refrigeration: Saves Half the Cost of Ice" which tells the story for the benefit of the prospective user of refrigeration. It illustrates a number of installations and gives practical data, comparing previous cost when ice was used and present cost with mechanical refrigeration, which in some cases show a decrease of 50 per cent in the ice bills. In terse sentences the booklet tells the reason why mechanical refrigeration is superior to the old method of cooling with ice. Written for the ultimate consumer, the booklet with its neatly printed pages and good make-up serves its purpose well and illustrates the progressive spirit shown by the company.

### The Power That Rocks the Cradle

Demonstrating that central-station service can easily play the part of nursemaid while assuming the varied rôles of servant in the house, the Marion (Ind.) Light & Heating Company has been featuring a window display of household devices in which a washing-machine motor is adapted to the unusual additional purpose of rocking the baby to sleep. As shown in the illustration, the scene depicts the housewife complacently reading, while about her in automatic operation are to be seen an electrically driven sewing machine, washer, wringer, flatiron, etc. At the front, at-



CENTRAL-STATION WINDOW DISPLAY IN MARION, IND.

tached to the washing-machine outfit, is a wheel and crank which gently oscillates the child's carriage, occupied by a big doll. This newest household application of electricity, which originated in Marion, contributes to the force of the local booster campaign to "make Marion move!" The manager of the new-business department is Mr. H. E. Gant.



### Electric-Heating Plans at Marblehead, Mass.

At a recent hearing given by the Massachusetts Gas and Electric Light Commission upon a petition of the Marblehead municipal electric light plant for authority to sell electricity at less than cost as defined by Section 22, Chapter 34, Revised Laws, a discussion of unusual interest was presented by the petitioner on the relation of prospective electric heating service to the existing average cost of production and to the coming summer campaign for new business on Marblehead Neck, a famous residential resort on the North Shore. The town desires to sell electricity for heating purposes at 5 cents per kw-hr., a price admittedly below the present average cost, but justifiable, it is contended, on commercial and engineering grounds.

The plans of the municipal light board were outlined by its consulting engineer, Mr. C. W. Whiting, who stated that for the year ended June 30, 1912, the average cost of all electricity sold, computed by the statute law above mentioned, was 6.66 cents per kw-hr. The station equipment consisted of two 200 kw. and two 100 kw. units, or a total of 600 kw., and the expenses upon which the above unit cost was figured were: Operating expenses, \$30,007; interest charges, \$3,180; sinking-fund requirements, \$1,000; depreciation, at 5 per cent on the cost of the plant, \$9,214; total, \$44,061. The plant sold during the year 661,056 kw-hr.

The municipality advanced the opinion that there may be two good reasons for selling this electricity below the average cost. First, if the price were greater than the actual cost of the specific service under consideration, there would be a profit from that service and it would be advisable to establish it. Second, even though the price were less than the cost computed as above, it might be a remunerative price because of some other reason.

It was shown that if the Marblehead plant had been built purely for electric heating service, its cost of construction would have been less by about \$18,052, giving a revised cost of plant of \$166,231 and a lower depreciation charge of \$8,312. The expenses of operation would have been less by \$3,939, since the cost of operating the lighting distributing system would have been omitted. The total yearly expense, estimated on the basis that the plant was built solely for electric heating, was \$39,220. This gave a unit cost of 5.93 cents per kw-hr. sold on the foregoing output, which was set forth by the town's engineer as the highest estimate which could reasonably be considered.

The accompanying load curves were presented showing the output of the plant at certain hours on a typical summer day when the maximum peak of the year was handled and on a winter day, when the output was greatly reduced. It was pointed out that with one of the larger units held in reserve as a spare machine the remaining unit have a capacity of 400 kw., which is sufficient to handle the peak

the town could handle the load for during the peak of the load, primarily because the peak occurs during the summer time and consequently during the peak of the day, the day when the sun is at its height and the temperature is at its maximum. The first of these two periods would be entirely off the peak and the second would merely touch the peak, if at all, by an

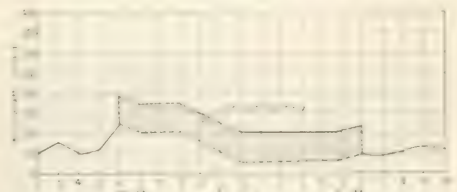


FIG. 2—PARTIAL LOAD CURVE FOR PLANT AT MARBLEHEAD, MASS., FEB. 14, 1913

unappreciable amount. The peak occurred directly at 2 o'clock. In the additional load due to heating were entirely off the peak, as it is believed it would be, then the additional cost of carrying it would be very low. If the additional load were as much as 10 per cent, the added cost would be almost negligible. The coal and water costs might be increased one \$ per cent, but the other costs would not be increased at all.

If such conditions obtained, the actual additional cost would amount to only four cents per kw-hr. This was the lowest estimate which was considered fair. The coal bought is a greater profit to the plant through the building up of an off-peak load. It was testified that if such a load could be built up by the introduction of heating and cooking devices, so that the total energy sold would be double the present output, the only added expense would be for fuel, oil, waste and water. If there were three, four and five per cent, 50 per cent and 80 per cent respectively, the cost of all electricity sold computed as at first, would be 4.7 cents per kw-hr., including all charges as provided by law.

Mr. Robert W. Carey, manager of the plant, testified that a twenty-four-hour service is given and that the town has many summer residents who do not anything but stoves, and most of the houses of gas stoves along the shore. Conferences with the manufacturers of electric stoves and ranges had been had and the results of such equipment, and it is estimated that 1 kw-hr. will cook three meals a day for one person with careful loading of the apparatus. The motor load in the town includes all but five of the industrial concerns within its borders, there being about seventy within limits. At times the average rate on the lighting system goes below 4 cents per kw-hr. A few customers use enough energy to obtain a rate between 3 cents and 4 cents, notably in glue-factory work, where the factories are run continuously night and day on the generating system. The town usually through the hot and winter months goes well from October to May, and at this period the generating load on the system is almost on account of the summer lighting business secured from cottages and bungalows. Summer cottages can be benefited for cooking. The summer residents' houses, about one-third are mainly wealthy persons who would use a large amount of electricity for ice-making and heating if the other were reduced.

Several of the larger contractors, including the Eastern Yacht Club, have arranged the design of their electric heating and cooking, using motor radiators to take off the heat of rooms early and late in the season. Mr. Carey stated that the town will require the best unit to put in the installation and will be building and designed that at 4 cents per kw-hr. the plant could compete successfully with water gas for heating water.

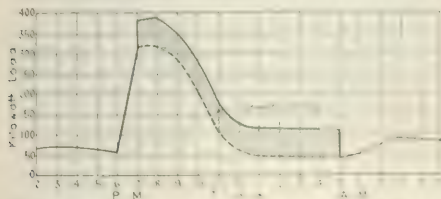


FIG. 1—PARTIAL LOAD CURVE OF PLANT AT MARBLEHEAD, MASS., AUG. 10, 1912

load. This normal capacity of 400 kw. would generate 3,600,000 kw-hr. per year, and yet during the fiscal year taken only 822,692 kw-hr. was generated. The station, the distributing system and many of the expenses have a reserve off-peak capacity figured at 2,677,000 kw-hr., and the managers of the plant contend that a heating load will help in this direction. Electricity used in the warming of

# Illumination and Wiring

## Lighting of a Department Store

The modern department store presents a large variety of conditions to be met by the illuminating engineer. To obtain perfectly satisfactory results it is often necessary to design special equipments of globes and reflectors and much experimental work has been done by designers and manu-



FIG. 1—DISPLAY WINDOW LIGHTED WITH CEILING TROUGHS

facturers to meet conditions encountered in such installations.

The lighting of the Bamberger Store in Newark, N. J., presents some interesting features in the illumination windows, showcases, etc.

The show windows are high and deep and are finished in massive panels of mahogany. For the illumination 25-watt tungsten lamps placed 9 in. apart in Frink trough reflectors are used. The reflector is contained in a ceiling gutter about 8 in. from the plate glass. It is made of metal and lined with rippled mirror glass designed to produce an even distribution of reflected light throughout the area to be illuminated. It was necessary to take into consideration back-reflection, as the high polish of the ceiling and back wall would ordinarily cause spots or high lights; moreover, the source of light had to be concealed so as not to be objectionable to pedestrians looking into



FIG. 2—ILLUMINATION IN HOSIERY SHOWCASE

the window. For this purpose a shield is inserted down from the inner side of the reflector. The wiring is arranged in alternate circuit so that half of the lamps can be lighted at dusk and the remainder later.

All showcases in the store are fitted with Frink showcase reflectors placed in the upper front corner and finished in bronze to harmonize with the case fittings, and they

vary in length from 4 ft. to 15 ft. The lamps are hidden from view and the reflection obtained is free from streaks. Tungsten lamps of 15 watts and 25 watts are used. In cases where material of dark texture is exhibited use is made of the larger size lamps, while in other cases where lighter material such as laces is shown the smaller size of lamp has been found sufficient. High wall-cases are



FIG. 3—ART-GALLERY ILLUMINATION

treated similarly, but wherever possible the reflector has been installed in a false ceiling with provisions similar to those in the windows. Each case is controlled by an individual switch so that the light in any section is entirely independent of that in the others.

The art gallery is illuminated from Frink reflectors supported by wall brackets 12 ft. from the floor. The light is of sufficient intensity to bring out the true color values and is reflected in such manner as to produce the desirable realistic effect. There is a total length of 175 ft. of reflectors.

In the rug department the rugs are suspended from hinged frames. To light these displays semi-circular reflectors measuring about 50 ft. in length were erected just outside the arc described by the swinging frames of the rack. This arrangement permits the whole surface of the rug to be uniformly lighted while being exhibited to cus-



FIG. 4—LIGHTING UNITS IN RUG SALESROOM

tomers. Directly under the reflector is placed a shield which cuts off any light which might fall within the range of vision. Fifty-five 16-cp carbon lamps are used in each reflector, this type of lamp having been found most suitable for the purpose. They are wired alternately so that all or half the number may be turned on as the occasion may require.



## The Effects of Radiation on the Eye

At a regular monthly meeting of the New England Section of the Illuminating Engineering Society on April 21 Dr. Louis Bell, of Boston, Mass., outlined the results of recent researches, in collaboration with Dr. Frederick H. Verhoeff, of the Massachusetts Charitable Eye and Ear Infirmary, upon the effects of radiation upon the eye. These researches extended over a year. The object of the investigation was to determine experimentally the effects of radiations from infra red to ultra violet upon the various media of the eye, quantitative relations being especially sought. Most of the experimentation was performed upon rabbits. The light sources chiefly used were the quartz tube mercury arc lamp of 3.3 amp rating and magnetic arc lamps of 6-amp and 16-amp rating. An enormous number of observations were made, and many of the data are yet to be worked into shape for publication. Dr. Bell said that as a result of the tests it was made absolutely plain that under ordinary commercial conditions surrounding the use of even the more brilliant illuminating agencies no special danger exists, and that only by the grossest neglect and deliberate protracted exposure of the eye to brilliant light sources at close range is there the slightest chance of injury to the organs of vision in the practical application of modern illuminants, except in so far as temporary injury may be due to the effects of ordinary visible radiation.

Observations were specially directed to the study of ophthalmia electrica. It was found that the cornea of the eye does not permit the passage of extreme ultra violet rays, waves of shorter length than about 2950 units being cut off. The absorbed rays attack the cornea, however, and the first effect noticed is a slight stippling, the next stage being a slight haziness which temporarily interferes with vision. The eye of the rabbit has probably somewhat greater recuperative power than has the human organ of vision. In the experiments the steadiness of the quartz tube mercury arc lamp was of great value, but where a point source of light was required greater concentration was secured by the use of the magnetic arc lamp. The researches showed that for wave lengths below 3000 units about 5000 ergs per second per square centimeter would produce in five minutes a barely perceptible effect on the cornea. The law of inverse squares was verified over a range of intensities of 100 to 1 for distances above 20 cm. The above figures mean that  $15 \times 10^6$  erg-seconds per square centimeter will produce an effect of stippling on the cornea. This gives a basis for figuring at what distance one can expose himself for a given time to a powerful source of light. The law of inverse squares means that if the effect is secured in five minutes at half a meter at a distance of 2.5 meters, twenty five times as long, or more than two hours, would be required to produce the same results. Therefore, under no ordinary circumstances, where any kind of powerful modern light source is treated with any sort of respect, can one injure the cornea. With a diffusing globe the length of exposure for the production of ophthalmia electrica is practically infinitesimal. Even with lamps which are most powerful in ultra violet radiation there is no practical chance of damaging the cornea.

The investigators also found that subdividing the exposures of the subject to the light source but applying the illumination at more frequent intervals produced the same effects as the longer exposures farther apart. The subsection of the cornea, however, to repeated exposures seemed to stimulate the natural repair processes, and with the longer intervals between exposures little cumulative effect was observable. With an exposure interval of forty-eight hours two weeks were required to obtain any material effect on the cornea. A subnormal exposure of the incant sufficient to show an effect on the cornea when given daily was found to be overcome by the repair processes when extended to a two-day interval. The eye apparently de-

velops power to fight the secondary and tertiary damage by comparing the exposure of a human eye of about half an inch exposed to the light source after a series of repeated exposures. The time was not found to be affected by the light source as well as did the eye after it had been under test the same for a long period of a part of the community.

More than 100,000 rays were counted in the eye at various and their glass, higher glass, quartz, quartz solution and other special media. A certain percentage of all the rays that the various flint glass and flint glass cut off, reflecting, matter that is wave length of less than 3000 units, every effect. The human eye cut off all wave length shorter length than 3000 units. With flint glass, matter that eye was tested in various ways, but not being long exposure. There were small changes in the eye exposed produced apparently by heat. When working with the near spectrum the heating effects were trouble, but the function of heat in killing bacteria rather than the characteristics of the light itself was indicated in other experiments. Results of changes were produced in the eye, which they are with the light source.

## Ousting Overhead Pole Lines from Panama

At Colon in the Canal Zone, the work of removing all poles and overhead wires from the thoroughfares is now in progress. All electric light and telephone wires of the Panama Railroad Company are being placed in conduit conduits. These conduits contain six lines each for the opening of the conduit being in concrete to a thickness of 2 in. Most of the conduits are designed to contain motor and lighting circuits; one is for the telephone cables, and the sixth is for possible future growth. Manholes of sufficient size to facilitate the drawing in of cables were built of terracotta tile concrete and cement. It was not found possible to keep three conduits free from sewage water from the street, and some openings were made in the sides of such manholes at the level of the tide to prevent the water from reaching the cables. Although the cables are waterproofed, it was found that the contact with salt water was caused on the outside of the conduits, which would tend to corrode them. Because there are many laid in conduits, some are buried in the ground to avoid trouble operated sewer pipes and similar apparatus.

## Recent Telephone Patents

CHARLES S. WINSTON

Mr. C. S. Winston, of Chicago, has invented a circuit system for use in public and office telephone systems. His patent is assigned to the Chicago Switchboard & Supply Company. The system is arranged for initiation of the central office. The opening circuit is connected in series with the central office, and the opening circuit is an excess current produced in a special circuit, opened key which the operator local office. In some cases, systems in this case the operator can transmit to the call at the end of each conversation, but in this system the system is arranged for the system of the call party. The system and the system are arranged that the operator relay upon the call party and the system is known as soon as the call party responds. When the operator key is depressed at the end of the call, the operator is known as the system of the call party.

## Telephone Exchanges

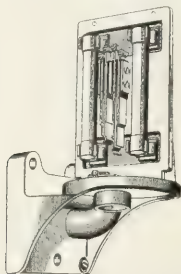
An improved system of the telephone exchange is the subject of a patent granted to Mr. F. Augustus Haddock, of Boston. The improvement comprises the combination of a group



Two compound magnets are built up of these and are secured at their extremities to flat soft-iron pole pieces. The magnets have all north poles together and form a ring which will slip loosely into the casing. The pole pieces extend slightly beyond the outer edge of the ring and are shaped and threaded to fit internal threads on the casing. The inner ends of the poles upon which the bobbins are mounted are bent up to face a diaphragm. An adjustment of the air-gap is effected by moving the magnetic system forward or back within the shell.

#### RAILWAY TELEPHONES

For dispatching of trains, especially interurban electric trains, telephone line terminals are frequently arranged along the right-of-way and telephone sets are carried in the cars. As telephone lines under such conditions are exposed to induction from high-tension lines, persons using the instruments frequently receive shocks of more or less severity unless proper protection is afforded. A patent



JACK BOX FOR RAILWAY TELEPHONES

granted jointly to Mr. A. Dixon, of Newark, N. J., and Mr. W. E. Freeman, of East Orange, N. J., covers a jack-box made for this service. The illustration shows a view of this box with the cover removed. The plug aperture is closed by a trap door and tubular fuses are included in the circuit. On the rear of the vertical plate ground protectors are mounted. This patent is assigned to the Western Electric Company.

## Letters to the Editors

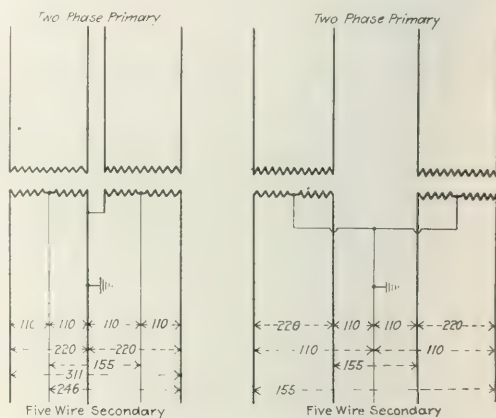
### Lamp Operation Due to Accidental Ground

To the Editors of the *Electrical World*:

SIRS:—The article on "Lamp Operation Due to Accidental Ground" in your issue dated April 5 forcibly illustrates some of the difficulties resulting from improper distributing methods. Referring to Fig. 1 herewith, in connection with the article mentioned, it will be observed that a ground on one wire places the other wires at varying potential to earth, ranging from 110 volts as a minimum to 311 volts as a maximum. The difficulty resides in the "series" connection of the two separate three-wire secondary circuits. It is impracticable to ground such a combined system, not only because the neutral wire of each three-wire system is placed at a potential of 110 volts to earth, but also by reason of the fact that the arrangement is such as to prevent the elimination of the neutral fuse which is essential to the safe operation of a three-wire system. Moreover, the middle wire of the system must carry 42 per cent excess current, and use must be made of neutrals which are larger than necessary because of mechanical reasons.

In Fig. 2 is shown the proper method of operating a five-wire combined lighting and motor-service secondary system. There are practically two separate single-phase circuits which are suitable for motor service at 220 volts. The

neutral wire is common to the two single-phase circuits. The arrangement minimizes the copper required and permits proper grounding. The maximum emf between wires is 220 volts, and the maximum to ground is 110 volts. With this connection the trouble mentioned in the article could not have occurred, as each customer is independent of the others in so far as interference from grounds is concerned. A ground on one customer's wiring would either immediately cause his service fuse to blow, if on a phase lead, or it would give an additional protection to the system and his own wiring if on a neutral lead.



FIGS. 1 AND 2—IMPROPER AND PROPER CONNECTIONS

The trouble from meters failing to register when the circuit is grounded is quite common. It is attributable to the careless practice of not testing two-wire circuits to ascertain which is the neutral lead, the chances being that one-half of the series coils of the meters are connected in the neutral lead, where they are liable to become shunted by a ground on the customer's side of the meters. The remedy for this trouble is simply never to connect a two-wire meter with its series coil in the neutral. If the service wires enter a basement through a conduit making of this test does not involve much additional work to bridge or remove the neutral fuse holder and at the same time connect the neutral wire to the wire used for grounding the service conduit to the water pipe. Such an installation is as near fool-proof as the present state of the art will permit. With it no such complications as those shown in the article can be encountered.

Toronto, Ont.

S. BINGHAM HOOD.

### Safety in Converter Substations

To the Editors of the *Electrical World*:

SIRS:—Among the safety measures adopted by the Public Service Commission of the First District of New York, as given on page 975 of your issue dated May 10, is one relating to the safety of attendants in rotary-converter substations, as follows: "There shall be at least two operators on duty in rotary-converter stations delivering energy at 500 volts or higher when the same are in operation." This rule places emphasis on the voltage of the direct-current circuits, while what the operators fear are the high-tension alternating-current supply circuits. The fact is that in many substations where the supply circuits operate at as high as 3000 volts only one operator is on duty. Under such conditions there should be at least two men in each substation, if the service is to be continuous.

Lawrence, Mass.

CARL H. LESURE.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Horizontal Tubular-Boiler Setting

A form of horizontal tubular-boiler setting which differs markedly in two of its features from any of the common forms that are used for horizontal tubular boilers is shown in the accompanying engravings taken from the publication of the engineering and inspection division of the Travelers-Insurance Company and the Travelers' Indemnity Company of Hartford, Conn.

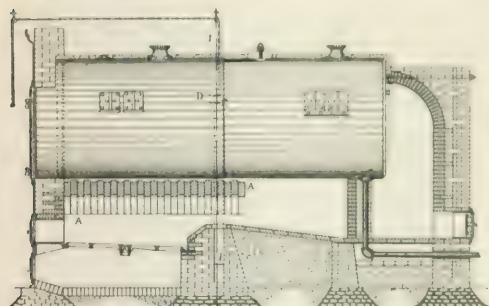


FIG. 1—VERTICAL LONGITUDINAL SECTION THROUGH BOILER SETTING.

The two distinctive features are by no means experimental, having been used to a limited extent for a long time and both having been thoroughly tried out in practice. For some reason they have not heretofore appealed very strongly to boiler designers and, therefore, they have not made much of an impression in boiler practice, yet experience has shown that if the settings are properly designed and constructed they effect a great improvement in the combustion of the fuel with a consequent increase in the efficiency of the boiler.

The features referred to are the ignition arch, *AA* which extends over the entire furnace, and the air duct, *BB* which permits of the admission of air to the furnace at the bridge wall.

### THE FURNACE ARCH

In the type of furnace that is commonly used for a horizontal tubular boiler the shell of the boiler forms a sort of roof over the fuel bed, and as this roof is colder than the fire immediately below it by 2000 deg. or more, it chills the gases that rise up from the fire and checks the combustion that would otherwise go on in the gas spaces of the furnace. The loss that results in this way is sometimes very considerable. By protecting the burning gases from the chilling effect of the relatively cold boiler the furnace arch causes them to retain their heat until the combustion is practically complete. To obtain the best effect the alternate courses of the arch should be set at slightly different heights, as is best shown in Fig. 1, the difference in level being an inch or so. The object of setting the courses at different heights in this way is to make the end surface of the arch uneven so that the furnace gases will be thrown into little whirls or eddies and become thoroughly mixed instead of sweeping along in a motion undisturbed except as they would be likely to do if the surface of the arch

were smooth and even. Furthermore, the projecting corners being exposed to the fire more intimately than they would be if the arch were smooth become very highly heated so that they tend to ignite any unburned gases that strike against them.

Another advantage of the furnace arch is that it affords a much needed protection to the boiler shell. Nearly all of the burned and cracked plate, bulges and girth-joint troubles that are met with in horizontal tubular boilers occur either directly over the furnace or close to the bridge wall. The heat to which the lower part of the shell is exposed, over the furnace, in the usual form of setting is so intense that a slight deposit of scale upon the sheet or a slight coating of oil is often sufficient to lead to very serious damage to the boiler. The furnace arch protecting this part of the boiler from the direct action of the fire minimizes the action and does away with nearly all of these defects and thus greatly prolongs the life of the boiler.

The cost of a bulge or crack or other defect upon the fire sheet of the boiler as by no means fairly represented by the boiler-maker's bill, for putting a boiler out of service for repairs, particularly in a small plant where there are only a few boilers, often means serious loss of production while the repairs are being made, and the furnace arch by preventing losses of this kind, increases the efficiency of the plant as a whole by an amount which may be large and very real, although not capable of being stated definitely in figures. It should be noted, too, that the furnace arch itself does not add to the number of things that may require the plant to close down or to curtail its production, because the boiler could still be operated with fairly good economy even if part of the furnace arch should fall, and the arch could be repaired later when convenience would permit.

The arch, as will be seen, spans the furnace from side to side and extends toward the rear to a point just back of the bridge wall. There is doubt in the minds of many who have not had experience with furnaces of this kind if an arch of this nature can be made durable when exposed to



FIG. 2—HORIZONTAL SECTION THROUGH BOILER SETTING.

such a fierce heat from below. There is no trouble in making one of a few built properly in the first place, but it should not be assumed that an interior furnace set with iron material. It should be built of specially shaped bricks made with a taper adjacent to the ends, so that the arch is in line and set with a thin mixture of fireclay and water. The bricks are buttressed against where

the ends of the arch rest should also be adapted to their own special duty, and buckstays or other devices should be provided if they appear to be necessary to sustain the horizontal end-thrust of the arch. If these things all receive proper attention, the arch should be quite durable, because in its regular service it has no weight to sustain except its own, but if the man who puts in the setting tries to build the arch of ordinary firebrick trimmed by hand to a guess-work taper, or if he uses a proper brick that is made with a wrong taper, then the arch is quite likely to give trouble. This, however, is no fault of the designer.

It is hardly necessary to point out that the boiler should be set higher than usual when a furnace arch is to be used, so that there may be plenty of space under the arch for the fire and for the operations that are necessary in maintaining and cleaning it. The only objections that are used against the use of the furnace arch are (1) that it is hard to maintain such an arch in position over the fire, (2) that the arch interferes with the inspection of the shell plates of the boiler, and (3) that more or less of the heating surface of the boiler is sacrificed by the introduction of the arch. None of these objections is serious, however.

#### AUXILIARY AIR SUPPLY

There are times in running a boiler under natural draft when the air that passes up through the fire is not suffi-

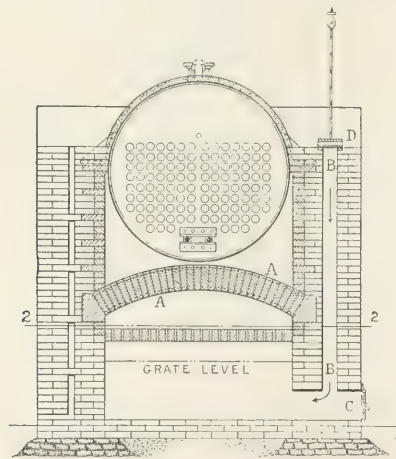


FIG. 3—SECTION THROUGH IGNITION ARCH

cient to insure the complete combustion of the fuel, and it is then important to furnish an additional supply of air in some other way. This is usually accomplished by opening the registers in the fire doors and perhaps "cracking" the doors themselves. The cold air that then enters through the doors does not all mingle immediately with the gases from the fuel, but a considerable part of it rises up over these gases and forms a sort of screen or blanket between them and the boiler. If the doors be opened only a trifle, the cold air may not have any serious effect upon the boiler; but when they are opened wide enough to admit a large excess of air, and there is no furnace arch present, the boiler plates are likely to become chilled and to develop cracks or defects of other kinds. This action is practically eliminated when the furnace arch is used, because the entering air cannot strike the boiler plate without first traversing the entire length of the furnace and becoming well heated; but even in this case it is better to admit the supplementary air at a point further back in the setting, rather than to allow it to enter through the fire doors. In fact, experience indicates that it is best to introduce it at the bridge wall.

The bridge wall is hollow in the setting here shown, a chamber 6 in. wide running through it from one side of the furnace to the other. This chamber is covered by a layer of firebricks that are set on edge and separated from one another by free intervals of about  $\frac{1}{4}$  in. A duct leads to the interior of the bridge wall from the outer air, the draft through it being regulated by a butterfly valve, *D*, that is controlled by a cord or chain or other convenient means. When it is desired to introduce more air into the furnace—as, for example, after firing with fresh coal—the butterfly valve is raised by means of the controlling cord. Air then enters the duct, flows into the chamber in the bridge wall, streams upward through the narrow spaces between the bricks at the top, mingles with the gases coming from the fire and provides the oxygen that is needed for completing the combustion of these gases. The air has become warmed to a considerable extent by the time it leaves the bridge wall, and it is correspondingly more effective than it would be if it mingled with the gases while at the temperature of the boiler room.

As indicated at *C*, a suitable cleaping door is provided for removing the fine dust that accumulates in the bridge wall chamber. The setting that is shown in the illustrations is designed for a single boiler. When several boilers are to be set in a battery the design should be slightly modified in several respects, but the changes that will be needed are rather obvious.

Boiler attendants should thoroughly understand that the loss that results from incomplete combustion, due to a deficiency of air in the furnace, is far greater than the loss that is due to heating a moderate excess of air from the temperature of the boiler room up to that of the gases in the base of the chimney. In ideal firing the supplementary air would be admitted in precisely the right amount; but as ideal conditions cannot always be realized, the fireman, when in doubt, should err on the side of admitting too much rather than too little.

#### Re-establishing Service After Flood

The recent floods which wrought such havoc in the Middle States and also did considerable damage along the Atlantic seaboard will long be remembered by the electrical fraternity. One of the companies in the East which passed through a trying experience was the Adirondack Electric Power Corporation, which has two hydraulic plants on the upper Hudson River above Albany and Troy, N. Y. As a result of the flood the Spier Falls station was covered with water to a depth of about 3 ft., or practically up to the shaft of the generators. The flooring over the wheel pit, being of wood, floated around the station, and when the water receded debris of all kinds was found to have accumulated. Many of the transformers in that plant are of the air-cooled type and the water entered the air ducts and flooded the transformers and the blower motors, putting them out of commission.

As soon as the power house became accessible the generators, which are wound for 2300 volts, were first turned over for about twenty-four hours without excitation, thus throwing the water out of the rotors by centrifugal force and starting the air circulating around the field structures. An exciter unit was brought by automobile from the works of the General Electric Company at Schenectady, and for three days the generators were run short-circuited upon themselves with low excitation. The air-cooled transformers were wound for 30,000 volts and, although a constant blast of hot air was passed through them and the coils heated by electricity in addition, they still "dripped" after two weeks of such treatment.

At the Mechanicsville plant of the company, lower down the Hudson, greater damage was done. The operating



head at that point is 18 ft., and the water backed up in the station to a maximum height over the floor in the generator room of 9 ft. As the water receded everything was found to be covered with a thick greasy mixture of oil and mud. It was practically a week before the generator room floor was free from water. The machines, which were wound for 12,000 volts, were put under load after being dried out and cleaned with much misgiving.

## Output of Ice-Cream Plant to Be Increased with Same Electrical Equipment

By altering the system of freezing used in the ice-cream plant of the Banner Creamery Company, of St. Louis, Mo., Mr. G. A. Bang, president of the company, hopes to obtain a considerable increase in the output with the same electrical equipment. About 140,000 gal. of ice-cream was manufactured in 1912, and he expects to realize an output of 200,000 gal. in 1913 with the new freezing equipment. Numerous experiments were conducted by him last year in which attempts were made to discover more efficient methods of freezing ice-cream. As the air surrounding the cream becomes relatively warm unless a current of air is maintained, the still or loft system, which was previously used, has been replaced by a system of his own design.

One 40-hp wound-rotor General Electric induction motor is used for driving all of the apparatus connected with the

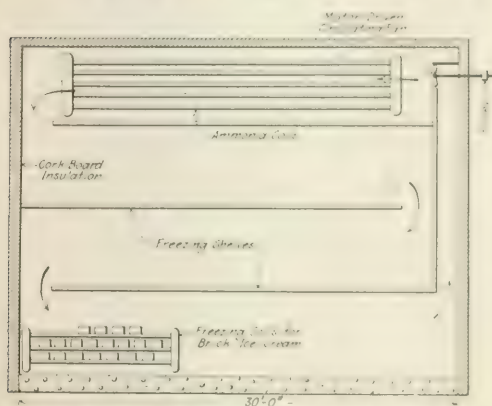


DIAGRAM SHOWING DIRECTION OF AIR PATHS

manufacture of the ice cream. This method has been found satisfactory as the load on the motor is maintained practically constant and very close to the load at which the motor runs most efficiently. It is the characteristic of a wound-rotor motor, however, to drop off rapidly in efficiency if the load varies from this point very much. Driven from the main shaft by belting are an ice crusher, a deep-well pump, a 20-ton Frick ammonia compressor, four 10-gal. freezing cans, an ice-cream mixer and a Sorocco fan for circulating cooling air through the cold-storage room.

Unless the freezing cans are filled automatically, there is generally a considerable waste in the manufacture of ice-cream. Ice cream expands to about double its original volume when frozen, so that a definite quantity should be put in each freezing can. Anything in excess of this amount is wasted, as there is only limited room for expansion. Less than this quantity necessitates the working of the freezers below rating. An automatic system is used by the company for filling the cans which avoids the waste of cream for the reason mentioned.

Forty gallons of ice-cream are frozen to the consistency

of apple butter every ten minutes in the four motor-driven freezing cans. It is drawn off from the cans at about 18 deg. Fahr. into other cans or bricks, and the freezing operation is completed in the cold-storage room.

Three inclosed shelves about 30 ft. long and 3 ft. wide have been arranged one above the other on each side of the cold storage room, so that a current of cold air can be conducted along the top shelf and returned along the bottom tiers in succession. The walls of the room are insulated against radiation with cork board and ground cork for a depth of from 11 to 13 in. in addition to the regular building construction. The ceiling is lined with 5 in. of cork and thoroughly asphalted.

In the loft of the room but partitioned off from it is the apparatus used for chilling the air which circulates through the inclosed shelves in the cold-storage room. It consists of ten ammonia coils 29 ft. long and eight pipes high on each side of the loft. A Sirocco fan draws air from the lower part of the building and blows it over the ammonia coil and down through the freezing shelves again. In this way the air is used over and over and stagnant spots of warm air are eliminated. A practically uniform temperature of from 2 to 4 deg. below zero can be maintained with this system. Mr. Bang has found that while from eight to twelve hours are required to convert to freeze the cream with the still system, only three hours are required with the present system.

For freezing the bricks additional ammonia coils have been installed in one of the frozen storage in the frozen storage room. The pipes are 8 ft. long and are arranged six high and eight deep in a corner in order, so that the ice-cream bricks may be laid in between pipes to hasten the freezing.

In addition to the apparatus named, a central fan-chlorine is driven by the main motor. On the second floor of the building is an ice plant, in which about 7000 lb. of ice is made in 200-250 min. by the flooded system. A 2-hp. pump, r.p.m., 220-volt, 60-cycle General Electric motor drives the brine agitator. As the brine is called it is conveyed directly to the ice-storage room, which is located over the delivery room. An ice-storage bulk tank with the door delivers the crushed ice to the delivery wagon below.

The ammonia compressor is a double cylinder single-acting machine and operates at 100 r.p.m. One cylinder furnishes compressed ammonia for freezing the cream while the other cylinder furnishes refrigeration for the ice plant. The compressor and the main shafting are driven through the engine belt so that either one may be cut out without disturbing the other.

### Installation of Collector Rings on a Direct-Current Machine

[illegible]

In a six-pole wave winding per electrical degree corresponds to two, three or five mechanical degrees, the electrical degrees on the commutator correspond to 180, 270 and 900 degrees. The design phase (number of the first pole) should be determined for one electrical degree, that is, one should be at zero and the other at half, one or two mechanical degrees. A synchronous machine is 180 degrees or one-half way around the commutator. Commutation should be made at 45° N. and 22.5° W. The angle can not be determined from the commutator. With one pole set at a speed of 200 rpm, 360 rpm per second would be 180° at 900 rpm per second. The average between commutator rings would be 22.5° = 15° pole.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Cascade Connection.**—H. MEYER-DELIUS.—An illustrated article giving circle diagrams for cascade connections of polyphase induction motors with commutator machines.—*Elek. Zeit.*, May 1, 1913.

**Amortisseur Winding.**—M. C. SMITH.—An illustrated article in which the author first describes the construction of an actual amortisseur (or "deadening") winding built into the field of a synchronous motor and explains its theory by a brief exposition of the principles of operation of the squirrel-cage induction motor. A short discussion (with curves) is made of the effects of the amortisseur winding on the starting characteristics of a motor, while the next section shows its advantages over the solid pole. A simple theoretical explanation is given of certain characteristics of the amortisseur winding which may be observed in the operation of motors thus equipped, while another section indicates the advantages of this construction in preventing hunting and in improving the operation and regulation of single-phase alternators.—*Gen. Elec. Rev.*, April, 1913.

**Variable-Speed Generator.**—A note on a recent British patent (No. 1205, 1913) of T. W. Tattersall. To regulate the output of an automobile axle-driven generator three field windings are provided, namely, shunt and series windings and a balancing series winding, which is in series with an iron wire or other resistor having a high positive temperature-resistance coefficient.—*London Elec. Eng'ing*, April 17, 1913.

### Lamps and Lighting

**Half-Frosted Incandescent Lamps.**—A. J. MAKOWER AND U. A. OSCHWALD.—An account of experiments in which the variation in candle-power due to frosting was investigated. Eight lamps were experimented with. A distribution curve over the lower hemisphere having been taken for each of the lamps unfrosted they were frosted over the lower half

The candle-power of the lamp is reduced by the frosting from 100 to 90.8 in the horizontal direction and increased from 20.5 to 34 in the vertical direction. The mean hemispherical candle-power of the lamp with clear bulb is 77.5 and that with half-frosted bulb 67.9 units.—*London Elec. Review*, April 25, 1913.

### Generation, Transmission and Distribution

**Cost of Oil Engines.**—A. N. RYE.—An article on the cost of gas and oil engines for electric supply stations, giving data of cost, etc., from actual practice. The author concludes that internal-combustion engines can give a perfectly satisfactory supply, particularly if batteries are installed, but they are essentially different from a steam plant and must be installed and run with due regard to this fact. Under favorable circumstances these machines are economical, but it must not be forgotten that there are other expenses besides the fuel bill, and the fuel bill of the internal-combustion engine must show a handsome saving to justify the use of this class of plant. The Diesel oil engines appear to have certain advantages over gas engines for central-station work, but as long as the price of oil is subject to such severe fluctuations the use of this engine is likely to be restricted to special cases. The most useful field for the internal-combustion engine appears to be in small central stations. As the size of the station increases the advantages of this type of plant decrease, until a point is reached where internal-combustion engines can pay only in exceptional circumstances, and at the present date this point appears to be reached when a station under average English conditions is of sufficient size to use steam turbines of 1000 kw or larger. The results in Guernsey have fully justified the installation both of gas and oil engines, the great saving in the fuel bill being more than sufficient to balance the increased costs in other directions.—*London Elec. Review*, May 2, 1913.

### Traction

**Single-Phase Commutator Traction Motors.**—S. B. SMITH.—The conclusion of his paper presented before the (British) Institution of Civil Engineers. The characteristics of single-phase commutator motors and the means for overcoming their limitations are now fairly well known, and it remains to be seen whether these machines can be made to satisfy the severe requirements of traction work. Though the motors possess nearly all the undesirable qualities that a machine for such duty could possess, these requirements have been made none the less severe for that reason. On account of space, cost, efficiency, simplicity of control, mechanical considerations, etc., it has been found necessary to reduce the number of units on the locomotive to a minimum, so that single units of 800 hp, 1200 hp and even 2000 hp will be commonly met with. Such machines can no longer be built about the driving axles, but have to be placed in the body of the locomotive. To transmit this power to the driving axles, gearing through toothed wheels, or, what seems to be gaining favor, a direct drive through cranks or through an idle counter axle must be adopted. The speed of such motors may vary from 2000 to 500 r.p.m., while the diameter of the driving wheels may be anything from 3 ft. up to 6 ft. It would scarcely seem possible that motors of the repulsion type—burdened with lim-

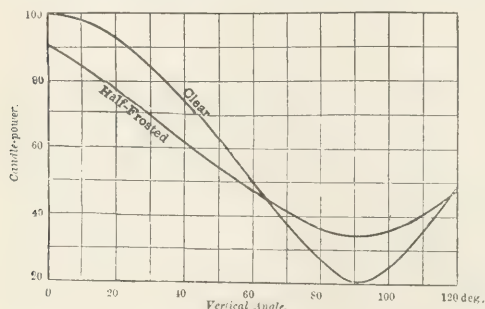


FIG. 1.—CURVES SHOWING RESULTS OF TESTS OF LAMPS

of the bulbs and re-tested under the same conditions as those of the original test. The horizontal candle-power of each lamp with the bulb unfrosted was called 100 units, and all other candle-powers of the lamp before and after frosting were reduced to this basis so as to facilitate comparison of the distribution curves. The results of the test for a 100-volt, 25-watt tungsten lamp are given in Fig. 1



itations as they are—can ever be made to withstand the severe conditions of long distance traffic. The ultimate solution of the single-phase commutator motor for railway work will doubtless have to be sought in some form of the series type. The cross flux necessary for commutation can be provided either by means of a local commutating pole, as in the compensated series motor, or by means of a spreading spread over the whole pole pitch, as in the series repulsion motor. Both methods are adopted in practice. In the former fewer exciting ampere turns are required, in the latter energy is also transmitted on the repulsion motor principle. With all single-phase locomotives for large outputs it is necessary to provide ample ventilation on account of the large amount of heat developed. In this respect locomotives equipped with series motors suffer badly, for not only is there the heat due to the losses in the motor (or motors) to be got rid of—which is about twice the amount that would be developed in continuous-current motors of like output—but there is also that dissipated by the transformer. The output of this transformer must equal that of all the machinery on the locomotive, including that of auxiliary motors for pumps, lighting, etc. In addition, it is also usually necessary to have an induction regulator to prevent jerking when starting and when passing from one tapping point to another, which might otherwise cause mechanical trouble, apart from the discomfort to passengers. This is another source of heating on the locomotive. Altogether, then, there is a very large amount of heat to be got rid of, and with the extra losses at starting the ventilation problem becomes exceedingly difficult. In face of all these drawbacks, therefore, it is not to be wondered at that the single-phase motor has so many active opponents and that all other possible alternatives are being vigorously studied. As yet, however, no better scheme has been forthcoming, and it must be left for the future to show whether an alternative method is possible.—*London Electrician*, May 2, 1913.

**Wireless Traction.**—MAX SCHUEMANN. A profusely illustrated lecture on the latest developments in wireless traction, the cars being supplied with direct current or alternating current for overhead trolley wires by means of flexible arms.—*Elek. Zeit.*, April 24, 1913.

**Electric Locomotive for Industrial Purposes.**—I. ROPY. The first part of an illustrated article on electric locomotives supplied with current from an overhead trolley wire for mines, industrial works and schings.—*Elek. Zeit.*, April 24, 1913.

**Storage-Battery Traction.**—H. BECKMANN. An illustrated article on the modern practice of using storage batteries on electric locomotives, motor cars, yachts, etc.—*Elek. und Masch. (Vienna)*, April 20, 1913.

### Installations, Systems and Appliances

**Symbolic Load Curves for Electric Stations.**—C. A. ROSSANDER. If all load curves at a central station during a year are decomposed into elements of, say, an hour, and the load elements thus obtained are arranged not according to their succession in time, but according to their instantaneous value, a curve is obtained extending over the whole year and beginning with the current  $i_0$  and ending with the maximum load current  $i_m$ . The abscissa of the total curve represents 8760 hours, and if the load current during 8760/x hours was below  $i_0$ , the ordinate corresponding to the abscissa 8760/x shows that the scale of the abscissas is hours. The author shows that in many cases it is possible to find a mathematical curve from a few characteristic data of the load conditions in such a way that this curve can be used instead of the empirical curve defined above without any serious error. This curve is given by the equation

$$i = i_0 + (i_m - i_0) \sqrt{x/8760},$$

where  $i$  is the current,  $x$  the time,  $i_0$  the value of the minimum load current to the maximum load current, and the ratio

of the total ampere-hours produced during the year to 8760 hours, and  $i_m$  the maximum load current.

of the total ampere-hours produced during the year to 8760 hours, and  $i_m$  the maximum load current. It is shown that it can be used with an accuracy sufficient for practical purposes in many various problems of central station practice.—*Elek. Zeit.*, May 1, 1913.

**Operation in Parallel.**—A. COHEN. The author describes a case from practice in which parallel operation of two alternating currents through the same secondary of transformer led to serious trouble and even to mechanical trouble of the origin of the oscillations.—*La Lumière Elec.*, April 26, 1913.

**Switchboards.**—C. H. SCHUEMANN. A description of his long serial air switchboard for alternating current power stations. In the present part of the construction of the motor, mechanically constructed switchboards is presented and profusely illustrated.—*Elec. Journal*, May, 1913.

**Electric Heaters.**—H. O. SAWYER. An article giving details of the materials used for electric conductors, thermal conductors and electric and thermal insulators in the construction of electric heaters.—*Elec. Journal*, May, 1913.

### Wires, Wiring and Conduits

**High-Tension Insulators.**—A. L. S. MARIN. An article on a study of insulators for extra high voltages. He discusses first what takes place in the dielectric, his discussion being based on the hypothesis that it is between two charged conductors there is a series of alternately electrified zones, one being positive and the next negative. He discusses what happens in an insulator while it is placed under increasing tension. He then takes up the dimensions and forms of construction of insulators and discusses the tests to which they should be subjected.—*La Revue Elec.*, May 2, 1913.

**High Voltage Cables.**—I. DUBINSKY. An illustrated paper presented before the Dresden Central Society on the manufacture and the electric properties of high voltage cables with special reference to a new line of the Siemens-Schuckert company. The author then discusses the problems of testing cables after they have been laid in the ground and supports the recommendation of Helmholtz of direct current for this purpose.—*Elek. Zeit.*, May 3, 1913.

### Electrophysics and Magnetism

**Verification of Magnetic and Dielectric Properties of Solids.**—A report on the comparative verification of the Bureau of Standards and the American Society for Testing Materials with the aid of the American Institute of Electrical Engineers. The investigation of the verification of the magnetic and mechanical properties of commercial iron with a view to determining their true magnetic properties was carried out in the most careful manner, and the destruction of the material point measurement is well in progress. A large amount of work has been carried out, and in every case investigated there have been suggestive differences between the values which had previously been determined. The work is very interesting. The question is a capital one, if possible it should be carried out over the magnetic and dielectric properties of all the materials used in the construction of electrical apparatus. At the present time the material is not satisfactory. The same suggestion has been made in the past, but it has been of no great benefit, as the little material of apparatus. Another part of this work concerned with these studies is now being subjected to a more thorough study, and the author is now working on the problem of the verification of the magnetic and dielectric properties of the materials used in the construction of electrical apparatus. The results of this work have been published.



in various ways—for example, by bending, nicking, stretching, drilling holes, etc.—and in every case the good and the defective material have shown characteristic differences.—*Journal Franklin Institute*, April, 1913.

**Transient Phenomena.**—H. W. LINKE.—An analytical investigation of the transient phenomena produced when electrical machines or apparatus are connected to a line or short-circuited, etc.—*Archiv. f. Elek.*, Vol. I, 1913; briefly abstracted in *La Lumière Elec.*, April 26, 1913.

**Sensibility of Photo-Electric Cells with Alkali Metals and Hydrogen.**—J. G. KEMP.—An account of a systematic quantitative study of the conditions of sensibility of photo-electric cells of alkali metals with hydrogen and a determination of the work required to draw an electron out of an atom. The following facts are established by this investigation: Owing to the low melting temperature of cesium the use of this metal in photo-electric cells for photometric use is very impractical. The temperature at which it is best to operate a potassium cell is about 25 deg. C. Cooling the potassium cell much below 25 deg. C does not increase its sensitiveness. The sensibility of a potassium cell can be increased more than a hundredfold by the process of forming the hydride surface. The distance between the electrodes for best sensitiveness is about 0.5 cm. The hydrogen gas pressure at which the cell is most sensitive lies between 2 mm and 3 mm of mercury. The potential difference applied to the electrodes for most sensitive conditions is about 330 volts. The minimum energy required to produce an ion by collision was calculated from the data and found to be of the order  $1.77 \times 10^{-11}$  ergs, while the theoretical value determined is  $1.63 \times 10^{-11}$  ergs. Assuming that the straight lines obtained which show the relation between current and intensity of illumination hold for exceedingly small intensities, then by using a tilted electroSCOPE of sensibility  $10^{-18}$  amp, a candle could be detected at a distance of 2.7 miles. This indicates that it is highly probable that a photo-electric cell could be used in astrophotometric work.—*Phys. Review*, April, 1913.

**Spectral Analysis and Electronic Theory.**—SPIES.—An account of an experimental lecture delivered before the Electrical Society of Cologne on the relations between spectral analysis and electronic theory. The fundamental point is that what oscillates in light is nothing but the electrons. The author discusses optical resonance as deduced from the theory of oscillations of electrons and the Zeeman phenomenon.—*Elek. Zeit.*, April 25, 1913.

**Cathodic Sputtering.**—G. W. C. KAYE.—An abstract of a (British) Physical Society paper giving an account of the volatilization of an aluminum cathode in a discharge tube containing helium. The sputtered deposit on the glass indicates that, under the conditions which prevailed, the disintegration was restricted to the edges of the cathode and did not occur elsewhere. Accordingly the complete outline of the cathode (made by rolling a sheet of aluminum into a nearly complete cylinder) was traced out by the deposit on the walls of the tube.—*London Electrician*, April 25, 1913.

### Electrochemistry and Batteries

**Carbon Electrodes for Electrolytic Cells.**—JOH. OARDEN.—An article giving notes on the manufacture of carbon electrodes for electrolytic cells and the testing of such electrodes with respect to homogeneity and grain, absence of cracks and flaws, porosity and specific weight, contents of inert material, electric conductivity, and resistivity to corrosion.—*Met. and Chem. Eng'ng*, May, 1913.

**Resistance of Graphite and Carbon.**—E. F. NORTHRUP.—An article describing some effects of temperature upon the resistance of carbide and carbon. The following experiment illustrates the difference between graphite and carbon. A rod of graphite and a rod of carbon were selected, each 1.25 in. long and 0.25 in. in diameter. These were used to connect together two plates of graphite. Two holes were

drilled in each plate of graphite into which were inserted, for a distance of 0.25 in., the ends of the carbon and the graphite rods. The graphite plates were connected to the low-tension side of a 2-kw transformer, which yielded, with 110 volts on its primary, 22 volts on open circuit on its low-tension side. A rheostat was put in the primary side of the transformer to limit to an approximately constant value the current delivered by the secondary. On closing the circuit the graphite rod came quickly to incandescence while the carbon rod, in parallel connection with it, remained for a time dark, because of its higher resistance at a moderate temperature. After a fraction of a minute the carbon rod began to heat, and in doing so its resistance rapidly lowered so that it took more current than the graphite rod, and it in turn became brilliantly incandescent, while the graphite rod greatly declined in brilliancy. The writer concludes that, for small laboratory furnaces at least, graphite makes a better resistor material than ungraphitized carbon.—*Met. and Chem. Eng'ng*, May, 1913.

**Corrosion of Iron.**—B. LAMBERT.—A paper read before the Faraday Society on the electrolytic theory of the corrosion of iron with reference to the properties of chemically pure iron considered in connection with the electrolytic theory of corrosion.—*Met. and Chem. Eng'ng*, May, 1913.

### Units, Measurements, and Instruments

**Exhibit of Instruments.**—H. ARMAGNAT.—An illustrated description of the most prominent exhibits at the recent instrument exposition of the French Physical Society in Paris. Some of the exhibits are described in separate notes in the *Digest*.—*La Revue Elec.*, May 2, 1913.

**Sensitive Photo-Electric Cell.**—A. L. HUGHES.—During the course of a research it was found necessary to measure the transparency of a quartz plate over a considerable region of the spectrum. To effect this, use was made of the law that the photo-electric effect is proportional to the intensity of the light. The following cell was found to be extraordinarily sensitive. As shown in Fig. 2, it is a pear-shaped flask to which a quartz plate *Q* is joined by sealing wax. Communication with the electrodes is made by means of platinum fused into the glass, so that the only waxed joint in the cell is that between the quartz plate and the flask. The illuminated electrode is a thin layer of sodium which covers the whole of the inside of the flask, and the other electrode is a brass rod projecting into the flask.

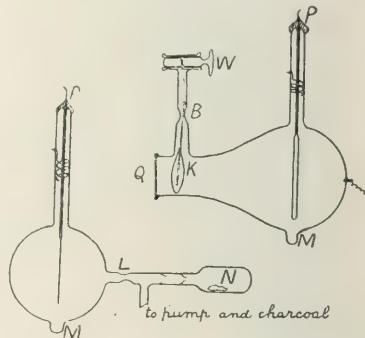


FIG. 2—SENSITIVE PHOTO-ELECTRIC CELL

This is the electrode which is connected to the electrometer, and therefore it must be well insulated. The glass tube around the platinum wire at *P* is warmed and covered with sealing-wax, which is a good insulator. If the apparatus is properly dried and evacuated, the inside of the glass tube near *P* insulates perfectly. Sodium, which is introduced into the bulb *N*, is strongly heated to drive off gases which

are removed by a Toepler pump and charcoal in liquid air. Meanwhile the cell is warmed to drive off condensed gases and vapors from the walls. The apparatus is then tilted so as to cause the melted sodium to pass through the traps and constriction *L* into the small bulb *M*. The sodium in *M* is now heated until the inside of the flask becomes covered with a layer of distilled sodium. To prevent any deposition on the quartz window, the following device was employed. A piece of thin lead foil (shown obliquely at *K*) is cut so as to fill the cross-section of the tube and this foil is held up by a thin glass rod, which in turn is suspended from the winch *W* by a silk thread. When sufficient sodium has been distilled the lead foil is raised by means of the winch and is crumpled up in the side tube out of the path of the light. The blow-pipe is then applied to the constriction *B*, which collapses around the glass rod and is sealed off. Finally the apparatus is sealed off at *L*. A very convenient way of measuring the photo-electric current was to balance it against a current through a suitable xylol-alcohol resistor. The following test was made on the sensitiveness of the cell: The wave length  $\lambda$  4300 was isolated by a monochromator, the aperture ratio of the lenses being about 1.5. The slits were 2 cm by 2 mm. The power absorbed by the mercury lamp was 120 watts. The photo-electric current obtained with the cell was as large as  $580 \times 10^{-10}$  amp.—*Philos. Mag.*, May, 1913

### Telegraphy, Telephony and Signals

**Physiological Radio Receiver.**—An account of the researches of Lefevre on using muscular contractions by electric currents for recording the minute currents which occur in radio-telegraphic receivers. With a frog's leg mounted in connection with a recording drum, he receives the radio signals coming from the Eiffel Tower station at Paris, 200 miles distant, and the waves are recorded with precision upon the drum. In Fig. 3 *A* is the antenna, *S* the tuning coil, *D* a Ferrié electrolytic detector, *R* a pair of 4000-ohm telephones, and *P* the potentiometer. Wires are taken off in parallel from the telephones and lead to

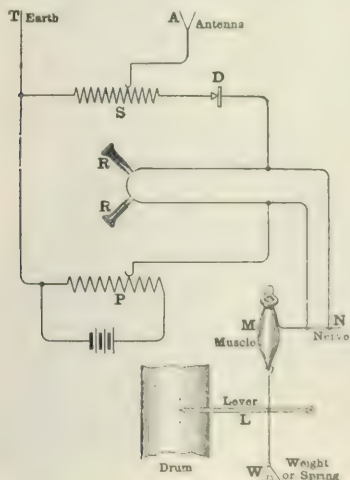


FIG. 3.—CIRCUIT DIAGRAM FOR RECORDING MINUTE CURRENTS

the nerve of the frog's leg. The contractions of the muscle act upon a lever so that they are magnified and recorded upon a rotating drum.—*London Electrician*, April 25, 1913

### Miscellaneous

**German Electric Patents.**—E. BUTZMANN.—Some statistical data on the activity of the German Patent Office in

1912. The number of new patent applications made during the year in the electrical class has now reached 3009. By passing the 1000 mark it stands out prominently which has not been equaled so far by any other class. The number of new applications in the electrical class has always been high in recent years, being 2846 in 1909 and 2987 in 1911. Applications numbering 2225 were carried over from former years into 1912 (of these 1000 were carried over from 1909 and 1000 from 1911). The total number of patent applications finally granted during the year 1912, of these 1000 patents were finally granted. The total number of German electrical patents has recently increased in years in which 4041 were still in force at the end of 1912. Only 100 electrical patents granted fifteen years ago were still in force. This is due partly to the rapid progress of electrical engineering and partly to the "invention patent" of electrical laws.—*Elek. Zeit.*, May 1, 1913.

## Book Reviews

**ELECTRICAL PHOTOGRAPHY AND ILLUMINATION.** By Hermann Bohle. Philadelphia: J. B. Lippincott Company. 222 pages, 200 illus. 15 cents.

A textbook designed for the use of students in technical colleges. It is clearly written, written from the standpoint of British practice. The seven chapters of the book are devoted to the following subjects: Photometric units and standards, radiation and its effects, photometric apparatus, light flux and distribution, testing of electric lamps, the design of reflectors and shades, illuminating engineering. The formulas presented are simple and easily remembered. Theories are only very briefly referred to. Practical examples are presented abundantly in diagrams, tables and examples. The book will be useful to the student and practitioner of illuminating engineering.

**THE DYNAMICS OF PARTICULATE AND RIGID ELASTIC AND FLUID BODIES.** By Arthur Gordon Webster, A.B. Second edition. Leipzig, Germany: B. G. Teubner. New York: G. E. Stechert & Company. 588 pages, illus. Price, 14 marks.

An excellent volume of mathematical treatise on dynamics intended as a text book for mathematical physics. The chapters treat of the following subjects: Laws of motion, particular motions of a material point, work and energy, least action, oscillations, continuous motion, rotation of rotating bodies, Newtonian rational mechanics, dynamics of deformable bodies, statics of deformable bodies, hydrodynamics. The treatment is very thorough but is somewhat original and detailed. As a text book of mathematical dynamics of solids bodies it is one of the best in the English language, which contains a goodly number of such books.

**PROBLEMS IN PHYSICAL CHEMISTRY WITH APPLICATIONS.** By Edmund B. R. Pribram, D.Sc. New York: G. Van Nostrand Company. 112 pages, 100 mathematical charts illus. Price 50.

An excellent text book on physical chemistry intended for college students and also suitable as a reference manual for chemists, physicists, engineers and scientists generally. The book is divided into eight sections dealing with the following topics: 1. Units, measurement, systems of units, component, mixtures, gas reactions, treatment of solution, electromotive force, kinetic of molecular and radiative changes. It is filled with numerical examples and illustrative problems. It contains a list of chemical and mathematical processes most commonly employed and some 1500 tables of logarithms. Thus the book is of a reference text book or research physics, chemistry, the study of one description of high concentration.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Electric Time Switch

The Reynolds Electric Flasher Manufacturing Company, Chicago, is now placing on the market a weatherproof one-day time switch for use in any convenient place inside or out of doors.



ONE-DAY TIME  
SWITCH

The clock is of standard make and requires no other attention than daily winding. The switch mechanism is mounted on a porcelain block and the tripping arrangement is of simple construction. The cabinet is provided with a door at the back to permit easy access to all of the winding levers, switch set, wiring, etc.

This switch is suitable for turning off electric signs, show-window lamps, store or hall lighting, isolated street lamps, patrol alarm systems and numerous electrical installations of a similar character.

### Heavy-Duty Internal-Combustion Engine

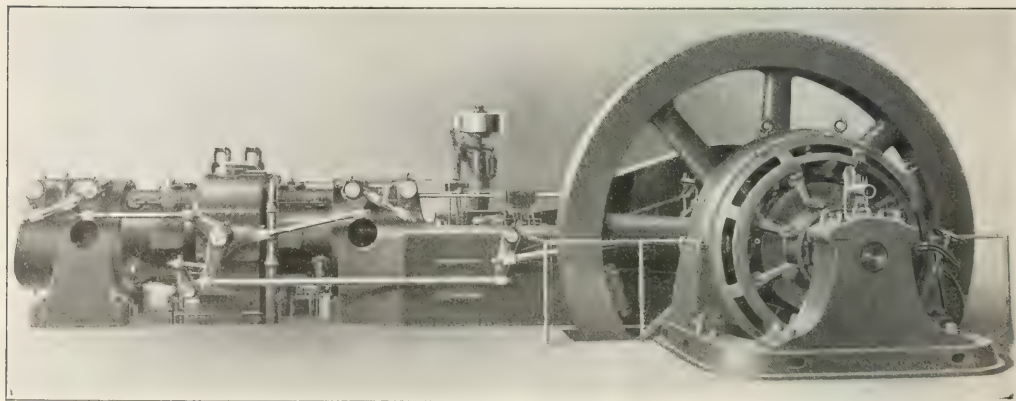
An internal-combustion engine of the double-acting, two-stroke type, known as the Illmer gas engine, has been placed on the American market by the Reading Iron Company, Reading, Pa. In Europe this type of engine has been made for some years and units rated at 2000 brake-hp are now successfully operated there.

Simplicity is the keynote in the design of this engine. Comparing the working parts of this engine and those of a tandem double-acting four-stroke engine, the only arrange-

ment before discharging through the inlet port. The inlet valve, which is of the poppet type, acts as a baffle to the incoming charge and causes the charge to enter the cylinder in the shape of a hollow cone. In this manner the charge is well stratified and fills the cylinder to the maximum of its volumetric capacity. Owing to the generous port opening, it has been found that a pressure of from 1 lb. to 2 lb. per sq. in. is sufficient to drive the charge into the cylinder. Pump cards taken when the piston speed of the engine was 700 ft. per minute show that the power required to drive the pump is somewhat less than 5 per cent of the indicated horse-power of the engine. The charging pump has been made double-acting and so fulfils the duty of the separate air pump and gas pump.

Being of the two-stroke type, it has been possible to use the piston-controlled exhaust port, and the operation is less troublesome than is usually experienced with the poppet-type exhaust valves. Since the inlet valves are not subjected to severe heating as are the exhaust valves, the poppet type can be made to serve very well in that position. The inlet valves are positively actuated both in opening and closing by means of an eccentric. The motion is imparted to the valves through a double-toggle linkage shown in the accompanying illustration.

The piston of this engine is arranged for water cooling, the water being introduced through the hollow piston rod. Arrangements for cleaning the interior of the piston are made by constructing it in halves and bolting it together. Twelve snap rings resist piston leakage and offer a factor of safety against ring breakage. Lubrication of the piston is facilitated by its considerable length. Eight lubricator plugs furnish the oil to the cylinder. All other important



DOUBLE-ACTING TWO-STROKE GAS ENGINE DIRECTLY CONNECTED TO GENERATOR

ment of that type suitable for high-power service, it will be found that there are forty-five or more working parts in the latter as compared with seventeen in the Illmer type.

The scavenging of the cylinder in the Illmer engine embodies an improvement. The conveying conduits turn the working fluids and impart to them a direction of flow parallel to the cylinder axis, producing final longitudinal move-

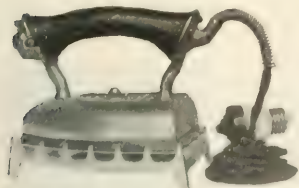
parts of the engine are lubricated by a flush-oiling system, the oil being drained to a central filter before being returned to the bearings.

Notwithstanding the relatively long stroke of the double-acting two-stroke engine, the over-all floor area is less than that occupied by a short-stroke, tandem, double-acting, four-cycle engine.



### Variable-Heat Electric Iron

In most cases the cord is attached to an electric iron by a plug, the heat control being effected by means of the plug or otherwise. In the "Garland" iron, made by the Michigan Stove Company, the cord is permanently attached to the iron and the current is turned on and off by means of a switch at the end of the handle. This switch is so placed that it can conveniently be operated by one finger while the iron is being used, thereby affording a simple method for keeping the iron at any desired temperature. The iron is said to be so designed as to concentrate heat on the heat at the point and bottom edges, which strike the surface first.



ELECTRIC IRON WITH SWITCH ON HANDLE

The electric tractor and trailer illustrated herewith was made by the Anderson Electric Car Company, Detroit, Mich., for the Murphy Power Company of the same city. It was designed for the transportation of coal from the

### Twelve-Ton Electric Tractor and Trailer

The electric tractor and trailer illustrated herewith was made by the Anderson Electric Car Company, Detroit, Mich., for the Murphy Power Company of the same city. It was designed for the transportation of coal from the



TRACTOR AND TRAILER

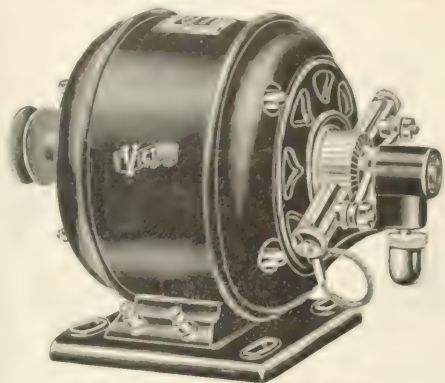
yards to the company's power plant. The carrying capacity of the trailer is 12 tons and the tractive effort of the tractor is said to be ample for handling this load under the local road conditions. The tractor is equipped with sixty battery cells of the Edison Storage Battery company's make, type A-12. The motor is of series wound type, rated at 85 amp and is made by the Anderson Electric Car Company.

### Small Series-Type Alternating-Current Motors

The Victor Electric Company, Chicago, has recently brought out a line of small series-type alternating-current motors the most interesting features of which are said to be practically sparkless commutation and nearly perfect control. The motors are built in two sizes,  $\frac{1}{2}$ -hp. and  $\frac{3}{4}$ -hp. rating. They are designed for operation at 110 volts and 60 cycles, 220 volts and 60 cycles, 110 volts and 25, 30 or 40 cycles, and 220 volts and 25, 30 or 40 cycles. All are built in the same frame, which is approximately 6.5 in. wide, 7 in. high and 9.75 in. from end to end of shaft; the shaft protruding  $1\frac{1}{2}$  in. from the end bearing. The field as well as the armature cores are built up of specially annealed Swedish-iron laminations and the commutator is

made of a specially tough copper composition. The brushes are made either semi-enclosed, entirely inclosed with the exception of external binding posts, or entirely inclosed without external binding posts, the leads in this instance being brought out at the top of the motor and incased in conduit.

One type has been especially designed for the operation

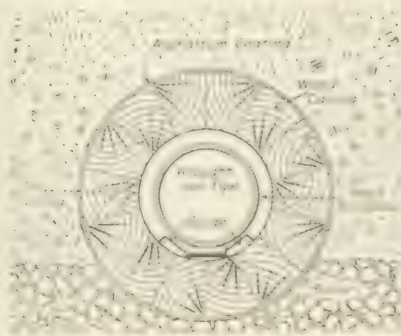


SMALL SERIES-TYPE ALTERNATING-CURRENT MOTOR

of any apparatus requiring full torque, such as printing machines, vacuum cleaners, carbonators and many other devices that are made in the construction of some types. There are no starting devices, consequently starting is free but if the motor should become overloaded. The speed of this type can be controlled with a separate rheostat similar to those used on direct-current motors.

### Steam-Pipe Casings

An essential point in long distance transmission of steam and hot water for heating and other purposes is to obtain an efficient steam-carrying pipe casing. A casing for such purposes must be able to reduce the condensation and radiation losses to less than that of a pipe built in three quarters of the cost and yet able to stand the same conditions by the Michigan Pipe Company, Bay City, Mich. The



CROSS SECTION OF PIPE CASING

illustration shows a cross-section of the various pipe insulation. The central shell is made of the three best being a cast-iron shell with a layer of lead and a layer of asbestos. The shell is lined with a reflecting and preventing coming of heat in and the outside is protected by a covering of insulation cement. The jacket is made of lead the first layer being centric with the inner casing and the second layer is in the

guides have roller bearings. The casings are shipped ready to lay, the operation of laying merely consisting in placing each section together in the trench and making a driving fit. The ends of each section are treated with a creosote preparation which protects the only exposed portions during transportation and installation.

### Rheostat Terminal

A terminal connector for joining the dial to the grids of field rheostats is shown in the illustration. The shank of



TERMINAL CONNECTOR

the connector is elongated so as to admit the cable in a direct line, while the contact disk is slotted to fit over the grid and is offset slightly to the right or left respectively to facilitate the work of installation. This connector is made by Dossert & Company, New York.

### Indirect Lighting in Department Store

In the Plate Glass Block, a large department store in Duluth, Minn., use is made throughout of the indirect-lighting system with results said to be much more satisfactory than those obtained formerly with arc lamps. On the main floor, where dress goods, silks, linens and men's furnishings are displayed, twenty-seven fixtures have been found sufficient to give the required illumination. No additional conduits were laid, as the old arc-lamp outlets were

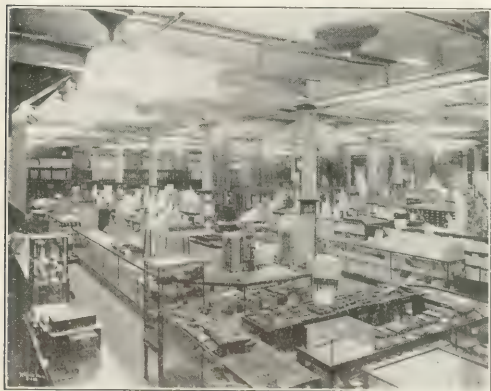


FIG. 1—INDIRECT LIGHTING ON FIRST FLOOR

utilized in each case. Fig. 1 shows a view of the first floor entirely illumined by artificial light.

On the second floor, which is devoted to the display of cloaks and suits, twenty-two units were installed. Owing to the predominance of dark cloth, the intensity required is high, namely, 4 ft.-candles, which is said to have proved entirely satisfactory. Fig. 2, which is a view of this floor, shows that practically all shadows are eliminated.

Ample illumination was obtained on the third floor, where millinery, lingerie and pictures are sold, by the use of twenty-two fixtures, and the true colors in rugs and draperies on the fourth floor were brought out most satisfactorily by the subdued light from similar fixtures.

Desk lamps were entirely dispensed with in the offices after the new installation. The units now employed are of



FIG. 2—ILLUMINATION IN SUIT AND COAT DISPLAY ROOM

the 250-watt tungsten type. No trouble has been experienced from light being reflected by glass-topped show-cases since the installation of the indirect-lighting system.

All of the fixtures were furnished by the Central Electric Company of Chicago and are of the type known as "Alexalite."

### Electricity Applied to the Shoe-Shining Art

The Sanax Company, of 125 East Twenty-third Street, New York, has found a new field for its "Foen" portable hot and cold air blower. A very large sale is claimed for



DRYING SHOES ELECTRICALLY

it in hotel, restaurant and other bootblack stands for use in hastening the shoe-shining process. Motor, fan and heating element in this device are all inclosed in a strong light case of aluminum and the switch is the only exposed part, so that it can withstand the rough usage that it would be likely to receive in this service. The accompanying cut shows the facility with which the device can be applied to the above-mentioned work.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Electric Hoist Business Not Suffering.**—In a recent talk with one of the large manufacturers of electric hoisting apparatus it developed that in this line no diminution in the volume of business had been noticed and that the outlook was considered to be satisfactory in every way.

**More Space for Electric Washer Company.**—The Maytag Company, Newton, Ia., which builds electric washing machines, is about to commence work upon a new gray-iron foundry, 400 ft. by 90 ft. This is to cost about \$20,000 and has become necessary on account of the continual increase in the company's business.

**Steam-Turbine Business Normal.**—The De Laval Steam Turbine Company, of Trenton, N. J., writes as follows: "General business conditions in our line at the present time seem to be about normal and as far as we can see they will continue so. The proposed tariff changes have no direct effect on our product."

**Waterwheels for Plant at Fountain Falls, Can.**—The Northwestern Ontario Light & Power Company, Ltd., has placed an order with the L. P. Morris Company, Philadelphia, for two waterwheels for its Fountain Falls development near Cobalt, Ontario, Canada. The contract covers two 1500-hp vertical-shaft, single-runner turbines which are to operate under a head of 30 ft.

**Insulation Maker Enlarges Plant.**—Like many other manufacturers of electrical equipment at the present time, the Hemming Manufacturing Company, Garfield, N. J., the product of which is heat-resisting molded insulation, has found it necessary to enlarge its facilities in order to handle the increasing volume of business in its line. On this account the company has trebled its plant equipment.

**Mexican Disturbance Causes Depression.**—A firm of well-known exporters reports that the recent revolution in Mexico and the subsequent governmental turmoil have caused a decided falling off in the volume of business in that country. The sales of electrical machinery and supplies have been decreased by approximately 75 per cent and at the present time show little indication of recovering their former volume.

**Steam-Boiler Business Not Brisk.**—From interviews with several of the smaller concerns supplying steam-boiler equipment and accessories it was learned that following a period of exceptional activity in this line there has been a tendency for business to fall off of late. While replacements are being obtained at a good normal rate the volume of new business has decreased because of the lack of new developments owing to present money market conditions.

**Steel-Pole Manufacturing Not Hampered by Fire.**—The Franklin Steel Company, Franklin, Pa., stated that its transmission and lighting pole department was not injured by a fire which took place recently at its plant and that it is still in a position, therefore, to handle orders for that line of equipment. Nearly \$200,000 of damage was done in other departments, however, the bar mills being destroyed. The mill for 18-in. stock and the assembling shops were not injured.

**Expects an Excellent Fan Season.**—The Monarch Electric & Wire Company, Chicago, discussing the 1913 fan season, said this week: "We have had a very successful and unprecedented response from our special campaign with Hunter and Tuerk fans. Our accounts number more than double those of any previous year and all we need now is a few days of warm weather to have the largest sale, by far, in the history of the company. These conditions are also true of our other agency lines."

**Hurley Machine Company Markets a New Line.**—The "Hurley Six" is the name of a new electric vacuum cleaner

which has just been placed on the market by the Hurley Machine Company of New York and Chicago, manufacturer of the "Five Minute House" battery sitters. The cleaner is of the portable type, works at a regular speed and has several new features. One of these is a simple device for picking up through any passages and the company states that a large number of the machines have been sold and that numerous orders for the machine are being received daily from all parts of the country.

**Chinese Trade in American Electrical Supplies Remains Steady.**—Exporters to China report that although recently there have been no shipments of large orders the trade in lamps and electrical supplies is remaining constant. An immediate falling off in American exports to China has been experienced as the result of the withdrawal of the United States from the Chinese loan syndicate and the resultant attitude of the American agents and bankers as regards the severe hardship will result from the failure of the national government in the Chinese loan matter.

**New Jobbing House in Binghamton, N. Y.**—The Blanding Electrical Supply Company, Inc., has succeeded the Binghamton, N. Y. Electrical Construction Company, which has been prominent in many ways in the electrical contracting and engineering business. In addition to conducting the same lines of business as were handled by the Binghamton Electrical Construction Company in the past the Blanding company will continue an electrical supply jobbing business. The stock of supplies has been increased and additional stock orders have been taken at 145 State Street, Binghamton, N. Y., and stock rooms being maintained at 145 State Street as heretofore.

**Oil-Engine Performance.**—An oil-engine performance being set consisting of an 18-hp DME engine was recently completed for a ship. Binghamton and those who have recommended to the Government recently for use in connection with wireless telegraphy service following a series of tests made up by a Government representative. At these tests the sets used were Sun or Sun oil and kerosene oil. The density of these fuels from 20 deg. to 100 deg. F., and some have a paraffin and others an alcohol base. The fuel consumption and horsepower output in these tests was 0.1605 gal. per running on Sun oil with 9 gal. on Eagle oil and 0.094 gal. on kerosene.

**Appliance Manufacturers Open Pacific Coast Branch.**—The Birtman Electric Company, 14 South Street, Chicago, manufacturer of vacuum cleaners, massage vibrators, hair dressers and similar appliances, is completing arrangements for opening a branch office in San Francisco. The move has been made necessary in view of the rapid increase in the company's business in the Pacific Coast and the difficulty it has encountered in handling this business properly without local distributing facilities. The new office will be in charge of A. J. Strickland, who will carry a complete stock and handle the Birtman line of massage, Pacific Coast. The company recently placed an improved line of its Model D suction vacuum on the market.

**No Change in General Electric Executive Officers.**—In the past month or two there have been very persistent rumors circulated in the business world to the effect that President C. C. Coffin, of the General Electric Company, who is now on his sixtieth birthday, would retire and recommend to the board of directors of the company the appointment of J. W. Smith, Jr., as president and chief executive officer. Mr. Coffin's resignation and recommendation were denied at a meeting of the board of directors held on May 13, when the rumors were made and dismissed. The board is composed of 12 directors.



C. A. Coffin; vice-presidents, E. W. Rice, Jr., Anson W. Burchard, J. R. Lovejoy, J. R. McKee and Owen D. Young; treasurer, Henry W. Darling; secretary, M. F. Westover.

**Chicago Fuse Company Busy.**—In response to our request for information concerning the present state of its business, the Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, says it is finding trade conditions very satisfactory. "We have noticed but little tendency toward the depression it was feared would take place to some extent as a result of opening up the tariff and other questions in which the present administration is interested," the company adds.

**Large Fuse Orders.**—The Economy Fuse & Manufacturing Company, Chicago, maker of renewable cartridge fuses, fuse accessories, etc., has received a large order through a prominent Eastern jobber for a quantity of fuses ranging in size from 10 amp to 600 amp, inclusive. This order came from the United States Navy Department, which will use the fuses at the Brooklyn Navy Yard. Another large order received a short time ago by the Economy company came from the Singer Manufacturing Company, Elizabethport, N. J. The material supplied on this order includes a large quantity of the company's ferrule-type fuses in a wide range of sizes and also a large number of knife-blade-type fuses in sizes from 100 amp to 400 amp, inclusive.

**Conduit Engineer Receives Large Contracts.**—G. M. Gest, conduit engineer, of Montreal and New York, has been awarded the contract for constructing the first section of the underground conduit system as planned by the Montreal Electric Service Commission. There were four tenders submitted, and the commission recommended that the tender of Mr. Gest, at \$271,758, be accepted. This will be one of the most complicated pieces of work ever undertaken, the construction being under the sidewalks of St. Catherine Street, the most congested street in the city. Mr. Gest has agreed to complete the work in six months, while the next lowest tender asked twenty-four months. A contract covering the construction of large extensions to the conduit system in Vancouver, B. C., has also been awarded to the same engineer.

**Absorption Ice Plant for Chicago Stock Yards.**—The Carbondale Machine Company, Carbondale, Pa., recently installed and placed in operation a 50-ton ice plant in connection with a power station for the Union Stock Yards & Transit Company, of Chicago, where all of the local conditions are favorable for making ice at a lower cost than anywhere else in this country. The engines at the stock yards are run non-condensing, with 3-lb. back pressure, throughout the year for heating purposes, the exhaust steam being used in dry kilns, etc., even in the summer months, so that an abundant supply of exhaust steam will be available at all times for the ice plant. From 1,000,000 gal. to 3,000,000 gal. of water is pumped each day through the stock yards, so that no additional pumping will be required for ice-making. The only extra labor will be that needed for pulling the ice.

**Mixed-Pressure Turbine Sales Increasing.**—"Whereas our last year's business showed an increase of about 50 per cent over that of the year before, this year's business thus far is double that in the corresponding period of 1912," said a representative of the George D. Atwood Company, 149 Broadway, New York, this week. This company makes a specialty of mixed-pressure turbine work, furnishing complete equipment for power plants, and is the general Eastern agent for the Kerr Steam Turbine Company, the Northern Equipment Company and the Uehling Instrument Company. One notable installation of this nature will be made in a plant which is being built for the Sicilian Asphalt Paving Company on Newtown Creek, Brooklyn, N. Y. This consists of a 100-kw mixed-pressure turbine generating set, with condenser, rotative dry-vacuum pump and motor-driven circulating pump. The unit is unique on account of its flexibility for several kinds of service. A pulley is to be arranged on the generator shaft, so that 50 hp can be transmitted mechanically from the turbine set to a line shaft, and the set is to be designed to operate either on high-pressure or low-pressure steam at both. It will be possible to drive a mechanical load of

50 hp, with no electrical load, if desired, in which case the set can be run non-condensing, or the latter can develop an electrical load, without having the turbine in operation by connection with the line shaft, or, in the event of the mechanical load being heavy, power can be transmitted to the line shaft, thus reducing the load on the engine. Should the electrical load be heavy and the mechanical load light, power can be transmitted from the line shaft to help out the turbine.

**Insulated-Wire Business Reaches Record Proportions.**—The Detroit Insulated Wire Company, Detroit, Mich., reports that its business in the first four months of this year was more than 100 per cent in excess of that in the corresponding period of 1912. April was the banner month in the company's history, and from present indications the May business will be even larger than that of April. Orders on hand insure disposal of the entire output for several months, despite the fact that the company's productive capacity was recently increased by extensive additions and improvements to the factory equipment. The export branch of the company's business also shows a decided increase. President Keller feels certain that, barring restrictive legislation, the outlook for continuation of his company's rapid growth is decidedly bright.

**Esterline Company's New Plant.**—This letter was received recently from the Esterline Company, of Indianapolis, Ind.: "Following the flood at Lafayette, we moved our entire plant to this city. This move had been planned for some time this summer, but after the flood subsided we decided not to re-enter the old plant. We have here a three-story reinforced-concrete factory building with over 100,000 sq. ft. of floor space, which is more than four times the space we had at our Lafayette plant. Business has been exceptionally good during the past month in our meters department, and the outlook in this line is particularly bright. We do not expect to be bothered by the tariff. We are selling a good many of our lines abroad now, and if we can make them in this country and ship them to other countries, we are not much afraid of the other fellows beating us out here."

**Waterwheels for Western Canada Power Company.**—At the annual meeting of the Western Canada Power Company, of Vancouver, B. C., C. H. Cahan, K.C., the president, stated that in addition to ordering two additional 13,000-hp double Francis turbines from Escher, Wyss & Company, the directors have given a contract to the Canadian General Electric Company for two generators, and have ordered from the Canadian Westinghouse Company the switchboards and other accessories to double the present rating of the company's generating station. Although under its contract, which was recently completed, the British Columbia Electric Railway Company, Limited, is not required to take electrical energy from the Western Canada Power Company, before Sept. 1 next, that company has already commenced to take 6000 hp. Mr. Cahan added: "The establishment of grain elevators, flour mills and cement mills, together with the new steel works, which will soon be in operation in Vancouver, will insure large increases in our sales of energy, and we must now prepare for the large demand which these industries will certainly make upon us."

**Electrical Contractors Expect Much from Society for Electrical Development.**—"While we are doing a fair amount of work in Pennsylvania, Virginia and elsewhere outside of New York, we are finding business right here in the local field much lighter just now than it was at this time last year," said one of the members of a New York electrical contracting firm this week. "In fact, as far as our company is concerned, things are very dull, and if it were not for our outside work the amount of business we are doing in New York at present would hardly pay expenses," he continued. "The price-cutting is very severe, too, which indicates that there are a great many others in this line who are willing to take business at nearly any price in order to help meet expenses. I believe that the Society for Electrical Development, when it gets its plans under way, will do some very good work in improving conditions in the entire electrical field. Everyone in the business is certain to be benefited by the society's publicity campaign, even those who are not broad-minded enough

to become members of the society. Just as soon as the plan is placed in operation a great many concerns which have not already joined will do so and with the united efforts of every branch of the industry the latter will surely receive a decided impetus along commercial lines. When the movement was first attempted several years ago the financial troubles in 1907 were so acute that the plan was naturally unsuccessful at that time. The general trade situation is also somewhat unsettled at present, but by the time things brighten up a little the Society for Electrical Development will have all the funds it needs to start its campaign, which, I am sure, will be very beneficial to the entire industry."

**Tennessee Hydroelectric Station Nearing Completion.**—The hydroelectric station of the Chattanooga & Tennessee River Power Company at Hale's Bar, on the Tennessee River, about 12 miles below Chattanooga, is nearing completion. Energy from this plant, which is to have a rating of 56,000 hp, will be transmitted to Chattanooga and the surrounding territory. A 20,000-hp steam auxiliary station is to be erected by the Chattanooga company.

**Meridian (Miss.) Company Improving Its Property.**—The Meridian (Miss.) Light & Railway Company, which is one of the subsidiaries of the Consolidated Cane Light, Power & Traction Company, is making a number of improvements to its system. These include the installation of a 2500-hp unit in the generating station, additional cars and 7 miles of new gas main.

**Completes Transmission Lines to Nashville.**—Erection of the transmission lines from the hydroelectric plants of the Tennessee Power Company on the Decatur River to Nashville, Tenn., has been completed and the delivery of energy to the Nashville Railway & Light Company has begun. When the developments of the Tennessee company are completed they will have a rated output of approximately 100,000 hp. Details of the company's plans were given in these columns April 30, 1912.

**Doherty Faction Sustained in Toledo Utility Suit.**—Judge Killits in the United States District Court at Toledo has handed down a decision in the case of the Toledo Traction, Light & Power Company versus Barton Smith and others, sustaining all acts of the board of directors and officers of the Toledo company nominated by Henry L. Doherty & Company, and declaring their election legal. Details of the controversy over which this suit was brought were given in these columns April 26.

**Personnel of E. W. Clark & Company Management Corporation.**—As was mentioned in these columns last week, E. W. Clark & Company, of Philadelphia, bankers and one of the oldest concerns in the public-utility field, recently organized a new corporation under Delaware laws to take over their engineering and management departments. The newly formed company is known as the E. W. Clark & Company Management Corporation and its principal operating office will be at Columbus, Ohio. It was first called the E. W. Clark Management & Engineering Company, but this name was changed to that given above. The officers are: President, C. M. Clark; vice presidents, S. G. McMeen and M. S. Hopkins; secretary and treasurer, G. I. Estabrook; assistant treasurer and assistant secretary, A. J. Burlington.

**Westinghouse Electric Earned Record Gross in 1912.**—The annual report of the Westinghouse Electric & Manufacturing Company for the year ended March 31, 1913, issued this week, shows gross earnings of \$4,000,000, the largest in the history of the company and comparing with \$3,406,446 in the previous year. The net income available for dividends was \$3,164,032, and this was exceeded only in 1911, when the figure was \$4,886,408. Net earnings, after paying dividends of 2 per cent on the preferred stock, were equal to \$2 per cent on the outstanding common stock, as compared with 6.12 per cent on the same amount of stock last year. Common stock dividends to the amount of \$1,053,000 were paid, as against \$813,000 in 1911, leaving a balance of \$1,830,457 against \$1,812,000 on March 31, 1912. Deductions for depreciation, etc., for the total surplus at \$7,348,522 as compared with \$6,048,000 for the previous fiscal year. The value of inflated stock as of March 31, 1912, was \$8,137,000, as of March 31, 1913, the value of

unfilled orders and 1912, 6, 1911. The foreign situation of employees during the year was as follows:—continued and an average of 10,000 for the year. In 1912, the company to the stockholders Guy E. Tripp, chairman of the board, stated that all of the foreign Westinghouse companies, with the exception of the Italian company, showed better improvement during 1912. The outlook for the British and French companies he regards as particularly good. During 1912 the Italian company secured large orders from the Italian government for electric machinery and other equipment, delivery of which is to begin shortly.

**Spartanburg (S. C.) Utility Company to Enlarge Its System**—The South Carolina Water, Light & Power Company, Spartanburg, S. C., is making extensive alterations to its water and other systems and is planning to let contracts in the near future for the erection of a hundred-thousand-dollar steam generating station to be used as an auxiliary to its hydroelectric plant at Gaston Shoals. The company will also erect another hydroelectric plant at Palmer Shoals, about 6 miles above the present plant. This will have a rating of 16,000 hp. The Gaston Shoals plant currently 12,000 hp.

**To Consider Financing of New Station.**—At the annual meeting of the Columbia Gas & Electric Company, Cincinnati, last week William F. Phelps, of J. & W. Seligman & Company, was elected a director in place of George H. Worthington, of Cleveland. J. H. Murray was named to the board of the Union Gas & Electric Company, a subsidiary of the Columbia company, in place of Theodore Chubb, secretary of the company, and J. F. Workman succeeded J. T. Cronin, president. After the elections, the meetings were adjourned for two weeks. It is expected that at the adjourned meetings something of a definite nature regarding the financing of the new generating system will be created by the Columbia Gas & Electric Company at a cost of \$2,000,000 will be presented to the stockholders of the Union company.

## Industrial Securities

Source of Data	Estimated Species (range)	Estimated Number of Species	Number of Species	Number of Species
Albino (white) (1950-1951)	100-150	100	100	100
Albino (white) (1952-1953)	100-150	100	100	100
Albino (white) (1954-1955)	100-150	100	100	100
Albino (white) (1956-1957)	100-150	100	100	100
Albino (white) (1958-1959)	100-150	100	100	100
Albino (white) (1960-1961)	100-150	100	100	100
Albino (white) (1962-1963)	100-150	100	100	100
Albino (white) (1964-1965)	100-150	100	100	100
Albino (white) (1966-1967)	100-150	100	100	100
Albino (white) (1968-1969)	100-150	100	100	100
Albino (white) (1970-1971)	100-150	100	100	100
Albino (white) (1972-1973)	100-150	100	100	100
Albino (white) (1974-1975)	100-150	100	100	100
Albino (white) (1976-1977)	100-150	100	100	100
Albino (white) (1978-1979)	100-150	100	100	100
Albino (white) (1980-1981)	100-150	100	100	100
Albino (white) (1982-1983)	100-150	100	100	100
Albino (white) (1984-1985)	100-150	100	100	100
Albino (white) (1986-1987)	100-150	100	100	100
Albino (white) (1988-1989)	100-150	100	100	100
Albino (white) (1990-1991)	100-150	100	100	100
Albino (white) (1992-1993)	100-150	100	100	100
Albino (white) (1994-1995)	100-150	100	100	100
Albino (white) (1996-1997)	100-150	100	100	100
Albino (white) (1998-1999)	100-150	100	100	100
Albino (white) (2000-2001)	100-150	100	100	100
Albino (white) (2002-2003)	100-150	100	100	100
Albino (white) (2004-2005)	100-150	100	100	100
Albino (white) (2006-2007)	100-150	100	100	100
Albino (white) (2008-2009)	100-150	100	100	100
Albino (white) (2010-2011)	100-150	100	100	100
Albino (white) (2012-2013)	100-150	100	100	100
Albino (white) (2014-2015)	100-150	100	100	100
Albino (white) (2016-2017)	100-150	100	100	100
Albino (white) (2018-2019)	100-150	100	100	100
Albino (white) (2020-2021)	100-150	100	100	100
Albino (white) (2022-2023)	100-150	100	100	100
Albino (white) (2024-2025)	100-150	100	100	100
Albino (white) (2026-2027)	100-150	100	100	100
Albino (white) (2028-2029)	100-150	100	100	100
Albino (white) (2030-2031)	100-150	100	100	100
Albino (white) (2032-2033)	100-150	100	100	100
Albino (white) (2034-2035)	100-150	100	100	100
Albino (white) (2036-2037)	100-150	100	100	100
Albino (white) (2038-2039)	100-150	100	100	100
Albino (white) (2040-2041)	100-150	100	100	100
Albino (white) (2042-2043)	100-150	100	100	100
Albino (white) (2044-2045)	100-150	100	100	100
Albino (white) (2046-2047)	100-150	100	100	100
Albino (white) (2048-2049)	100-150	100	100	100
Albino (white) (2050-2051)	100-150	100	100	100
Albino (white) (2052-2053)	100-150	100	100	100
Albino (white) (2054-2055)	100-150	100	100	100
Albino (white) (2056-2057)	100-150	100	100	100
Albino (white) (2058-2059)	100-150	100	100	100
Albino (white) (2060-2061)	100-150	100	100	100
Albino (white) (2062-2063)	100-150	100	100	100
Albino (white) (2064-2065)	100-150	100	100	100
Albino (white) (20				

## NEW YORK METAL MARKET PRICES.

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## Personal

**Mr. N. T. Fortun** has been elected manager of the Lyle (Minn.) electric-light plant, succeeding Mr. N. G. Fischer.

**Mr. W. N. Chatfield** has succeeded Mr. L. C. Phipps, Jr., as treasurer and manager of the Pacific Power Company at Boise, Cal.

**Mr. Charles Schaefer** has succeeded Mr. W. H. Hartman as superintendent of the municipal electric-light and power plant at Opelika, Ala.

**Mr. Gerald H. Moore** has been appointed resident engineer of the Canadian British Engineering Company, Ltd., of Winnipeg, Manitoba.

**Mr. C. T. Wheat** has succeeded Mr. William McKinley as superintendent of the Madison County Light & Power Company, Carlinville, Ill.

**Mr. E. Cutting** has been appointed superintendent of the municipal electric-lighting plant at Riverside, Cal., succeeding Mr. F. A. Worthley, resigned.

**Mr. Harry Frith** has been reappointed commercial manager for the Central Illinois Utilities Company at Watseka, Ill., succeeding Mr. D. B. Maxwell, resigned.

**Mr. R. T. Morris**, municipal electrician of South Vancouver, B. C., has resigned to associate himself with Mr. G. M. Gest, the well-known conduit engineer and contractor.

**Mr. Herbert L. Harries**, son of Gen. George H. Harries, has succeeded Mr. P. T. Glidden as manager of the Louisville Lighting Company, with the title of assistant to the president.

**Mr. L. W. Byers**, until recently general manager of the Atlantic City (N. J.) Electric Company, has been transferred to the New York office of the American Gas & Electric Company.

**Mr. P. T. Glidden**, until recently general manager of the Louisville Lighting Company, has been transferred to St. Paul to assume the duties of manager of the Consumers' Power Company at that city.

**Mr. O. F. Whitehurst**, formerly engineer of the Nashville office of the General Electric Company, has been appointed vice-president and general manager of the Capital Light & Power Company, Jackson, Miss.

**Mr. John Wise**, who has been general manager of the Harwood Electric Company, Hazleton, Pa., has been made general manager of the Lehigh Navigation Electric Company, which has acquired the property of the former company.

**Mr. J. W. Lieb, Jr.**, associate general manager of the New York Edison Company, delivered an illustrated lecture on the engineering features of the Dayton flood before the Yale University branch of the American Institute of Electrical Engineers on May 14.

**Mr. Frank H. Golding** has resigned his position as general manager for the Rockford (Ill.) Electric Company to accept a position as manager for the Atlantic City (N. J.) Electric Company, effective June 1. He will be succeeded by Mr. Adam Gschwindt, of Scranton, Pa.

**Mr. J. J. Roe**, president and manager of the Hampton (Ia.) Electric Light & Power Company, has disposed of all his holdings in the company and has been succeeded by Mr. M. A. Harrison, formerly manager of the Nevada (Ia.) Electric Company, who represents the new owners.

**Mr. Sydney W. Ashe** has completed the work of organizing the educational activities at the Harrison Lamp Works of the General Electric Company, and has been transferred to the Pittsfield works of the same company, where he will co-operate in handling the educational and welfare work.

**Mr. Kempster B. Miller**, consulting engineer, of Chicago, will sail for Glasgow via Montreal on June 14 and plans to visit Edinburgh, London, Antwerp and Paris. Mr. Miller will be accompanied by his family and after establishing them in Switzerland for the summer he expects to return about the middle of July.

**Mr. E. L. Sherwood**, formerly district manager of incandescent lamp sales for the General Electric Company

at Cincinnati, has resigned and joined the sales force of the National Carbon Company of Cleveland, Ohio. Mr. Sherwood's territory will embrace southern Indiana, southern Ohio, West Virginia, Kentucky and Tennessee.

**Mr. W. A. Leland**, of Charleston, S. C., has been elected president of the Tennessee Eastern Electric Company with offices in Johnson City, Tenn. This company recently purchased the lighting properties in Johnson City, and is now engaged in building a dam across the Nolachucky River, and will erect a hydroelectric station near Greeneville and distribute electrical energy in eastern Tennessee towns.

**Dr. Leo H. Baekeland**, industrial chemist, of Yonkers, N. Y., who has won renown among electrical men by the invention of bakelite, an insulating material, and in the photographic field by the invention of velox paper, was the recipient of the third Willard Gibbs medal in Chicago on May 16. The medal was founded by Mr. William A. Converse and is bestowed each year by the Chicago Section of the American Chemical Society upon a man who has gained pre-eminence in chemical research. A banquet was held in honor of Dr. Baekeland at the Hotel Sherman on the evening of the ceremony. This is the first time that the medal has been presented to an industrial chemist. Previously it had been bestowed on pure-science chemists. Mr. W. D. Richardson presented the medal, and Dr. Baekeland responded by reading a technical paper on "Recent Developments in Phenolic Condensation Products."

## Obituary

**Francis M. Rites**, inventor of the Rites governor for steam engines and at one time chief engineer of the Westinghouse Machine Company, was found dead at his country home in Slaterville, N. Y., on May 8. It is supposed that he suffered an attack of acute indigestion and died suddenly about May 2.

**Horace G. Burt**, chief engineer for the Chicago Association of Commerce committee of investigation on smoke abatement and electrification of railway terminals, died at the Oak Park (Ill.) Hospital on May 19. Mr. Burt was sixty-four years of age. He was a civil engineer by profession and a graduate of the University of Michigan. He had devoted his life to railroad work and was president of the Union Pacific Railroad from 1898 to 1904.

**Stephen D. Field**, one of the pioneers in electric railways, died at his residence in Stockbridge, Mass., on May 18, 1913. Mr. Field was an inventor in many fields of electrical work and in 1879 and 1880 applied for patents for an electric railway, including a stationary generator, trolley wire, electric car, under-running trolley and bonded rails for return circuit. In 1880 he constructed an experimental electric line in Stockbridge and in 1883, in connection with Mr. Edison, operated an electric locomotive by a third-rail at the Chicago Railway Exposition. He also made a number of inventions in telegraphy. Following his early work he did little in the electric railway field except in the later nineties, when, representing American capitalists, he had engineering charge of the electrical equipment of the tramway system at Geneva, Switzerland.

**George D. Rosenthal**, district manager for the General Electric Company at St. Louis, Mo., died May 19 in the German Hospital in New York City. He was operated on for appendicitis on May 12 and suffered a fatal relapse a week later. Mr. Rosenthal had been connected with the General Electric Company for nearly twenty-five years. He was born in New York City forty-five years ago. His father was chief statistician for the Thomas A. Edison Lamp Works at Harrison, N. J., before they were consolidated with the General Electric Company. Mr. Rosenthal began his business career with the Edison company as a lamp salesman. After its consolidation with the General Electric Company he went to the Chicago office of the new company as a salesman for railway apparatus. About fifteen years ago he was transferred to the St. Louis office. He was one of the best salesmen in the organization and gradually worked up to the position of district manager. He is survived by his widow.





to connect the Northern Virginia Pwr. Co. The company does not intend to engage in the railway business, but will confine its efforts to furnishing electricity for municipal, manufacturing and commercial purposes. The electric railway to be built from Bluemont, Va., through Berryville, Winchester, Williamsport and Hagerstown will secure power from the plants of the Northern Virginia Pwr. Co.

WASHINGTON, D. C.—Bids will be received at the Engineer Depot, United States Army, Washington Barracks, D. C., until May 27 for furnishing cambric-insulated cable. For further information address Major W. L. Haskin.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until June 2 for furnishing two carloads of bituminized fiber conduit (approximately 25,000 ft. to carload), as per specification 238-D, and 100 gal. jointing compound for 3-in. fiber conduit (extra) to be furnished in lead cans. Major W. L. Clarke is disbursing officer.

WASHINGTON, D. C.—Bids will be received until June 7 at the office of the chief signal officer, War Department, Washington, D. C., for furnishing wire and cable as follows: (1) For 20,000 ft. rubber-covered and braided, 51 mils. copper wire, N. E. code standard for 600 volts; (2) 30,000 ft. pothead, 36 mils. wire; (3) 10,000 ft. twisted pair braid, 51 mils. wire; (4) 5000 ft. single braid, 51 mils. wire; (5) 50 mils galvanized, 81 mils. iron wire; (6) 85,000 ft. house, 36 mils. wire; (7) 10,000 ft. cable, type 413; (8) 3000 ft. cable, type 418; (9) 10,000 ft. cable, type No. 411; (10) 5000 ft. cable, type 417; (11) 50 mils galvanized, 144 mils. iron wire; (12) 10,000 ft. cable, type 213; (13) 35,000 ft. cable, type 321; (14) 6000 ft. cable, type 324; (15) 18,000 ft. cable, type 327; (16) 10,000 ft. cable, type 401; (17) 6000 ft. cable, type 403; (18) 10,000 ft. cable, type 407; (19) 3000 ft. cable, type 408; (20) 10,000 ft. cable, type 409; (21) 1000 ft. cable, type 624; (22) 1000 ft. cable, type 644; (23) 5000 ft. cable, type 325. Reels are to remain the property of the contractor to be returned by the government when empty. Major W. L. Clarke is chief signal officer.

## North Central

DETROIT, MICH.—The Ford Motor Co., it is reported, will add another unit to its power plant to furnish power to the large addition to its works which will soon be erected. Edward Gray is engineer.

DETROIT, MICH.—The Paige-Detroit Motor Car Co. is planning to erect a factory building on McKinstry Avenue. A separate building will be erected for power plant. John Scott & Co. are architects.

INGALLS, MICH.—Work will begin as soon as possible on rebuilding the dam, owned by Ira Carley, which was recently washed away, carrying with it a dynamo and two waterwheels. A new generator and two waterwheels will be purchased to replace those carried into the river.

MARQUETTE, MICH.—The Light and Power Commission has decided to build a spillway at Silver Lake, where storage water for the Dead River power plant is dammed. The commission has also voted to furnish the Marquette City & Presque Isle Ry. Co. with electricity to operate its street-railway system. The company will place orders at once for a 200-kw rotary converter and two 100-kw transformers for its power plant. Charles Retailic is manager of the street-railway company and also of the municipal electric-light plant.

MENOMINEE, MICH.—Funds are being solicited for the installation of an ornamental street-lighting system. It is proposed to erect ornamental standards, carrying five-lamp clusters, manufactured by the Prescott Co., of Menominee.

NEWBERRY, MICH.—Plans are being prepared by Charlton & Kuenli, architects, for the construction of various buildings for the Newberry State Hospital, for which \$85,000 was appropriated by the State Legislature. Considerable new machinery will be installed in the power plant.

ST. CHARLES, MICH.—The city of St. Charles contemplates the purchase of a series Mazda street-lighting system, consisting of about 150 lamps, within the next 12 months. L. V. Troup is superintendent.

WHITEHALL, MICH.—The Frugale Co. is erecting a power plant to furnish light to the summer-resort districts.

MARIETTA, OHIO.—Preparations are being made by the Parkersburg, Marietta & Interurban Ry. Co. to begin work in the near future on the construction of dams and hydroelectric power plants along the Muskingum River in Ohio to furnish electricity to the Muskingum, Little Kanawha district and a great part of the Ohio Valley. Henry N. Archer, of Parkersburg, is general manager.

AUBURN, KY.—The owners of the Auburn Mills are contemplating the installation of an electric-light plant to furnish electricity for lighting the town and would like to communicate with manufacturers of electrical equipment and contractors in regard to same. Charles E. Bates is manager.

PADUCAH, KY.—The City Council is considering the purchase of an additional engine in the municipal electric-light plant and the installation of a generator and motors to operate the pumps which are to be located at the water-works station. Frank Burns is chairman of the public improvement committee of the Council.

BLOOMINGTON, IND.—The Southern Indiana Pwr. Co., of Bedford, will erect a transmission line from its power plant in Williams to Bloom-

ington, to furnish electricity for the large quarries, etc. Switching equipment and 2500 kw in transformers will be distributed and installed between three stations, 21 miles No. 3 wire and 500 steel towers will be required for the transmission line. D. J. Angus is superintendent.

BRAZIL, IND.—The Brazil El. Co., it is reported, will close down its power plant and secure electricity from the Terre Haute, Indianapolis & Eastern Trac. Co. to operate its system.

CLAYTON, IND.—Arrangements are being made for the installation of an electric-lighting system in Clayton. Electricity for operating the proposed system will be furnished by the Danville Lt., Ht. & Pwr. Co., of Danville. A transmission line about 5 miles in length will be erected to furnish the service. The street-lighting system will consist of about 40 arc lamps. Bids for construction of system will be asked about July 1. The Foxworthy El. Co., of Indianapolis, has charge of the engineering work.

FORT WAYNE, IND.—The Wabash Valley Utilities Co., of Fort Wayne, has purchased the holdings of the Kehoe Lt. & Pwr. Co., of Fort Wayne, which furnishes electricity for lamps in the cities of New Haven, Ossian, Rockfield, Flora and Camden, Ind.

HILLSBORO, IND.—A movement has been started by citizens of Hillsboro and farmers near here to organize a telephone company with a capital stock of \$12,000.

WINGATE, IND.—The installation of an electric-light system in Wingate is contemplated. Electricity for operating the system will probably be secured from Crawfordsville. The erection of transmission lines from Crawfordsville to furnish electrical energy in Linden, New Richmond and Waynetown is contemplated.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co. has closed contracts to furnish electricity to operate the plants of the Aledo Brick & Tile Works and the T. D. Winders Cold Storage Co.

ALTON, ILL.—We are informed that the city of Alton does not contemplate the installation of flaming-arc lamps, as reported in the issue of May 10. An ornamental street-lighting system has already been installed. B. R. Kennedy is city clerk.

BLOOMINGTON, ILL.—Arrangements are being made to install one 200-kw Fort Wayne generator, one 250-hp Hamilton Corliss engine, switchboard and instruments in the municipal electric-light plant within the next month. The city of Bloomington expects to purchase within the next 12 months one 500-hp water-tube boiler with mechanical stokers for the municipal plant. S. S. Noble is superintendent.

BUCKLEY, ILL.—It is reported that an agreement has been reached between the Village Board and the Central Illinois Utilities Co., whereby the village has sold the municipal electric-light plant to the company for \$4,750. The company is to be given a franchise and also a contract to pump water for the municipal water-works system.

CARLINVILLE, ILL.—The Madison County Lt. & Pwr. Co. is reconstructing both its power house and transmission line in Carlinville. The equipment will consist of one 190-kw direct-connected unit, consisting of an Erie simple engine and a Westinghouse 2300-volt alternator. A 60-kw motor generator set to receive current at 33,000 volts will be installed for auxiliary purposes. No changes will be made in the boiler equipment at this time. New switchboard equipment will be installed for the 190-kw unit and 60-cycle motor generator, together with one distributing panel and one panel for operation of the street-lighting system, to be selected later. The distributing system will be rebuilt for 2300-volt, 60-cycle current (poles used). All material has been purchased with the exception of the street-lighting system, which has not yet been decided upon, the decision resting with the City Council. C. T. Wheat is local superintendent and E. D. Bell, of St. Louis, Mo., is general superintendent.

DECATUR, ILL.—The Wabash R. R. Co. contemplates the installation of a telephone system on the Springfield division between Montpelier and Chicago. J. P. Church, of Decatur, is superintendent of telegraph.

ELGIN, ILL.—A petition which will be presented to the Board of Local Improvements is being circulated on North Liberty Street for the installation of an ornamental street-lighting system. Petitions are being circulated for ornamental lamps on Lindon and Forest Avenues and on Lily and Park Avenues between North Liberty Street and Lords Park. Conrad Ackerman, 582 Park Street, Elgin, is interested.

ELLIOTT, ILL.—The Village Board has granted the Central Illinois Utilities Co., of Piper City, a franchise to construct and operate an electric-light system here. The company has been given a ten-year contract for street lighting.

FREEPORT, ILL.—The Board of Park Commissioners is contemplating installing a lighting system in Taylor Park.

GLASFORD, ILL.—The Canton Gas & El. Co. has applied to the Village Board for a franchise to furnish electricity for lamps and motors in Glasford.

GRIDLEY, ILL.—The Village Board has closed a contract with the Illinois Traction System for lighting the streets of the village.

LEWISTOWN, ILL.—The Lewistown El. Co. has submitted a proposition to the City Council, asking for a new contract for street-lighting and that tungsten lamps be substituted for the arc lamps now in use. The company also offers to furnish electricity for pumping the city water for \$200 per month and 10 cents per 1000 gal. for all over that amount.

FLORIDA, ILL.—City Electrician Wolgamott has recommended to the



City Council, that the work of the line in a power plant section of paved underground and the system extending.

**PIPER CITY, ILL.**—The Village Board has granted the Central Illinois Utilities Co., of Piper City, Ill., a franchise for line.

**QUINCY, ILL.**—The Quincy Gas & Electric Co. has completed the cable installation of the underground system and expects to begin stringing over the overhead lines in association with the city to make the necessary changes in its plant to utilize power from the Central Board, which will require the installation of frequency transformers and large steam boilers as well as a switchboard. The company is expected to distribute 60-cycle current for lighting purposes, the hydroelectric current being 25 cycles. H. O. Chatham is manager.

**SHEFFIELD, ILL.**—The American Gas Co. of Chicago has purchased the property of the Sheffield Electric Co. A series of improvements will be made to the plant and the service will be extended. It is expected within a few months the company will be reorganized from Kewanee to Sheffield, when a franchise will be obtained.

**SPRINGFIELD, ILL.**—City Electric Co. has been authorized by the City Council on the installation of an improved system of gas and fire alarm signals.

**STERLING, ILL.**—The Rock Road Light & Power Co. of Sterling has authorized H. H. Green, general manager, to negotiate the franchise and street lighting contracts in Sterling, Morrison, Langdon, Prosperity, Erie, Lyndon, Fulton and Albany. The company had received authorization with a capital stock of \$300,000 by H. H. Wood, Edward F. Lawrence and H. S. Green.

**TIMPEWILL, ILL.**—The Village Board has granted the Central Illinois Public Ser. Co., of Mattoon, a franchise to install a streetcar in Timpewill.

**VERSAILLES, ILL.**—The Central Illinois Public Ser. Co., of Mattoon, has been granted a franchise by the Village Board to install a streetcar in Versailles.

**WILLIAMSVILLE, ILL.**—The Illinois Electric System is contemplating installing an electric distributing system in Williamsville and is trying to secure a contract for lighting the street here.

**YORKVILLE, ILL.**—The Village Board has granted the Public Service Co. of Northern Illinois, of Chicago, a franchise to install conductors for lamps and motors in Yorkville.

**MADISON, WIS.**—Plans are being considered by the State Street Improvement Association for the installation of an ornamental street-lighting system, to consist of 20 ornamental lamp standards carrying one-lamp clusters (one 100-watt and four 60-watt lamps), maintained by underground wires; low-voltage, lead-covered, three-conductor cable will be used. The cost of the standards is estimated at \$42,000 and construction, erection, etc., at about \$5,000. The association would like to correspond with concerns furnishing any or all the material in connection with street-lighting installations. F. W. Hawks, 111 State Street, Madison, is chairman of lighting committee.

**MILWAUKEE, WIS.**—The Milwaukee Electric Ry. & Light Co. is testing a new lamp and, if satisfactory, expects to install several hundred.

**MILWAUKEE, WIS.**—The Common Council, Public Co., has applied to the City Council for an extension of its franchise and in the downtown district.

**ALBERT LEA, MINN.**—The Minnesota Gas & Electric Co. is erecting a new power house and is installing three 400-hp Hoernig heaters and steam heaters, Detroit stokers, two 300-kw and one 300-kw Westinghouse turbine, one 300-kw and one 200-kw Westinghouse rotary converter, coal and ash conveyor, exciters, pumps, etc., and is rebuilding an existing system and street-lighting system. Funding Kemper is manager.

**BIG FALLS, MINN.**—The Big Falls Mfg. Co. expects to erect within the next three months a power plant and distributing system for lighting the town of Big Falls, for which material was already been produced. The company expects to purchase within the next three or four months miscellaneous electrical appliances and supplies. A. L. Sengary is manager.

**BUFFALO, MINN.**—The town of Buffalo is completing securing electricity from the plant at the Bush Co. and is now installing its line to the Mississippi is completed. H. H. Chatham is manager.

**DETROIT, MINN.**—The city of Detroit is installing an ornamental street-lighting system, covering a distance of about 10 miles. J. J. Bestick is purchasing agent.

**FARMINGTON, MINN.**—The Farmington Electric Co. has completed the purchase within the next 10 months a steam generator, engine, a 600-volt alternating-current, 150-hp motor, a part of a hydroelectric plant, with switchboard for same, cables, an oil engine, a generator, an engine or a steam engine with a rating of about 200 hp, and other electrical appliances, including vacuum cleaners, electric fans, etc. The company has recently purchased a 240-volt switchboard, motor, switchboard, etc., and will establish a telephone service to be installed. F. H. Faby is manager.

**FULDA, MINN.**—The power plant at the Fulda Electric Co. of Fulda, which was recently damaged by fire, has been repaired and is now in operation. The company is contemplating installing an ornamental street-lighting system in the town of Fulda. The company is also planning to install streetcar lines for those towns for lamps and motors. A. L. Sengary is manager.

**KENOSHA, MINN.**—M. G. Thompson, manager of the Kenosha Electric

Co., has been authorized by the Kenosha City Council to install a street-lighting system.

**LAKE CITY, MINN.**—The Lake City Electric Co. has been authorized by the Lake City Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**LAKE MINN.**—The Lake Minn. Electric Co. has been authorized by the Lake Minn. Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MADISON, MINN.**—The Madison Electric Co. has been authorized by the Madison Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MORRISVILLE, MINN.**—The Morrisville Electric Co. has been authorized by the Morrisville Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**ST. PAUL, MINN.**—The St. Paul Electric Co. has been authorized by the St. Paul Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**WHITE RIVER, MINN.**—The White River Electric Co. has been authorized by the White River Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**CEDAR RAPIDS, IA.**—The Cedar Rapids Electric Co. has been authorized by the Cedar Rapids Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**CEDAR RAPIDS, IA.**—The Cedar Rapids Electric Co. has been authorized by the Cedar Rapids Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**CHARLES CITY, IA.**—The Charles City Electric Co. has been authorized by the Charles City Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**CLINTON, IA.**—The Clinton Electric Co. has been authorized by the Clinton Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**DOOR CITY, IA.**—The Door City Electric Co. has been authorized by the Door City Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MINOTA, IA.**—The Minota Electric Co. has been authorized by the Minota Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MINOTA, IA.**—The Minota Electric Co. has been authorized by the Minota Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MONROEVILLE, IA.**—The Monroeville Electric Co. has been authorized by the Monroeville Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**MONROEVILLE, IA.**—The Monroeville Electric Co. has been authorized by the Monroeville Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**PAVING, IA.**—The Paving Electric Co. has been authorized by the Paving Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**SHILOH, IOWA.**—The Shiloh Electric Co. has been authorized by the Shiloh Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**ST. LOUIS, MO.**—The St. Louis Electric Co. has been authorized by the St. Louis Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.

**FULTON, ARK.**—The Fulton Electric Co. has been authorized by the Fulton Board of Trustees to install a street-lighting system. The company is also planning to install a streetcar line for those towns for lamps and motors. A. L. Sengary is manager.



**MARYVILLE, MO.**—Bids will be received by the Board of Public Works at Maryville, at the office of F. L. Flynt, superintendent of construction, until June 2, for the following equipment: For one high-service compound condensing duplex direct-acting pump of 1,000,000-gal capacity; two low-service horizontal split-case centrifugal pumps (directly connected to steam engine) of 1000 gal. per minute capacity each; one boiler-fed pump; two pressure filters of 250,000 gal. capacity each; one 4-kw, 120-volt, direct-current generator directly connected to steam engine; one 150-hp open feed-water heater and low concrete dam, gravity section. Plans and specifications are on file at the office of the superintendent of construction, Maryville, and also at the office of Hiram Phillips, consulting engineer, St. Louis, Mo. Copies of specifications will be furnished upon application to F. L. Flynt, superintendent of construction.

**OREGON, MO.**—Preparations are being made for the installation of a 60-hp oil engine in the municipal electric-light plant. When improvements are completed a 24-hour service will be established.

**PORTAGEVILLE, MO.**—The Portageville State Co. is contemplating the construction of a stove mill, electric-light and ice plants in the near future. N. V. Turner and J. B. Drerup are interested in the project.

**KENMARE, N. D.**—The installation of an ornamental street-lighting system is contemplated by business men. Mayor Cole is interested in the project.

**VELVA, N. D.**—Preparations are being made by O. J. Kauffman, of Hillsboro, Wis., for the construction of an electric-light plant in Velva. Mr. Kauffman is open for bids for the following equipment: One 16-ft. by 60-in. return-flue boiler, one 14-in. by 30-in. Corliss engine, one 60-kw, three-phase, 60-cycle, 2200-volt generator, complete switchboard equipment, one 120-kw constant-current transformer for series street-lighting system, 100 meters and 2000 tungsten lamps. Cedar poles and 5 miles of No. 6 and 3 miles of No. 10 weatherproof wire will be required for overhead distributing system. Contracts will be awarded between June 1 and 15.

**HUDSON, S. D.**—Steps have been taken toward organizing a company to install an electric-light plant in Hudson. J. B. Bradley is interested.

**BENEDICT, NEB.**—The town of Benedict is planning to rebuild the entire lighting system and expects to purchase 75-25 ft. (on top) poles. O. B. Canfield is manager of the municipal electric-light plant.

**COOK, NEB.**—Bonds to the amount of \$5,000 for the installation of an electric-lighting system have been voted.

**SIDNEY, NEB.**—The City Council has called a special election to be held in June to vote on the proposition of issuing \$22,000 in bonds for the purpose of installing an electric-light plant with sufficient power to pump the city water.

**WISNER, NEB.**—Arrangements are being made to change the system of the municipal electric-light plant from direct current to alternating current. Bids will be called within the next ten days for the following equipment: One 75-kw, three-phase, 60-cycle, 2200-220-110-volt generator, one 3-kw, 125-volt exciter, one 30-hp, three-phase, 2200-volt belted motor, one remote-control regulator with main-line switch for 30-hp motor, one three-panel switchboard with instruments, switches and other protective devices; also transformers, lightning arresters, wire and other line material (no poles), series street-lighting regulator and hoods for street lamps. Paul Smith is superintendent of light and water department.

**LANE, KAN.** The property of the C. W. Smith El. & Ice Co. of Larned, has been purchased by a group of Newton capitalists for \$110,000. It is stated that the new company may establish a power plant here for the proposed Arkansas Valley interurban railway west from Hutchinson.

**MADISON, KAN.**—Bids will be received until May 29 for construction of a combined municipal electric-light plant and water-works system. Rollins & Westover, Midland Building, Kansas City, Mo., are consulting engineers.

**TESCOTT, KAN.**—An election will soon be called to vote on the proposition to issue \$25,000 in bonds for the construction of an electric-light system. Rollins & Westover, Midland Building, Kansas City, Mo., are engineers.

## Southern States

**CHERRYVILLE, N. C.**—At an election held recently the proposition to issue \$25,000 in bonds for an electric-light plant was defeated. The city will submit the proposition to the voters again in 12 months. E. C. Sharp is city clerk.

**SPENCER, N. C.**—At an election held recently the proposition to issue \$50,000 in bonds to install an electric-light plant and water-works system was carried.

**WASHINGTON, N. C.**—At an election held recently the proposition to issue \$20,000 in bonds for extensions to the municipal electric-light plant was carried.

**JONESVILLE, S. C.**—The question of issuing \$22,000 in bonds for the installation of an electric-light plant and water-works system is under consideration. John T. Scott is Mayor.

**WALTERBORO, S. C.**—The Walterboro Ice & Lt. Co. has been granted a 25-year franchise to operate an electric-light plant in Walter-

boro. Work will begin on the installation of the power plant about October, 1913. As yet nothing definite has been decided upon.

**BUFORD, GA.**—The power house of the Georgia Ry. & El. Co. in Buford was completely destroyed by fire recently, leaving the city without electric service. Work will begin on rebuilding the station immediately.

**MACON, GA.**—The Central Georgia Pwr. Co., of Macon, has purchased material for 2 miles of 6600-volt transmission lines around Macon and for a 11,000-volt transmission line to Hampton, 12 miles long. L. C. Magraw is chief engineer.

**McDONOUGH, GA.**—J. G. Smith, owner of the local electric-light plant, expects to purchase an arc-lamp circuit for lighting the streets of the city within the next two months and may also purchase a small direct-connected unit for day service, either turbine or reciprocating engine, and a three-phase, 2300-volt generator, with necessary switchboard equipment, etc., within the next two months. He may possibly purchase also a small rectifier for battery charging.

**VALDOSTA, GA.**—The Valdosta Ltg. Co. has just completed the installation of a new 500-hp Casey-Hedges boiler and a 650-kva Westinghouse-Parsons turbine and Wheeler condenser and has nearly finished rebuilding its distributing system. W. G. Eager is general manager.

**LABELLE, FLA.**—E. E. Goodno, owner of the local electric-light plant and ice plant, contemplates doubling the output of his plant this year. The present output of the electric plant maintains 1000 lamps and the ice plant has a daily capacity of 10 tons.

**SARASOTA, FLA.**—The Sarasota Ice & El. Co. contemplates increasing the output of its electric-light plant and is said to be asking for bids on 200-hp equipment. R. E. Ludwig is manager.

**TARPON SPRINGS, FLA.**—The Southern Utilities Co., Heard National Bank Building, Jacksonville, which recently purchased the property of the Polar Ice & Lt. Co., in Tarpon Springs, contemplates improvements to the plant, including the installation of additional machinery. H. C. Adams is general manager.

**ALICEVILLE, ALA.**—The Aliceville El. Co. is planning to install an electric-light plant here, to cost about \$8,000. The company has already secured a franchise.

**GREENVILLE, ALA.**—The Henderson Lt. & Pwr. Co. has recently installed a 20-ton ice plant to be operated in connection with its electric-light plant. C. C. Henderson is president and manager.

**MOBILE, ALA.**—The Gressner & Groh El. Welding Co. contemplates installation of an electric-power plant (to cost about \$5,000) in connection with an electric-welding plant for repairing steamship boilers and steel plate.

**OPELIKA, ALA.**—The city of Opelika expects to purchase within the next six months one 225-hp engine and a 150-kw generator for the municipal electric-light plant. Charles Shaefer is superintendent of the light and water department.

**ROANOKE, ALA.**—At an election held recently the proposition to issue \$20,000 in bonds to rebuild the municipal electric-light plant and water-works system was carried.

**SYLACAUGA, ALA.**—The town of Sylacauga expects to purchase within the next few months a new street-lighting outfit, consisting of from 25 to 30 series Mazda street lamps. L. D. Coker is superintendent.

**BOONEVILLE, MISS.**—The Booneville Wtr. Wks. Co. has taken over the electric plant of the Citizens' El. & Tel. Co. and is rebuilding the same. The company is in the market for a 50-kw, three-phase 60-cycle, 2300-volt generator with exciter and switchboard with instruments; also lamps and line material, including wire, insulators, pole steps, etc., and electrical supplies; electric and water meters. Also motor-driven pumps and a constant-current transformer for street-lighting circuit. When improvements are completed a 24-hour service will be established. A. W. Kearley is president and general manager.

**PORT GIBSON, MISS.**—The city of Port Gibson expects to purchase within the next two months one 150-hp water-tube boiler for the municipal electric-light plant. H. D. Brownlee is superintendent.

**GREEN FOREST, ARK.**—The Green Forest Milling & Elevator Co. contemplates the installation of an electric-light plant to furnish electricity for lighting the town. J. Villines is president.

**HUNTINGTON, ARK.**—The Coal & Gas Belt El. Co. of Huntington, expects to purchase within the next 30 days an extra panel for switchboard and 25 100-watt Mazda series lamps for street-lighting system, and within the next three months one carload of 25-ft., 30-ft. and 25-ft. (6-in. top) cedar poles, 100,000 ft. of No. 6 bare copper wire and high-tension transformers rated at 225 kw. L. E. Lake is secretary and manager.

**MENA, ARK.**—The Mena El. Lt. & Pwr. Co. expects to install within the next two months a series Mazda-lamp street-lighting system and controller for same.

**CLARKSVILLE, LA.**—The Clarksville El. Lt. & Pwr. Co. is changing the street-lighting system from arc lamps to tungsten lamps. The arc lamps are for sale. A. D. VanMeter is manager.

**RAYNE, LA.**—Improvements are contemplated to the municipal electric-light plant and water-works system involving an expenditure of about \$15,000.

**INGERSOLL, OKLA.**—Bonds to the amount of \$5,000 have been

ALAMEDA, CAL.-Extensive improvements are being made to the municipal electric light plant, including the construction of a new power

River Pwr. Co., of Bliss, a franchise to furnish electricity for lamps and motors in, *Unpublished*.

**COLORADO SPRINGS, COL.**—The grand jury recently discharged by Judge Morris has recommended that steps be taken under the existing ordinance for rewiring immediately the following-named hotels and schools: Alta Vista Hotel, Elk Hotel, Glockner sanitarium tents, De Graff Building, McIntyre-Barnett Building, High School, Bristol School, Lincoln School and Lowell School. The city electrician is authorized to see that the work is carried out.

**GLENWOOD SPRINGS, COL.**—The Mutual Lt., Ht. & Pwr. Co. expects to erect a hydroelectric power plant and to purchase water turbines and generators, switchboard, etc., transformers, etc., and material for 3 miles of transmission line within the next six months. A. A. Haley is manager.

## Canada

**PRINCE RUPERT, B. C.**—A by-law will soon be submitted to the ratepayers for the installation of a complete new distributing system.

**BRANDON, MAN.**—By-laws will be submitted to the ratepayers in the near future authorizing an expenditure of \$26,618 for street-lighting equipment and \$150,000 for street-railway extensions.

**ENGLEHART, ONT.**—The power plant of the Englehart-Charlton Pwr. Co. was destroyed by fire on May 4.

**NORWOOD, ONT.**—W. C. Harrison, owner of the local electric-light plant, contemplates the installation of an additional 50-kw or 60-kw generator within the present year.

**PORT DOVER, ONT.**—The ratepayers have recently approved a by-law authorizing the construction of a municipal electric-light plant, to cost \$40,000.

**MONTREAL, QUE.**—Extensions contemplated by the Maritime Coal, Ry. & Pwr. Co., Ltd., include additions to the power plant at Chignecto and equipping the colliery at Joggins Mines for electrical operation.

**QUEBEC, QUE.**—The Dorchester El. Co. has been awarded the contract for lighting Battlefields Park. The contract calls for 78 standards, 34 carrying a single 250-cp tungsten lamp and 44 carrying tungsten lamps (clustered). All lamps will be maintained by underground wires.

**ESTEVAN, SASK.**—Plans are being considered for doubling the output of the municipal electric-light plant in the near future.

**WEYBURN, SASK.**—The town of Weyburn is installing two 266-hp water-tube boilers in the municipal electric-light plant. It is understood that a 500-kw steam-driven generating unit will be installed in the near future.

## Miscellaneous

**PEARL HARBOR, HAWAII.**—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 10 for furnishing the following supplies to the navy yard at Pearl Harbor, Hawaii: Schedule 5467—Two positive-pressure, motor-driven blowers, one motor-driven buffer and grinder, two motor-driven automatic gear cutter, one multiple-spindle, all-gear, motor-driven drill, four stationary head, belt and motor-driven drills, two upright, belt and motor-driven drills, one portable electrically driven bench grinder, two double dry, motor-driven grinders, three combination wet and dry, motor-driven grinders, two single wet, motor-driven grinders, three 1-ton electric hoists for foundry use, two 2-ton and 4-ton electric hoists, one motor-driven buffing lathe, two motors, 50-hp and 15-hp, fitted with pulleys, one motor-driven crank-shaft lathe, four motor-driven speed lathes. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster, U. S. N.

**PANAMA.**—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until June 5 for furnishing two-retort cremators, switches, frogs, galvanized steel, steel pipe, pipe fittings, cable clips, bronze wire, etc. Blanks and general information relating to this circular (No. 776) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

## New Industrial Companies

**THE ASHMUSEN MANUFACTURING COMPANY**, of Kings Park, N. Y., has been incorporated by W. M. Hyde, K. L. Long, of Central Islip, and D. Myers, of Kings Park. The company is capitalized at \$100,000 and proposes to manufacture motors, engines, etc.

**THE CENTRAL CONDUIT COMPANY**, of Tulsa, Okla., has been chartered with a capital stock of \$150,000. The incorporators are: Robert H. Childs, Charles A. Guy and Carter Smith, of Tulsa.

**THE CLEVELAND ELECTRO METALS COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$20,000 by John W. Brown, Holly G. Wellman and Fred S. Wellman.

**THE DULITH-SMITH McMillan CORPORATION**, of New York, N. Y., has been incorporated with a capital stock of \$10,000 to deal in railroad and electric supplies. The incorporators are: E. D. Smith, Eugene Dulith-Smith and Christian N. Berchtold, all of 165 Broadway, New York, N. Y.

**THE ELECTRIC MAIL BOX ALARM SYSTEM**, of Santa Rosa, Cal., has been granted a charter with a capital stock of \$75,000. The incorporators are: M. W. Grindle, E. J. Thompson and J. W. Pemberton.

**THE ELECTRICAL SURGICAL APPLICATION COMPANY**, of San Francisco, Cal., has been incorporated with a capital stock of \$500,000 by H. R. Douglass, F. H. Hadley, E. Loebner, C. Loeffler and W. M. Aydelotte.

**THE THERMO ELECTRIC STARTER COMPANY**, of Detroit, Mich., has been incorporated with a capital stock of \$10,000 by Richard B. Hewett, Edwin S. Bissonette, W. R. Creer and Floyd W. Barstow.

**THE TRI-CITY ELECTRIC SERVICE COMPANY**, of Hammond, Ind., has been incorporated with a capital stock of \$10,000 to do a general electric work. The incorporators are: F. D. Jarvis, L. J. Granger and A. H. Lietz.

**THE UNITED STATES SIGN COMPANY**, of Gadsden, Ala., has been incorporated with a capital stock of \$10,000 for the purpose of manufacturing a patented electric sign. The officers are: W. P. Lay, president; W. G. Bellenger, vice-president; H. P. Barret, secretary; J. W. Penn, treasurer, and W. R. Huston, general manager.

**THE VAN DORN ELECTRICAL TOOL COMPANY**, of Cleveland, Ohio, has been incorporated with a capital stock of \$300,000. The company will take over the business of the Manufacturing Electrically Driven Tool & Machinery Co., now carried on by the Van Dorn & Dutton Co.

**THE WILLIAMS ELECTRIC MEDICAL BATTERY COMPANY**, of New York, N. Y., has been incorporated by Louis F. Kuntz, Edgar L. Ostendorf and William W. Northrup. The company is capitalized at \$2,000 and proposes to manufacture medical batteries and other electrical batteries.

## New Incorporations

**SAN FRANCISCO, CAL.**—The Erie El. Co. has been incorporated with a capital stock of \$1,000,000 by F. V. Pering, J. W. Goodwin, J. L. Holton and F. S. McAllister.

**DOVER, DEL.**—The American Mining & Pwr. Co. has been incorporated with a capital stock of \$6,000,000 by Willard B. Jones and M. M. Bays, both of New York, N. Y.

**SUBLETT, IDAHO.**—The Sublett Reservoir & Pwr. Co. has been incorporated with a capital stock of \$200,000 by Charles H. Powers, L. A. Corey and Daniel Horn. The company proposes to conduct a general irrigation and power business.

**HIGHLAND PARK, MICH.**—The Highland Park Lt. Co. has been incorporated with a capital stock of \$3,000.

**IRON RIVER, MICH.**—The Iron Range Lt. & Pwr. Co. has been incorporated with a capital stock of \$50,000.

**ASH GROVE, MO.**—The Ash Grove Milling & El. Co. has been incorporated by M. L. Weygandt and others.

**OMAHA, NEB.**—The Fremont Pwr. Canal Co. has been incorporated with a capital stock of \$100,000 by E. S. Eastman, Irving Allison, C. A. Grimmel, James McKenna and Martin W. Dimery.

**WATERBURY, N. Y.**—The Northern New York Utilities Co., Inc., has been incorporated with a capital stock of \$1,000,000 to erect a hydroelectric plant on the Beaver River and to distribute electricity in Jefferson, Lewis, Oneida, Oswego and St. Lawrence Counties. The incorporators are: George Babcock, H. G. Davis, J. B. Taylor, S. L. George, O. A. Kline, F. A. Rogers and C. C. Burns.

**BOLIVAR, OHIO.**—The Bolivar Lt. & Pwr. Co. has been incorporated with a capital stock of \$100,000 by H. L. Lash, J. O. Lash, Joseph C. Becker, J. B. Bowen and W. B. Ramsey.

**UTICA, OHIO.**—The Utica Gas & El. Co. has been incorporated with a capital stock of \$30,000 by James M. Kirkpatrick.

**HARRISBURG, PA.**—Charters have been approved by the State Water Supply Commission for charters for five water and power companies in Lancaster County under the following names: Lancaster County Wtr. & Pwr. Co., to operate in Lancaster County; the Buchanan Wtr. & Pwr. Co., of Lancaster Township; Lafayette Wtr. & Pwr. Co., of Pequea Township; Hamilton Wtr. & Pwr. Co., of Manor Township, and Stevens Wtr. & Pwr. Co., of Conestoga Township.

**SOMERSET, PA.**—The Somerset El. Co. has been granted a charter with a capital stock of \$5,000 to furnish electricity in Somerset. The incorporators are: J. A. Berkeley, C. L. Shaver and P. G. Coker.

**ALTO, TEX.**—The Alto Lt. & Pwr. Co. has been incorporated with a capital stock of \$10,000 by E. C. Bates, W. B. Bates and J. I. Perkins.

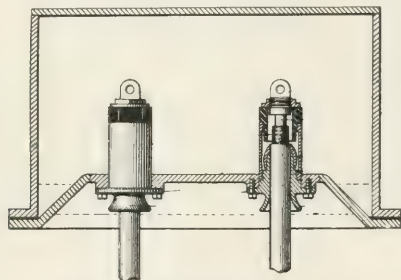
**EDNA, TEX.**—The Edna El. Lt., Ice & Wtr. Co. has been incorporated with a capital stock of \$20,000 by L. E. Ward, Rudolph Linnartz and W. W. McCreery.

**ELLENSBURG, WASH.**—The Ridgeway El. Lt. & Pwr. Association has been incorporated with a capital stock of \$1,000 by J. E. Rege and P. G. Prater.





- 1,061,369. ELECTRODE FOR ELECTRIC-WELDING MACHINES; J. C. Healy, Washington, D. C. App. filed Oct. 7, 1912. Composite rod of steel and copper, copper being used for its conductivity and steel for its high compression factor.
- 1,061,377. ELECTRIC-WELDING SYSTEM; J. A. Heany, Washington, D. C. App. filed Oct. 7, 1912. Welding transformer has its primary connected to direct-current supply, and auto-manual switches are operated to break primary circuit and induce momentary welding current in the secondary.
- 1,061,378. ELECTRIC-WELDING MACHINE; J. A. Heany, Washington, D. C. App. filed Nov. 14, 1912. Duration of the welding current is governed by the mechanical means by which the welding electrodes are shifted toward and away from each other.
- 1,061,433. ELECTRICAL HEATING APPARATUS; H. M. Wicker, New York, N. Y. App. filed May 27, 1908. Linotype pot with thermal control whereby effect of several heating groups is varied by shifting their connection from parallel to series or vice versa.
- 1,061,471. TROLLEY CONTROLLING DEVICE; A. A. Grossarth and T. E. Barker, Chicago, Ill. App. filed April 5, 1909. Motor operated by compressed air is automatically clutched to the drum for the trolley rope when trolley leaves the wire.
- 1,061,512. HAMMER; H. B. White, Canton, Ohio. App. filed March 21, 1908. Magnet coil, switching mechanism and a common manually operated means for raising and depressing part and operating the switch mechanism to control the coil.
- 1,061,514. ELEVATOR ALARM; J. C. A. Anderson, Chicago, Ill. App. filed Nov. 7, 1911. Alarm is operable only when car is standing still, and hence only the dead weight is indicated and not the increased weight at starting or accelerating speed.
- 1,061,515. TELEPHONY; C. A. Bals, Chicago, Ill. App. filed April 24, 1911. Trunk line between exchanges, cord circuit and means to dissociate the electromagnetically controlled cord circuit apparatus from the cord circuit when the cord circuit is to be used in connection with the trunk line.
- 1,061,516. TELEPHONE EXCHANGE SYSTEM; C. A. Bals, Chicago, Ill. App. filed March 3, 1909. When cord circuits unite two lines in conversation the operator's telephone is rendered temporarily inoperative to prevent eavesdropping.



No. 1,061,527.—Junction Box for Electrical Cables.

- 1,061,519. CONTROLLING APPARATUS; W. G. Blauevelt and E. C. Molina, New York, N. Y., and East Orange, N. J. App. filed Nov. 13, 1911. For automatic telephone systems; counting apparatus comprising series of contact devices corresponding to a series of impulses and arranged in groups, with an energizing circuit and means for alternately carrying the groups to the circuit.
- 1,061,527. JUNCTION BOX FOR ELECTRICAL CABLES; C. W. Davis, Edgeworth, Pa. App. filed Feb. 24, 1909. Box has a dish bottom through the raised portion of which the conductors are passed; a thimble engaging the cable sheath and the wall of the box makes a water-tight joint.
- 1,061,529. ALTERNATING CURRENT DYNAMO-ELECTRIC MACHINE; W. Doinkoff, Baden, Switzerland. App. filed April 28, 1909. Auxiliary armature core with winding inserted between the main winding and the commutator, with inductive winding on the field poles separate from main field winding, and commutating poles with winding fed from second winding on the main field poles.
- 1,061,541. PRIMARY BATTERY; E. E. Hudson and D. Elmes, Newark and Orange, N. J. App. filed Sept. 19, 1910. Positive plate having a small depression on the side furthest from the negative element, which as the plate is consumed produces a hole in the plate and thus gives warning of the need for renewal.
- 1,061,550. DEVICE FOR DRIVING ELECTRIC CLOCKS AND SIMILAR APPARATUS; G. O. Larson, Stockholm, Sweden. App. filed Oct. 1, 1908. A condenser takes up and delivers the driving currents of the clock, circuit of the condenser being periodically made and broken by the clock.
- 1,061,572. ELECTRIC BATTERY; C. F. Schub, Newark, N. J. App. filed Aug. 9, 1912. Dry battery in which loops of conducting wire are connected to the respective electrodes and serve as terminals, the loops being covered with insulation displaceable by pressure.
- 1,061,578. PUSH-BUTTON SWITCH; H. Wischhausen and A. Hepke, Berlin, Germany. App. filed March 25, 1912. A single spiral spring subjected to both compressive and torsional strain serves both to return the push-button and to rotate the switch member.
- 1,061,583. APPARATUS FOR REPAIRING ELECTRIC METALLIC FILAMENT LAMPS; O. Arendt, Berlin, and C. Schlesinger, Strassburg, Germany. App. filed Oct. 4, 1911. Holes fused in end and sides of bulb through which old filaments are removed and new ones introduced.
- 1,061,589. BUSY SIGNAL ATTACHMENT FOR TELEPHONES; A. M. Beeler, Seattle, Wash. App. filed Jan. 9, 1912. Receiver hook operates switch to close circuit through lamps carried by the other instruments on the circuit, thus giving notice that the circuit is in use.
- 1,061,598. ESCAPING-GAS ALARM; O. Casilli, Newark, N. J. App. filed March 25, 1912. Alarm is inflated by the escaping gas and operates a bell.
- 1,061,599. REGULATING ELECTRIC FURNACES; P. L. T. Herault, La Praz, Savoy, France. App. filed Jan. 21, 1909. A regulating circuit for bridging furnace to the desired operation, means for changing course of current in said circuit and holding it in its course until the regulation is effected, and an interrupter for causing the current to pass intermittently.
- 1,061,620. INSULATOR; H. R. Markel, Columbus, Ohio. App. filed July 31, 1911. Base and a crown with wire grooves therebetween, the crown having tapered flugs fitting in corresponding recesses in the base.
- 1,061,624. ELECTROMOTOR; C. R. Moore, Lafayette, Ind. App. filed March 14, 1912. Combination with a slidably mounted armature of a permanent magnet and an electromagnet.
- 1,061,647. FLUSH SWITCH; J. J. Wesley, Douglass, New York, N. Y. App. filed April 6, 1911. Has two end clips and an intermediate clip, and switch plate has end blades and an intermediate blade to co-operate therewith.
- 1,061,650. TELEPHONE SYSTEM; F. G. Agrell, Stockholm, Sweden. App. filed Oct. 10, 1906. Semi-automatic calling subscriber is automatically connected to central exchange and when so connected his talking circuit is entirely independent of that of any other line.
- 1,061,651. TELEPHONE SYSTEM; F. G. Agrell, Stockholm, Sweden. App. filed Oct. 10, 1906. Semi-automatic calling subscriber is automatically connected to a switching circuit controlled by an operator or other means which is not busy at the time.
- 1,061,666. MAGNETIC SEPARATOR; H. W. Freese, Chicago, Ill. App. filed Sept. 11, 1909. Rotating electromagnets extend into the material and deflect therefrom, carrying material into the recess formed in a member of magnetizable material located under the apron.
- 1,061,671. LIGHTNING ARRESTER; J. D. Hillard, Jr., and C. E. Parsons, Gales Falls, N. Y. App. filed Jan. 29, 1906. For multiphase circuits; bridge between each line and a common point, an adjustable high-potential discharge means and an adjustable resistance in each bridge, and a separate high-potential discharge means between the common point and ground.
- 1,061,733. HARMONIC ELECTRIC BELL OR RINGER; C. J. Erickson, Chicago, Ill. App. filed Dec. 18, 1905. Polarized type; striker is mounted on a pivoted stroke secured between two electromagnets, and striker is slidably adjustable for different frequencies or periods of vibration.
- 1,061,758. ELECTRODE; C. R. Krueger, Schenectady, N. Y. App. filed Oct. 16, 1911. Contains titanium carbide and a small percentage of metallic cobalt.
- 1,061,763. ELECTRIC FIRE ALARM; L. J. Loeffler, Stapleton, N. Y. App. filed Jan. 13, 1912. Spring motor and circuit-breaker.
- 1,061,766. DIAPHRAGM OF TELEPHONIC RECEIVERS AND LIKE INSTRUMENTS; A. Marr, Manchester, England. App. filed Sept. 12, 1912. Diaphragm is gripped only around the extreme peripheral corners of both faces so as to have great freedom of movement.
- 1,061,786. DEVICE FOR SYNTHESIZING GAS; W. Seibert, Charlottenburg, Germany. App. filed Feb. 5, 1906. Gases are passed while rotating into an annular space between two electrodes whereby the arc takes a disk-like form.
- 1,061,809. BINDING POST; F. E. Bocroselski and C. K. Lassiter, Richmond, Va. App. filed Nov. 2, 1911. Movable sleeve is actuated by spring to clamp the wire automatically.
- 1,061,813. TELEPHONY; S. G. Brown, London, England. App. filed Feb. 4, 1910. Variable-resistance contact device comprising two hard surfaces with a granule of osmium-iridium alloy interposed between them.
- 1,061,823. TIE WIRE FOR HIGH-VOLTAGE CIRCUITS; J. Cronin, Wilkeson, Pa. App. filed May 1, 1912. Two wires are passed around on opposite sides of the insulator and are attached together, the free portions of the wires being wrapped around the live wire, and the wires are provided with looped ends by which they are manipulated.
- 1,061,830. LIGHTNING ROD; J. Z. Curnutt and E. E. Lloyd, Maryville, Mo. App. filed April 9, 1912. Central tension wires, spacing wires wrapped spirally about the same, and outer spirally wound conductor wires; also has a sheet-copper terminal clamped upon the cable.
- 1,061,849. TRANSMITTER; F. Kayser, Philadelphia, Pa. App. filed Jan. 7, 1913. A pivoted carbon lever extends up through the post of the instrument, being connected with the diaphragm at its upper end and bearing upon carbon granules at its lower end.
- 1,061,852. EXCHANGE SYSTEM FOR TELEPHONE LINES AND THE LIKE; A. Lawrence, Elizabethtown, Ill. App. filed April 13, 1912. A jack for each transmission circuit, circuits connecting all jacks in multiple, plugs co-operative with the jacks to interconnect selected transmission circuits, and a signal for each transmission circuit.
- 1,061,863. RAILWAY SIGNAL SYSTEM; W. D. Nickum, Los Angeles, Cal. App. filed April 2, 1909. Cab system with insulated contact rail along trackway.
- 1,061,892. METHOD AND APPARATUS FOR THE PRODUCTION OF LONG ELECTRIC ARCS FOR THE TREATMENT OF GASES; F. H. A. Wielgolaski, Christiania, Norway. App. filed Sept. 19, 1912. Form a pair of electrodes between the inner ends of a pair of electrodes disposed in a pair of branching channels and blows the roots of said arcs back from the inner ends of the channels by passing currents of gases through the channels.
- 1,061,894. PROTECTIVE APPARATUS FOR ELECTRIC CIRCUITS; K. B. Baker, New York, N. Y. App. filed Jan. 13, 1912. Fuse plug with reciprocal plunger normally held retracted against tension of a spring by the fuse.
- 1,061,895. CABLE ROLLER; F. M. Bierce, Cincinnati, Ohio. App. filed Oct. 21, 1911. Open frame carrying a roller which supports the cable is clamped adjustably upon the messenger wire.
- 1,061,898. TELEPHONE LOCK-OUT; W. L. Campbell, Chicago, Ill. App. filed Feb. 26, 1907. Automatic system; calling dials automatically connect the calling subscriber with the called subscriber.
- 1,061,919. MAGNETIC SWITCH; C. G. Miller, New York, N. Y. App. filed Sept. 19, 1912. Imperforate support, with a pivoted circuit closing arm carrying a permanent magnet located on one side of the support and an armature movably mounted on the other side of the support.
- 1,061,960. ELECTRIC SIGNALING; F. W. Lyle, Lynn, Mass. App. filed Aug. 22, 1911. Selective devices each comprising a plurality of bottom resistance of unequal resistance break-down characteristics.



# Electrical World

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**The N. E. L. A. Convention in Chicago** For the seventh time the National Electric Light Association—which might be more comprehensively termed the National Electric Association—is preparing to hold its convention in Chicago. This will be the thirty-sixth convention of the association, although the organization is only twenty-eight years old, semi-annual conventions having been held before 1892. As has been the case for several years, elaborate preparations have been made for the great gathering which is expected. The officers and the various committees of the association do a large amount of hard work in preparing for these meetings, the staff at headquarters, the local convention committee, the hotel committee and the transportation committee being particularly active in the two months preceding the convention. Nowadays all the committees are working committees, and many of them hold numerous meetings and give a great deal of attention to the work of the organization, the activities of which are now exercised all the year round. This year's convention program gives promise of the contribution of much information of value to those engaged in the electric-service industry. General, technical, hydroelectric and transmission, commercial and accounting sections are provided in seventeen sessions, beginning Tuesday morning, June 3, and ending Friday afternoon, June 6. On several occasions there will be simultaneous sessions. As in recent years, much of the material presented will be in the form of reports from committees, but there will also be a number of contributed papers. Class D members will exhibit electrical apparatus during the convention. The city selected for the convention is extremely interesting from the viewpoint of the electric-service operator. It is easy of access and has ample hotel accommodations. Entertainment on an elaborate scale has been provided for the visitors, especially the ladies. One novelty to which attention may be here called is the fact that some of the sessions of the technical and commercial sections will be held in a large tent on a lawn in the rear of Medinah Temple. With the attractions of convention week, it is sure that the attendance will be very large, although it would be idle to attempt to speculate in advance on the exact number.

## The Customer's Viewpoint

One of the most amazing things about human nature is the preconception with which the average purveyor of a service goes busily about rendering that service either as he thinks it should be done or as fits his convenience, without ever stopping to consider just what it is, after all, that the recipient of the service really wants or ought to have. This failure to get the customer's viewpoint is a shortcoming that is perhaps more seriously chargeable to corporations

that deal with large groups of the public than to any other class. In how many railroad stations of this country, for example, is there exposed for view a wall timetable showing train movements? And yet to every person who enters the station this would furnish the most useful information possible, saving needless inquiries at the ticket window, the time of the agent and a large portion of the folders—thrown away after a moment's consultation. In how many hotels of this country has the management thoughtfully framed and hung up a street map of the local community, showing car lines, principal buildings and industries? Yet every stranger would consult and appreciate such a map to guide him to his local destination, saving the usual indefinite and inaccurate verbal directions. It is gravely suspected that the business offices of some utility companies are arranged and run in ways that afford more convenience and peace of mind to the staff behind the counters and windows than to the unsophisticated customer who comes in to transact some simple business with the great corporation. It would be an illuminating experience for some central-station managers if they could assume an incognito and go through once, for themselves, the intricacies and embarrassments of making application for service, paying a bill or registering a complaint in their own offices.

## Chicago Central

The extent to which the electric central station development in Chicago has been carried on in the early and advanced territory is well shown in articles appearing in this issue. Following the purchase of the Chicago Air Light & Power Company and the absorption by the Commonwealth Edison Company of many small electric-service companies operating in the outlying portions of the city, since the consolidation of the two companies into the present Commonwealth Edison Company, the dominating force in the electric-service business in Chicago. About one-fifth the results of this company's operations are sold to other public-utility companies, notably electric-railway companies, at varying low prices. The cost of producing energy has been reduced greatly by eliminating unnecessary duplication of generating plants and by increasing the use of the generating units. In 1888 the generating units were rated at 100 kw each, in 1902 300 kw units were in service, in 1904 600 kw units were installed, and in 1905 the first 1,000 kw unit was installed. An increased year to the future of Chicago's electric service has been made, and there will be further expansion in the production of electrical energy, since it could be manufactured almost in large quantities and transmitted to practically almost any point to which it could receive sufficient pressure or be transported by other means.



tic or industrial service. Full advantage is always taken of the diversity-factor between the loads in the different industries and domestic services, the benefits being participated in by the consumers as well as the company. Thus has been developed an electrical energy supply system which exceeds every other single system in the amount of energy sold and the number of customers served. Its success, which has been founded on an enlightened application of the economic principle of monopoly in energy supply, proves that the economical benefit to the community served can best be shared with the public-utility company making such benefit possible, thereby encouraging the company to extend the application of the economic principles to the increased benefit of the community as a whole.

### The Mississippi Power Plant

To evaluate justly the characteristics of the huge hydro-electric system at Keokuk one must turn aside from ordinary precedents and consider the elements of design that are necessarily affected by mere increase of size. Commonly these are overestimated, and to meet imaginary conditions many a plant has been overburdened with complications that were both costly and needless. When, however, one deals with the necessary concentration of 300,000 hp in a single development under unusual hydraulic conditions and requiring a power house more than a quarter of a mile long, unusual methods may be logically required. To begin with, the Keokuk development is by far the mightiest low-head proposition ever undertaken. The Mississippi is not a precipitous stream, and it was sheer good fortune, the result of a geological freak, that enabled even so modest a head as 32 ft. to be utilized without absolutely prohibitive expense. The first striking feature of the plant, the single-runner colossal vertical-shaft turbine, is the direct consequence of the low head. Generally one tries to get a fairly high generator speed by using multiple runners. In this case the large output required very large units to avoid outrageous complications, and the enormous volume of water to be dealt with for each unit forbade the complication of multiple runners on so low a head. Hence the considerable variations of head from 20 ft. to 39 ft. had to be managed by finesse in turbine design without aid from the devices available with smaller units. So gigantic are the turbines that the scroll chamber delivering the water to the runners is nearly 40 ft. in diameter and is simply molded in concrete. Similar considerations apply to the generator design. With an output of 7200 kw at 57.7 r.p.m. the dimensions of the machines become imposing, each being more than 31 ft. in diameter.

The great output at low speed was very probably one of the chief factors in the choice of the low frequency of 25 cycles, which ordinarily is open to the objection of being too low for incandescent lamps and rather high for the supply of energy to alternating-current commutator railway motors. The necessity of supplying all energy through frequency changers or synchronous converters is a handicap on final industrial efficiency of which the wisdom remains to be proved. Certainly no plant except one of vast output, certain to sell its product at wholesale only and over

very long distances, could afford to take the chance. There are other points of interest about the generators. The mere fact that from the dimensions of the power house it has proved advisable to use alternating-current distribution of exciting energy to individual motor-driven exciters is in itself striking, but the complete control of the generators by the exciter field is of more real interest as tending toward simplification, and especially there should be noted the method of field regulation in which the automatic regulator responds to dangerous overload conditions by putting reactance in the generator excitation circuit so as greatly to depress the voltage without finally putting the machine out of action. The generators are in themselves designed for rather large reactance so that even without the precaution just noted the current on dead short-circuit is limited to five times the normal full load. Moreover, the possibilities of a short-circuit are guarded against by the use of a working bus sectionalized through reactors, each section carrying only four units and being provided with automatic means for isolating itself in case of too severe overloads.

One thing usually to be commended is the rather general use of non-automatic switches in the general working of the system. Recent experience has led to a certain distrust of relying too much on automatic devices to the exclusion of human intelligence, which itself seems all too inadequate to meet the exigencies of service. In the Keokuk plant the effort has been made to provide the system with such automatic safeguards as will retard the approach of dangerous conditions and give time for the operators to take care of the crisis without a shut-down. Along the same line of trusting intelligent operation to pull the system through is the installation of emergency switches in the generator room, a precaution too often neglected. Many things can happen while one is attempting to signal to a possibly flustered switchboard operator unable to see the conditions existing. Another interesting safeguard is the operation in parallel of all the generator regulators with series transformers in the main leads so that there is automatic regulation of exchange currents as between one unit and another.

The main transmission line from the Keokuk plant is operated at 110,000 volts to deliver energy to St. Louis, 144 miles distant. This line presents no extraordinary features except those of magnitude. There are two circuits of 300,000-circ. mil cable carried on steel towers set at a normal span of 800 ft., and provided with a steel ground cable, as is now common. The factor of safety in the insulators is noteworthy, however, being four when dry and three when wet, which is considerably higher than on the ordinary high-tension line. In fact, the insulation throughout the system is intended to have at least three as a factor of safety in spite of the extreme voltages. For the care of the line a special telephone line is erected at the edge of the right-of-way on its own poles, with telephone booths every 4 miles. The general supply of energy is just beginning to get under way, and the possibilities of the situation have as yet barely been touched. All told, the Keokuk enterprise is a huge one, with great output, high cost and immense possibilities of industrial usefulness over a large and prosperous territory.

## A Great Rural Network

The widely ramifying system now under construction by the Central Illinois Public Service Company and described in our columns this week is perhaps the most conspicuous example of what may fairly be called a rural distribution which has yet appeared. In calling it rural we do not mean to imply that there are not considerable towns and important industries included in the territory. It is merely that the fundamental plan of the network, which ultimately will sweep a radius of nearly 350 miles, is to gather into one management and one physical system the electrical requirements of a very large and not heavily populated territory. The magnitude of the scheme and the character of the distribution may be best realized by noting that, with a total population of a quarter of a million, 125 communities are to be served and 90 local generating plants will be replaced by a small group of modern central stations. The general plan of management is that obviously appropriate to the system, of having a central directing management charged with the general administration of the system but leaving each particular supply district in the charge of a district superintendent who is held responsible for all of the local work.

Physically the properties are of very diverse kinds, including direct-current plants and two-phase and three-phase plants at frequencies of 133, 60 and 25 cycles. This heterogeneous service is now in process of standardization to three-phase, 60-cycle distribution with transmission at 33,000 volts and distribution at 2300. The complete unification of the amalgamated system will require some 700 miles of transmission system, of which about 150 are now built. The line work is as nearly as may be uniform and of a very simple character. It consists chiefly of single circuit lines, on poles of moderate height, carried on porcelain insulators supported by steel pins on wooden cross-arms. Each circuit has a complete ground-wire system, is regularly transposed and is provided with exceptionally solid construction at every railroad crossing. Heavy stranded copper conductor is used at these crossings to reduce to a minimum the chance of breakage. An interesting feature of the line work is that while the circuits follow country roads or the railways, whenever possible the poles are actually set 2.5 ft. back in the adjacent land so that the pole line and conductors are in large measure on a private right-of-way adjacent to the public way. This arrangement has the double advantage of keeping clear of the frequent objections to having high-tension lines on public roads without sacrificing the accessibility and ease of inspection that such roads give. In some cases the public roads or the railroad rights-of-way have to be utilized, but the practice just noted is intended to be the standard one.

At all important centers there are substations doing the ordinary work of distribution, while where the local demand is smaller outdoor substations of rather interesting character are utilized. These substations consist of square skeleton steel towers carrying midway of their height, about 12 ft. from the ground, platforms, 13 ft. by 6 ft., suited to carry a group of three transformers of ratings up to 50 kw each. The tower carries the horn lightning arresters, and the ingoing lines to the transformers are fused. The base

of the tower is of concrete, forming the floor of a little switchroom containing the necessary oil switches for the local distribution and affording room if necessary even for a small series transformer for street lighting. These rudimentary substations are one of the particularly noticeable features from an engineering standpoint, and about thirty of them are in use. So much for the general and physical nature of the network.

As regards its load characteristics, there are numerous points worth considering. The territory covered included some 200,000 acres at the mouth of one of which the present chief generating station is located. It is expected that a large and constantly increasing amount of energy will be utilized for the operation of these mines, which are sufficiently numerous to give on the whole a fairly steady load. Moreover, the territory comprises a considerable and consequently the mining load will greatly help the diversity-factor of the system, since it will be above wholly off at the time the lighting peak comes on. Another striking feature of the load is the pumping work which has to be fully undertaken. Part of this is the ordinary steady load pumping of small town water-works, extremely helpful to the diversity-factor inasmuch as the *stoppage* *stoppage* *stoppage* keep the load off the peak. A second class of pumping work is that in connection with the drainage pumping of the valleys of the Illinois and Mississippi Rivers. In the territory reached there is not less than 200,000 acres of rich farming land just enough below the high water level to require drainage by pumping at certain seasons of the year. A large part of this area is now drained by steam pumping plants of a somewhat expensive and inconvenient character, although a beginning has already been made in electric pumping. The total amount of water to be disposed of during the year is equivalent to about 100,000,000 cu ft., but the lift is only some 10 ft. or 12 ft. Most of the pumping load is concentrated into three months of the spring. Here again the load is excellent in its relation to the diversity factor because not only does the general lighting load fall off by the time of year when the main pumping load comes on, but the mines are through the same season usually working at reduced output, so that ample generating equipment for supplying energy for pumping is released. The electric pumping has shown high efficiency and tendency to be economically advantageous so that the chance of obtaining in this way a marked fur-energy from the mines is excellent.

In some of the towns now supplied with energy from this system there is a certain amount of central station heating from exhaust steam or otherwise, which has been taken on in the past. It is proposed to make out of this but in the general plan of energy supply under the new scheme. During the winter the existing system being used for heating and the system can be shut down to save on the heating demand only. As a relative matter, there are in operation nearly 3000 industrial plants, of which the steel activity has in the summer and which are expected to increase the load. The whole subject of a new striking example of modern tendencies toward conservation of physical production of small quantities and of further improvement in worth watching with close attention.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### The N. E. L. A. Convention

For the thirty-sixth convention of the National Electric Light Association, which will be held in Medinah Temple, corner of Cass and Ohio Streets, Chicago, on June 2 to 6 inclusive, elaborate preparations have been made as a very large attendance is anticipated. The advance out-of-town and local registration on May 24 had reached about 2500 names. Secretary T. C. Martin and his staff and Mr. H. G. McConaughy, secretary of the exhibition committee, have been in Chicago all this week, while a large number of Chicago electrical men, including Messrs. George B. Foster and Ernest A. Edkins, secretaries of the general convention and entertainment committees, have been at work on the preparations for several weeks. The condensed program of events for convention week is as follows:

Monday morning, June 2, opening of registration office at Medinah Temple at 10 o'clock.

Monday evening, opening of exhibition of Class D members, 8 o'clock; reception in the main auditorium of Medinah Temple, 9 o'clock, followed by dancing.

Tuesday morning, 10 o'clock, first general session.

Tuesday afternoon, 2:30 o'clock, first technical session, first commercial session, first accounting session.

Tuesday afternoon, 3 o'clock, musicale in the ballroom of the Blackstone Hotel, Michigan Avenue and Hubbard Place, for visiting ladies only.

Tuesday evening, 8 o'clock, circus and vaudeville in the main auditorium of Medinah Temple under the auspices of the Commonwealth Edison Company Section of the N. E. L. A. and the Electric Club of Chicago.

Wednesday morning, 10 o'clock, first hydroelectric and transmission session, second commercial session, second accounting session; 11:45 o'clock, second general session.

Wednesday afternoon, excursions to the Northwest generating station of the Commonwealth Edison Company and the Hawthorne works of the Western Electric Company; other industrial excursions available by selection. Invitations have been received to visit the Chicago Drainage Canal, the steel works at Gary, Ind., the Union Stockyards and the tunnels of the Chicago Tunnel Company. The annual baseball game, to be played at the grounds at Northwest station on Wednesday afternoon, will be between teams representing the New York Edison Company and the Commonwealth Edison Company of Chicago. Both of the nines are composed of excellent amateur ball players employed by the companies named, and an exciting and closely contested game is anticipated. The New York Edison Company will send to Chicago for this occasion nineteen men, who will travel in a special car, all of their expenses being defrayed by the company. Visiting ladies who do not wish to attend the ball game or the industrial excursions will receive tickets to an afternoon performance of the missionary pageant at the Auditorium entitled "Darkness and Light," also to the missionary exposition at the Coliseum known as "The World in Chicago."

Wednesday evening, 8:30 o'clock, public-policy session, with addresses by Messrs. Samuel Insull, W. C. L. Eglin and J. B. Douglas.

Thursday morning, 10 o'clock, second technical session, third commercial session, third and last accounting session.

Thursday morning, 10 o'clock, automobile trip for visit-

ing ladies. Leaving the Art Institute, Michigan Avenue and Adams Street, the party will proceed through the North Shore suburbs to Highland Park, where luncheon will be served at the Moraine Hotel. The return will be made in the same manner in the afternoon.

Thursday afternoon, 2:30 o'clock, second hydroelectric and transmission session, fourth and last commercial session.

Thursday evening, rejuvenation and joviation of the Jovian Order at White City Park, East Sixty-third Street and South Park Avenue.

Friday morning, 10 o'clock, fourth and last general session, third and last hydroelectric and transmission session.

Friday afternoon, 2:30 o'clock, third and last technical session, followed by election of officers and adjournment.

Some of the technical and commercial sessions will be held in a large tent on the lawn in the rear of Medinah Temple.

A feature of the convention not included in the earlier program is a paper on the electric-vehicle situation to be presented by Mr. E. E. Witherby, of the General Vehicle Company, Chicago, before the Commercial Section, on the electric vehicle as affording an excellent central-station opportunity.

### N. E. L. A. Preparations for the Ladies

Perhaps the most elaborate feature of the entertainment for the visiting ladies to the N. E. L. A. convention at Chicago will be an automobile ride to Highland Park and return and a luncheon at the Moraine Hotel on Thursday, June 5. Public-spirited electrical men will lend their automobiles and chauffeurs for this occasion, and a number of cars have been tendered to the committee. Mr. Godfrey H. Atkin, chairman of the transportation sub-committee of the Chicago committee, is making the arrangements with the owners for the use of the automobiles. The cars are to assemble in Grant Park just east of the Van Buren Street Viaduct at 10 o'clock on June 5 and will be placed under the direction of the transportation committee. It is expected that they will reach Chicago on the return trip about 5 o'clock that evening.

### Tentative Program of the Edison Association

The program for the twenty-ninth annual convention of the Association of Edison Illuminating Companies, which will be held this year at the Hotel Otesaga, Cooperstown, N. Y., during the week beginning Sept. 8, has been tentatively arranged. In addition to the regular reports of standing committees, papers on the following subjects will be read: "Murray Process of Collecting Cinders," "Boilers of Extra Large Steaming Capacity," "Model Public Utility Bill," "Depreciation," "Safety Devices in Central Stations," "Safety to Employees," "Welfare Work," "Electric Signs," "Electric Appliances Salesroom," "One Year's Activity by the Boston Edison Company in Promoting the Use of Energy-Consuming Devices and the Results," "Flaming-Arc Lamps," "Exchange of Advertising Material," "Corporation Schools," "Large Power-Station Design," "Hydroelectric Developments in Canada," "Rate Changes and



Their Effect on Earnings," and "Electric Vehicles." There will also be two papers prepared by representatives of the large electrical manufacturing companies, one from the General Electric Company and the other from the Westinghouse Electric & Manufacturing Company.

### Ithaca Meeting of Empire State Association

The third midyear meeting of the Empire State Gas and Electric Association was held in the rooms of the Business Men's Association in Ithaca on May 23 and 24. Papers were presented by Mr. C. A. Graves, of the Southern New York Power Company of Walton, N. Y., on "Special Problems of the Small Electric Company," and by Mr. V. A. Miller, of the Canandaigua (N. Y.) Gas Light Company, on "Problems of the Small Gas Company." An interesting discussion followed the presentation of these papers. An automobile trip around the city and the campus of Cornell University was given to the delegates after the meeting on May 23, through the courtesy of the Ithaca Automobile Club. They went to the Rogue's Harbor Country Club for dinner, following which another short business session was held. Most of the delegates spent the night at the Country Club, returning to Ithaca on the morning of May 24, taking in the Spring Day exercises at Cornell University and the baseball game and boat race in the afternoon. The arrangements which had been made by the Ithaca companies for the entertainment of the delegates provided a most enjoyable outing as well as an instructive meeting. Mr. C. H. E. Chapin, Engineering Societies Building, New York, is the secretary of the association.

### Resale Price-Fixing on Patented Articles Unlawful

The Supreme Court of the United States handed down a decision on May 26 in the case of the Bauer Chemical Company versus James O'Donnell relative to the sale of a nerve tonic for which a patent had been issued, holding that owners of patents do not have the right by patent law to control the price at which retailers must sell to consumers. The court stood five to four, and although the manufacturers relied chiefly on the celebrated "mimeograph case" decided about a year ago, Justice Day, who announced the decision, said that an examination of the latter case showed that that restriction was sustained because the machine was sold at cost or less, and that the owner depended on the profit realized from the sale of unpatented supplies to be used upon the machine for reward for his invention. The restriction in that case also had to do with the use of the machine and only a "qualified title" to the patented article passed, whereas in the present case the restriction was "to keep up the price," the sale to the retailer having been absolute. It was held that while the patent law gave the owner the exclusive right to "vend" articles, that was not the same as a right to "keep up the price." That the court held, was not granted by patent law.

### Publicity Campaign of Electric Vehicle Association

Active solicitation for contributions to the 1913-1914 co-operative publicity campaign fund of the Electric Vehicle Association of America has thus far resulted in the collection of over \$26,000. The committee, of which Mr. Frank W. Smith, of the United Electric Light & Power Company, New York, is chairman, is striving to obtain at least \$50,000 in order to continue the work of last year. It has been generally conceded that the active work of the association, particularly along the lines of co-operative educational publicity, has been no small factor in the great increase in the output of electric vehicles and accessories during the past twelve months, and if the benefits are to

be cumulative the work of the publicity and advertising committee needs to be carried on with greater haste. Last year the committee has been almost exclusively in operation, and this year the committee is so making more direct and specific appeal to the purchaser, giving data with respect to the operation of both commercial and pleasure cars. In addition, the committee will issue two booklets, one entitled "The Story of the Electric Commercial Vehicle" and the other "The Story of the Pleasure Vehicle." Both will be put up in attractive form for general distribution.

### Meeting of International Electrotechnical Commission

The International Electrotechnical Commission will meet at Berlin, Germany, Sept. 2 to 6 inclusive. The program of the meeting has not yet been announced, but reports from the committees on nomenclature, symbols, rating and prime movers will doubtless be presented. It is expected that several delegates from the United States National Committee of the American Institute of Electrical Engineers will represent America. The next meeting after that at Berlin is scheduled for 1915 and will take place in conjunction with the San Francisco congress to be held at the time of the Panama Exposition.

### National Electrical Supply Jobbers Convene

The spring meeting of the National Electrical Supply Jobbers' Association was held in the Congress Hotel, Chicago, May 26, 27 and 28. Unlike previous conventions, when certain portions of the day were devoted to entertainment features, the meeting this week was a purely business affair. During the first two days executive sessions were held, the general subject for discussion being commercial methods of conducting business. Mr. F. Overbaugh, of Chicago, secretary of the association, presided at the sessions and several well-known men in the electrical industry made addresses. One of the speakers at the meeting on May 28 was Mr. J. M. Wakeman, general manager of the Society for Electrical Development, who dwelt at length on the scope, aims and purpose of the society.

### A. I. E. E. Affairs

A meeting of the American Institute of Electrical Engineers will be held at Philadelphia on Oct. 14, 1913, under the auspices of the Philadelphia Section. Authority for holding this meeting was given to the board of trustees at its May meeting.

A few recommendations of the board of trustees at its May meeting were carried over and 142 delegates and 100 members were elected. Mr. Francis D. Egno, Pittsburgh, Pa., and Mr. Antonio J. Street, Puerto Plata, Santo Domingo, were transferred to the grade of members, and Mr. Louis Deming was transferred to the grade of fellow. That A. F. Gary was appointed a member of the board of trustees to fill a vacancy.

The section committee appointed by the board last January to examine applications for transfer to the grade of member and fellow filed under the recent action by the constitution resulted in a list of 122 applicants for transfer to the grade of fellow and 142 applicants for transfer to the grade of member. These applications were examined and examined and found to comply with the requirements of the special section. These 268 applicants were then transferred.

The board approved an amendment to the Edison Medal constitution, which the amendment providing that the medal shall be presented to any person and given in any way arranged by the officers of the Institute, provided that the presentation shall be made during the administrative year

in which the award is made. The by-laws formerly provided that the medal should be presented at the Institute's annual meeting in May. In accordance with this amendment, arrangements are being made to present the 1912 medal to Mr. William Stanley at the annual convention at Cooperstown, N. Y., June 23-27.

Mr. F. L. Hutchinson was unanimously reappointed secretary of the Institute for the administrative year beginning Aug. 1, 1913, in accordance with the constitutional provision that the secretary shall be appointed at the board of directors' first meeting of each fiscal year.

### Chicago Electric Club and Jovian Co-operation

The Electric Club of Chicago and the Chicago Chapter of the Jovian Order held a joint luncheon on May 22. About 144 men were present, 90 of whom are members of the Electric Club. The luncheon, which was planned by the Electric Club, was looked upon as quite eventful, in that it is the first time that the two societies have combined on such an occasion. Mr. Homer E. Niesz, chairman of the entertainment committee of the club, reported that the Commonwealth Edison Company and the Electric Club would join in reproducing the circus which was given on May 10 by the Commonwealth Edison Section of the N. E. L. A. This circus will be given at Medinah Temple on the evening of June 3 during the N. E. L. A. convention. Mr. Charles F. Hatfield, field secretary of the Panama-Pacific International Exposition of 1915, spoke briefly of the electrical features of that exposition. Mr. S. W. Harvey announced that the Jovian Order had received the application for membership of Mr. George C. Keech, president of the Electric Club, which was reciprocated by an application for membership in the Electric Club from Mr. A. R. Dean, statesman at large of the Jovian Order, Chicago Chapter. Mr. Eugene A. Rummier, patent attorney in Chicago, introduced Judge Cutting of the Probate Court of Chicago, who was the principal speaker of the occasion. Judge Cutting, in discussing "Judicial Efficiency," defended the judiciary, which is receiving harsh criticism from numerous sources at present. Mr. Frederic P. Vose expressed the club's appreciation of Judge Cutting's talk. Dr. M. G. Lloyd submitted a resolution declaring that the Electric Club of Chicago, desirous of increasing the efficiency of the judiciary, favors the elimination of all political party designations from ballots for the election of judges, and ordering "that a copy of this resolution be transmitted to each member of the Legislature from Cook County and to the Governor of Illinois." The resolution was adopted by a unanimous vote.

### Relief of Transportation Congestion in Chicago

As chairman of the executive committee of the Chicago Elevated Railways Association, Mr. Samuel Insull on May 19 submitted two plans before the City Council committee on local transportation for relieving the congestion in the loop district. One plan provided for the lengthening of all existing elevated-railway platforms within the loop so as to accommodate two six-car trains at a time. This proposition would require a total extension of platforms amounting to 6000 ft. in the loop district and would permit of 1220 cars being handled per hour in the same district. Eleven hundred cars could be circulated per hour if the loop schedules were properly adjusted and the existing platforms extended to accommodate only one six-car train.

A through north and south route was also provided for in the plans over the South Side and Northwestern Elevated Railroads' tracks with suitable transfers to the Chicago and Oak Park and Metropolitan lines. Transfers between the two last-named lines were arranged at the point where the roads cross each other west of the city.

The elevated railroads in Chicago at the request of the committee on local transportation submitted a draft of an ordinance requiring increased transportation facilities. The draft was referred to the corporation counsel of Chicago for examination.

Mr. James F. Bowers, president of the Loop Protection Association, protested against the plans, saying that the extensions to platforms are unnecessary. In a communication from the elevated railway companies, which were represented by Mr. W. G. Beale, attorney, they said that in the event the city did not approve of Mr. Insull's plans they would be willing to lease subways built by the city in case they were constructed in localities which were favorable to the operation of their trains.

The plans submitted were referred to the Board of Supervising Engineers and the Board of Public Works, which are to report at a subsequent meeting of the committee as to their feasibility and effectiveness.

### Electrolysis Problems in Chicago

Mr. Ray Palmer, city electrician of Chicago, submitted a report to the corporation counsel of that city on May 20 alleging that neither the surface nor the elevated traction companies are complying with the electrolysis ordinance effective April 15, 1913. A general inspection of several of the companies' generating stations and substations showed, according to Mr. Palmer, that no attempt had been made to equip uninsulated return feeders with pilot wires and instruments whereby the potential drop over different sections could be measured. Failure on the part of the companies to comply with this regulation of the ordinance has handicapped the Department of Electricity of the city of Chicago, it is declared, in checking the differences of potential between the negative busbars in the stations and sections of the return circuits.

Tests were made during the months of April and May at various generating stations and substations for elevated railways to ascertain whether the maximum limit of 12 volts drop between any two points of the return system is maintained. Mr. Palmer reports that under the most favorable operating conditions for the companies the maximum limit is being exceeded. The conditions existing on the surface railways are being inspected at the present time. It will be several more weeks before the preliminary experiments are completed, on account of the delay occasioned by the absence of the recording instruments required by the ordinance.

Mr. Palmer adds that the companies have made numerous improvements in the electric return circuits since the passage of the ordinance and says that more improvements are planned for this year, but he reports that none of the companies is complying with the ordinance at the present time. Potential drops between the negative busbars and certain sections of the return feeder were found to be as high as 35 and 54.5 volts in two cases during the rush hours. The maximum hourly average in one case was estimated as being 21.8 volts. The companies have intimated that the matter will be settled in the courts, as the requirements of the ordinance, in their estimation, are unreasonable.

It is provided in the ordinance that all uninsulated electrical return circuits must be of such current-carrying capacity and so arranged that the difference of potential between any two points on the return shall not exceed the maximum of 12 volts. Between any two points on the return 1000 ft. apart within a mile of the City Hall the difference of potential shall not exceed 1 volt. Between any two points on the return 700 ft. apart outside of this mile boundary, the difference of potential shall not exceed the limit of 1 volt. In addition, a proper return conductor system must be so installed and maintained as to protect all metallic work from electrolysis damage.



### Heavy Sleet at Glace Bay

Recent issues have contained references to record-breaking sleet deposits in northwestern New York and in and about Chicago, and in the April 27 number an accumulation of 2 in. of sleet upon the telephone wire of the Montreal &



FIG. 1—HEAVY SLEET ON TELEPHONE WIRE

Southern Counties Railway was noted. Through the courtesy of Mr. J. H. Winfield, general manager of the Maritime Telegraph & Telephone Company, Ltd., of Halifax, N. S., we are enabled to show herewith photographs of sleet as thick as 6 in. found on the telephone wires of the company at Glace Bay. Four severe sleet storms visited that locality within a period of three months, the last one of which left sleet in some places as thick as 8 in. On Feb. 19 a northeast wind and a heavy mist conspired to cover the lines with an enormous ice load. Not only were



FIG. 2—ONE-HALF FOOT OF SLEET ON TELEPHONE WIRE

the telegraph and telephone circuits interfered with, but the lighting and railway lines were broken in a great many places and where they were not down they were grounded. All electric public utility service was completely demoralized for days.

Fig. 1 is a view taken three days after the storm of Feb. 20 and shows sleet on telephone wires on Chapel Hill.

Glace Bay, Cape Breton, and Fig. 2 shows a portion of another wire in the same locality on which there was a 10-in. covering of snow and sleet, the ice itself being 6 in. thick and the wet snow covering making up the remainder. Another 6-in. coating of ice is shown in Fig. 3, taken on Dec. 2, three days after a storm at Glace Bay. All three



FIG. 3—HEAVY SLEET ON TELEPHONE WIRE

illustrations show unusual conditions of frost and give some idea of the damage caused by excessive snow in Cape Breton.

### Convention of Railway Telegraph Superintendents

Mr. J. B. Sheldon, president of the Association of Railway Telegraph Superintendents, presided at the thirty-second annual convention of the association held at the "Planters" Hotel in St. Louis, on May 20, 21, 22 and 23. Eight papers were delivered at the railway under "Some Facts Concerning Telephone Transmission" by Messrs. I. Miller and E. A. Robinson of New York; "Use of the Telephone in Railway for Dispatching, Cross-Handling Messages, etc." by Mr. J. C. Johnson of Philadelphia; "Inductive Disturbances as Affecting Telegraph and Telephone Lines" by Mr. P. J. Howe of New York; "Protection Against Lightning and High Currents for Telegraph and Telephone Equipment" by Mr. M. H. Camp of St. Paul; "Main-Line Power for Self-Starting Circuits Including Transmission and Signaling," by Mr. Richard L. Spamer, of New York; "Full Use of Wires," by Mr. H. D. Teed, of Springfield, Mo.; "Organization for Maintenance of Lines," by Mr. M. E. Allen of New York; "Organization for Wire Chiefs and Telephone Operators" by Mr. J. B. Sheldon, of Omaha.

An executive meeting was held on Thursday. Mr. William Bernhart, of the Chicago & Northwestern Railway, was elected president. Messrs. A. H. Tyson, of the New York Central & Hudson River Railway, and P. W. Snow, of the Milwaukee, St. Paul and South Sea State Railway, were elected vice-presidents and secretary-treasurer, respectively.

SEVERE weather during yesterday afternoon, a severe rain fall on the Mississippi and immediate after arrived St. Louis disrupted the arrangements during the convention. New Orleans was selected as the meeting place for next year's convention. Abstracts of the papers prepared by Messrs. Howe and Campbell will be published.

—Louisville, March 1913.

Mr. P. J. Howe, of the Western Union Telegraph Company, read an interesting paper on "Inductive Disturbances as Affecting Telephone and Telegraph Lines," the object of the readers is to enable them to make improvements in lines on or along parallel to communication telegraph and subject has become of increased importance to railway officials. The author treated inductive and electromagnetic inductive as considerable lengths, including the self-



known factors determining the relative intensity of each. The principal characteristics of telephone, telegraph, constant-potential distribution and constant-current distribution systems were next described. Polyphase systems, with the several possible methods of connecting transformers in three-phase distribution, were described in elementary terms with the aid of diagrams, and also the single-phase system of electric traction. Harmonics of the fundamental waves of emf and current, such as occur quite frequently in transmission systems, were briefly taken up and their effect explained.

After giving some general rules for the field inspection of parallel inductive exposures, the author discussed the several known methods for remedying such disturbances, treating first the means of prevention by suitable modifications of the transmission system and then the means of restriction by modifications in the telephone and telegraph system. The means of prevention include perfection of insulation and balance of the transmission or distribution line; use of the closed loop in series distribution and static balancing of the circuit by inserting consecutive lamps in alternate sides of the circuit; transposition of phase wires; avoidance of star-connected transformers with grounded neutrals; double feeding of single-phase trolley sections from both ends, and also shortening the sections; use of the three-wire trolley system, with track as the neutral, and short-circuiting generator harmonics by means of specially tuned or resonant circuits at the generating station.

Methods of restricting inductive disturbances by modifications of the telephone and telegraph system include special attention to the insulation and balance of lines; use of special transpositions; use of twisted pairs, or cable; electrostatic shielding by means of grounded conductors; special compensating transformers, such as those employed in parallel exposures of circuits in cable along the route of the New York, New Haven and Hartford Railroad, and the use of special apparatus, such as drainage coils or resonant shunts, connected to the telephone and telegraph circuits. In general, the means of prevention sacrifice something of the efficiency of the telephone and telegraph circuits. In conclusion, the author urged co-operation between lighting and telephone engineers in applying these preventive and remedial measures to solve the problem in the way which will be least burdensome as a whole upon the general public.

#### PROTECTION AGAINST LIGHTNING AND HIGH-TENSION CURRENTS

The author of the paper on "Protection Against Lightning and High-Tension Currents for Telegraph and Telephone Equipment," Mr. M. H. Clapp, called attention to the increasing necessity of installing efficient protective equipment on railway telegraph and telephone lines, owing in large part to the greater number of instances where such lines are paralleled or crossed by high-tension transmission lines. While the N. E. L. A. specifications have admittedly accomplished much in raising the standards of high-tension construction and thereby reduced the risks of accident and damage, there are yet many hazardous situations, and the question of protecting equipment is even more important than it formerly was. When such equipment is burned out by lightning or excessive currents the loss is twofold—first, the loss of the equipment and, second, the loss of time in use of the circuit. Last year the Northern Pacific Railway Company lost over \$1,500 worth of equipment on account of burn-outs.

The author sent out to several superintendents of telegraph on the large railway systems a series of seven questions relating to their practices and experiences in the use of protective equipment. The replies, as might be expected, revealed considerable divergence in results.

Brief descriptions were then given of the standard practices of the American Telephone & Telegraph Company and

the Western Union Telegraph Company, including also the use of metal blocks in open-space cut-outs, series choke coils in the line and the use of special heat coils.

The remainder of the paper was devoted to a consideration of the theory of proper protection, with a number of illustrations showing the preferred methods. The author believed it feasible to devise protective equipment against the following foreign voltages: constant-potential ungrounded circuits not exceeding 5000 volts; alternating-current series circuits not exceeding 5000 volts; direct-current series circuits not exceeding 7500 volts, and direct-current railway circuits not exceeding 1000 volts. For higher voltages the line construction should be so reinforced at places of exposure as to preclude failure, and wherever possible the lighting and telegraph systems should be adequately separated. The preferred method of protection consists of: (a) a large line fuse, (b) an open-space cut-out, and (c) a low-capacity fuse or heat coil. The heat coil or fuse may be omitted under certain conditions, more especially where telegraph equipment exclusively is to be protected. The author stated in conclusion that from his experience there is no way of losing efficiency faster than by using cheap (unsubstantial) protective apparatus.

#### Gasoline-Electric and Storage-Battery Cars

Mr. H. T. Bentley, of the Chicago & Northwestern Railroad, president of the association, presided at the fifth annual convention of the International Railway Fuel Association held in Chicago on May 21, 22, 23 and 24. Among the six papers presented at the convention the one on "Self-Propelled Railway Passenger Cars" is perhaps of the most interest to electrical readers. The paper, which was a very comprehensive report on the subject, was jointly prepared by Messrs. S. T. Dodd and B. H. Arnold, of the General Electric Company. A history was given of the different types of self-propelled cars used on branch lines or light traffic roads. The radius of operation of steam, compressed-air, storage-battery and internal-combustion-engine cars was discussed with a view toward the comparison of cars having the same seating capacity and tractive effort. The advantages, characteristics and operating costs of the gasoline-electric cars were discussed quite thoroughly. Satisfactory methods of testing fuel oils other than by gravity were suggested. In addition, sample examination blanks for gasoline-electric motor-car operators and inspectors were outlined. Fuel and oil performances of gasoline-electric cars operating on various roads in the United States were submitted in tabulated form with the paper.

Considerable discussion followed the delivery of the paper, in which the following men took part: Messrs. O. S. Byer, A. G. Kenyon, D. C. Buell, J. H. Tracy, F. E. Drake, J. C. Little, H. J. Osborne, J. Skelton, J. E. Hilton, E. McAuliffe and G. B. Pratt. Objection was raised against the gasoline-electric motor cars, on the ground that steam locomotives had to be kept on hand to replace them at short notice in case of breakdown. This objection was well answered by the statement that reserve locomotives always have to be kept on hand no matter what the prevailing motive power may be.

Reliability of service was another topic which interested many. Messrs. Buell, of the Union Pacific Railroad, and Hilton, of the Frisco road, practically removed all doubt concerning the reliability of service of gasoline-electric motor cars by their accounts of the service rendered the two roads which they represent. Mr. Buell believes that the gasoline-electric unit is the practical motive power for heavier traffic than that on which it is used at present. The only trouble which has been experienced with motor cars has been caused by the ignorance of the operators. Educational bureaus have overcome this difficulty to a marked

degree. Performance tests on the Union Pacific Railroad with gasoline-electric cars show a better fuel economy than with the steam locomotive. Mr. Drake gave some interesting figures on gasoline-electric motor-car performance in Hungary, Europe, and in Oklahoma. On the Arad-Csanad Railroad in Hungary seventy-two trains are operated in both directions daily. The average car mileage per year is 1,000,000 miles and total annual mileage is 5,300,000 car-miles, which, according to Mr. Drake, is considerably more than any steam locomotives in the United States are capable of. In Oklahoma the motor cars on the Muskogee Electric Traction Company's road operate 3.3 miles per gallon of fuel oil. Operating expenses and fixed charges amount to 16.4 cents per car-mile.

In a written communication from Mr. J. H. Tracy, which was read by Mr. H. M. Beck, some data were given on the performance of storage-battery cars compiled from actual practice.

#### STORAGE-BATTERY CAR OPERATION

The author claimed that gasoline or gasoline-electric cars offer the best solution to the problem of handling light, infrequent traffic when conditions call for long-distance hauls at relatively high speeds and with few stops, and that the storage-battery car "has a useful and economical field for service which is within the scope of the battery." The lead battery offers a wide field for usefulness. One hundred miles per charge at a free running speed of 30 miles per hour, with an equipment seating seventy passengers and providing a suitable baggage compartment, seems to be entirely within the range of conservative operation.

The Lewisburg, Milton & Watertown Passenger Railway Company in Pennsylvania has been operating since early last October a storage-battery car built by the J. G. Brill Company and equipped with an "Exide" lead battery from the operation of which data have been compiled. The car in operation on this line is 34 ft. 4 in. over the corner posts, has a seating capacity for thirty-two passengers in the passenger compartment and has a baggage room 17.5 ft. long. This car is of standard construction, and while carefully designed for light weight, embodies no special features except that ball bearings are used to reduce the running friction. The car weighs 32,200 lb. complete with battery, the battery weighing somewhat less than 8,000 lb.

Between Oct. 9, 1912, and April 1, 1913, the car operated a total distance of over 20,000 miles, regularly performing approximately 122 miles a day. During this time the car lost only 10 miles from the full schedule. This loss was due to a damaged charging plug which in turn damaged the car wiring. These figures, the author believes, show a reliability of operation which is certainly equal to that of the best class of apparatus in operation on the street railroads and in excess of that which can be shown by any other class of self-propelled car. The entire care of this car, including charging the battery, cleaning, inspecting, etc., is assumed by two crews, each consisting of one helper, man and one conductor, working, of course, under the general supervision of the officials of the Lewisburg, Milton & Watertown Passenger Railway Company, which company also operates a trolley road between the three places named.

During the six months of operation mentioned above, which it will be noted covers the winter months, the consumption of this car has averaged approximately 4.25 amp-hr. per car-mile. The battery equipment consists of eighty-eight cells having a rating of 425 amp-hr., the individual cells being identical with those which have been used successfully since September, 1910, on the street cars in New York. The battery averages 170 volts during discharge in this service, which gives an energy consumption of 720 watt-hr. per car-mile. Assuming an average live load of 1.5 tons, the actual energy consumed from the battery amounts to 41 watt-hr. per gross ton-mile. The ruling grade on this line is 0.7 per cent, there being a difference

of 88 ft. in elevation between the two termini. The number of stops averaged between one and one and one-half per mile, as the car is stopped at every public as well as at the regular passenger stations of the Pennsylvania Railroad Company.

The rating of the battery being 425 amp-hr., and the energy consumed in driving the car averaging 4.25 amp-hr. per car-mile, a mileage capacity on one charge of the battery of nearly one mile is indicated.

#### The Central Station and the Electric Vehicle

Among the papers presented at the convention held in Boston May 20 and 21 under the auspices of the New England Section of the Electric Vehicle Association of America and the Electric Motor Vehicle of Boston, read in our issue dated May 24, were three dealing with the attitude of central stations toward electric-vehicle owners and the popularity of the electric vehicle.

##### Central Station Attitude Toward Electric Cars

A paper was presented by Mr. F. R. Wallis, of the Edison Electric Illuminating Company, of Boston, which discussed the mutual responsibilities of the central station and the electric-vehicle manufacturer, emphasizing the point that only through the broadest cooperation and the logical development of the field be secured. Several questions were posed to the manufacturers of cars, for the service after the installation has been made with a view to determining the division of responsibilities. Is the manufacturer adequate factory representative the central station should attach a stamp to certify the vehicle during the waiting period, after which the vehicle as finished will warrant the manufacturer in installing apparatus and maintenance accessories in such localities. If a distinct line is drawn between the service to be rendered by the manufacturer and the central station, it appears desirable to make the division on the basis of inspection and supervision of that portion of the equipment supplied by each, the central station dealing chiefly with matters connected with battery charging and maintenance, the latter being required to make of manufacturer's instruction of electrical use of vehicle. Regular inspection of the electrical apparatus should also be made to insure constant service rate and satisfactory performance. The central station can render valuable service to the manufacturer as well as the user by maintaining a department of vehicle and battery engineering, whether it consists of one or more individuals, whose function it should be to bring the prospective customer and agent together for their mutual benefit and to safeguard the interests of each after the sale has been consummated. The procedure and maintenance of possible charging stations was discussed by the author in closing.

##### Discussion

Mr. Eugene Carpenter, Oak Street, Mass., expressed his opinion with lively smiles and gasoline engine power. He expressed offering a lot of cars and wanted the central station to cover the initial cost of the electric garage and also filling the gaps where the cars hang if not on energy as in the case of gasoline. He presented the construction of high-school and technical graduates in the construction and maintenance of electric vehicles under industrialization program. A vigorous discussion followed regarding the respective claims of the central station and the manufacturer as to who is to provide after care is given. Among the speakers were Messrs. W. M. Brown, Hartford; S. Fred Smith, Salem, Mass.; H. C. Sawyer, Salem, Mass.; Harvey Bissell, New York; J. C. Woodbury, Boston; R. W. Britton, Worcester; J. C. Garfield, Wrentham; electric garage Philadelphia; P. F. Whiting, Boston; and J. W. Cooke, Boston. The point was made that reference



work is done at Rochester, N. Y., by a traveling electric-vehicle inspector who follows up every private electric car in the city and facilitates its proper maintenance.

#### CENTRAL-STATION DEVELOPMENT OF VEHICLE LOAD

Mr. W. C. Anderson, president of the Anderson Electric Car Company, Detroit, Mich., presented a paper in which the importance of low rates for energy for battery charging was emphasized and in which the possibilities of co-operation between central stations and vehicle manufacturers were vigorously set forth. He paid a tribute to the work of the Edison Electric Illuminating Company of Boston in this field and cited a recent reduction in rates from \$10 to about \$4 for 100 kw-hr. as an example of the practical value of the company's policy, which Mr. Anderson said is in strong contrast with the policy followed by some central stations of unprogressive tendencies. The speaker pointed out that there are localities within 50 miles of the meeting place where 25 cents per kw-hr. is being charged for service. Such conditions are utterly discouraging to the development of the electric-vehicle business along broad lines.

The author contended that central stations everywhere should afford the utmost encouragement to representative electric-vehicle dealers. Much good can be done by helping the dealer through the supply of free energy for his batteries in the preliminary development until the business begins to pay him. The central station should stand back of the electric vehicle, and if no local representative can be secured lend the weight of its influence to the solution of the commercial problem. The rates for energy should be as low as is consistent with local conditions. When the lady owning an electric car tells her friend at the afternoon tea that her last month's bill for electricity was less than \$10 for about 600 miles of service, one may be sure that the friend resolves to make a strong point of this fact when she next discusses the matter with the master of the house. In closing, the author touched upon the work of the Hartford (Conn.) Electric Light Company, which maintains a battery department where owners of electric vehicles may rent batteries at a fixed cost per mile. This plan relieves the vehicle owner from investing money in battery equipment and from all responsibility regarding the care of batteries.

#### Discussion

In the discussion the necessity of appealing to women by handsome catalogs was emphasized. The field of the high-grade electric vehicle was pointed out, and the need of better material and closer fitting than in the gasoline car was cited as a reason for the relatively high cost of electric automobiles. Increasing demands should lead to lower ultimate prices. Among those who participated in the discussion were Messrs. C. D. Marsh, New York; F. H. Smith, Worcester; Colonel E. W. M. Bailey, Amesbury, Mass.; F. J. Stone, Boston; J. E. Gray, Providence, R. I.; Harvey Robinson, New York; W. C. Anderson, Detroit; P. E. Whiting, Boston, and J. H. Hunnewell, Lowell, Mass. The last-named speaker emphasized that the first cost of electric vehicles and the cost of energy are not the major problems. The manner of making the sale and taking care of the customer is the vital point, and the guarantee is a most essential feature in dealing with uncertain customers.

#### POPULARITY OF ELECTRIC VEHICLES

In a paper on the growing popularity of the electric vehicle Mr. H. H. Rice, president of the Waverley Company, Indianapolis, Ind., pointed out that the public in ever-increasing numbers acknowledges the desirable features of the electric car and that thousands of automobile owners are looking favorably upon the electric vehicle, as shown by the large number of gas cars "traded in" for electric vehicles. The manufacturers and dealers

in gasoline cars have changed their attitude of outright contempt or good-natured tolerance to recognition that the electric vehicle, both in the passenger and in the truck form, is a car which in its own field is unequaled by the gas car. According to the *Automobile*, there were in October, 1912, some 34,000 electric pleasure cars registered in the United States, while the new registration for the year was 5550, showing a gain of 20 per cent. Even these figures show that there are half as many electric vehicles in use in this country to-day as there are automobiles of all types in any leading country in Europe. The general use of high-priced gasoline touring cars for both city and country service is one of the most costly fads of the day. The modern electric pleasure car excels in luxury the most fashionable carriages of the last generation and has every advantage over the gasoline car for daily service. The man who has \$4,500 to invest in automobiles will do well to consider whether he can find a better investment than a three-thousand-dollar electric vehicle and a fifteen-hundred-dollar gas car for touring. The advertising done by electric-vehicle manufacturers has always been in advance of the volume of their business. They spend a larger percentage of their gross income on publicity than almost any gasoline-car company. Consequently, at present, when many gas-car factories are running on short time, it is not surprising to find the manufacturers of electric vehicles working full time and in some cases increasing their product over last year's business. To-day there is no manufacturing industry in the country on a better basis. The field of the commercial car is practically unexplored as yet. Day in and day out the electric vehicle invariably shows the lowest cost per package handled. The author closed with a tribute to the pioneer work of the Edison Electric Illuminating Company, of Boston, and other central stations in the electric-vehicle campaign.

#### Discussion

Citing the growth of the electric-vehicle business, Mr. D. C. Tiffany, Boston, said that he sold four cars in the year ended in March, 1912, against twenty during the year ended March, 1913. Mr. J. A. Hunnewell, Lowell, Mass., referred to a new 60-ft. by 100-ft. concrete garage with a capacity of thirty cars. Continuous day and night service is given. Messrs. D. C. Tiffany, F. J. Stone and E. S. Mansfield also spoke briefly.

#### Meeting of Ohio Society of Engineers

The twenty-seventh annual meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers was held at Springfield, Ohio, May 22 to 24, although the usual large attendance was this year somewhat depleted by the pre-occupation of many members owing to the recent floods in the State.

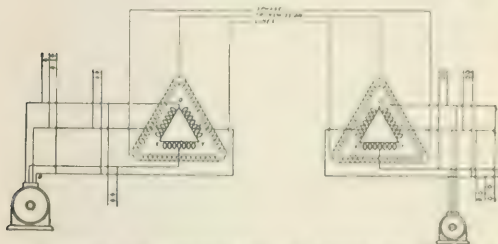
Mr. Evan G. Price, vice-president and general manager of the Indianapolis Switch & Frog Company, Springfield, Ohio, opened the technical program with an address on "Repairs and Welds by Electricity," describing the possibilities of the latest methods in building up broken and worn sections, reclaiming track parts, joining rails, etc. Mr. Price gave an account of the apparatus developed by his own company in which a fluxated steel rod forms one electrode of the short arc used and also supplies the material to be flowed onto the work. Later the society visited the plant and witnessed demonstrations of this method.

On Friday morning Mr. Frank T. Wyman, of the Pittsburgh Transformer Company, Pittsburgh, Pa., presented a paper on "Operating Characteristics of Transformers." Discussing the selection of apparatus of all-round efficiency for ordinary service, the author recommended a ratio of three to two between  $I^2R$  loss and core loss, in order to attain better regulation, higher efficiency at full load and



greater overloads without harm. In the self-cooled, oil-filled type of transformer, the windings require a surface of 3 sq. in. to 4 sq. in. per watt radiated, and the cases 6 sq. in. to 9 sq. in. The windings in an impregnated transformer will run cooler than those of one not impregnated, since in the former the copper and insulation are more nearly homogeneous. Surges impose severe voltage strains on the end turns of transformer windings. The higher the reactance the less the turns through which the surge is likely to travel. Consequently, if additional reactance is provided in the form of distinct and separate coils, the transformer end turns proper will be relieved of a large percentage of the abnormal voltage rises. Such coils are of course replaceable without withdrawing the whole transformer from service. In closing Mr. Wyman described a scheme of two-phase to three phase transformation which gives greater freedom from unbalancing with unequal loads. Both two-phase and three phase may also be taken from the two phase side. If the primary side of the transformer, for instance, is two-phase, then four times the rated capacity of the transformer in power may be taken as three-phase at the same voltage from the same side, or vice versa, without overloading the transformer. Two to three phase transformers of this type have been built as simple units.

A paper by Mr. Frederick W. Ballard, engineer of construction for the city of Cleveland, Ohio, discussed district steam heating with high pressure steam and described the plans for the new municipal system of this type now being installed at Cleveland. In large central-station systems, declared the author, it is not economical to run engines



CONNECTIONS FOR THREE-PHASE TO TWO-PHASE OPERATION

non-condensing in order to secure exhaust steam for heating, since hardly half the power of the steam is then available at the engine. But the greatest advantage of the high-pressure scheme lies in its reduced investment, since smaller sizes of pipe are necessary. The heat loss from the mains is also less, owing to higher flow velocities and smaller radiation surfaces of the underground mains. For the 8200 ft. of lines already installed at Cleveland the cost of equivalent low-pressure mains would have been nearly two and one-half times the present outlay, the difference between \$65,549 and \$167,330. This \$101,781 difference in investment would add at least \$10,000 per year to the fixed charges of the low-pressure system. For a 2500-hp boiler plant, generating 1800 kw by non-condensing means and devoting the remaining 80 per cent of the steam to heating, the saving would be \$8,470 on a basis of the per cent load-factor. Even with such an assumption this operating saving represents, however, only one-half the increased investment cost of the low-pressure system. Other disadvantages of the exhaust steam system, as stated by Mr. Ballard, are the lack of coincidence between heating and power loads, poor economy of non-condensing apparatus when steam heating is not required, and the high radiation losses from the large mains.

On Friday evening Mr. R. Hastings Peabody, works manager for the James Lefell Company, Springfield, Ohio, read a paper on "Interesting Foundry Experience with Semi-Steel Mixtures; the Molds and Cupola Charges."

During the days of the summer convention trips were made to many of the interesting industrial plants near by. Among those visited were the works of the Indianapolis Switch & Frog Company, the Lagonda Manufacturing Company, the Kelly Street Engine Company, the Summit Gas Engine Company, the Ohio Foundry, the Ohio Tool Engine Company, the Palmer & Myers Company, the International Harvester Company, the Lucas Engine Company, the Lucas Manufacturing Company, and the Cincinnati Iron, Steel & Power Company. A number of meetings in the evenings at the Hotel Hamilton were held, during which the house was entertained by a chamber party.

## Southwestern Electrical Association Papers

Among the papers presented at the bi-annual meeting of the Southwestern Electrical and Mechanical Association held in Indianapolis, Ind., on May 20, 21, 22 and 23, a study session was called on the same date (Wed. May 21), with special interest in central-station operating men. Brief abstracts of these papers are given below.

### PUBLIC SUPPLY RATES, NORTON AND NORTON

The rates charged by public utilities formed the subject of the paper by Mr. W. J. Norton, of the rate research committee of the N. E. A., and he indicated that these should be studied in order to bring to the utility a fair return on the money invested in it. He drew a marked distinction between the public utility and the private utility, and stated that because of certain factors associated with the business of supplying electrical energy that the public utility does not encounter in the other utilities, certain practices not tolerated in connection with the gas or water supply business are necessary to the successful operation of the electric supply business, the one particularly mentioned being the right to promulgate "development rates." The general tendencies in the line of regulation by commission, among the various states, were next taken up, the paper being of the opinion that so far these had been a marked illustration shown to deal fairly with the utility. He presented himself as taking entire satisfaction with the work possible, and, more than that, he said that voluntary rate reduction, where they had been found possible and have been found to result greatly to the advantage of the companies making them. Thus, he observed, had been considered in two ways, first, by an increase in popularity, and second, by a sufficient increase in business to make earnings fully as large as, or larger than, those had been before the reduction. Mr. Norton closed his paper with the statement that in his opinion, although the good will of the public has not been allowed to be sacrificed, it is a very considerable part of the cost of any business and should be utilized constantly against a time when it might prove of greater value than the physical property of the company.

### STANDARD ACCOUNTING FOR TRAIL PUBLIC UTILITIES

An exceptionally able paper was rendered in this session by Mr. E. C. Campbell, president of the Public Utilities Society of Texas, in which he considered the necessity of study and co-operation in the planning of a uniform system of accounts. This he said, would serve the true interests of both the larger and the small companies, and, in the case of the introduction of a public accountancy system in Texas, would permit the smaller companies to have a uniform system of accounts comparable to that of the larger companies that would be in line with the public utility. He stated that the public utility industry in Texas would permit the smaller companies to have a uniform system of accounts comparable to that of the larger companies that would be in line with the public utility. He stated that the public utility industry in Texas would permit the smaller companies to have a uniform system of accounts comparable to that of the larger companies that would be in line with the public utility.

### PREVENTION OF BOILER SCALE

That more careful attention should be paid to the quality of the boiler-feed is the claim of Prof. A. C. Scott, of Dallas, and in his paper he cited numerous instances where the failure to do so had resulted in damage to apparatus, if not in injury to employees. The three possible sources of boiler-feed water in Texas were stated to be rivers, lakes and wells, and in each of these cases there is more than an even chance that the water will not be fit for use in a boiler without some sort of treatment. Brief description was given of the four most generally adopted methods for effecting a partial or entire purification of the water so that scale would be reduced. For large plants the "cold process" was favored, but for smaller plants the use of boiler compounds in the proper proportion was thought to be sufficient.

### THE COMMERCIAL DEPARTMENT IN THE GAS BUSINESS

Advocating the establishment of a commercial department by those operating gas utilities, Mr. R. E. Turrentine, of the Houston Gas & Fuel Company, proceeded to outline the several ways in which such a department could co-operate with the other departments of the business to the great benefit of both the public and the company. By accelerating the work of the shop and installation departments, and by making the men in them feel that they are part of the organization, the general efficiency of their work could be increased. By having the meter-reading and inspection departments under the control of a commercial department, the author claimed that an increase in accuracy could be obtained and quicker and more effective action secured on complaints as to inaccuracy of meters or readings. Co-operation between the accounting and collection departments and the commercial department would, it was stated, enable the company to keep track of bad accounts and also to make an extra effort to land desirable customers. Mr. Turrentine favored the handling of complaints by personal calls instead of by letter, as being more satisfactory to the customer, and for the same reason he thought that the employment of demonstrators to see that stoves and other apparatus are properly installed and understood was a wise policy.

### WINDOW DISPLAYS OF APPLIANCES

Mr. E. W. Jones, of the Galveston Gas Company, made a plea for more extended use of window displays for appliances. He said that a window display should be made a "silent salesman," and to do this he maintained that it should first be made to attract the attention of the passer-by and then to arouse his interest so that he would either enter to find out more about the articles displayed at that time or later on or else would carry away such a strong recollection of the display that when approached later by a solicitor he would still retain a distinct impression of it. Errors to be avoided, according to the author, are the overcrowding of the display, the insertion of too much decorative effect, poor lighting, too little explanation and too few changes. He contended that the whole burden should not be put on the window, but that the store should co-operate to the extent of being open and ready to supply the information required by prospective customers attracted by the window. He thought that a fine window display is a waste of money unless the store is open and ready for business at the same time.

### ADVANTAGES OF OIL-ENGINE DRIVE

A very brief paper by Mr. A. L. Chase, of the Clarendon Light & Power Company, gave data which he considered as favoring the use of fuel-oil engines for driving the generators in small stations. In connection with the remodeling of a small steam station owned by him and operating in a town of about 2500, he stated that it was found that the fuel cost was reduced from \$225 to \$164 per month

by the installation of oil engines of rating equivalent to the steam equipment at first used, and this in spite of the fact that the service with the present equipment is a twenty-four-hour one while formerly it was only a six-hour to nine-hour service daily. The initial cost of oil-engine equipment, he said, was about \$65 per hp for this type of engine, but he claimed that this comparatively high first cost was more than offset by the difference between five cents per gallon for distillate and \$2.25 to \$4.50 per ton for slack coal delivered.

### PROTECTION OF HIGH-TENSION CIRCUITS AND APPARATUS

Means for protecting employees and apparatus from injury due to accidental contact with high-tension conductors or to lightning phenomena, natural or artificial, were described simply and clearly in the paper of Mr. E. E. Nelson, of the Northern Texas Traction Company. His first advice was that in the design of a generating station the exact placing of all cables, especially those carrying high tension, should be a matter of preliminary design and that low-tension and high-tension lines should be kept strictly separate, the latter being isolated as far as possible. Oil switching and remote control, he said, were modern methods for reducing the danger incidental to the opening of high-tension circuits. The various classes of lightning arresters at present available and also the use of large choke coils to reduce the damage from surges due to lightning or short circuits were touched upon. For the safety of employees working on transmission or other high-tension lines the precaution of having the lines grounded by instructions of the responsible party and only cut in again by special order of the same party was recommended.

### PROBLEMS OF THE SMALL CENTRAL STATION

In few words the paper by Mr. E. D. Kelly, of the Terrell Electric Light Company, gave some glances from behind the scenes at the problems which the operator of a light and power station in a small town has to face. The lighting load is far from being a money-making one, considered alone, and it possesses a poor load-factor. It is not possible in the small plant to get the same degree of exactness in cost accounting and in division of labor possible in a large station, and so the advantages incidental to these refinements are not attainable. The salvation of these small plants lies in the introduction of energy-consuming devices for domestic use and in the making of attractive rates for special service, such as for store illumination. The station which furnishes the auxiliary service of wiring, repairing and supplying of fixtures and appliances is in a position to win customers by making this service particularly satisfactory. Competition from municipally operated plants is often met with and can be best overcome by maintaining a superior service, by instituting an active publicity campaign and by seeing that every employee of the station uses tact and courtesy in all dealings with the public.

### Sanitary District Considering an Increase in Rates

A committee of which Mr. Thomas M. Sullivan is chairman has been delegated by the Board of Trustees of the Sanitary District of Chicago to report on the equitable distribution of construction costs before new rates are fixed. This action has been required because of the fact that the Sanitary District operates two departments, which are interlinked because of construction details—one for disposing of Chicago's sewage by the Drainage Canal, and the other for generating electricity by the incidental water-power. In 1900 water was turned into the canal. Three years later a permit was granted to enable the Sanitary District to build a water-power plant at Lockport. The two activities of the District are so closely allied that it has been difficult to apportion construction costs fairly. During







Table III shows the total cost of the plant to March 12, 1913, classified.

TABLE III—PLANT INVESTMENT

Land .....	\$30,648
Power house and dams .....	113,389
Wooden buildings (three) .....	3,881
Penstocks, waterwheels and auxiliaries .....	67,384
Generators (three) .....	23,090
Poles and fixtures .....	17,181
Copper conductors .....	60,242
Arc lamps .....	7,703
Transformers .....	38,830
Motors .....	30,057
Motors .....	1,518
Substation building .....	4,210
Water-works and substation .....	1,383
Miscellaneous .....	2,162
Total .....	\$401,678

Since 1900 a total of \$52,193 has been expended on replacements and extraordinary repairs and charged to expenses; of this amount \$44,644 represents replacements.

#### RETURN ON INVESTMENT

Allowing for 5 per cent depreciation, which is probably more than ample, the following showing is made for return on the investment: Net earnings from operation, \$48,383; depreciation, \$20,084; balance, \$28,299, the percentage of return on investment being 7.05.

Of course, this figure leaves out of consideration any capital allowance for stores and supplies on hand and working capital. Considering that the city borrows money at the rate of 4½ per cent, however, there is evidently a net profit in the operations.

TABLE IV—ENERGY GENERATED AND SOLD

	Kw.-Hr.
Total energy generated at plants .....	2,689,800
Energy purchased .....	112,875
Total output .....	2,802,675
Used for street lighting .....	280,790
Used by plant .....	59,424
	340,214
Transmitted to substation .....	2,462,461
Received at substation .....	2,311,020
Loss in transmission (6 per cent) .....	151,441
Residence consumption .....	462,350
Business consumption .....	568,010
Motor consumption .....	644,804
City buildings and parks .....	40,050
	1,715,214
Loss in distribution (26 per cent) .....	595,806

The commission in its report presented a tabulation of unit costs based on station meter readings, which is reproduced in Table V.

TABLE V—UNIT COSTS

	Cents per Kw.-hr.
Manufacturing .....	0.00277
Transmission and distribution .....	0.00105
Commercial expense .....	0.00120
General operating .....	0.00238
Total operating .....	0.00740
Average receipts .....	0.03450

The load-factor for the year was given as 35 per cent. No data were given to show the source of funds from which the plant was built, except that \$71,000 of bonds bearing 4½ per cent interest are now outstanding. These fall due serially up to 1917.

## Massachusetts Legislative News

Governor Foss has vetoed Senate bill No. 415, relative to the issue of stock and bonds by electric-light, gas and power companies, which provided that bonds might be issued by such corporations to the amount of twice their paid-in capital without the necessity of securing such bonds by mortgages. Street-railway companies also came within the provisions of the bill through their use of the public highways. Chapter 725 of the Acts of 1912 permits railroad corporations to issue bonds secured by mortgages to the amount of twice the paid-in capital. In his veto Governor Foss points out that an important purpose in the existing limitation upon the amount of bonds and preferred stock is to secure for the corporation the benefits resulting from the active interest of those possessing a substantial share in the securities; that a large interest responsible for the actual management tends to increase the security of the property for all classes of investors, and that with rare exceptions these Massachusetts companies are financed under existing laws by the issue of a single class of stock and not at all by bonds. The Governor further says that the companies are not likely to need such legislation for the promotion of the public interest unless hereafter, through the issue of an undue burden of securities or through mismanagement, their stock-issuing credit shall become impaired. The veto points out that if the securities of these corporations are weakened by permitting inflated issues of imperfectly secured bonds, a high interest rate will have to be paid on the bonds, to which the public must contribute through increased rates and poorer service.

## Limitations of Franchises

The Crawford Electric Company was organized in 1897 for the purpose of generating and selling gas and electric service in the counties of Knox and Waldo, including the town of Union, Maine, but had not exercised that privilege. In 1911 the Knox County Power Company was chartered to supply the same service in the same territory, but it also had not exercised the privilege. In the latter part of 1911 Hollis M. Shaw received a permit from the town of Union to erect an electrical distributing system in that town and subsequently supplied electricity to it for lighting and industrial purposes. A bill was brought by the Crawford Electric Company against the Knox County Power Company and Hollis M. Shaw, and application was made for an injunction restraining them from making or supplying electricity for lighting and industrial purposes in the given territory. The case was tried before the Supreme Judicial Court of Maine, and the bill against each of the defendants was dismissed (86 A. 119). The Knox County Power Company was shown to have no intention of engaging in that line of business in the territory in question and, in dismissing the bill against Hollis M. Shaw, Judge Cornish rendered the following opinions: (1) When a corporation has been organized under the general law to make and sell electricity for lighting and mechanical purposes no other corporation subsequently organized may, except by special legislative act, undertake to make and supply electricity for the same purposes in the same territory, but this prohibition does not extend to individuals. (2) There is a distinction between a "franchise" and a right or "power." The former represents a privilege which can be exercised only through legislative grant, as in creating a corporation. But the right to do certain things under such grant is a "power," and the right to make and sell electricity is an inherent power of a natural person, the exercise of which would not be usurping a public franchise. (3) The Legislature, by virtue of its control over public roads of the State, may grant to a person or a corporation authority to erect lines on such roads, or it may delegate that power to the officers of the several towns.

## Competition and Municipal Regulation

In a recent opinion delivered by the United States Supreme Court in the case of the Madera (Cal.) Water Works versus the city of Madera it was held that, although a private water company might be serving a community under municipal regulation of rates, the act or power of regulation carries no express or implied contract that the municipality shall not construct its own water-works and engage in competition, even though the company may hold an exclusive franchise. This opinion, however, is founded upon the presumption, which amounted in this instance to fact, that when the private company built its works the constitution of the State authorized cities to build water systems regardless of the existence of such private systems. Therefore the owners of private systems took the attendant risk. Although the court said that it is impossible not to feel the force of the plaintiff's argument as a reason for placing a different construction upon the state constitution, so as to avoid the result of double regulation with its anomalous situation, the contention arrives too late. There is no pretence that there is any express promise to private capital that it shall not encounter subsequent municipal competition. The original action was brought against the city of Madera by the water company to enjoin municipal competition, under an appeal to the Fourteenth Amendment, but the Circuit Court sustained a demurrer and dismissed the bill. The plaintiffs then took an appeal, with the result announced above.

## Public Service Commission News

### NEW YORK COMMISSIONS

The Public Service Commission, First District, New York, has approved the application of the Consolidated Gas Company for the right to acquire the common and preferred shares of the New York & Queens County Gas Company and of the New York & Queens Electric Light & Power Company.

### MARYLAND COMMISSION

Action that may mean a sweeping investigation of the condition of electric wires in Baltimore has been taken by the Maryland Public Service Commission, following the death of George C. Cox, who was killed not long ago at Maryland Avenue and Russell Street by coming in contact with a feed wire. Chief Engineer Charles I. Phelps and Assistant Engineer Charles G. Edwards of the Public Service Commission report that four and possibly six companies have wires crossing at or about that point. It is pointed out by them that the construction of the cross-overs is not up to the standard and that immediate steps should be taken to prevent a recurrence of the accident mentioned. There are also two railways crossing at this point. Copies of the report have been sent to all the companies involved, and it is probable that the investigation will be extended to other points where similar conditions obtain.

### OHIO COMMISSION

The Ohio Public Service Commission has set aside the ordinance of the Toledo Council fixing the rate for artificial gas at 70 cents per 1000 cu. ft. and has ordered that a new rate be made not in excess of the old rate of 95 cents. The commission, after investigation, declared the new rate unjust and unreasonable. An investment in gas equipment of \$1,000,000 was claimed by the company. The commission found that the company had an investment of \$1,120,000, but that much of the equipment is useless. A valuation of \$673,000 was placed upon that which is necessary, but it was found that last year the net return on this was less than 3 per cent. The company had asked that a rate that will yield a return on the investment be made.

## Current News Notes

**CITY ELECTRIC PLANT AND CITY BONDS.**—An unusual event took place recently when the South Norwalk (Conn.) city electric works purchased, at a profit, some \$20,000 of city of South Norwalk bonds. The plan of selling city bonds to municipal plants, besides being a practically new system of municipal business, will, if continued, eventually clear South Norwalk of debt, save perhaps for a sum which it will in reality owe itself.

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**LOUISVILLE CONTRIBUTION TO ANNUAL NATIONAL CONVENTION.**—The Louisville Electrical Contractors' Association has decided to attend the annual convention of the National Electrical Contractors' Association July 15-20 in a body, and expects to make a big showing there. The convention will be held in a neighboring city. In view of the activity of the Louisville body in the electrical work it is reported that one of the leading corporations of the Kentucky metropolis is anxious to fill an executive position of importance and influence.

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**CANNOT OBTAIN A FAY RATE.**—The Ohio Supreme Court has handed down a decision in the case of the City of Springfield against the Springfield Light, Heat & Power Company to the effect that the company cannot make a charge of \$1 per month for service in violation of an ordinance which fixes the rate at 8 cents per 100 watts as the legal charge to be made. This was in the nature of a service charge when the consumer used less than 1200 watts per month, and the decision, therefore, in a general way covers the practice some companies have made of charging a fixed sum for service up to a certain amount, after which the rate agreed upon is applied.

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**TELEPHONES IN NEW YORK.**—In London there are 245,000 telephones, in Berlin 210,000, and in Paris 92,000. The three leading cities of Europe combined have but a few more telephones than New York City alone. On Saturday, May 24, the half million mark was passed, and today New York City has more than 500,000 telephones linked together in a system that requires 1,500,000 miles of wire and sixty-seven telephone exchanges to make it the most complete and up-to-date system in the world. Through the telephone exchanges in New York City over 2,000,000 calls are made daily. In spite of the difficulties of establishing an effective system of intercommunication, New York's telephone system has enjoyed a rapid growth. The first telephone was installed in 1876. In 1900 there were 100,000 telephones, in 1905 there were 160,000, and by the last night before this number has been increased to over 500,000.

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### EXISTING PATENT SYSTEM DROPPED BY MANUFACTURERS

In an address before the convention of the National Association of Manufacturers, May 21, at the Grand Tourist train, Detroit, Mich., Mr. Gilbert H. Montgomery of the New York bar, assailed the Gilchrist bill and other efforts at patent reform as endangering the peace, comfort and useful character of the nation, the material prosperity of the country is diminished. Mr. Montgomery insisted that the Sherman law, privately administered, will never all the abuses in the patent law and declared that any tendency to restrict invention would injure the American standing in the industrial life. At the present time, he pointed out, the 35,000 United States patents being issued annually constitute more than one-fourth of those granted by all the countries of the civilized world. Indeed, American patents exceed in number all those issued by Germany, Great Britain and France taken together. Forty years ago, said the speaker, an effort was made to amend the United States patent system so that income by paying a fixed royalty to



the patentee might carry on the manufacture of an invention, but the perils of such an industrial policy were even then discovered in time to prevent Congressional enactment of the plan.

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**VERTICAL VERSUS HORIZONTAL TURBINE UNITS IN FLOOD TIMES.**—In spite of the tendency of modern design away from the vertical type of turbo-alternator in favor of horizontal units, operators of power plants in the Ohio districts recently devastated by floods did discover one advantage of the former type when the waters rose in their plants. The horizontal units were in many cases totally submerged, and their generators required a tedious process of drying out before they could be started up. The electrical parts of the vertical machines, on the other hand, were well above the flood waters, so that when the tide receded it was necessary merely to scrape the mud off the turbine casing and valve mechanism and start operation again.

\* \* \*

**VOLTAGE REGULATION IN TENNESSEE.**—In the Knob country of Tennessee there is a small electric-lighting plant which is operated during the early morning hours by the coal-black negro fireman who has received instructions in the simple duties of keeping the engine going until the engineer comes on at daylight. Especially was it urged upon the dusky attendant that he must keep the voltmeter needle exactly on the 110-volt division of the scale. After experience with the field rheostat, the responsibilities of his task began to weigh upon the darky and he cast about for some way of keeping the pointer from straying from its authorized position. Finally he solved the problem, and the next morning the startled engineer found a nail driven into the voltmeter scale with the pointer fixed hard and fast to its approved indication.

\* \* \*

**CANADIAN TELEPHONE STATISTICS.**—A copy of telephone statistics of the Dominion of Canada just issued shows that the total number of telephones in service in Canada is 370,884, 212,732 common-battery and 158,152 magneto. During 1912 there was an increase of 37,738 in the number of telephones operated by common battery and an increase of 30,387 in the number operated by magneto. The total number of miles of wire is given as 889,572. This is divided into urban and rural as follows: urban, 636,961; rural, 252,610. This indicates that there is one mile of telephone wire in use for every 8.1 of the total population of the Dominion and one telephone for every 19.3. There was one telephone for every 2.3 miles of wire. The class of wire used was as follows: Galvanized, 271,191 miles; copper, 20,096; overhead cable, 232,393; underground cable, 364,875; submarine cable, 1,015. The aggregate capital expenditure in telephones is now placed at \$46,276,851, though the cost of real property is placed at something over \$10,000,000 beyond this figure. This indicates a capitalization of \$124.75 per telephone in use. The gross earnings from all telephone companies for the year amounted to about \$12,250,000, as compared with a little over \$10,000,000 the previous year. Operating expenses were 74 per cent of gross earnings as compared with 69.32 for the previous year. Gross earnings amount to \$33.90 per telephone in use, or \$13.79 per mile of wire.

\* \* \*

**TRANSMISSION OF HEAT INTO STEAM BOILERS.**—An investigation of the transmission of heat into steam boilers is one of several researches now being carried on by the Bureau of Mines having for their object the determination of methods by which the mineral fuels of the country may be more efficiently used. The results of the bureau's investigations indicate that the conductivity of boiler plates is so high that present steam capacities can be tripled and quadrupled by forcing over the heating surfaces three or

four times the weight of gases now passed over them. By employing well-designed mechanical draft apparatus this greater weight of gases can be forced through the boilers at comparatively small operating cost. In this way it is possible to increase the capacity of many of the present boiler installations without much reduction of efficiency, and by proper arrangement of the heating surface the efficiency can be raised somewhat. In a 180-page bulletin Messrs. Henry Kreisinger and Walter T. Ray present the results thus far obtained in the investigations which the bureau is conducting. The subject matter has been treated under five heads. Part I is introductory and contains an exposition of the path of heat travel from the source to the water within the boiler. It contains also a dissertation on boiler efficiency, with general deductions on the methods of increasing efficiency and output. Part II presents the original investigations made by the steam engineering section of the United States Geological Survey, which consist mainly of about 300 tests on small laboratory multi-tubular boilers. Part III comprises a historical review of the work done by other investigators, including the writings of Messrs. Osborne Reynolds, John Perry, Dr. Nicolson and E. Stanton, of England. Part IV contains a mathematical discussion of the physical laws governing the three modes of heat transmission. In Part V the application of the laws of heat transmission to steam boilers is taken up, and also the possibility of improving the performance of existing boiler installations by special arrangements of baffles and grates. It also presents a few instances where the principles previously treated have been successfully applied, and it concludes with a summary of the significance of surface combustion as applied by Professor Bone to boiler heating.

\* \* \*

## SOCIETY MEETINGS

**THE COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.**—The eleventh annual convention of the Colorado Electric Light, Power and Railway Association will be held in Denver during the week of Oct. 6, in juxtaposition with the electrical and industrial exposition under the auspices of the Colorado Electric Club. The secretary is Mr. Thomas F. Kennedy, 90 Fifteenth Street, Denver.

\* \* \*

**REJUVENATION AT LOUISVILLE.**—Arrangements are being made by Louisville (Ky.) members of the Jovian Order to hold a rejuvenation at that city on June 4, when a chapter of the national body will be formally instituted. Mr. Eli C. Bennett, Mercury of the national organization, was recently in Louisville arousing interest in the matter, and Mr. Carl A. Klemm, manager of the Louisville office of the Westinghouse Electric & Manufacturing Company, statesman in that territory, has arranged several informal dinners which have been held with a large number of electrical men in attendance.

\* \* \*

**ANNUAL MEETING OF CREDIT MEN.**—The fourteenth annual meeting of the National Electrical Credit Association will be held at the University Club, Chicago, commencing at 10 a. m. on June 4. There will be a luncheon served at the club, a meeting of the national board in the afternoon and an automobile ride through the parks of Chicago, ending with a dinner at one of the clubs at night. Reports will be received from the New England Electrical Credit Association of Boston, the New York Electrical Credit Association, the Philadelphia Electrical Credit Association, the Chicago Electrical Credit Association and the Pacific Coast Electrical Credit Association, together comprising the national body. Mr. George J. Murphy, treasurer of the Pettingell-Andrews Company of Boston, is president; Mr. John H. Dale of the Dale Company, New York, is vice-president, and Mr. Frederic P. Vose, Chicago, is secretary and treasurer.



Electric Service in Chicago

ognized by the National Electric Light Association for one of its thirty-six conventions, seven, including the first one in 1885 and that on the present (fourth) Chicago convention. No other city has welcomed the association so often.

Such results as have been attained in the electric service industry in the convention city of 1913 cannot have been the result of accident. To be sure, Chicago is a large and progressive city, peculiarly receptive to new ideas and still retaining something of that civic zeal which resulted in the White City of 1893, now a beautiful memory. It offers a good market for the sale of electricity. But there must be good goods, good service, as well as good opportunity. It would seem to be evident that there must have been an understanding of the fundamentals of the business—study, prompt grasp of new principles, courage to take large undertakings; faith in the future; correct financing and business methods; the mutual respect and intermingling of engineering and salesmanship; the economies, gradually achieved, of large output, concentration of production and diversified demand, and an organization of men of brains and spirit to achieve the record that has been made. Such has been, in truth, the case.

But the main driving force was and is one man—a big thinking, far-seeing man—who came to Chicago in 1882. To Mr. Samuel Insull, president of the company, credit is due for the date mentioned, must be given the proposition of having built up what may be truthfully considered as the premier electric-service organization at the world. The company started the business of exceptional ability, and the

[illegible]

Nearly one-fourth of the earnings of the nation from the oil and aluminum are the oil revenues, that is,

The Commonwealth Edison Company, which owns and operates the great electric-service system of the city, has a greater output than any other source of electricity supply in the world under one ownership. It has more customers than any other single source of electric-service supply. It has been a pioneer in bold engineering development to reduce the cost of production. It was perhaps the first to realize the importance of massing of production, diversity of output and effective merchandising. It has possibly the most modern generating stations to be found in this country or in the world. It has reduced its rates voluntarily to an extent probably unequalled elsewhere. In welfare work for employees it has been a leader. It has stood fearlessly for years for the economic principle of monopoly in the electric-service utility and has offered itself as an exemplar. Few electric-service companies, if any, pay more money annually into the public coffers; few have more modern



FIG. 1. Schematic diagram of the experimental setup.

rates, and perhaps none selling energy as cheaply returns as much money on the dollar invested. Furthermore, few large public utilities of any sort have such a favorable record of amicable relations with the community served and recognize so unequivocally the justice of the principle of fair-minded regulation of monopoly on behalf of the public.

Chicago is a strenuous city, not without its defects, but it is indeed fortunate in the character of electric service it possesses. This would seem to be rec-

way companies supplied with energy for propelling cars as well as for lighting and heating. This is an outstanding central-station achievement, but it will not do to ascribe the success of the company to this fact alone. Consider the number of small residence customers, the widespread use of electrical energy for industrial purposes, both at wholesale and at retail, the voluntary reduction of rates,

#### GENERAL FEATURES

**Offices.**—The administrative center of the Commonwealth Edison Company is in the Edison Building, 120 West Adams Street, Chicago. This building stands on the site of the original generating station of the old Chicago Edison Company. In addition to offices it contains three large storage batteries, constituting a portion of the reserve for the downtown business district. It was outgrown as office headquarters years ago, and the company rents space in adjoining buildings on the east and west. In addition the company has a larger office building at 28 North Market Street, where about 60 per cent of the office help is housed. Here the engineers have three floors and there is an interesting testing laboratory. In a year or so the scattered offices of the company will be concentrated in what is now the Commercial National Bank Building, at the northeast corner of South Clark Street and West Adams Street. This building has been purchased on behalf of the Commonwealth Edison Company. It is a half block east of the present headquarters and is a large, modern eighteen-story office building, erected at a cost of \$3,800,000.

**Personnel.**—The names of some of the officers and heads of departments are as follows: President, Mr. Samuel Insull; second vice-president, Mr. Louis A. Ferguson; assistant to president, Mr. John F. Gilchrist; secretary and treasurer, Mr. W. A. Fox; auditor, Mr. John H. Gulick; assistant to second vice-president, Mr. P. Junkersfeld; general contract agent, Mr. E. W. Lloyd; chief operating engineer, Mr. W. L. Abbott; electrical engineer, Mr. R. F. Schuchardt; engineer of distribution, Mr. H. B. Gear;

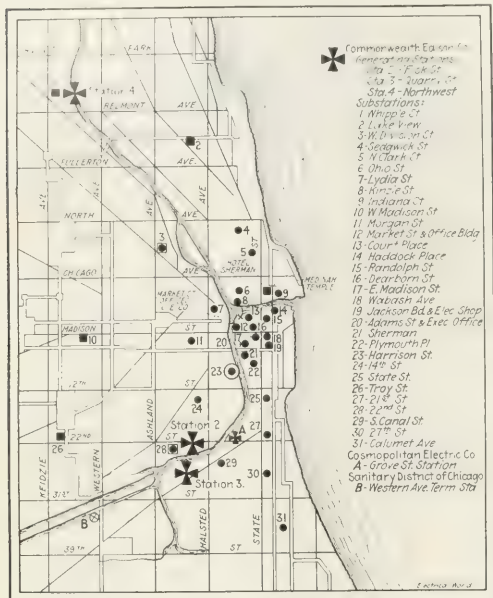


FIG. 2.—SKELETON MAP OF CENTRAL PORTION OF CHICAGO, INDICATING POINTS OF ELECTRICAL INTEREST

the satisfactory relations with the public and the satisfactory returns to the stockholders through a long period of years, and the engineering achievements of the company. These and many other factors enter into the whole result.

What is said here is not intended as a mere panegyric of any system or any man. The idea is to give some idea of what has been accomplished in Chicago in the hope that the recital may be helpful. As a matter of fact the saturation point of electric service in Chicago is a long way off. It has been estimated that the Commonwealth Edison Company has secured possibly 35 or 40 per cent of the possible electricity-supply business of the city at the present time. Some companies in smaller cities furnish a larger percentage than this. But the effort to advance is unceasing. Both in reducing the cost of production by utilizing the most modern engineering methods and in securing a wider field and a greater demand for the product the company is steadily pressing ahead. The principal competitors of the Commonwealth Edison Company are isolated plants, the so-called "block-lighting" plants and the Sanitary District of Chicago.

So many articles have been published in the *Electrical World* relating to the engineering and equipment of the Commonwealth Edison Company that but little space will be devoted to description of apparatus in the present summary. The accompanying illustrations tell their own story. An effort is made here to present a conception of the whole enterprise in the mass, so to speak, and to treat briefly of some of the departments of the work, including the diversified uses to which some of the energy sold is put. What follows immediately is somewhat like a directory.



FIG. 3. EDISON BUILDING, 120 WEST ADAMS STREET, CHICAGO

superintendent of construction, Mr. J. H. Goehst; statistician, Mr. E. J. Fowler.

**Stockholders and Employees.**—The company has about 1700 stockholders and about 3600 employees. About 300 stockholders are employees.

**Financial and Statistical.**—On Dec. 31, 1912, the capital stock issued amounted to \$37,764,140 and the bonds out-



FIG. 4—TURBO-GENERATOR ROOM IN NORTHWEST STATION, CHICAGO, SHOWING TWO 25000-KW. UNITS.



FIG. 5—TURBO-GENERATOR ROOM IN THE FISK STREET STATION.



FIG. 6—TURBO-GENERATOR ROOM IN THE FISK STREET STATION.



standing to \$32,000,000. Seven per cent is paid on the stock and 5 per cent on the bonds. The total operating revenue in 1912 was \$15,361,649; net revenue, \$6,506,077. From this \$1,127,194 was paid in taxes and municipal compensation. After paying bond interest and dividends and making allowance for depreciation, \$921,445 was carried to surplus, which then stood at \$5,252,146. On the date mentioned the



FIG. 7—LOAD DISPATCHER'S OFFICE AT HEADQUARTERS

company had \$3,965,576 in cash. An analysis of the earnings from the sale of electricity showed 47 per cent from retail light, 24 per cent from railway load, 17 per cent from retail power and 12 per cent from wholesale light and power. The output for the year 1912 was 799,000,000 kw-hr. and the maximum load (on Dec. 11) 233,000 kw. The connected load on Dec. 31 last (exclusive of energy supplied to other public-service corporations) amounted to 8,293,523 16-cp equivalents. The company has about 185,000 customers of all sorts. Its annual load-factor is about 43 per cent.

**Generating Stations.**—The company has five generating stations, three of which are modern steam-turbine stations. All turbo-generators now in service are of the vertical type, but the units under construction or contemplated are of the horizontal type. The best known station is the historic Fisk Street plant, at West Twenty-second and Fisk Streets, where the first 5000-kw Curtis vertical steam turbine in the world was put in operation in 1903. That machine has since been superseded and has been set up in Schenectady as a monument. This station has ten 12,000-kw units. An addition is in progress by which the rating of the station will be doubled eventually. In the newer part which is under construction there will be erected a 25,000-kw horizontal Parsons turbo-generator, built at Newcastle, England, and a 20,000-kw horizontal General Electric turbo-generator. Across the South Branch of the Chicago River from "Fisk Street" is the Quarry Street station with six 14,000-kw units. This was first placed in service in 1908. These two plants are entirely distinct, but are operated together. The latest station is the Northwest station, on the North Branch of the Chicago River, at Roscoe Street and California Avenue, put into operation in 1912. Here there are two 20,000-kw units in service, with room for great extension. A 30,000-kw horizontal unit, which will be, no doubt, the largest in the world, has very recently been ordered for this station. The coal-handling apparatus (including an elevated electric railway), oil-switch construction and recreation grounds at this station are of special interest. The total generator rating of the system at the present time is about 260,000 kw, exclusive of storage batteries. In 1912 the company burned 1,100,000 tons of coal.

Harrison Street direct-current station, dating from 1892, is used mainly as a substation.

**Transmission.**—Energy is transmitted from generating stations at 9000 volts and 25 cycles, 12,000 volts and 60 cycles, and 20,000 volts and 25 cycles. There are about 135 direct transmission lines and 35 tie lines. By far the greatest portion of the output is transmitted over the 9000-volt, 25-cycle system. Several tunnels under the Chicago River were built as a part of the transmission system.

**Load Dispatching.**—The direct control of the operation of the system centers in the load dispatcher's office at 120 West Adams Street. A private telephone system connects this office with all stations and substations. Diagrammatic boards show every generator, line and switch in the system, and plugs are used to indicate oil switches open or closed.

**Substations.**—There are forty-one substations. At least two transmission lines are provided for each substation. The new Court Place substation in the City Hall Square Building, on Clark Street, where there is a 3500-kw rotary converter; the Market Street substation at 22 North Market Street, where there are three different types of rotaries, and the Whipple Street substation, at 3435 Whipple Street, near the Northwest station, are interesting examples of Edison light and power substations. As Edison railway substations those at 1920 South Harding Avenue and at 4650 Lincoln Avenue may be mentioned. Those interested in "straight railway" substations may find one of the Chicago City Railway Company at 2020 South State Street and one of the Chicago Railways Company near the corner of North LaSalle Street and West Illinois Street. A typical railway substation is at 321 South Franklin Street.

**Distribution.**—Direct current is distributed to customers in the central portion of Chicago and three-phase, 60-cycle alternating current in all the remaining portion, which is more extensive. In the direct-current district thirteen of the twenty-two rotary-converter substations have auxiliary batteries, and there are three exclusively battery substations. There is an intricate network of direct-current mains. In the alternating-current district energy at 2000-4000 volts is supplied from the substations to line transformers installed where required.

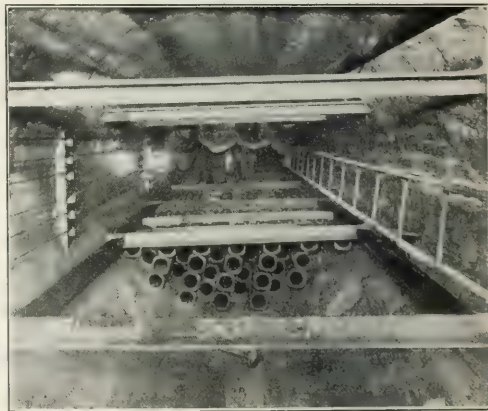


FIG. 8—SHAFT TO WASHINGTON STREET TUNNEL

**Display Rooms.**—Perhaps the most beautiful electric exhibition and sales establishment in the country is that of the Electric Shop, on the northwest corner of Michigan and Jackson Boulevards. Here there are several rooms fitted up with electrical conveniences and luxuries. Ladies may do their electrical shopping here just as they may select wearing apparel, jewels or furniture at other shops.

Another salesroom is maintained on the rear of the second floor of the Edison Building, at 120 West Adams Street, and electrical supplies of any nature may also be obtained at the Logan Square branch office at 2537 Kedzie Boulevard and the South Chicago branch office at 9163 South Chicago Avenue.

#### WELFARE WORK

In many ways the company looks after the welfare of its employees. The employees' saving fund has been in operation for about four years. During a subscription period of five years the subscriber pays in an amount equal to 3 or 5 per cent of his salary. At the end of that period he receives back all the money he has paid in with interest compounded semi-annually at the rate of 6 per cent. However, if he prefers, instead of this cash payment he may take as much of the company's capital stock as the amount of his cash payment and accumulations will then purchase at par if the selling price is then at or above par, or at the average market price during the two preceding calendar months if the selling price of the stock is below par.

A service annuity system has been established with a view of making some provision for faithful employees who have completed a certain term of service. The plan provides for retirement at the age of fifty-five, sixty or sixty-five years under varying conditions, with an annuity in general consisting of 2 per cent of the average annual pay of the employee during the particular consecutive five years when his average pay was the highest, multiplied by the number of years of service, provided that in no case shall the service annuity be less than \$240 a year.

Another plan for recognition of faithful and competent service is provided by a merit system, in which merits and demerits are marked according to a carefully worked-out system. In the performance of duty ratings are based on receptiveness, application, courtesy, loyalty, accuracy, speed and reliability. The merit system applies to all employees receiving less than \$2,000 a year.

The company maintains a library of 2600 volumes and about 100 periodicals, which is at the disposal of employees. The librarian issues a weekly digest of articles appearing in technical journals.

Rewards are paid for suggestions of value to the com-



FIG. 9.—WHIPPLE STREET SUBSTATION

pany. Prizes of \$50, \$40, \$30 and \$20 are awarded every six months, with single prizes of \$10, for the ones sending in the greatest number of accepted suggestions and a reward of \$1 for every suggestion accepted. The suggestions are expected to tend toward the reduction of expenditures without lowering the standard of service or affecting the amount of new business to be secured, and the improvement

of the service without unwarrantably increasing expenditures in the securing of new business.

The company members (11,000) make the Commonwealth Edison Company Section of the National Electric Light Association. This section has about 3700 members and the company is generous in providing facilities for improvement and entertainment. The *Edison Round Table* is a



FIG. 10.—MARKET STREET SUBSTATION

clever monthly magazine which is published by the company section and is supported by the company. The company also sends a number of delegates each year to the annual convention of the association.

Recently the practice has been adopted of giving to each employee who has been in the service of the company five years or longer an appropriate service badge in the form of a gold pin which may be worn as a badge of distinction. Additional five-year periods of service are indicated by means of blue enameled stars and jewels. For instance, Mr. J. Henry Goebel, who has been with the company at its predecessors since 1882 and has the record for longest continuous service, received a badge decorated with one ruby and three blue stars.

It is the policy of the company to far as possible to assist the employees by contributing to their health and enjoyment. Rest rooms are provided for women and outings are given for men and women. The company maintains a number of tennis courts and also provides other facilities for sports, such as baseball, bowling, etc.

#### STATISTICAL DEPARTMENT

One of the most useful departments in the organization of the Commonwealth Edison Company, but one about which little is heard, is the statistical department. The president of the company has from thirteen to fifty men under him. He keeps all manner of statistical records. In preparing statistical statements relating to customers the Holcomb perforated-card system is employed and is found very useful. In this department data relating to output, load, unit costs, meter income and many other things are collected and evaluated. There is a work order system which issues work orders and keeps track in a general way of the cost.

#### STREET LIGHTING

The general street lighting of Chicago is supplied mainly by arc lamps and arc-sustaining lamps operated by the Sanitary District of Chicago under a contract arrangement with the city. Examples of the new fluorescent lighting may be seen at East Forty-third Street and Cottage Grove Avenue and of the new series-arc street lighting at East Forty-third Street and Lake Avenue. The Commonwealth Edison



son Company does a large amount of business in supplying and maintaining systems of private street lighting under contract with business men in various localities. The company furnishes and installs curb-lighting systems in compliance with the standards prescribed by the city. Usually there are clusters of four or five 60-watt tungsten lamps on an iron post, although in some installations single 250-

stalled in August, 1912, and have received no attention since except for cleaning.

#### ELECTRIC SIGNS

Chicago has a number of spectacular electric roof signs, but progress in this direction has not been particularly noteworthy. However, the number of electric signs on build-

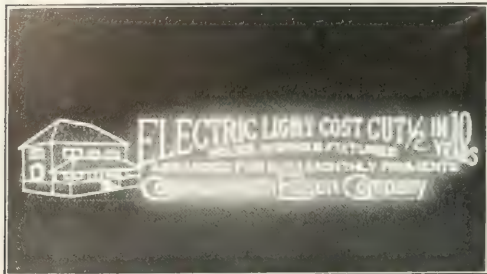


FIG. 11—SIGN ON HARRISON STREET STATION



FIG. 13—PRIVATE STREET LIGHTING IN NORTH AVENUE

watt lamps are used. For this service flat rates ranging from \$1.75 to \$2.37 per week per post are charged, the variation being due to the type of post used and to the hours of consumption. On April 1 last the company maintained 2571 private street lamp-posts.

The beautiful boulevard lighting on Michigan Boulevard from Lake Street to Twelfth Street, and recently extended on Jackson Boulevard, was installed by the South Park commissioners, energy being obtained from the Sanitary District. The new flame-arc lighting on Dearborn Street, utilizing street-railway posts, is the result of an arrangement made by a property owners' association with the city and the Sanitary District. An interesting example of park lighting is that in Lincoln Park and on North Side boulevards where small arc lamps are placed in opal balls mounted on graceful concrete lamp-posts. One of the most

ings or projecting over sidewalks is very large. The city ordinance allows electric signs to project from buildings as far as the curb line, but the Mayor has absolute authority in the matter of revoking electric-sign permits.

Not only is the company an advocate and an extensive advertiser of the advantages of electric vehicles, but it is itself one of the largest users of such vehicles in Chicago. Its fleet consists at present of seventy-one cars—trucks, delivery wagons and passenger vehicles—and these are used for all the varied purposes of the company. Edison men co-operate actively with the Chicago Section of the Electric Vehicle Association and with manufacturers, dealers and garage operators. The main garage of the company is at 211-213 Morgan Street. As typical modern commercial electric vehicle garages the Terminal Garage, at 4464 Evanston Avenue, and the Fashion Garage, at Fifty-first



FIG. 12—ROOF SIGN ADVERTISING ELECTRIC SERVICE



FIG. 14—ELECTRIC DISPLAY SIGN

interesting street-lighting installations in Chicago consists of the six quartz-tube lamps suspended by steel booms from buildings on West Randolph Street between North LaSalle Street and North Fifth Avenue. These powerful lamps are operated on 220-volt Edison circuits, each taking 726 watts, and are rated at 4800 cp each in the direction of the lamp's maximum efficiency as installed. They were in-

Street and Cottage Grove Avenue, are worthy of mention.

The large contract department of the company devotes itself not only to getting new business but to retaining old customers and co-operating and advising with them in relation to their electrical needs. The work is carefully systematized under the supervision of the general contract agent. The assistant to the general contract agent, the



engineer of the department, the special agent and the power engineer have charge of the various branches of the work. The department has specialists who advise owners of electric vehicles, storage batteries, factory installations and lighting equipments as to the economical uses of electrical energy, taking the customer's viewpoint. The department has several notable campaigns to its credit in introducing electric flatirons and other devices. Meetings are held monthly, at which the agents discuss various problems connected with the merchandising of electrical energy.

Under the terms of the contract with the city of Chicago which went into effect in 1908, and under which the company is still operating, the company agreed that its rates for electricity for lighting should be gradually reduced until the net primary rate should not be more than 12 cents, and

They begin at the regular rates and are lowered by quantity discounts. There are also wholesale rates for electricity supplied in large quantities under varying conditions ranging as low as 0.7 cent per kw-hr. for the secondary rate, or lower for the secondary rate under certain stipulations. Another schedule of rates relates to throw-over switch service where the customer desires to be in position to cut the company's service during the temporary break down or cessation of his own plant. In this case the customer is required to pay a minimum monthly charge based on the lamps or motors in service, regardless of the actual consumption of electricity.

Twelve years ago the Chicago Edison Company, predecessor of the Commonwealth Edison Company, made its first contract to supply electric energy to the city of Chicago.



FIG. 17—INTERIOR OF EDISON HOME, CHICAGO

the net secondary rate not more than 6 cents a kw-hr. However, the company has established the policy of making voluntary reductions when found practicable, and by a series of such reductions it was able to bring its net primary rate to 10 cents a kw-hr. on April 1, 1912, and its net secondary rate to 5 cents on Oct. 1 of the same year. These are the present maximum rates and may be styled the general lighting rates. They include free lamp renewals of standard carbon-filament lamps. In addition to these regular rates, but in no case in excess of them, there are schedules of rates for lighting, including flat rates for constant potential lamps, flame-arc lamps, tungsten incandescent lighting, sign lighting, private street lighting and series-arc lamps. The rates for motor service are measured rates exclusively

plus an additional, the first centimeter being added to the Chicago & North Lake Shore Electric Company. This service has been demonstrated to be found on practically economically sound, and at the present time is one of the energy requirements of all the electric and other railways of Chicago if supplied by the local electric company. By entering the present rate of the electric energy company is granted to make to make the company pay which, while very low, are sufficient to the producer.

The committee on the part of the Electric Home of the City Council of Chicago has been working on the possibility of reducing the present rate of the company at the end of the five-year period provided for in the contract ordinance with the city. The same is understood to be

reductions so that it may be of interest to note that the company has 12,000 customers whose monthly bills in 1912 averaged \$1 or less.

#### THE ADVERTISING DEPARTMENT

One of the characteristics of the company for many years



FIG. 16—MAGAZINE AND ADVERTISING LITERATURE

has been the liberal use it has made of printer's ink. Large appropriations for advertising were made early in Mr. Insull's administration when such a procedure was much less common than it is now. This policy has been followed consistently, with very good results, it is believed. New business is obtained largely by personal solicitation, but this is backed up by a continuous campaign of publicity. This publicity consists not only in newspaper advertising but also in booklets, circulars and a large amount of other printed matter which is issued from time to time. In addition the company advertises by means of electric signs, moving-picture films, signboards and various demonstrations and exhibits. Each month's lighting bills have a short announcement or advertisement.

The advertising and publication department has its headquarters in the building at 28 North Market Street, where an entire floor is devoted to it. The department is in charge of Mr. D. H. Howard, who has been at its head for the last twelve years and has brought it to its present high standard. The advertising committee of the company consists of Messrs. Gilchrist, Lloyd and Howard. It meets weekly with the representative of the agency placing the newspaper advertising and determines the nature of copy to be inserted in the newspapers the following week. The advertising copy is carefully prepared and is fresh, original and timely.

The company publishes a monthly magazine, *The Electric*, in its tenth year, and this is used as an educational feature for distribution among customers. These are distributed through the drug stores in Chicago without charge, and there is also a large mailing list.

The *Edison Round Table*, the official publication of the Commonwealth Edison Section of the National Electric Light Association, is also issued from this department. The activities and resources of the advertising department are extensive and varied. For instance, it has recently issued a large mail-order catalog in connection with the business of the Electric Shop. Another attractive booklet of recent date is entitled "Electricity in the Home."

At White City, at Sixty-third Street and South Park Avenue, one of the largest amusement parks in the city, the company leases a building for the purpose of exhibiting and demonstrating various electrical appliances, particularly such as are used in the household. The main portion of this building is equipped as a moving picture theater, wherein the company shows a number of comedy films illustrating in a practical way the convenience and desirability of cooking by electricity.

#### SOME OF THE USERS OF THE PRODUCT

In a city like Chicago the most diversified uses are made of the electrical energy sold by the central-station company. Department stores, office buildings, hotels, newspapers, theaters, garages, clubs, hospitals, grain elevators, foundries, ice plants, steel and iron fabricators, printing establishments, woodworking shops and miscellaneous factories are large users.

Nearly all of the large State Street department stores are

**ECONOMY  
CLEANLINESS  
CONVENIENCE  
SAFETY**

*Electric Light in the home is one of humanity's greatest benefits—a comfort you owe yourself and your family, if you do not already enjoy it.*

Commonwealth Edison Company  
120 West Adams Street

**It is easy to rent houses wired for Electric Light**

If you have property to rent, which is not equipped with electric light, you should install it. You should install the modern, necessary light for your tenants and a demonstrated, economical safety convenience plan from the Commonwealth Edison Company of Electric Light. This plan increases the value of your property and saves you time, energy and money in use.

**The "For Rent" sign comes down when Electric Light is installed**

Even if prospective tenants did not rent on Electric Light, you should install it. You should install the modern, necessary light for your tenants and a demonstrated, economical safety convenience plan from the Commonwealth Edison Company of Electric Light. This plan increases the value of your property and saves you time, energy and money in use.

Commonwealth Edison Company  
120 West Adams Street

**Does Your Power Increase As Your Business Grows?**

Mr. Store Owner, have you ever been asked for increased power? Do you want to get the best results from your lighting equipment? It is essential to use too much light, when a scientific distribution or concentration of lights will result in really better lighting. Whether you are now a user of our service or not, you can have the advantage of our Illuminating Engineering Department, absolutely free.

**Get More Effective Lighting at Present Cost—or Less**

If you are running some lights when you get them changed, the result will show it. If your lights are not hoisted properly, or if you don't have the right kind of light, you will know it. Just write today to the Illuminating Engineering Department. Say you want to confer with our Illuminating Engineering Department—you won't have to.

Commonwealth Edison Company  
120 West Adams Street

**Mr. Store Owner—**

You Can Have the Services of Our Illuminating Engineering Department Absolutely Free

Hundreds of stores are not getting the best results from their lighting equipment. It is essential to use too much light, when a scientific distribution or concentration of lights will result in really better lighting. Whether you are now a user of our service or not, you can have the advantage of our Illuminating Engineering Department, absolutely free.

**Get More Effective Lighting at Present Cost—or Less**

If you are running some lights when you get them changed, the result will show it. If your lights are not hoisted properly, or if you don't have the right kind of light, you will know it. Just write today to the Illuminating Engineering Department. Say you want to confer with our Illuminating Engineering Department—you won't have to.

Commonwealth Edison Company  
120 West Adams Street

FIG. 17—SAMPLES OF NEWSPAPER ADVERTISING

customers of the Commonwealth Edison Company, Marshall Field & Company alone having a connected load of 1200 kw for lighting and nearly 5000 hp for motors.

The list of office buildings on the company's circuits would be a long one if given. It includes the Railway Exchange Building with 530 kw in lamps, the Insurance Exchange, the Monadnock, Marquette, City Hall Square, Bell



Telephone, Harvester, Republic, Merchants' Loan & Trust and many other buildings.

Among hotels may be mentioned the Hotel Sherman, Palmer House, Metropole, Plaza, Briggs House and a number of others.

In the metal trades are some of the largest consumers. The Crane Company, manufacturers of pipes, valves and

Company, W. F. Hall Printing Company, A. C. McClurg & Company, Kenfield-Leach Company, and many others.

Theaters are among the large customers in many of the houses by electric light supplied by the Edison company. The Grand, McVicker's, Princess, Powers, Illinois and Colonial theaters are customers of the company, among others.

A large number of manufacturing establishments are sup-



FIG. 18—CLOTH CUTTING BY ELECTRICITY IN SHIRTWAIST FACTORY

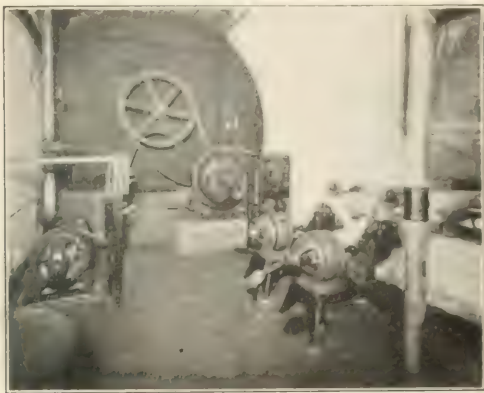


FIG. 20—VENTILATING AND LIGHTING EQUIPMENT IN MECHANICAL TEMPLE

fittings, requires no less than 7000 hp in motors; the I. Wolff Manufacturing Company, plumbers' supplies, takes about 1500 hp; Joseph T. Ryerson & Son, 1500 hp; Ajax Forge Company, 1200 hp; Union Drop Forge Company, 550 hp; Vierling Steel Works, 500, and so on. Among other consumers of this class are Foote Brothers' Gear & Machine Company, Griffin Wheel Company and the Seng Company (furniture hardware).

Ice-making plants constitute a desirable class of customers. The Consumers' Company takes 640 hp for its Lexington Avenue plant alone, and the Lincoln Ice Company requires 507 hp. There are a number of others.



FIG. 19—PUMPS IN BASEMENT OF MARSHALL FIELD STORE

Among newspapers operating by central-station energy are the *Tribune*, *Examiner*, *Journal*, *American* and *Evening Post*. The *Tribune* establishment requires 1200 hp in motors alone.

Some of the largest printing and publishing establishments in Chicago are electrically operated by central station energy, including Poole Brothers, R. R. Donnelly & Sons

plished with central-station energy. The H. P. Nelson Press Company takes 530 hp; the J. W. Landis Mill Company 275 hp, and Joseph E. Sturdy 100 hp. Among other customers of this general description are E. T. Filer, the Hafner Furniture Company, W. W. Knibb and A. G. Spalding & Brothers Manufacturing Company (baseball bats).

With the increasing use of the electric-vehicle public garages become correspondingly important as users of electricity. The Fashion, Terminal, Hyde and Grand garages have connected loads rating from 100 hp to 185 hp.

The Mueller & Young Grain Company has a connected load of 750 hp in its grain elevator, and the Pennsylvania



FIG. 21—VIEW IN ELECTRICALLY OPERATED GRAIN ELEVATOR

elevators, J. Rosenbaum Grain Company and W. G. Burns are other grain elevator customers.

A large number of manufacturing industries are connected with the company's circuits. Among them are engineering plants like that of the Industrial Engineering & Construction Company, silk manufacturers like the Oscar Heinemann Company, and Hugo Dieblich & Company, makers of bath-tubs.



# Unified Public Utilities in Central Illinois

**Interconnected system for supplying 125 communities from 700 miles of 33,000-volt transmission lines—Value of diversity factor**



AR-REACHING plans to replace ninety local generating plants by a handful of modern central stations and 700 miles of transmission lines are being carried out by the Central Illinois Public Service Company, which is preparing to serve the electrical and utility needs of a population of a quarter of a million in forty counties and more than 125 communities of the central, western and southern parts of the State, in addition to extensive and diversified power applications in the operation of coal mines, drainage plants, electric railways, water-works, ice factories, etc., scattered over the 350-mile radius of the company's activities.

## THE COMPANY'S RICH TERRITORY

The territory reached by the lines of this public-service corporation includes some of the richest counties in the central and southern sections of Illinois. Within a radius of 25 miles of two of its future central stations are practically all the mines of the two great coal fields of the State. In the broad valley of the Illinois River lie 250,000 fertile but submerged acres only waiting to be reclaimed as rich farm land by electric drainage pumping. Farm applications of electricity present another great prospective industrial load for the secondary ramifications of the company's system, which is sure to develop as fast as the practical uses of electrical energy in agriculture are brought to the realization of rural communities. And with progressive towns and cities demanding their quota of electricity for motors and lamps, rapid electric railways driven from the same buses linking these centers of population, electric operation of water-works and ice factories, etc., the possibilities of such a unified rural system mount to a magnitude comparing well with some of the largest urban undertakings.

Viewed in the light of a human benefaction, such syndicate operation has made available in small, remote communities electric service at any hour of the day or night which would otherwise be either altogether out of the question or feasible only at a rate far in excess of that which transmission makes possible.

But perhaps the most interesting aspect of the Central Illinois situation is the

diversity of demand with which the various loads occur, making possible high system load-factors and great operating economies. The coal miners of this district, for example, insist on quitting work at 4 p. m., and after that hour the great electrical installations in the mine plants are largely standing idle, thus leaving corresponding station capacity available for the town lighting loads which come on a little later.

Again, electrical energy for drainage pumping of the river bottoms is required chiefly during the spring months, a time when the coal mines are running at their minimum output if at all, so that here again there is a distinct annual diversity between these great power loads. By extending its policy of operating electrically driven raw-water ice factories in local communities where a market is offered for the frozen product the company further assures itself a source of summer load and income, to offset the seasonal decrease in kilowatt-hour production. Town water pumping is another long-hour application which has a distinct season load-factor in addition to the flexibility with which, by pumping into a standpipe, the load can be kept clear of the evening lighting peaks.

## DISTRICT-HEATING SERVICE

Even the district-heating service of the company contributes to this remarkable diversity of operation which, like Emerson's principle of compensation applied to human affairs, seems to be a veritable law of the central-station industry. In taking over the numerous small steam plants acquired during consolidation it has been the plan to continue in operation during the winter months those stations which furnish local heating service through the medium of either exhaust steam or hot water. A utility service is thus preserved which is both valuable to the community and profitable for the company, in addition to which the company makes available during its heavy winter demand the electrical generating capacity of these combination heating plants, securing their kilowatt-hour output at very low net expense. During the warm months these non-condensing heating plants are shut down, the local electrical service being furnished over transmission lines from the company's central and highly efficient turbine condensing stations.

The Central Illinois Public Service Company is a subsidiary of the Middle West Utilities Company and in the

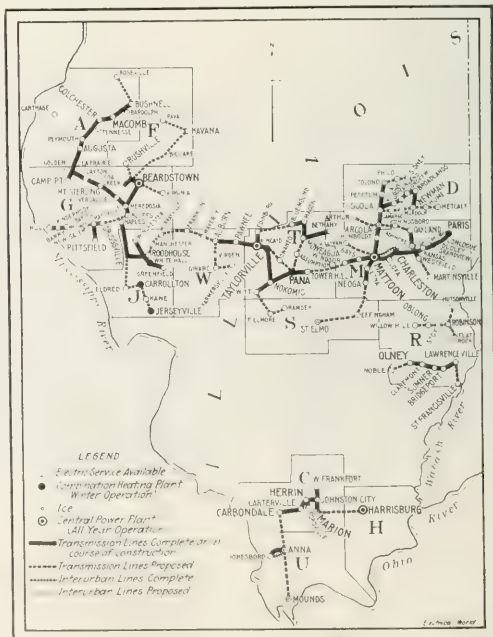


FIG. 1—CENTRAL ILLINOIS COMPANY SYSTEM

section of the State named supplies service in communities scattered over an extreme range of 350 miles. The general offices of the company are at Mattoon, Ill.

#### DIVISIONAL PLAN OF COMPANY ORGANIZATION

The great territorial distances encompassed in the company's operations have made necessary a plan of operating organization of its 1200 employees somewhat similar to the divisional scheme used in railway management. For convenience the territory reached by the lines is divided into districts, as shown on the accompanying map. These districts are designated by letter, usually the initial of the principal town, and each is in charge of a district superintendent who as a single individual represents and reports to the several engineering, operating, accounting and commercial departments at the company's headquarters.

Although the district superintendent is the executive authority in his district, he reports on matters of local operation to the general superintendent at Mattoon, on construction to the chief engineer, on subjects of accounting to the secretary-treasurer, and on matters of new-business getting to the commercial manager.

Detailed as his assistants and reporting to him, but under the control of their own department heads, the district superintendent has the help of his operating staff of plant engineers and local town superintendents, accountants and commercial salesmen. He directs their activities and is in general held responsible for the conduct and operation of his district, but these members of the staff remain under the control of their own departments and cannot be removed except by their own chiefs. In staff adjustments, of course, the recommendations of the district superintendents are carefully considered.

It is the aim to have the local superintendents identify themselves with their communities by displaying active interest in local affairs, at the same time receiving from the public recognition as the company's representatives in the fullest sense. While thus instilling confidence in the individual and stimulating him to his best efforts, this scheme of organization makes for the greatest unity in the local staff. Full co-operation between the local operating, accounting and commercial departments is assured because all three are represented in the single person of the district superintendent. On the other hand, the invaluable element of specialized knowledge and division of labor is supplied by detailing departmental experts to work under the supervision of the local executive.

With such a form of organization there is little likelihood of the varying attitudes too frequently assumed toward the customer by the sales, accounting and operating staffs respectively under "absentee-syndicate" operation. Instead the local manager fully realizes that the customer must not only be treated well at the outset but must receive good service and courtesy from all departments as long as his patronage is to continue. There can then be no quarrels between the various local departments unless the district superintendent chooses to take himself to task, for the entire responsibility of the operation of the district is placed in his hands.

As shown by the accompanying diagram the various main-office functions of auditor, electrical distribution engineer, right-of-way man, purchasing agent, stockkeeper, maintenance of way department, safety inspector, etc. are placed under the supervision of the secretary-treasurer, the general superintendent and the commercial manager, who, with the chief engineer, the statistician and the legal de-

partment, report to the president and vice-president. These officers in turn confer with the officials of the holding and associated companies with which the Central Illinois Public Service Company is closely related.

The principle of unified management of electric properties affords economy in many other respects besides its savings in operating costs. In maintenance outlays, for instance, the advantages of making purchases through an experienced centralized purchasing department result in substantial savings in the quantity buying and close attention to prices.

Requisitions for supplies among engineers and the local superintendents are prepared in a memorandum of request and forwarded to his district superintendent. This official in turn approves and forwards the requisition to the Mattoon office where it is referred to the chief of the department.

See above and p. 316. With the department head's signature it is sent to the purchasing agent, who makes the purchase. About seven days is the usual interval required for a requisition to traverse this route, and it is filled in the purchasing department.

Meanwhile it is scrutinized by the various authorities qualified to pass on the justification of the expenditure.

Thirty-two district offices formerly furnished electrical service in the territory now controlled by the line of the Central Illinois Public Service Company. By substituting substations the number of these generating plants has now been reduced to about twelve, including the central power houses and the heating plants, which later are operated only during the winter months to furnish local steam or hot-water heating service. At other times of the year these local non-operating plants will be shut down.

Electrical energy is then supplied to the eastern turbine condensing stations now in course of construction.

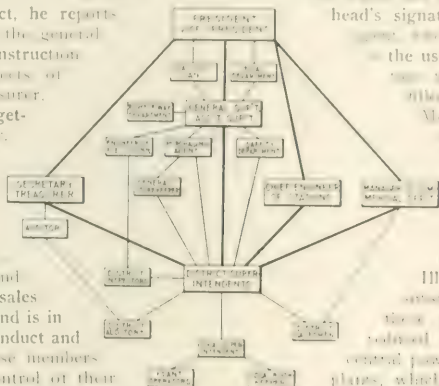
Among the individual generators installed by the Central Illinois company there was little or no uniformity in the character of service furnished. Some supplied direct current, and others offered a wide variety of single-phase, two-phase and three-phase alternating current at frequencies of 1, 3, 60 and 110 hz. The Central Illinois company, all being standardized to three-phase, 60-cycle alternating-current generation, with 22,000 volts as the maximum potential and 2,300 volts as the line-to-line operating pressure. Later 8000-volt circuits may be employed at branch lines from the 22,000-volt transmission lines.

See p. 316, March Electric Power, at bottom.

When the present plans are completed the generating situation of the company will consist of a turbine condensing plant located near the mouth of the Mississippi, centrally operated and known as Grand, the experimental 2000-kw steam-engine plant at Mattoon, a new turbine condensing station in central Illinois at Beardstown, and a three condensing steam-heating plant, now only during the winter months.

A glance at the map will show the symmetrical generating plant along the river with transmission trunk lines of the company's three principal generating stations at Grand, Beardstown and Mattoon. In the case of some of the local heating plants it will have to be proved in the future that the best method of operating the particular plant will be to shut it down at night and use the steam from these stations to all-year operation to supply the electrical demands, then close.

At Kewanee, Ill., a 1000-kw plant is the result of new water and a





almost the geometrical center of the great central Illinois coal field, there is now under construction for the company a modern 4000-kw turbine condensing station. The pit which will supply coal to this plant will be itself electrically operated with energy from the station buses. Electric coal-cutting machines will free the fuel from the carboniferous seams 400 ft. below ground, and electric hoists will raise the coal to the surface, where it will be discharged into transfer cars bound for the plant, a few thousand feet distant. While the chief fuel supply for the station will come from this mine coal may, of course, be taken from any of the large number of pits in the vicinity, several of which are being developed by interests associated with the electric company.

The initial equipment of the Kincaid station comprises one 2500-kw and one 1500-kw horizontal General Electric turbine-generator set. Steam for these units will be generated in a battery of one 500-hp and two 350-hp Babcock & Wilcox boilers. As shown by the sectional elevation of the station, coal brought in by standard-gage cars will be discharged into the 102-ft. x 25-ft. concrete storage pit, 16 ft. deep, or transferred by crane to the hoppers feeding to the automatic stokers. Ashes will be removed by narrow-gage cars on the basement level. The 10-ft. smoke breeching is carried on the roof outside the boiler room, contributing to the low temperature and comfort of this compartment. A 13-ft. concrete stack, 200 ft. high, will carry aloft the products of combustion.

#### AUXILIARY AND ELECTRICAL EQUIPMENT

Of the auxiliaries for the turbine equipment, the dry-vacuum pumps will be steam-turbine reciprocating machines, while the circulating pumps are to be of the motor-operated centrifugal type. The selection of surface condensers in this station will permit the re-use of the feed water, over and over again, contributing to improved boiler performance. The condenser for the 2500-kw unit has 7200 sq. ft. of surface; that for the 1500-kw set, 3200 sq. ft. Both are located at the basement level. A pair of 30-in. pipe lines provide for the condenser circulating supply and discharge.

Adjoining the 90-ft. by 56-ft. turbine room, and forming a part thereof, is the 24-ft. by 90-ft. switch house, which on two gallery levels contains the controlling switchboard, the 33,000-volt high-tension oil switches and lightning arresters and the line entries. In nine separate concrete cells, their floors depressed 12 ft. below the turbine-room floor, pro-

gaps will be installed on the second floor of the switch house. Control of the station equipment, oil switches, etc., is centered in a benchboard and group of vertical panels located at one end of the present switch house, but which will ultimately become the center of the plant as the station is enlarged. The Kincaid plant is expected to be in operation by Oct. 1 of the present year.

#### RECONSTRUCTION OF MATTOON STATION

In the plant at Mattoon a new Chuse engine driving a 500-kw Westinghouse 2300-volt, 60-cycle, three-phase alternator is now being installed, while a former 25-cycle Rice & Sargent engine set is being converted to 60-cycle operation with the addition of a General Electric alternator and a 25-ton flywheel. In the downtown district Mattoon has been supplied with direct current from a group of small machines in the station, while the residence districts have received 133-cycle lighting service.

The local plant also furnishes nearly 140,000 sq. ft. of hot-water radiation. Steam pumps circulate the water which is heated in surface condensers in the engine exhaust line. A back pressure of 5 lb. to 7 lb. per sq. in. is thus imposed during the heating season. The Mattoon plant, however, will afford an exception to the company's general policy of summer shut-down of its combination heating plants. Partly on account of the summer use of hot-water service in the town, it is the intention to run this non-condensing plant all the year round as one of the principal generating stations of the system.

A 300-kw rotary converter in the plant furnishes 600-volt energy for the local street railway and for the Mattoon-Charleston interurban line. A 500-hp automatic-stoker Babcock & Wilcox boiler has also been newly installed, supplementing the existing equipment of two 300-hp Babcock & Wilcox boilers, one 300-hp Stirling and one 425-hp Altman-Taylor boiler.

#### WINTER OPERATION OF COMBINATION HEATING PLANTS

Among the heating plants which will be continued in commission but will be shut down each year during the five months from May 31 to Oct. 1 are the 1200-kw engine and turbine plant at Taylorville, 800 kw in engines and turbines at Paris, 500 kw in engines at Charlestown, 700 kw at Macomb, 500 kw in turbines and engines at Tuscola, 500 kw in engines at Bushnell, and the engine plants at White Hall, Jerseyville and Carrollton.

In preparing these plants for interconnected operation

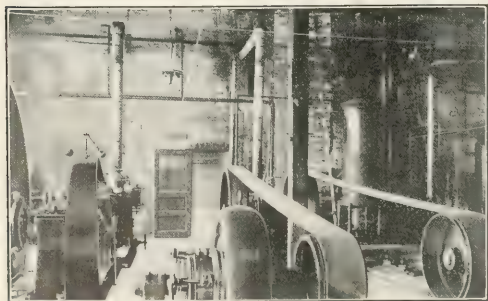


FIG. 2—INTERIOR OF TUSCOLA STATION, TYPICAL OF PLANTS REPLACED

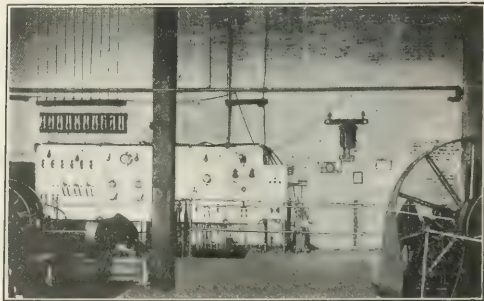


FIG. 3—SWITCHBOARD IN TUSCOLA PLANT, TYPICAL OF OLD EQUIPMENT REPLACED

vision is made for isolating three 1000-kva banks of single-phase transformers which will step up from the generator voltage to the line potential, 33,000 volts. With the arrangement shown, the 30-ton crane which spans the turbine-room floor becomes available for handling the heavy transformers as well as the prime-mover apparatus.

Aluminum-cell lightning arresters with indoor-type horn-

with the rest of the system it has been necessary to replace in many cases existing station equipment with 60-cycle, three-phase alternating-current apparatus. In many cases however, only night service was formerly given, and as the lamps which made up the chief load operate equally well, of course, on the new service, the burden of apparatus exchanges has not been heavy.







approximately 13 ft. above the ground level, is an 11-ft. by 6-ft. platform for supporting three single-phase, self-cooling transformers of any rating up to 50 kva.

At the top of the structure, 26 ft. above the ground, are mounted the horn gaps for protection against surges and the choke coils in the entry lines leading to the 33,000-volt transformers. Inserted in the lines are very light fuses designed to be blown at a low ampere.

As first erected the transformer equipment in these outdoor substations has been exposed to the weather, but the upper sections are later to be inclosed by corrugated sheeting.

An 8 ft. by 8-ft. reinforced concrete slab with foundations extending 4 ft. 6 in. into the ground forms the base of the steel structure, whose corner angles are bolted to plating legs previously embedded by template in the concrete of the foundation. The top of the base is 18 in. or more above the ground and forms the floor of the inclosed switch house, which in some of these substations occupies the space between the four tower legs. Room is here provided for the switch panels and oil switches controlling the local distribution service, besides affording a place to install a constant current regulating transformer if required for the town street-lighting service.

For primary distribution 2300-volt, three-phase circuits have been adopted as standard. For single-phase secondaries the 110-220-volt, three-wire arrangement is employed, with all secondaries thoroughly grounded at the transformers.

#### DRAINAGE PUMPING AS A CENTRAL STATION LOAD

In the valleys of the Illinois and Mississippi Rivers there is an area of 250,000 acres of rich and valuable farm land which on account of its depression below the normal water levels of the streams during part or all of the year must be drained by pumping. Of the total available area 148,000 acres have already been reclaimed by the installation of pumping plants, most of which have heretofore been steam-

per year at a (estimated) average of about 100 in. of water (10 ft.). The total amount of water to be carried off during the twelve months is equivalent to 10 in. of rainfall, and this is the basis for the 100 in. of water (10 ft.) figure.

In the drainage of the many Illinois River valleys water distributed in fairly long periods, but the maximum demand of the pumping plant usually occurs during the winter



FIG. 8—TRAN-MISSISSIPPI RIVER PARALLEL TO RIVER—DRAINAGE TOWERS ALONG LINE

total consumption would run about 580,000 kw-hr. at average charge per unit.

From 60 to 75 per cent of the total year's pumping is now ordinarily required to be done during the three months from March 15 to June 15, while over the rest of the year there is about as evenly distributed the remaining 25 to 30 per cent of the consumption. From this it will be seen that the drainage load offers a most desirable load-factor, both with respect to the determining load of current for lighting after March 15 and also on account of the reduced consumption of the coal mines during the spring months. This valuable element of continuity between the pumping and mining loads thus enables practically the same station and system equipment to be devoted to first the one and then the other application, reducing investment costs and raising the system load-factor.

Most of the drainage systems in the Illinois River valleys are connected to the nearest transmission line, so that to install the pumping equipment and to maintain its operation. If, by the Illinois Drainage Act, 25 per cent of the same means to be given drainage districts desired the installation of such a pumping plant, the remaining 75 per cent may be assumed for their present load, more or less.

More than 3000 miles of artificial drains are already in service, many more, in fact, than of the plentiful natural streams of the Illinois River valley. The same is true, indeed, of the lower part of the valley to its mouth, the water being collected by a pattern of parallel drains and tiled drains. From the submerged load which is generated from the river by the lower and higher.

#### SAVING POWER COSTS BY ELECTRIC PUMPING

Comparison of the drainage of the lower Mississippi valley with that of the upper valley shows that the latter has smaller installations of constant speed pumping machinery, because the first uses of water is in the lower valley. On the

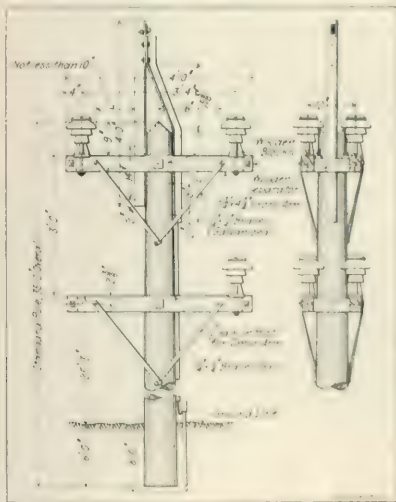


FIG. 7—DOUBLE-ARM TWO-CIRCUIT ELECTRIC DISTRIBUTION

driven. In the electrification of these drainage valleys a start has already been made, however, by putting 6000 acres under electrified operation at the present time, while 20,000 acres additional are now contracted for to be drained by electric pumping as soon as the equipment can be installed.

Tests have shown the average consumption of such motor-driven drainage plants to be about 23 kw-hr. per acre



count of the high operating efficiency of the electric equipment, even in the smaller sizes, it is also practicable to divide the station pumping apparatus into three units, improving the flexibility of operation and more accurately adjusting the pump capacity to the amount of work to be done during minimum periods.

Electric pumping plants occupy hardly half the space re-

sibilities of management and superintendence, at the same time guaranteeing them dependable drainage service at a fixed cost over a number of years. Motor-driven pumping stations can be advantageously located at the best topographical position, without regard to conditions of accessibility for fuel supply, etc.

The average initial cost of installing a system of electric



FIG. 9—STANDARD DOUBLE-CIRCUIT 33,000-VOLT LINE

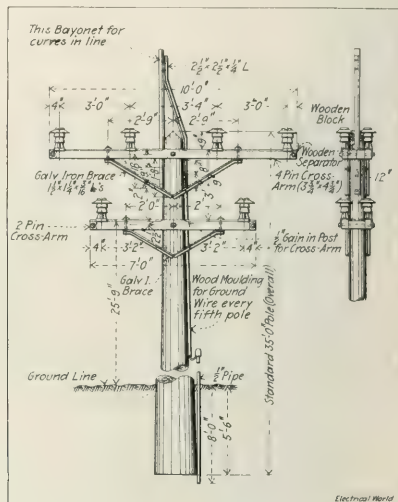


FIG. 11—STANDARD DOUBLE-CIRCUIT CONSTRUCTION

quired by steam stations. They may be started without delay and operated without the presence of an attendant or skilled engineer. Additional motor equipment can be added on short notice if the drainage needs of the district require

it. Furthermore, the electric pumping station is subject to small depreciation and need for repairs, and besides lubricating oil no supplies or fuel have to be delivered to or stored at the plant. Fire risks are, of course, reduced by the elimination of furnaces and boilers. High pump efficiencies are also attained by reason of the higher motor and pump speeds available with electric drive.

Steam pumping plants often require as many as seven attendants when operated twenty-four hours a day, while one man can perform all necessary work about the largest electric drainage station.

During the minimum pumping seasons the control of the pumps can be made entirely automatic by means of float-operated switches. From the owners of the pumping station central-station drive removes all the cares and respon-

drainage is \$2.22 to \$2.41 per acre served, which is to be compared with \$3.71 per acre for steam pumping plants. Items of labor and supplies in an electric plant will not exceed 16 per cent of the total cost of operation. Since the total cost of pumping in well-designed steam plants is \$1.25 per acre per year, it can be shown that, besides all the other advantages of electric pumping, such an electric pumping plant will save money by buying energy at 4 cents or less per kw-hr. The Central Illinois company furnishes pumping service on a sliding energy scale with the quantity steps based on the acreage.

Within 25 miles of the Central

Illinois Public Service Company's future generating stations at Kincaid and South Herrin are located practically all of the principal mines of Illinois' two great coal fields, one in the central section and the other at the southern extremity of the State. Besides the 200 mines now being operated within the 25-mile radius referred to, a number of new pits are being opened up.

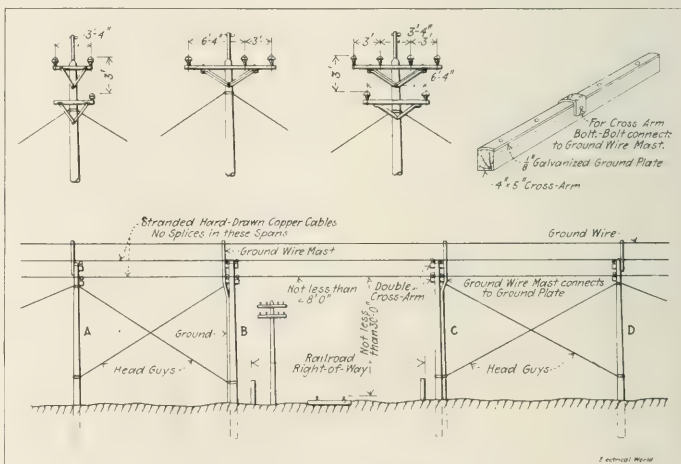


FIG. 10—STRAIGHT-LINE RAILWAY CROSSING

Six of these mines are now being equipped for electric operation, the initial block of power thus contracted for aggregating 5500 hp. Records of electrified operation of mines in these fields have shown that about 1.6 kw-hr. are required for each ton of coal mined under such conditions.

on throughout the twenty-four hours. The fortunate timeliness of this interruption to the mining load renders available, of course, an equivalent rating of generating plant equipment to serve the evening lighting peak which follows shortly thereafter. In this way the mining load becomes

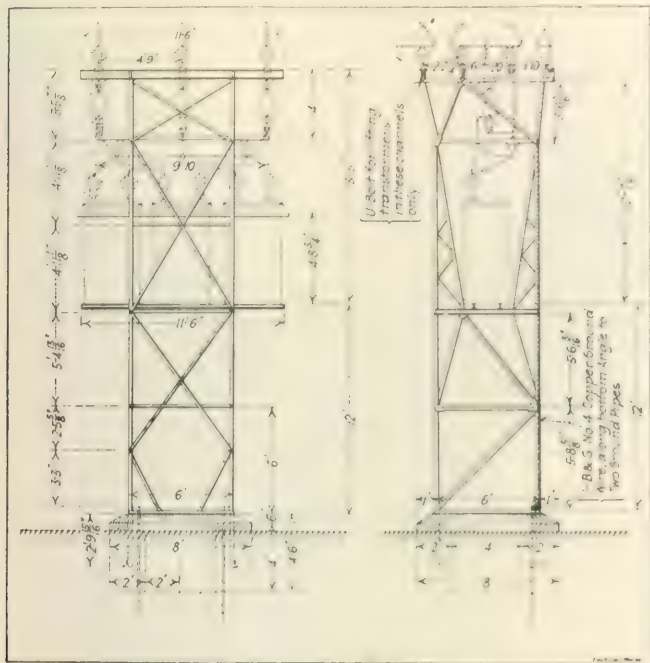


FIG. 12—STEEL SUPPORT AND FOUNDATION FOR OUTDOOR TRANSFORMERS



FIG. 44.—SILVER TOWHEE FEEDS OFF THE GROUND. (J. A. S. STODOLSKY.)

Since in the Illinois fields alone some 50,000,000 tons are produced each year, the reader will be able to form some estimate of the possible future demand for electricity.

The average Illinois mine runs eight hours per day dur-

a good factor in contributing to the diversity of the system.

One large mine in the central Illinois field has contracted to purchase 1500 kw of energy from the transmission company. In this mine substation there is being installed a

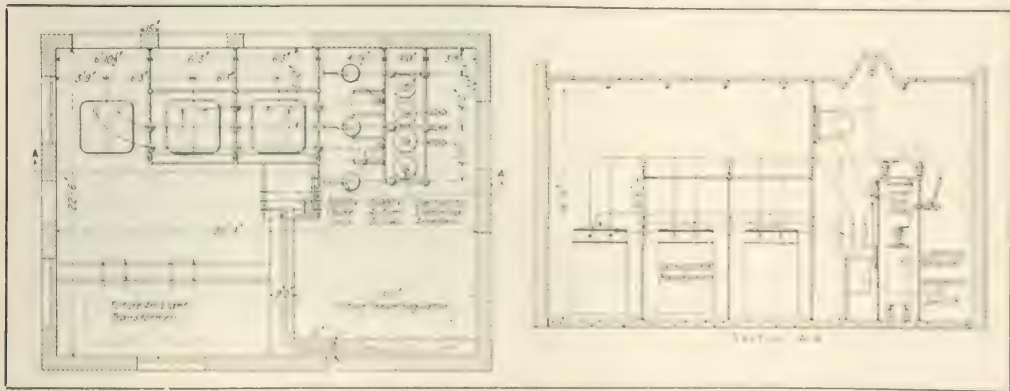


FIG. 15—STANDARD DESIGN FOR SITUATION 2 (continued)

ing 200 to 225 days of the year. Beginning their work at 7:30 a. m., the miners "knock off" about 4 p. m., with the consequence that all mine-conveying machinery is thereafter shut down except various idle loads averaging perhaps 40 kw per mine. This reduced demand then continues

1000-kw underground storage of steam being sent to the boiler parts will allow the sale of most of the steam being. The steam itself will also give off some energy to heat the rest of the system, but in the event of emergency, electricity to the power supply and cooling.

idle, it will operate for an hour and a quarter before coming to rest. The hoisting equipment will have a production of nearly 1000 tons of coal per hour during the working day.

Besides the work of hoisting, electricity is used in the mines of this field for operating coal-cutting machines, haulage locomotives, pumps, etc., and for lighting.

To promote the industrial growth of the communities



FIG. 15—DRAINAGE PUMPING STATION AT HAVANA, ILL.

which it serves, the Central Illinois Public Service Company has established an industrial bureau which keeps in touch with the needs of manufacturers desiring to locate factories in its general vicinity. With the co-operation of local civic organizations, the advantages of the various towns supplied with central-station energy from the unified system are pointed out, and the "prospect" is encouraged to build in one of these communities.

To act as director of its industrial bureau, the company plans to secure the services of a man of ability and diplomatic approach, who will be able to meet manufacturers and men of affairs on a common footing, present his arguments with conviction and effect, and "swing" the contemplated factory location for a home town. In accomplishing such valuable promotion work, the management feels that it will be acquiring valuable prospects for its own lines, as well as contributing to the prosperity and welfare of its friends and fellow-citizens.

Up to the present time the company has done little direct advertising of its service, since its lines are new in most of the communities reached and it has yet to complete much of its generating and distribution arrangements before being in a position to promote local campaigns for new business. It has, however, begun using advertising matter on the backs of its monthly statements, encouraging the use of electrical devices, irons, fans, etc. In most of its local offices it also maintains window displays and showroom exhibits of appliances, etc. Moving-picture films loaned by the large electrical manufacturers have also been used with effect to advertise the conveniences and comforts of electricity in the household. Every little community lighted by the company's service has its moving-picture theater, and this method of reaching the local citizenship with films and slides has proved to be one of the best methods of publicity under such conditions.

#### COMMERCIAL SALES WORK AND INSTRUCTION

As already mentioned in the account of company organization, the manager of the commercial department at Mattoon details members of his staff to aid local district superintendents. Although these local salesmen become part of the district-office staff and report to the district executive, they still remain under the control of the sales manager. In his office at headquarters the latter has spe-

cialists in the subjects of motor applications, lighting, ice-making, heating, gas service, coal mining, drainage, pumping, etc., whose services are available to aid local salesmen in handling situations calling for special knowledge.

The company's sales staff is recruited from various sources, only experienced men, however, being employed. The principle of civil service advancement obtains throughout the company's organization, the plan being to reward wherever possible continued faithful service with promotion at the first opportunity.

The Central Illinois Public Service Company is one of a number of properties interested in the Central Station Institute recently organized in Chicago with Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, as president. The purpose of this institute is the training of men for central-station sales work by both classroom instruction and field work. Its course is of eleven months' duration, so divided that one month is devoted to each branch of the subject. Students can thus enter on the first of any month, completing the curriculum eleven months later. Following are the general subjects treated: Salesmanship; rates for service; electricity in residences, theaters and on the farm; electric motor-drive and factory lighting; electric signs and decorative lighting; lamps; construction; electricity for stores; accounting and metering; generation and distribution; isolated plants. Class instruction occupies half of each day, the rest of the time being given over to practical experience in outside work in charge of department specialists. The tuition fees are \$50 for each of the two terms of the complete course, but the companies to which the students are assigned pay these men a fair rate of compensation for their services during the period of practical field instruction.

While as yet no graduates of the recently organized Central Station Institute have become available, the Central Illinois Public Service Company and the central-station organizations interested in the Institute's work are counting on getting much valuable recruit material from this source.

#### AN APPLIANCE EXHIBIT ON WHEELS

The properties of the Central Illinois company will probably be the first to make use of the traveling central-station

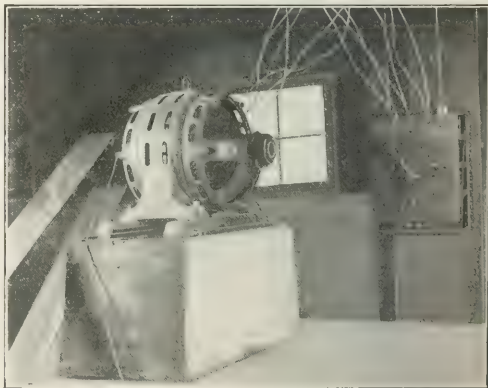


FIG. 16—75-HP MOTOR BELT-CONNECTED TO PUMP IN LACY DRAINAGE DISTRICT

exhibit carried in a special railroad car which has just been constructed for the Middle West Utilities Company, of which the Central Illinois company is a subsidiary. In its exterior design this exhibit car somewhat resembles a standard baggage coach although its interior is made attractive with a complete exhibit of electric lamps, fans, appliances, heating and cooking devices, etc., for demonstrat-



ing the convenience of central station service. Its width, 9 ft., permits moving-picture shows to be given in connection with lectures at the towns where the car is displayed. One end of the interior is fitted up as a business office. Connection to operate the electrical devices will, of course, be taken from the lines of the local company where the car is on exhibit. The car is without motors and will be attached to regular railroad trains for moving it from one community to another.

#### HOUSE WIRING AND SALE OF APPLIANCE

Wherever possible the business of selling electrical supplies and wiring houses is left in the hands of the local dealers and contractors, although if good service is not forthcoming from these sources the company will itself prepare to do the work for its customers in accordance with a fixed schedule of unit costs. With the aid of this tabulation

#### UNIT SCHEDULE OF HOUSE-WIRING COSTS

Main switch and outlet	1.00
Drop cord with sockets and fan	1.00
Flush switches	1.00
Hanging fixtures, each	1.00
Porch outlet cord with fan	1.00
Three-way switch and switch	1.00
Snap switch	1.00
Center outlets in one-story house	1.00
Center outlets in two-story house	1.00
Basement wiring, one lamp and switch	1.00
Basement, additional lamp and switch	1.00
Switch openings	1.00

a price can be quickly set for any job so that the customer may know in advance what the cost of the work will be. The contractors are also encouraged to make use of the same unit schedule, rendering the cost of house wiring uniform throughout the system, whether done by the company or local contractors.

Care is taken, however, to preserve all possible cordial relations with the local electrical trade, and this trade receives every advantage in promoting its business of selling fixtures, supplies, etc., and wiring buildings. The company does not aim to sell fixtures itself, although it will furnish them for the convenience of its patrons if for some reason satisfaction cannot be obtained through the local dealer.

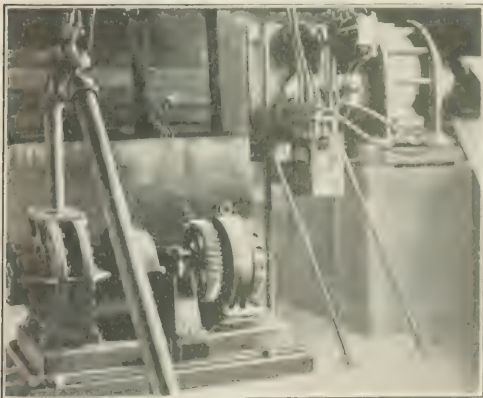


FIG. 17—5-HP PRIMING-PUMP MOTOR AND 7.5-HP DRAIN-PUMP MOTOR

In many of the towns served by the Central Electric system there is no electrical inspection. In these places the company maintains its own inspection service, which must approve all construction as fulfilling the requirements of safety before connection will be made from the central-station lines. This inspection service is a part of the work of the line-construction department.

In the Central Electric territory, no customers' electric irons have been sold in the past, and the company is now to handle the sale by order only for the time being. A number of electric ranges have, however, been sold, although the company offers no special rate for cooking service because its standard price is 7 cents net per kw-hr., which becomes available when the 4th day of each month is the



FIG. 18—USE OF ELECTRICAL ENERGY IN STANDARD RATE PLANT

maximum. Standard 6-lb. electric irons are offered for sale at \$3 to encourage the household to do its building up the day load.

#### RATE FOR STANDARD SERVICE

Wherever possible the company is introducing a standard rate for electric lighting service, although the use of these rates is at present confined to the attention in towns at the time the local plant was taken over. The maximum-demand principle is employed in fixing this standard lighting rate in which the customer is charged 44¢ per kw-aggust per month for all energy consumed up to three hours' use of the maximum demand, which the standard element is 8 lamps (1600 w.) per kw-hr. That 44¢ figure does not, however, include a 10¢ per kw-hr. discount of 10¢ per kw-hr. if the monthly bill is settled within ten days of ending of the statement.

Long-term contracts are included in this standard rate, which covers energy only. The customer being required to buy his own lamps. The company offers business a discount of 10¢ per kw-hr. for all lighting and general service, but does not offer a discount.

#### ANALYSIS OF THE SERVICE PROVIDED BY THE SMALL TOWNS

In some of the smaller communities now covered by the twenty-four-hour service of the central system the former local plants have continued their night lighting service. With the inauguration of other services, including business hours, have been necessary to the community's convenience. When this is not possible in the longer lighting hours for the lamps and the difficulty of obtaining at some times in dark rooms and in dark days, the proper method of the company is to be applied in the introduction of electric ranges and cooking appliances. The business portion of the company also supplies its units of standard for the standard service, giving energy to some businesses and to some blacksmiths' shops, laundry, grocery stores, etc., and pumps, refrigerating plants, etc., and so on, in three various cases, maintaining the standard. When connections are made, all other work is done, then the payment.

Financially, the company and the Central Electric system has its standard service, which is the same as the

by 25 hp to 40 hp in motors, such elevators make desirable long-hour day loads for the central station, although their demand comes principally during the winter and spring months.

Town water pumping is another class of business desirable on account of its long-hour characteristics. Where standpipes or other forms of reservoirs are employed the pumping load can be shut down altogether during the peak period. A number of these town-pumping plants are now in operation from the lines of the company, the schedule of charges followed for this service being the regular "power" rate. In eleven communities which it supplies the company itself owns the water-works plants. Electric pumping for railroad water tanks is another application of energy from the countryside network which is being developed by the transmission company.

#### MANUFACTURE OF RAW-WATER ICE

Among the local properties taken over were a dozen or more combination ice plants. The largest of these, that at Mounds in the extreme southern part of the State, is steam-driven and has a daily capacity of 200 tons of ice, most of which is shipped to surrounding towns by railroad. A small electric plant is operated in connection with this ice factory, which will probably be continued on its present basis.

Most of the company's combination ice-electric plants are, however, very much smaller, averaging only 10 tons to 15 tons daily capacity, which is usually ample for the supply of their local communities. These plants it is proposed to shut down in most cases, replacing the steam-driven equipment with motor-operated ammonia compressors manufacturing ice from raw water with the aid of an air-agitation system. The demand for ice occurs at a time of year, of course, when the consumption of electricity is reduced to its minimum, so that ice-making affords a profitable seasonable load for the interconnected system. Here again, it is seen, the element of the diversity-factor is on the side of the central station so that a minimum of equipment will be required to operate the summer ice-making load. The decision to use the raw-water system of ice manufacture—although dictated by the lack of distilled water due to the shutting down of local steam plants—is based on the successful experience in Chicago, where several hundred tons



FIG. 19—TYPICAL COAL-MINE INSTALLATION

of ice is being produced daily by electric power, at an expenditure of 45 kw-hr. to 60 kw-hr. per ton of ice manufactured.

At the present time the Central Illinois company has combination ice plants at Paris, Tolono, Arcola, Charleston, St. Elmo, Macomb, Virden, Carbondale, Marion, Harrisburg and Anna.

#### WORK OF THE SAFETY BUREAU

The Middle West Utilities Company, of which the Central Illinois Public Service Company is the principal subsidiary, maintains at its Chicago headquarters a bureau of safety. In conjunction with the co-operative fire and liability insurance fund contributed to by the several subsidiary companies at the rate at which they formerly pur-

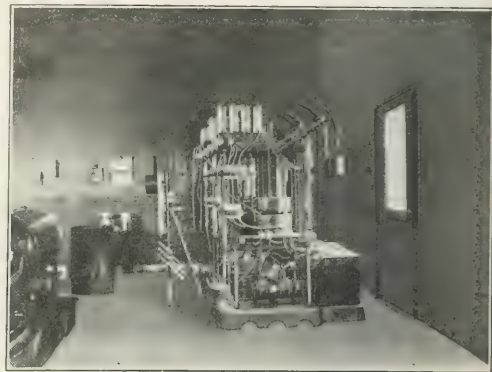


FIG. 20—MERCURY-ARC RECTIFIER EQUIPMENT FOR PARIS STREET LIGHTING

chased outside insurance, it is the purpose of this safety bureau to improve safety conditions throughout the properties and to minimize losses due to fires and to personal accidents sustained either by employees of the company or by others.

Bulletins are sent out at intervals discussing fire hazards and fire protection, methods of prevention, precautions to be taken, use of fire-fighting appliances, etc. Monthly reports are required of local men, detailing on a blank which imposes more than a hundred questions the exact conditions prevailing about the properties which have any bearing on safety. In filling out such a report the operator is thus required to make an extremely complete survey of his property, in this way reminding himself automatically of conditions to be remedied.

An experienced traveling inspector is also employed to investigate local plant conditions and to recommend improvements. In addition the Central Illinois Public Service Company has detailed a man at its Mattoon headquarters in special charge of the safety bureau work in the company's system. At the meetings of district superintendents held at intervals of one to three months addresses are given on the subject of safety and accident prevention. Similar talks are presented from time to time before the local meetings of the district men, who are usually called together once a month.

Among the subjects in which marked improvement has already been accomplished since the bureau's work was started on Jan. 20 of this year are the provision of proper fire hose and extinguishers and pails of sand and water, the elimination of greasy rags from hazardous positions, correction of faulty wiring and improper conditions behind switchboards, screening of transformers and high-tension apparatus, greater cleanliness, etc.

Mr. Marshall E. Sampsell is president of the Central Illinois Public Service Company, and Mr. F. S. Peabody, president of the Peabody Coal Company, is vice-president. Mr. R. B. Donnelly is secretary-treasurer, Mr. G. W. Hamilton is general superintendent, Mr. A. J. Authenrieth is chief engineer, and Mr. J. Paul Clayton is manager of the contract department. Messrs. Sargent & Lundy, Chicago, have acted as consulting engineers for the company in its construction work on plants and lines.



# The World's Largest Water-Power Plant

**Inauguration of first half of 300,000-hp development of the Mississippi River Power Company at Keokuk—110,000-volt transmission to St. Louis**



DEVELOPING 150,000 hp from the Mississippi at Keokuk, Ia., where the mighty river's flow exceeds by 50 per cent the water passing over Niagara—the initial section of the world's largest water-power plant is now practically completed, and by July 1 it will be transmitting 110,000-volt, 25 cycle energy to St. Louis 144 miles away. To utilize the normal 32-ft. head of the old Des Moines Rapids, now flooded by the new

dam, fifteen waterwheel units rated at 10,000 hp each compose the present installation, although the massive concrete substructure for the second 150,000-hp section is in place awaiting the extension of the plant to its full capacity, 300,000 hp.

Besides the huge power house, 900 ft. long and 133 ft. wide, and the great dam which, 50 ft. high, stretches for a distance of nearly a mile between the Illinois and Iowa shores, the present great project has included for the benefit of river navigation the creation of a lake 65 sq. miles in area, in place of the former tedious rapids and canal, a navigation lock 400 ft. by 110 ft. with a 40-ft. lift—as wide and high as those at Panama; a dry dock 150 ft. by 403 ft., and a river-crossing bridge 30 ft. wide, carried on the piers of the dam structure.

No mere description can give an adequate conception of the magnificent magnitude involved in the work at Keokuk. Although there are other water-power plants whose future extensions will bring them within the range of its horsepower capacity, these are chiefly high-head installations whose physical scale can hardly be compared with the huge hydraulic structures necessary to wrest 300,000 hp from

the 32-ft. fall available in the Des Moines Rapids. The Keokuk dam, power house, lock and dry dock in 1912 constituted one huge monolith of concrete extending more than 2 miles from tip to tip.

But the Keokuk development is so far interesting in its numerous features of hydraulic and electrical construction than for its great size. This matter of mere magnitude, indeed, has introduced many fresh detail difficulties within the main design problems confronting the engineers. The scale of the development and the relatively low potential of the water-power available have resulted in some interesting departures.

## FEATURES OF THE DEVELOPMENT

From the standpoint of American practice this is the first large plant to employ two-speed generating direct-connected to single-runner turbines. The spiral turbine chambers are also unique in being cast directly in the monolithic concrete of the substructure, without the usual steel linings employed elsewhere. The method of turbine setting was necessarily unusual to withstand the tremendous weights which have to be supported, not only from the hydraulic reaction weights of the water, but also from the generator itself.

Again, such, for instance, is the scale of labor which such an energy is required by the main units that it is found desirable to generate this energy in distributing circuit by auxiliary windup waterwheel units. In such form it can then be distributed to the various individual motor-driven exciter generators ranged along the 200-ft. power-house gallery, each receiving its own prime unit. The main alternators are then regulated by adjusting the field of these individual exciters, in



FIG. 1—GENERAL VIEW OF MISSISSIPPI RIVER POWER COMPANY'S DEVELOPMENT—KEOKUK, IA.





are submerged 4 ft. below the low-water level. The tower is 8 ft. wide at the top and 16 ft. across at the base.

Incidental to the raising of the water level of the river above the dam, it has been necessary to relocate on a higher grade a number of miles of the Chicago, Burlington & Quincy Railroad track which skirts the Iowa bluff. A sea wall 110 ft. long has also been built, varying in height from 45 ft. to 73 ft., to serve as a retaining wall for the newly graded track.

Retaining walls, lock, power-house substructure and dam are all tied together as a single monolith of concrete whose length, 10,560 ft., or 2 miles, measured from end to end, is believed to make it the longest monolith of its kind.

For the entire construction at the Keokuk development site, including the dam, power house and navigation works, about 650,000 cu. yd. of concrete was required, including 650,000 barrels of cement and 300,000 cu. yd. of cement.

Parallel to the lock there is being constructed the large dry-dock on both sides. This will be devoted to the government. It will contain two masonry cranes by which the location at the dam site makes possible, of course, the filling and emptying of the dock without pumping.

As the result of the building of the Keokuk dam and associated structures, and entirely exclusive of the valuable



FIG. 4.—INTERIOR OF KEOKUK DAM

and dry-dock property, it is estimated that the government will in future save the annual \$40,000 outlay required to operate the old Des Moines River canal, now to be used over by the constructed lock. The improved means of navigation of the Keokuk enterprise has been estimated to cost \$11,000,000 at present estimates at this point.

#### General Structure of Upper House

The monolithic concrete substructure for the entire thirty-unit power house, 758 ft. long and 115 ft. wide, is now practically completed although not the monolithic concrete superstructure for the initial fifteen-unit installation was erected in this case. The structure is 25 ft. high, measured to the generator-room floor, while the superstructure adds but 11 additional, taken from basement floor to roof. For the subsequent installation construction was started in taking the surface of the limestone bed of the Mississippi.

From the bottom on the Iowa side the water comes



FIG. 5.—TURBINE, UPPER HOUSE OF KEOKUK DAM

through the rock and gate structure at the 240-foot section at the center. From entering there branch pipes take the water through various openings each section of 11 ft. 2 in. apart in section. There are branch lines running out a corner passage which delivers water to the scroll chamber at the side and rear of the turbine setting. The turbine is self-contained in its

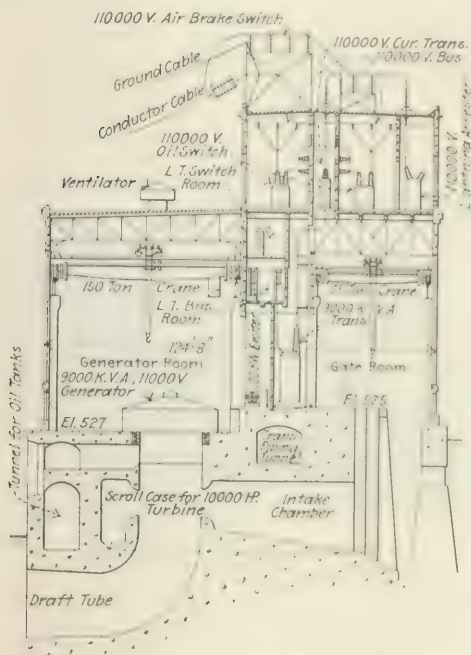


FIG. 5.—CROSS SECTION OF KEOKUK POWER STATION

The standard mixtures employed ranged from 1:3:5 to 1:3:6, the richer being used in special locations.

#### NAVIGATION LOCK AND DRYDOCK

In connection with its power-development work proper, the Mississippi River Power Company has constructed and will deed to the United States government free of all cost a 400-ft. lock, 110 ft. wide and having an extreme lift of 40 ft. The upper gates, which are in duplicate, are of the hollow floating type, operated by compressed air. The lower inner gate has twin leaves each 50 ft. by 67 ft. and weighing 300 tons. An entirely separate small water-power plant will also be installed to furnish energy for operating the lock.

Since the Keokuk dam will impound deep water for a distance of 65 miles up the stream, river steamboats will save two hours over the time formerly required to run at reduced speed through the old Des Moines canal with its three locks, and thence on through the shallow channels of the upper river.



the guide vanes, and supplies the front section of the wheel. By the design of the scroll chamber, 39 ft. in diameter, and molded to follow the mathematical curvature required, the water is impinged upon the turbine blades from all sides with equal force and velocity.

The draft tubes leave the bucket wheels as circular discharge openings having a diameter of 18 ft., but rapidly en-

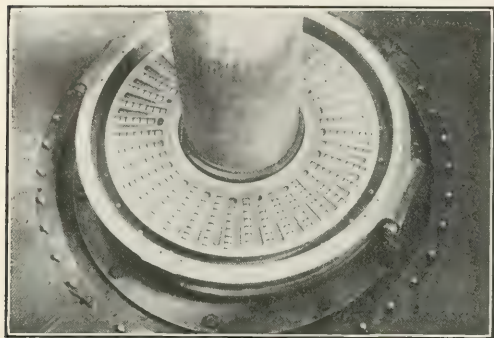


FIG. 8—ROLLER BEARING FOR MAIN TURBINE UNIT

large in section as the tubes assume a horizontal direction to empty into the tailrace. At the final point of discharge the velocity is but 4 ft. per second, or less than 3 miles per hour, assuring quiet entry into the tail-pool. At the top of the draft tube, in the constricted cross-section, however, the water is required to move with a speed of 14 ft. per second, or 9 miles per hour. The tailrace openings from the draft tubes measure 22 ft. 8 in. by 40 ft. 2 in., being made up in section by two semicircles joined by straight lines at top and bottom. The lower edge of these openings, as well as the bottom of the tailrace, is 25 ft. below the bed of the river. The tailrace is excavated to this depth for a distance of half a mile down stream.

#### THE 10,000-HP TURBINES

Each of the main 10,000-hp waterwheel units consists of a single 15-ft. runner equipped with balanced guide vanes controlled, through exposed operating mechanism, by a governor on the main generator-room floor. Eight

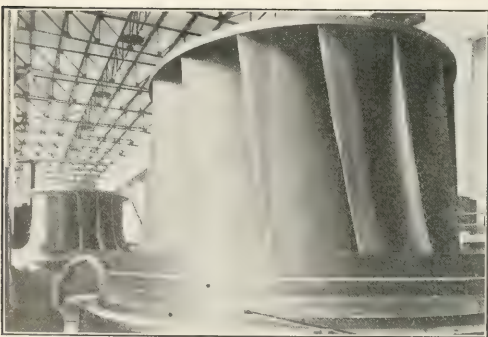


FIG. 9—RUNNERS FOR 10,000-HP WATERWHEELS

of the main turbine sets were built by the I. P. Morris Company, Philadelphia, Pa., the other seven, as well as the pair of auxiliary exciter wheels, having been constructed by the Wellman-Seaver-Morgan Company, Cleveland, Ohio.

The main turbine shafts are 25 in. in diameter and 21 ft. long. With the rotary alternator field in place, the

total revolving weight to be carried is 225 tons. This is carried by a thrust bearing and by two main-shaft bearings. On the first twelve machines the Standard combination roller and oil-pressure bearing employed utilizes oil at 225-lb. pressure, which normally keeps the 225-ton load lifted off the rollers. In case of failure of the oil pressure, of course, the load is transferred to the roller bearings. Oil is supplied by gravity to the upper bearings, being there drained to the reservoir under the lower bearings, from which it is pumped to central-supply tanks. Kingsbury thrust bearings are to be used for the remaining three machines. This new type of bearing requires oil circulation at only atmospheric pressure and introduces a low degree of friction.

The pivoted turbine gates are steel castings with hollow-forged stems which have bronze bearings in the crown and curb plates above and below the gates. Grease lubrication is employed, the lower bearings of the gate stems being fed through holes bored the length of the shanks.

Each main runner carries twenty buckets and weighs 65 tons, while the complete turbines weigh approximately 1,000,000 lb., or 500 tons. The runners made by one manufacturer were cast and delivered in a single piece, while those of the other were built in quarters and assembled at the power house. The latter method necessitated, however, the addition of a steel-cover plate and steel-band

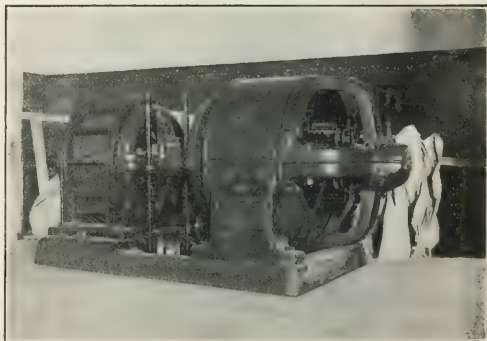


FIG. 10—INDIVIDUAL MOTOR-GENERATOR EXCITER SET

rings, increasing each of these runners' weight by 25 tons.

Conditions of high and low water will cause varying operating heads on the Keokuk plant, ranging from 39 ft. maximum to 20 ft. minimum. For the average nominal head obtained, 32 ft., the turbines are rated at 10,000 hp. At 39 ft., however, each unit will develop 14,000 hp, and at 20 ft. 6000 hp. This low-head condition was a factor in the selection of a turbine speed of 57.7 r.p.m., probably the lowest ever employed in installations of this class. At times of low head it becomes of the greatest importance, of course, to get all possible rating out of the machines at 57.7 r.p.m.

Tests of models of these waterwheel designs, made at the Holyoke flume, have indicated efficiencies of 88 per cent and higher, showing a marked gain over the ordinary efficiency figures obtained for similar units, which range from 75 to 80 per cent. By adopting a double-runner design the speed of the shafts might have been increased to the advantage of the electrical equipment, but as such construction would have rendered the controlling mechanism much less accessible for inspection and repairs, the single runner type was adhered to.

#### GOVERNING MECHANISM FOR 10,000-HP UNITS

Of equal interest with the great turbines are the governors which effect their speed control at varying loads. These notable governing devices were built by the Lombard





features which would require no special provision in the ordinary plant become, as here, real problems when considerable distances are involved. Thus the use of alternating current for distributing even the excitation energy results in a considerable saving in investment and operation over the direct-current distribution ordinarily employed.

The exciter motor-generator sets can also be driven with 440-volt, 25-cycle energy taken from the main 11,000-volt bus through transformers provided for the purpose, thus

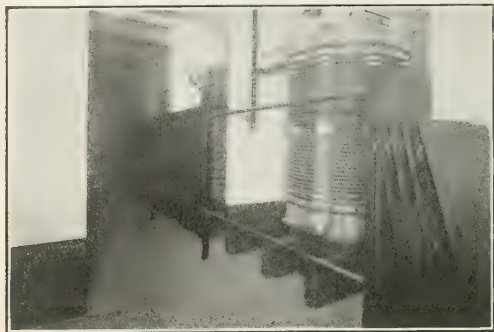


FIG. 14—REACTANCE COILS BETWEEN 11,000-VOLT BUS SECTIONS

giving an alternative source of excitation energy, besides the special auxiliary alternators. In case of emergency, connection can also be established with one of the duplicate 320-amp-hr. storage batteries used for operating the oil switches. Parallel operation of all the Tirrill regulators controlling the exciter fields of the various main alternators is accomplished with the aid of series transformers inserted in the machine leads, so that exchange currents between units are automatically compensated for.

#### 9000-KVA HIGH-TENSION TRANSFORMERS

In the gatehouse section of the building in a separate concrete cell opposite each main alternator is grouped its corresponding 9000-kva, three-phase transformer unit, stepping up from the generator pressure, 11,000 volts, to the transmission potential, 110,000 volts. These trans-

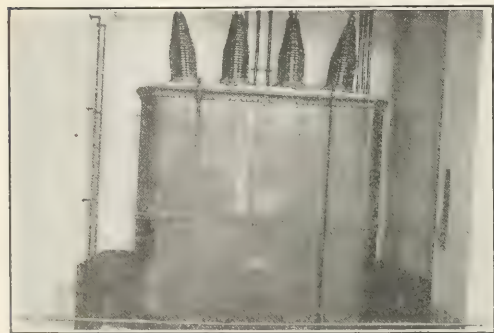


FIG. 15—ONE OF THE 9000-KVA, 110,000-VOLT TRANSFORMERS

formers have star-connected high-tension secondaries, four insulated terminals being brought out, with the neutral lead grounded.

Their huge boiler-steel cases measure 16 ft. by 8 ft. in plan and were shipped to Keokuk in two sections, to be riveted together on the job. The transformers measure over all nearly 25 ft. from the floor to the top of the compound-filled porcelain-and-fiber bushings. The units are

mounted on rollers and can be run out from their cells under the traveling cranes of the gatehouse for removal or dismantling in case repairs are necessary. Each of these transformers, complete with core and oil, weighs 123 tons.

The efficiency rating of these 9000-kw transformers is 98.5 per cent, although on account of their great size the dissipation of the remaining 1.5 per cent as heat requires 56 gal. of cooling water per minute.

Pipe connections to the bottom of the transformer cases permit filling or emptying the tanks while in position. The 4-in. supply line for admitting oil is controlled by a gate valve whose hand-wheel is inclosed in a glass-covered box in the generator room. Similarly, the quick-opening valve in the 6-in. discharge line is also extended through the wall to a hand-lever which can be easily reached in emergency, for dumping the \$2,500 oil contents of the transformer into the tailrace if made necessary by fire peril.

There are duplicate pipe systems of circulating water for cooling the transformers, the valves and visible discharge nozzles of each unit being mounted on the generator-room side of the wall opposite its cell and under the direct supervision of the generator-room operators.

While each alternator is closely grouped with its 9000-kva transformer, both in its position and its operation, connection of the two, as the accompanying diagram shows, is actually established through means of the duplicate

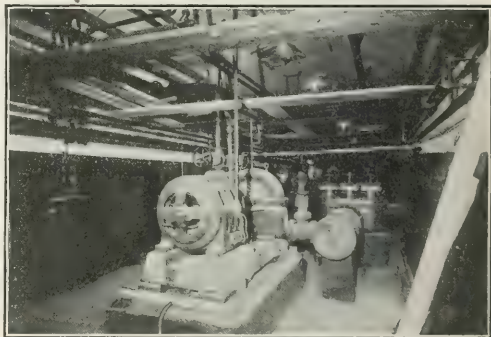


FIG. 16—1000-GAL. PER-MINUTE PUMP FOR TRANSFORMER COOLING WATER

11,000-volt buses, to which General Electric H-6 motor-operated oil switches connect both generators and transformers. Four generators and four transformers constitute a section, one such section feeding each of the two St. Louis circuits. Another unit is to be ordinarily devoted to the local Keokuk service, and the remaining six will serve the Fort Madison and Burlington circuits, which are operated at the generator pressure, 11,000 volts.

#### REACTANCES AND PROTECTIVE FEATURES

The 11,000-volt bus is in duplicate, the "long bus" extending solidly through the station while the short bus is broken up into sections each of which groups together three or four generators and transformers. These sections are tied to one another by automatic oil switches and reactances which limit the flow of current from one section to another in case of a fault. The reactances, it will be especially noted, are not inserted in the generator leads but are located in the tie links between bus sections or groups of four generators. The reactor units are constructed of 1-in. copper cable wound on wooden forms and are adjustable for a reactance of 4, 6 and 8 per cent at 9000 kva.

Owing to the slow-speed design of the main alternator, it has been possible to include considerable reactance in the windings of the large machines themselves so that on



short-circuit these units will deliver only from three to five times their normal full-load output. The transformers are also wound for 5.7 per cent reactance.

While it is evident that the individual units are thus well protected against the occurrence of heavy discharges in case of short-circuit, the sheer size of the whole plant is such, however, that the total short-circuit output of a number of these machines might cause tremendous damage.

It is here that the busbar reactors prove of service. Through them the total current input into a dead short-circuit on the low-tension bus is limited to a maximum of from thirty to forty times the full-load current of one generator unit, depending upon the per cent reactance used on the busbar reactors. The total current is independent of whether the station consists of the present fifteen or the ultimate thirty units; that is, only half of the units in the ultimate station will be affected by a dead short-circuit on the low-tension bus. The total short-circuit current, it will be noted, is equal to that given out at instant of short-circuit by only two turbo-generators, each equal in rating to those at Keokuk.

In case of a dead short-circuit on one of the high-tension lines close to the power station not more than two sections on each side of the one short-circuited will be affected. This result is attributable to the intervention of the transformer reactance in series with the reactance of the busbar reactors. The total current input into a short-circuit,

coolly and to last advantage, but never permitted to prevent indiscriminate "killing" of the line needlessly for slight troubles, with the consequent annoyance to customers, shutting down of synchronous apparatus, etc. As long as the tie switch remains closed, however, the reactance not only limits the cross-flow of current between sections but also assists in holding up the voltage on the other sections from which current is being taken.

The reactance of the different reactance bus bar supports

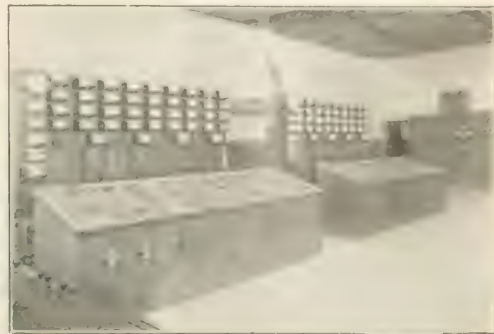


FIG. 16—Concrete substructure for the utility building.



FIG. 17—HIGH TENSION SHAFT CONNECTING BUS STRUCTURE AND TRANSFORMER COMPARTMENTS.

whether high-tension or low-tension, due to the high generator reactance is practically the same whether taken at the instant of short circuit or after considerable time delay.

Thus it is immaterial as far as concerns the interrupting capacity of the oil switches whether they open short-circuits instantaneously or after some delay. Instead, however, of utilizing this feature as an excuse for delaying opening of short-circuits, it was decided to make use of the long time required to overheat any apparatus to the danger point by using non-automatic switches in the short-line between a high-tension circuit and its source of supply. To this end the only automatic switch in the station are the outgoing low-tension line switches and the high-tension bus-sectionalizing switches.

The bus-sectionalizing switches are opened by prearranged time limit relays operated by the current in the transformers connected to an outgoing line, so that in a case of line trouble the section affected will be automatically isolated. Operation with non-automatic switches is extended as far as possible over the transmission system as it is hoped thereby to eliminate a source of trouble and failure.

The settings of bus-sectionalizing switches are rather high in order to deter the opening of the circuit under the possibility remains of clearing up the trouble itself. This feature not only gives the operator time to think and act

tioned that the line voltage on a section adjacent to the one short-circuited will always be higher than a certain amount of normal voltage. By parallel operation of its generators, therefore, there is means without special disturbance to adjacent sections a stability in operation and a flexibility which reduce to a minimum the application of equipment required to maintain reliable service.

An additional automatic feature intended to secure the quickest possible clearing of such troubles is wiring grounds or cross-arms to ground circuit in the Circuit Breaker so arranged that the opening of the oil switch will increase reactance into the generator circuit, so that the voltage on the ground bus will be less than the one will go out from lack of potential to contact it. By this means it is hoped to clear a certain class of troubles without even interrupting the operation of synchronous apparatus and



FIG. 18—Concrete substructure for the utility building.

lines, thus economy in the use of the line and the oil switch is maintained.

As a result of the careful study of the requirements in respect to the use of the line and the oil switch, it was decided to use a certain class of troubles without delay in case he discovers imminent trouble, dupli-



cate emergency cut-out switches are provided at each machine station, one being on the main generator floor and the other at the side of the exciter gallery. By breaking the glass cover the attendant can reach and close the remote-control switch within, which instantly both removes the machine from the bus and disconnects its field supply, thus totally isolating the unit.

#### 11,000-VOLT BUSES AND OIL SWITCHES

The 11,000-volt bus compartments are on the second story, the General Electric H-6 oil switches being mounted on the floor above. Concrete-slab construction has been used in these bus structures, the 1.1 mile of compartments thus far erected having required 3200 of the molded slabs. For the buses copper of rectangular section, 3.5 in. by 0.375 in., has been employed, being mounted on Thomas porcelain pedestal insulators of special local design. Series and potential transformers for the instruments are similarly inclosed in concrete-slab barriers.

The 11,000-volt oil switches are of the motor-operated type and are rated at 300, 500 and 2000 amp. Directly below the oil switches are the corresponding disconnect

switches each made up of seven 10-in. disks. For branches and leads to the oil switches 1.25-in. pipe is used. For pipe connections special union couplings are employed sweated to insure good contact. In the case of the vertical risers in the shafts the high-tension pipe is supported on seven-part pedestal insulators mounted on the side walls.

High-tension disconnect switches with 4-ft. blades enable the oil switches to be isolated from the transformers. The hook stick with which these disconnect switches are handled is provided with a ground ring just above the operator's handle. This ring is attached to a cable and clip which must be affixed to a nearby ground connection each time the stick is used.

The "long" high-tension bus has a tie switch for interconnecting the two 110,000-volt sections, while the "short" bus is in each case limited to the four-unit sections.

All of the high-tension oil switches are of the General Electric K-15 solenoid-operated non-automatic type. The switch tanks measure 3 ft. by 6 ft. by 6 ft. and, complete, the switches weigh 4 tons each.

For convenience in operation the plan of distinctly labeling all apparatus, followed throughout the whole plant, is



FIG. 20—110,000-VOLT ARRESTER GAPS AND AIR-BRAKE SWITCHES, KEOKUK PLANT

switches. These disconnectors are arranged with special locking devices holding their blades securely, in either the closed or the open position, against accidental or automatic movement.

Not only are all the oil switches themselves clearly labeled, but the three phases are also lettered. And on the barriers between the separate switches broad red lines have been run, marking distinctly the respective switch-cell groups so that by no mistake can a wrong trio be accidentally chosen. It is also of interest to note that the extreme length of the busbars in the Keokuk plant has made necessary special provision to take care of the expansion and contraction which occur with changes in temperature.

Sand pails and Pyrene holders are provided throughout the bus structures, and every precaution is taken against fire.

#### 110,000-VOLT STRUCTURE

From the high-tension terminals of the 9000-kva transformers on the first floor of the gatehouse the 110,000-volt leads are carried up through spacious concrete air shafts to the high-tension switches which connect to one or the other of the duplicate 110,000-volt buses. Two-inch galvanized-iron pipe coated with bronze paint forms the main high-tension buses, which are supported on suspension in-

also carried out here, the various transformers, tie and line oil switches being all marked. A float gage shows the oil level in each switch tank, and pipe connections with quick-operating valves permit the contents to be replenished or discharged in case of fire. All oil piping in the building is painted a gray color, and the inlet and discharge lines are labeled in large letters.

Inserted directly in series with the main outgoing 110,000-volt line circuit are the current transformers, whose secondaries are led to armatures in the switchboard room, reading directly the amperes per phase for each high-tension line.

#### HIGH-TENSION ROOF STRUCTURE

The vertical porcelain roof bushings through which the high-tension circuits leave the switch room measure 12 ft. in length and several feet in diameter. Pairs of 300,000-circ.-mil helical choke coils, mounted on the roof structure, are inserted in each phase wire at a point just below the tops to the lightning arresters.

For wholly disconnecting the transmission lines from all the high-tension apparatus of the building pivoted air-break switches are mounted on the roof structure. These Pacific Electric switches have centrally pivoted arms 12 ft. in length, ending in vertical horn-gap members which aid

in interrupting the charging current when the line is opened. The actual carrying contacts in the closed position of the switch are spring clips which engage stationary members.

The three switches of each circuit are manipulated by a single crank lever worked from the roof. After the switch members have been opened, ground connections are applied to the line wires by raising grounded switch arms. In this way complete discharge and "killing" of the line is assured when the switches are opened.

A marine type weatherproof telephone station and a 500-watt tungsten lighting standard are adjuncts to the high-tension roof equipment, for the convenience of the men operating this apparatus.

From the span wires and air-break switches a straight path is provided back to the lightning-arrester horn-gaps, the main busbar connections being tapped off at right

ground and 5.5 ft. between phases have been used in the aluminum line construction.

#### CONTROL OF THE LINE

As already mentioned, the operating control of the station is centered in the switch room in the north end of the fourth floor, a position which will give maximum control with the extension of the plant to its maximum capacity. There are separate benchboards for the remote control manipulation of the two southbound circuit groups and each of the machine groups (for excitation) and local circuits. All the instruments are mounted on these benchboards and the question of reading them is by pilot lamps. Control buttons for the switches are interlocked against accidental misconnections. The generator control circuits are also brought to these operating positions for paralleling and similar operations.

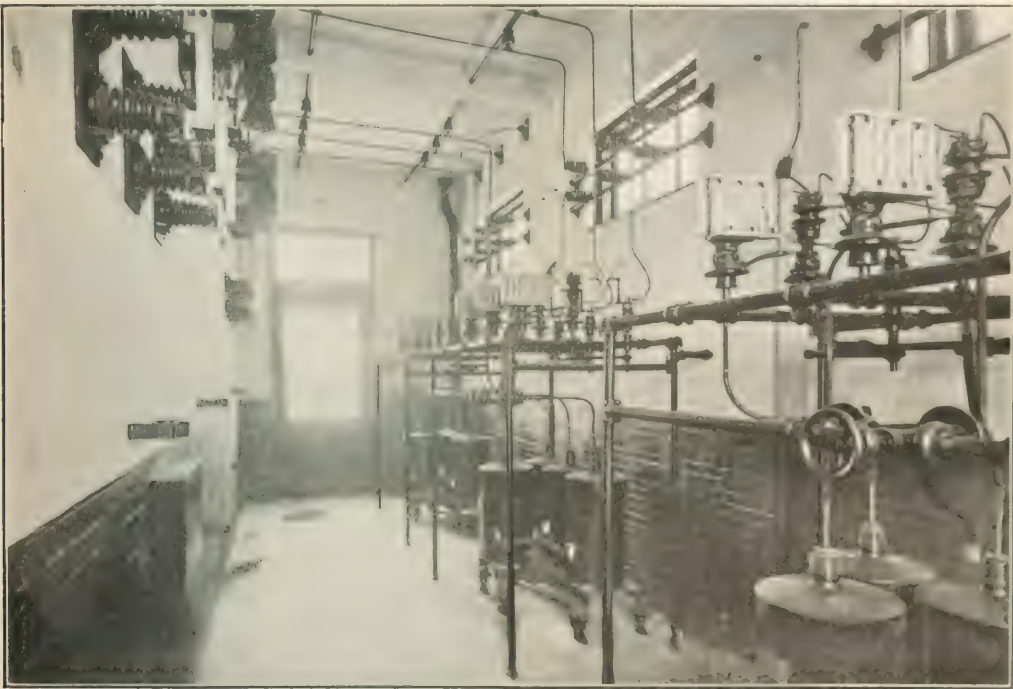


FIG. 21. INTERIOR OF CAMLTON ARRESTER OFFICE FOR STATION NO. 1

angles. The arrester gaps are of the double horn type with charging resistors connected between the upper and lower sets of horns. The cross-connecting device for charging the arresters can be manipulated by lever handles both on the roof and in the fourth-story compartment where the electrolytic cells are installed. There are four of these huge General Electric aluminum-cell arresters in each set, three being connected in star to the phase wires and the fourth forming a ground connection to the neutral point which is thus established. In all approximately 500 aluminum cones are contained in each one of these phase-volt arrester cells.

Throughout the high-tension installation a safety factor of three to one has been maintained both mechanically and electrically. The roof bushings and suspension insulators, for example, are capable of withstanding 330,000 volts even under wet test. Minimum clearances of 3.5 ft. to

While the switchroom is shut off and men have been removed from the fourth floor, the switchboard apparatus can be removed or rearranged from the floor by descending a long flight of stairs to the inspection gallery. This gallery is suitable for visual observation of construction both during, etc., in addition to the complete and efficient control system installed between the switchroom and operating floor.

The principle of tying the three phase synchronous motors together, the motor arrangement having been described, is applied to the handling system provided for the Keokuk plant. The system in this plant has been designed for a variety of purposes, at Peoria, Ill., they had already it had been designed for the construction. Any motion of the motor affects a corresponding movement of the disk, and so on. The system is designed to control only a movement for its motion. The final potentials in the generator system will be connected with the generator.

pedestals, bringing both under the hand of the floor attendant.

On receiving a signal, the attendant will reply, confirming the indication, over an entirely separate circuit, in this way insuring that the order is correctly received and understood. Later a time-recording element is to be added, giving a graphic record of the signals and the times of



FIG. 22—INSULATORS, 3000-FT. RIVER SPAN AT KEOKUK

starting and stopping the various units. The first position of the signal device is also to be arranged so that when "start" is shown a whistle will be blown calling the floor operator's attention, while at the same time a lamp will be lighted indicating the number of the unit that is to be started up.

In addition to these operating signals, nearly a hundred telephone instruments are scattered throughout the building, so that communication can be had with all important positions in the power house.

On panelboards at the rear of the operating benches are the usual banks, indicating instruments, ammeters, wattmeters, voltmeters, synchroscopes, etc. A duplicate bus diagram of the station connections is provided for the load dispatcher, who has a semicircular board at what will be the center of the completed room. A telephone switchboard on his desk enables him to communicate with any part of the system.

For operating the oil switches there are provided duplicate Exide 320-amp-hr. storage batteries, with E-9 plates in E-15 jars. These batteries, with their duplicate motor-driven charging sets, are located on the fourth floor adjoining the switchroom, which contains the battery switchboard.

#### STATION LIGHTING AND AUXILIARIES

Special attention has been devoted to the illumination of the Keokuk power-house structure. Tungsten lamps are used throughout, and the station-lighting circuits are equipped with automatic induction regulators which maintain uniform voltage on the lamps.

In the generator room an intensity of 3.5 ft.-candles is provided at the floor level by 114 500-watt tungsten lamps in Holophane-D'Olier shades. In each of the thirty-eight 24-ft. bays there are three of these units, one at the center of the ceiling and two suspended on ornamental side brackets. Similar illumination is provided in the gate

house and in the apparatus compartments on the first and other floors.

The switchroom is furnished with diffused illumination by a skylight which forms the whole ceiling. At night the natural lighting is replaced by tungsten lamps behind these skylight panels, affording the same diffused quality of illumination.

At all points throughout the station where hand-lamp extensions are likely to prove useful for examining machinery push-type plug-in outlets have been liberally provided.

Emergency lighting of the building in case of plant shut-down is provided for by automatic switches which, upon failure of the bus pressure or over-voltage, connect batteries to selected circuits which feed about one-third of the lamps in the building. These lamps are so distributed that light will be available all throughout the structure. In this way the emergency lamps can be operated for an hour or more while carried by the storage batteries. Separate switchboards controlling the station lighting and power circuits are located on the generator-room gallery.

More than 1500 three-pane window sashes, which make up the movable sections of the 120 power-house windows, are motor-operated through Lupton window gear. From central control points all the windows in the structure can then be closed quickly on the sudden approach of a rain-storm, a feature which is of importance in the case of a great building like the Keokuk power plant, housing equipment that might be damaged by a wetting.

For handling the huge parts of the waterwheel and generator equipment two 150-ton Alliance traveling cranes serve the generator room from overhead runways which extend the length of the building. There are also passenger and freight elevators for reaching the upper floors on which the electrical equipment is located.

Imported red Welsh quarry tile, set on a cement founda-

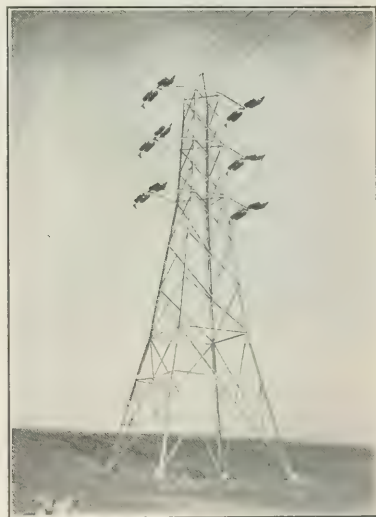


FIG. 23—ANCHOR TOWER WITH STRAND INSULATORS

tion, is used for the station flooring. The interior walls are tinted a light cream color, with olive-green base strips. The steel trusses supporting the roof have a similar green color, presenting an attractive trimmed appearance. Outside, the concrete walls of the building have been coated a pure white by treating the whole exterior with a wash of Lafarge cement, sand and water. Architecturally the lines



of the power house structure are simple and attractive, and the picture presented by the whole development is one of considerable beauty.

Modern locker rooms and toilet facilities are provided for employees at a number of points throughout the station.

## 110,000 VOLT TRANSMISSION LINE TO SOUTHERN STATES

From Keokuk to St. Louis, a distance of 144 miles, extends the main 14,000-volt transmission line, consisting of twin circuits carried in parallel vertical planes on a single set of towers. The conductors are 300,000 circ. mil in cross-section, by far the heaviest ever used for transmission construction. Each cable consists of thirteen strands of hard-drawn copper, the diameter of the whole being 6.25 in. The ultimate strength of this cable is 145,000 lb., giving a wide safety factor even under such extreme conditions as a half-inch ice coating in a 60-mile wind at 0 deg. Fahr. Under such conditions a loading of not over 7,000 lb. is estimated for the 800 ft. standard span employed on the line. The corona point for these 300,000-circ. mil conductors is 145,000 volts, which is nearly 35 per cent above the operating potential.

The steel towers for the St. Louis line are of the R. C. Conley type and on straight sections measure 70 ft. in height and 20 ft. by 20 ft. at the base. Each tower weighs 3,4 tons. The cables are carried on suspension insulators, each cable being in a vertical plane on its side of the tower. These suspension insulators, manufactured by the Ohio Brass Company, are each made up of seven porcelain disks, the "strings" measuring over all nearly 4 ft. in length. They have been subjected to dry tests of 40,000 volts and wet tests of 330,000 volts. The standard towers used with the freely suspended type of construction on tangent stretches are designed to support the weight and side strain of all conductors under the most extreme weather conditions, in addition to the unbalanced pull which may be exerted by two broken conductors.

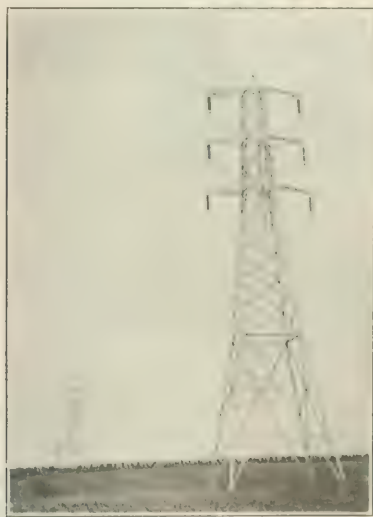


Fig. 24. LINE POWER: WATT (POWER SUPPLY: 1500 WATT)

Each leg of these towers is built to a concrete base, a concrete foundation weighing 2 tons. These foundations extend 6 ft. below ground. In the marshes and lowlands, which the line traverses, the mudlines are carried up to the level of the high water mark. The towers were raised into position with the aid of an A-frame, an ingenious huge sucker being attached to the top of the

note. The sample could have been fitted out at the one end, the transposition directly in by means of pins at the corners, e.g. 28 mm. or covered by the dynamometer (figure).

At resonance, instead of the stiffening provided by the shell at large, constant, transverse displacements, there are, instead, large transverse displacements of a heavier construction than the shell, provided, are sufficient.

Title: *2,2'-bis(4-chlorophenyl)propane* (Dichloropropane) (100%)

anchor towers are 74 ft. high and have bases 24 ft. by 24 ft. Each tower weighs approximately 3 tons and is set on four concrete foundation legs extending 5 ft. below ground and each leg weighing 7½ tons. The foundation legs are set so that, when the towers are disassembled, they can be

In addition to the two types mentioned, there are two types of wire used in the construction of the towers. A ground wire of 0.5-in. galvanized steel is used. This wire is carried on the poles of the structures. The ground wire has an ultimate strength of 17,000 lb. Although the line has several insulator connections, the insulator connections will not exceed 5500 lb.

On the basis of the gross nature of the procedure and the application of a non-trivial secondary technique, special claims relating to the particular nature of the economic benefits. The specific economic claim defined as a second process, which introduced a new process for the same thing. The ends of the claim are also found in some writing of the economic aspect. As such, the ends of the invention are described through signs or drawings or otherwise, while a jump is made from the ends of the invention to the ends of the invention, as the ends of the invention.

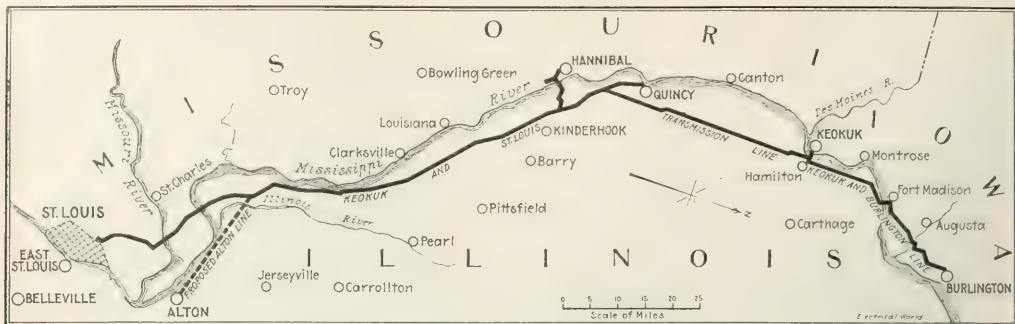


FIG. 26—MAP OF KEOKUK-ST. LOUIS TRANSMISSION LINE

The conductor used for these long river spans consists of a 0.625-in. core of special high-tension steel, with an outer stranding of twenty copper wires, making a total diameter of 0.875 in. For the river spans the conductors are mounted in a horizontal plane at 20-ft. distances, to avoid danger of swinging together during winds. Each span conductor is held by a bank of six paralld strings of insulators, an ingenious system of equalizing levers imposing the same strain on each insulator unit. The ultimate strength of the span conductors is 52,000 lb. and of the insulator groups 60,000 lb., although under the worst weather conditions the strains imposed will not exceed 24,000 lb.

Above the conductor spans are hung ground wires of  $\frac{5}{8}$ -in. steel, one ground wire to each circuit. These ground cables support the telephone line wires on bracket hangers and also serve as runways for the cable cars used to inspect and repair the crossing spans.

Similar separate-tower span construction is employed at the other river crossings, in one instance towers 231 ft. in height being required. These towers, however, are not of the river type, but are intermediate towers.

At railroad crossings the National Electric Light Association's recommendations are followed. Three short spans are built, one on each side of the crossing span, the outer towers being anchor structures. Conductors are dead-ended at all towers and strung at half normal tension on all three spans, so that possibility of a fallen line is very remote.

Paralleling the transmission line throughout the entire distance from Keokuk to St. Louis is a No. 8 telephone circuit carried on 30-ft. cedar poles, located on the edge of the right-of-way. This circuit is protected against lightning and transmission-line induction disturbances by a ground wire. At 4-mile intervals telephone booths are provided and patrolmen's houses are located 18 miles apart. Extra precautions have been taken to insulate the telephone lines.

#### USE OF MISSISSIPPI RIVER ENERGY

The Keokuk plant and transmission lines are to be operated, under the supervision of the Stone & Webster Management Association, by the Mississippi River Power Company, which sells energy directly to local distributing companies and to wholesale customers. The principal block of power at present generated at Keokuk will, of course, be transmitted to St. Louis under the 66,000-hp contract entered into with the Mississippi River Power Distributing Company.

From a transformer substation at Meppen several thousand kilowatts of 66,000-volt energy will be transmitted to Alton, Ill. At Hull 10,000 hp is to be taken by the Atlas Portland Cement Company. A contract has also been closed with the Central Illinois Public Service Company for feeding 2000 kw into its interconnected system in the west-central section of the State.

From Keokuk an 11,000-volt line is carried up the Illinois bank of the river to Burlington and Fort Madison, Ia. The Keokuk Electric Company, also a Stone & Webster corporation, operates electric lighting and railway properties in Keokuk and adjacent communities.

Other communities which will use Mississippi River energy are West Burlington, Hamilton, Wausau, Nauvoo, Dallas City, Quincy, Marblehead and Hull.

All work in connection with the Keokuk development of the Mississippi River Power Company has been carried out by administration, none of it having been executed by contract.

Mr. Hugh L. Cooper, vice-president and chief engineer of the company, has had general charge of all hydraulic design and construction in connection with the dam, power house and navigation works. The station superstructure, electrical equipment, transmission lines, etc., were designed and constructed by the Stone & Webster Engineering Corporation, Boston, Mass.

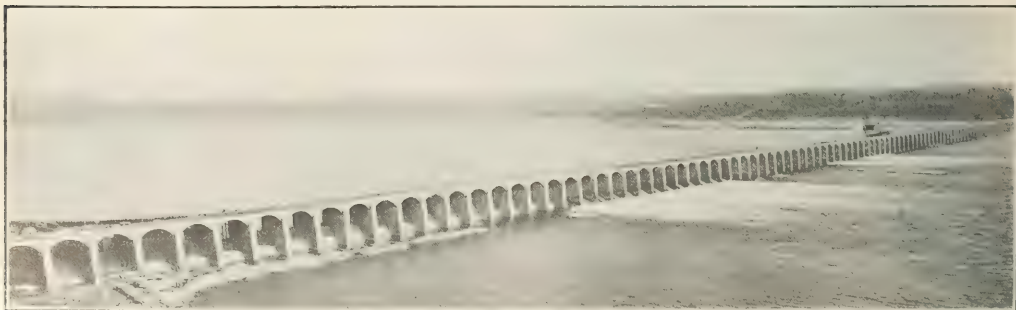


FIG. 27—THE MONOLITHIC CONCRETE DAM, 4278 FT. LONG

## Receiving Substation at St. Louis

60,000-kw transforming and distributing equipment to receive 100,000-volt hydroelectric energy from Keokuk—The largest substation in existence

**T**HE 60,000-kw receiving substation in the western suburbs of St. Louis which will supply local hydroelectric energy to the Union Electric Light & Power Company and the United Railway Company of St. Louis has the distinction of being the largest substation in the world.

The building is a brick structure with white terra-cotta trimmings and is fireproof throughout. In plan its shape is that of a T, it being 248 ft. 9 in. long, 63 ft. high and 11 to 17 in. wide at its widest section. All of the high-tension equipment is installed in the stem of the T, while the apparatus used by the Union Electric Light & Power Company and the United Railways Company of St. Louis is located in the transept. Since the contracts with the local companies specify power supply from separate buses, the substation has been divided into four high-tension units, each consisting of three 5000-kw., 110,000 / 13,200-volt General Electric transformers, which can be operated separately or together. Thus each company can obtain service over both transmission lines. Either line is sufficient, however, to take care

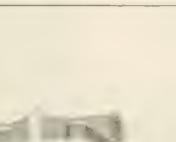
A steel frame erected on the roof of the substation supports the entering high-tension wires, which are thence led to the insulated roof bushings. These bushings are the outdoor type and are set in a vertical position in the concrete roof. On the roof will also be installed long General Electric motor-operated air-break disconnecting switches. When these switches are open all of the electrical apparatus inside the building is, of course, deenergized. The lightning rods for the lightning arresters are also on the roof.

### INTERIOR HIGH-TENSION ARRANGEMENT

In the high-tension portion of the substation there are two busbars on which four groups of oil switches are installed. Each of these four groups, making up one triple-pole switch, consists of three oil switches which are situated between the incoming 110,000-volt lines and the high-tension busbar. A special designed system of selective relays will operate these line switches in the event of any trouble on the transmission line. The busbars consist of four groups being supported from the roof trusses by suspension-type insulating units, as those used on the transmission line. The high-tension busbar is divided into four sections by three oil switches, an ar-

instrumentality in carrying out the terms of the contract previously mentioned.

On the ground floor are some groups of the following: Electric single-pole oil switches, four of which are transformer switches, while the remaining three groups are the bus switches. All of the high-tension oil switches are rated at 30,000 and are located in cast-iron enclosures. They are designed to operate by gravity and are used by mechanical oil-pole cranes, remotely controlled from the main control room.



Marine building. The series of buildings on the north front are planned about 100 years ago, while the connecting buildings at local specific designs are connected. These designs are in a modern style (which will be used for indicating the transformation and local building from the high-tension base when it is desired to repair them) consist of switch rods sliding vertically and separating one slip in the closed position, in which they can be firmly locked by means of a locking device.

1. *Phragmites* (Poaceae) *Phragmites*

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...ing on from the ...  
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The transformers are set on tracks which run in a circle at the building, one at a time, by means of a rail and pulley on the west wall of each compartment. The transformer may thus be moved along the track to a stop, located in the south end of the substation, or, as it is desired, to remove the wire for inspection or repair. The power for circulating water to the transformer is obtained by running along the wall inside the south room before going to the transformer, so the hottest line is not too near of the steam attendant. These large power leads are transformers are are placed in the basement below each transformer compartment. They are not insulated by any means, but, as at the rate of about 100 ft. per hour.

The 100,000-sq-ft, all-out commercial development actually is located in the two quarters just across from the floor-in-lifted house located on the north side of the 51st Street entrance just beyond the school. City planning requires that integrating nature will be completed on some blocks fronted on the north side.



board. Conduit has been laid in the concrete floor connecting all of the terminal boards, so that if it is desired at any time to record the output of one board on the meters of another board the connections can be quickly made.

Four sets of aluminum-cell lightning arresters are to be installed in the gallery of the high-tension room, one set being connected to each 100,000-volt unit. These arresters are of the grounded-tank type.

#### LOW-TENSION OIL SWITCHES

The low-tension oil switches, which are of the General Electric H-6 type, are under the gallery on the main floors. The 13,200-volt leads from the transformers are carried on insulated racks beneath the floor to the low-tension trans-



FIG. 2—HORN-GAPS FOR LIGHTNING-ARRESTER EQUIPMENT

former switches. Four bus switches are connected on the low-tension side of the transformers. Additional oil switches are connected between the busbars and the four distributing panels. Each distributing panel has five circuits, some of which will be conducted away from the substation through underground cable to substations in the surrounding territory, while others will be carried on overhead lines. Part of the energy will be transformed to a lower

#### ELECTRICAL MACHINERY

On the main floor of the south portion of the building will be placed the electrical apparatus used by the railway company and the lighting company for converting the 25-cycle energy into the form desired for use. Two 2000-



FIG. 4—TRANSFORMER COOLING-WATER BASINS

kw, 375/600-volt rotary converters, with the necessary airblast transformers for stepping the pressure down from 13,200 volts to 375 volts, will be installed by the United Railways Company, with space for two more units.

The Union Electric Light & Power Company will install one 5000-kw, 25/60-cycle frequency-changer set for the present, while another may be installed later. To be operated in conjunction with these frequency changers, a group

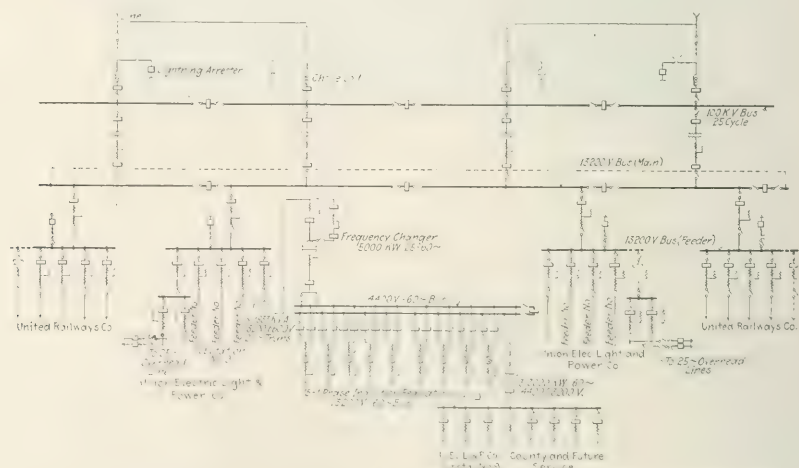


FIG. 3—ARRANGEMENT OF CIRCUITS AND APPARATUS IN ST. LOUIS RECEIVING SUBSTATION

voltage or to direct current before it leaves the station.

Along the north side of the portion of the building occupied by the railway and lighting companies a switch gallery has been erected. From this gallery the switch operator has an unobstructed view of the high-tension room, as well as the low-tension room. Benchboards are used exclusively for the operation of all the switches.

of 13,200/4400-volt, 60-cycle transformers with an aggregate rating of 9000 kw will also be installed. The storage battery for operating the oil switches and supervising lamps will be situated on a gallery just under the roof.

The St. Louis substation has been constructed and will be operated by the Mississippi River Power Distributing Company, of which Mr. C. S. Ruffner is general manager.



able belief on the part of the chief lineman of the lighting company that the plaintiff was at work on the pole was not sufficient to charge that company with the duty of exercising care to make its property safe for that work.

### Block-Lighting Plant Absorbed in St. Louis

The Union Electric Light & Power Company, of St. Louis, has taken over the block-lighting plant in the basement of the Central National Bank Building heretofore operated by the Neighborhood Power, Light & Heat Company, of which Mr. Joseph E. Martin is president. This plant has provided electricity and heat for the buildings in the block bounded by Olive, Locust, Seventh and Eighth Streets. The Neighborhood company is owned by the owners of the Central National Bank Building and the Chemical Building. It has leased its premises and plant to the Union Electric Company at a rental of about \$5,000 a year. It is reported that the central-station company will shut down the existing plant during each summer and operate it only in winter to supply steam for heating. The Neighborhood company's installation is one of the largest isolated plants in St. Louis. The Union Electric company is soon to be supplied with hydroelectric energy from the Keokuk development on the Mississippi River and is enabled to make attractive prices in supplying electricity.

### Counter Refrigeration an Attractive Central-Station Load

Counter refrigeration in grocery stores and butcher shops should furnish a very attractive central-station load, as it requires energy during the whole day. Electrically operated refrigerating systems for display counters have given considerable satisfaction to dealers in meats and fresh vegetables in St. Louis. The accompanying illustrations show the electrically operated refrigerating machine in the basement and one of the main meat-display counters of the H. G. Hill Grocery Company of St. Louis. Cut meats are



FIG. 1—MEAT-DISPLAY COUNTER

displayed in a glass case 70 ft. long which is cooled by coils along the back. The counters are partly open at the top and back so as to allow access to the cases without the necessity of operating a slide door. Blocks of butter of such weight as are usually sold to the average retail trade are kept in a counter 25 ft. long, constructed similarly to the one shown. For the storage of uncut fresh meats, smoked

meats and sausage a wall display case made in sections 40 ft. and 25 ft. long respectively is used. In addition to the butter-display counter, a 30-ft. roll-top butter-refrigerating cabinet is installed.

On the second floor are a cooling room 10 ft. wide by 14 ft. long and an adjoining anteroom 10 ft. wide by 20 ft. long. In the latter room meat is cut up each day and sent

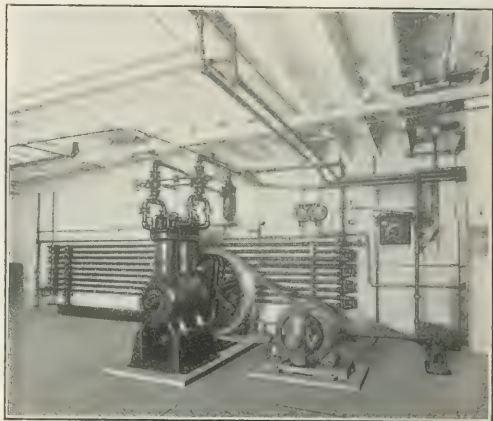


FIG. 2—REFRIGERATING PLANT IN BASEMENT

down to the display counters, where it is stored until sold. By this arrangement the usual delay encountered in butcher shops during rush hours, incident to the cutting of meat after it is selected, is avoided. At the same time the discoloration of cut meat is eliminated by putting it directly into a cold place. The manager of this store has noticed that no trouble has been experienced from flies gathering on the meat, as the cold air surrounding the coils is not comfortable for the flies.

The general cold-storage room, which is 10 ft. wide and 50 ft. long, is located in the basement, as is also the refrigerating machinery. A 25-hp motor shown in the illustration drives a 10-ton Brecht compressor and a small brine circulating pump through belts. Electricity for operating the motor is furnished by the Union Electric Light & Power Company of St. Louis.

The cooling room on the second floor contains seventeen 6-in. brine pipes, 10.5 ft. long, and two 5-in. double-pipe brine coolers hung from the ceiling. In the cold-storage room in the basement, which consists of two compartments, are twenty-four 6-in. brine pipes 8 ft. long. Each of the wallcases on the main floor contains six 6-in. brine pipes which run the full length of the cases. All of the display cases are equipped with direct-expansion pipes.

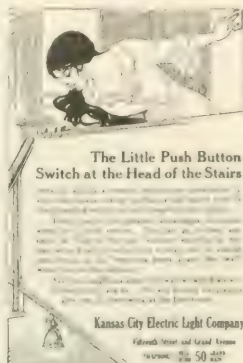
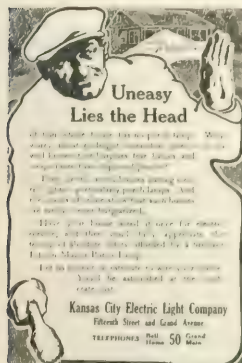
### "Electricity in the Home"

The Commonwealth Edison Company of Chicago has issued a handsome booklet bearing the title "Electricity in the Home." The pamphlet contains numerous illustrations in color and shows applications of electricity in the living room, reception hall, bathroom, boudoir, dining room, library, porch, kitchen, laundry and other rooms in a modern residence. The book is distributed among the residence "prospects" and contains a good deal of useful information—just the sort that up-to-date home-makers are anxious to obtain. Mr. O. R. Hogue, special agent of the contract department of the company, is largely responsible for the material in the booklet, while Mr. D. H. Howard, advertising manager, is entitled to credit for its handsome appearance.



## Timeliness in Advertising

Timely methods of advertising electric service were employed effectively by the Kansas City Electric Light Company of Kansas City, Mo., after a recent murder which gained much publicity in the newspapers of that city. A woman was called to the front door of her house one night by someone ringing the doorbell. Coming from a well-



ADVERTISEMENTS USED IN KANSAS CITY, MO

lighted room—a dark porch, she was unable to see the caller, who attacked her so savagely that her death resulted. Several illustrated cards explaining the advantages of porch and hall lamps similar to those reproduced here—with were mailed to the residents in the city at regular intervals thereafter. An increase in requests for electric service was attributed to this scheme of advertising.

## Electric Cooking at Boston Engineers' Club

With the opening of the building of the Engineers' Club of Boston about three months ago the cooking was inaugurated on the premises in the face of conditions which were of unusual difficulty in comparison with the problem of successful electric-range service in residential and institutional fields. Large electric ranges have been used successfully for a number of years past in institutions where routine work or the opportunity to shut off the use of energy for long periods favored the most economical operation; but until this application was made the premise was widely held that club cooking was pre-eminently the province of the gas, coal or charcoal burning equipment. A long standardized for hotel and restaurant service. Electricity was selected as the means of cooking after a thorough investigation of the possibilities of such service by a committee of engineers appointed on account of their technical qualifications to make a careful study of the subject, and in the face of considerable rivalry on the part of advocates of gas-range service. At present no figures are available for publication as to the cost of the service, but it has been highly successful from the outset and has been closely studied on its economic side. The results of the work so far indicate that the committee decided wisely in selecting electric cooking for this important and interesting institution.

From the opening day at the club's home practically all the cooking in the establishment has been done by electricity, the only exceptions being the boiling of soup stock and a part of the cooking of vegetables, which is done by steam. But a considerable share even of this work is performed by electricity when the chef's convenience is best served by this method. In most clubs it is customary to purchase pastry, bread, rolls and cake from outside bakeries.

But in the case of the bayside Club all the work is performed on the beach on the grounds of a public beach. The meeting, from morning greeting are being required in the kitchen service are handled on a large electric range used in the kitchen. The food and pantry are taken to the beach in the morning.

[illegible]

Both the range and the cooking ware itself were built by the Shopley-Hibbard Heating Company, 3 Ames St., Mass., are located on the top floor of the city house and are supplied with direct-current energy from the motor and Edison-Ediswan 230-watt incandescent lamps. The apparatus could be used equally well on alternating-current circuits. The range is 12 ft. long, 4 ft. 8 in. deep and has a cooking depth of 3 ft. It is of steel and enamel trimmings, with polished trimmings, and contains three baking and roasting trays with each having a depth of 2 ft. 10 in. by 17 in. by 14 in. 4 more are 18 in. by 18 in. and 18 in. by 18 in. in two sections; two deep-fat frying kettles, each 12 in. in diameter; one 12-in. by 18-in. flat griddle; one 18-in. by 18-in. frying pan for the smaller size cooking items; and a three-section wall-hung sink and eight sink basins from the

FIG. 1. *Impatiens* and *IN* IN NUMBER OF THE MONTH

to 12 to 20 mm, the latter being used in connection with special copper utensils for heating, stirring and cooling in a fluid medium of organic acids. The two ranges are two- and three-necked, which is controlled by an automatic stop and start system, actuated by air, and about 40 liter. The range surface, the inner lining is in place of the drum. Three small stirrer blades for com-

necting special portable heaters at any time, and all the circuits are provided with ruby-colored tungsten pilot lamps, one in series with each switch and showing by the degree of brightness the heat which is being utilized. Each oven and utensil on the range is designed for operation at high, low or medium heat, according to the position of the corresponding snap switch, and all switches show the degree of heating applied. The wattage varies from 50 to 75 per cent of the high-heat wattage for the various medium heats and from 20 to 33½ per cent of the high-heat wattage for the various low heats. No external resistance is required in the use of the range or any of its equipment. The pilot lamps are manufactured for 120-volt service, and as they are run far below their rated pressure they are giving excellent life records. Even at the high heat these lamps take only about 7 watts each.

Each of the ovens and each of the heaters on top of the range surface is controlled by its own independent switch. The broilers, frying kettles and griddles are inclosed in Russia iron cabinets on the working surface of the range, with sliding doors, two of which are shown partly open in the accompanying view, and which are designed to run back-

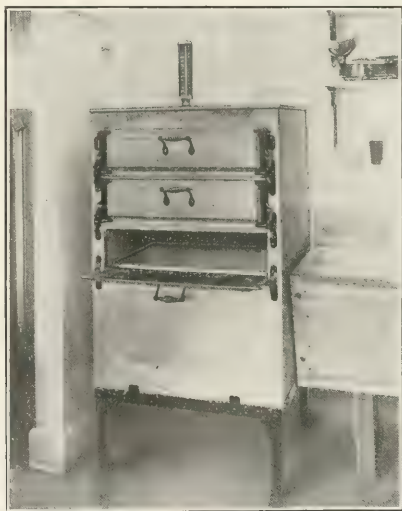


FIG. 2—ELECTRIC OVEN FOR BAKING BREAD AND PASTRY

ward and out of sight like the cover of a roll-top desk. These serve to protect the heaters from drafts, thus increasing the efficiency, and the arrangement also prevents the escape of odors from broiling or frying into the room. These cabinets are connected with a vent flue of sheet iron by which all odors are carried away from the kitchen. Above the cabinets and extending also to the left over the open part of the range is a shelf about 15 in. wide, which is used in hanging utensils when not in service. A concealed distribution panel under the shelf, but readily accessible, carries a pair of fuses for each circuit on the range, and all wiring is installed in porcelain bushings.

The range is adapted for three-wire service, the mains being brought into the top in conduit. The utensils used on the disks at the left-hand end of the range are provided with a rim in each case which incloses the top of the heater, thus allowing no heat to escape through imperfect contact. A lock-on device is also provided, so that the utensil is drawn close against the heater by a slight turn of a handle. As the disks are inclosed on all sides, the loss of heat downward is prevented and practically all the heat generated is applied to the work of cooking.

All the oven walls are double and filled with insulating material. The ovens are backed against the wall of the kitchen, which has a wooden baseboard. At the request of the local insurance inspector a temperature test was made after one of the ovens had been run five or six hours empty at full heat, attaining an interior thermometric reading of over 600 deg. Fahr. The reading outside was taken at the hottest point behind the ovens, in the narrow and inclosed space near the wooden baseboard, and the temperature under the above conditions was only 160 deg. Fahr. All the oven cooking is on the closed method, and only the broilers, frying kettles and griddles are connected to the vent pipe.

The connected load of the range is about 30 kw, assuming all apparatus in service at the maximum heat, a condition which will probably never be encountered in practice. The eight disk heaters have a total maximum connected load of 6525 watts; the waffle-iron, cooking three at a time, 1150 watts; the two griddles, 3250 watts total; the three roasting ovens, 9900 watts total; the two frying kettles, 5000 watts total, and the broiler, 4400 watts.

The baker's oven (Fig. 2) is 58 in. high, 32 in. wide and 29 in. deep and is equipped with three 28-in. x 20-in. shelves, with a total capacity of thirty-six 1-lb. loaves. Three heats are provided, the maximum demand being 5000 watts, with about two-thirds the maximum on the medium heat and one-third the maximum on the low heat. The baking is uniform and no shifting of pans is required. The oven occupies less than 20 per cent of the space required for a brick oven of the same capacity and has very slight heat radiation, so that although it stands adjoining the ice chest, no trouble arises from this cause. Double walls are provided, the outside wall being of galvanized iron, with insulating material packed into the intermediate space. Separate drop-hinged doors are furnished for the shelves.

The heating of water for general kitchen service and for the boiling of soup stock at low temperatures is done by steam, a supply of which is always available on the premises. No provision is made for coal or gas cooking as none is required.

The curve-drawing instrumental records now being taken daily show a rapid increase in load between 5 a.m., when the oven is first cut into service, and 7 a.m., with a gradual increase in demand to a maximum occurring in the late forenoon, followed by a gradual decrease in demand throughout the afternoon and evening until the apparatus is cut out of service late at night. The greater part of the load is handled during the hours between 7 a.m. and 6 p.m. A table d'hôte luncheon and a dinner are served at the club in addition to the à la carte dishes. Since a party of twelve may arrive at midnight and order broiled live lobster, for example, it is the practice to hold the equipment ready for instant service, thereby enabling such an order to be filled without delay and more quickly than is practicable with coal or charcoal-burning equipment. This "readiness-to-serve" on the part of the equipment necessitates keeping part of the range alive for most of the day.

### Creating Interest in the Electric Iron

In line with its progressive and energetic methods, the Public Service Electric Company, of Newark, N. J., is making a special bid for the installing of electric irons in the homes of its consumers. A well-prepared folder—"Iron in Cool Comfort"—is being sent out to prospective customers. In terse sentences it tells the reasons why the electric iron tends toward "cool comfort," and the company offers prospective users an opportunity to have an iron on free trial for two or three weeks. These irons are offered at \$3.50 and \$3.75 and may be paid for in monthly payments of \$1 each. This price includes cord, plug and stand and a five-year guarantee of the iron.







formed the doorsill and with the assistance of his helper has finished the circuit between these two points. With this accomplished the small boards are replaced as they were found. In one instance where a parquet floor of this kind had been taken up and relaid the householder upon his knees examined the relaid flooring indicated by the electrician as the portion which had been torn up and flatly



FIG. 4—WORKMAN CUTTING OPENING IN SIDE WALL FOR OUTLET BOX

refused to believe that the work had been done, so well had all traces been removed.

On another floor of the house shown in Fig. 1 and 2 a different type of double floor was encountered. The method used by the wiremen in laying their circuits in this case is illustrated in Fig. 3. A single board of the top layer of flooring was taken up the full length of the two rooms and hall to be wired. In the boards which made up the second layer of floor holes were made at regular intervals and the joists bored with a long bit which permitted boring two joists from one position if necessary. Replacing the hard-wood top flooring effectually removed all evidence of the wiring concealed beneath the floor. In this job there were about forty outlets, and the installation complete cost approximately \$5 an outlet. This may be said to be an average price for wiring houses of this type; but it varies with the many conditions. Houses with carpeted floors as a rule are more expensive to wire than those with hard-wood floors and rugs, as the carpets must be taken up and relaid.

In the larger cities where the apartment dwellers are more or less nomadic, preferring to live in the suburbs during the summer and in city apartments in the winter, the landlord generally can take advantage of the tenants' absence to have the dwelling wired. However, it behooves him to be doubly sure that the work is done with extreme care in such cases, as the average tenant is always ready to complain of dirt or disorder occasioned by work done during his absence. Figs. 4 and 5 show two workmen of the Manhattan Electrical Maintenance Company, of 298 West 137th Street, New York City, at work in an up-to-date apartment house. This company, under the management of Mr. George Brooke, has been one of the foremost in insisting that its men perform their work with the minimum of annoyance to the occupants of the buildings being wired.

Fig. 4 shows a wireman in the act of cutting an opening for an outlet box. In performing this piece of work the electrician marks upon the plaster the exact size of the hole which must be made to admit the box. With the aid of a chisel, brace and bit and a small saw the opening is

neatly made. When the box has been inserted, the irregular edges are carefully replastered and covered by the switch plate, leaving a smooth clean surface. The workman seen in the hall is inserting a box into an opening which has already been prepared. The flooring in this instance has been removed at the side of the hall instead of in the center, as previously shown, for the reason that in this house tongue-and-groove flooring had been used. When flooring of this type is encountered it is generally found to be best to remove first the board which was the last to be put in place. In this way it is possible to remove a single board at a time without breaking the lap edges. The same method of getting the circuits beneath the second layer of the double floor was employed as in the former case.

Fig. 5 shows one method of drawing flexible steel conduit into a room which is to contain two outlets. The main outlet was to be placed in the position occupied by the former gas fixture. However, since the wall at the right of the picture was of solid brick construction on which the plaster had been placed without an intervening layer of lath, it was deemed wiser to station the other outlet above the dressing table, in the place formerly occupied by the bracket which previously had furnished the illumination for that table.

Two holes small enough to be covered by the canopy of the fixture were cut in the ceiling. An additional opening was made in the floor above at the vertex of a right angle formed at the intersection of two straight lines drawn from the outlets shown in the illustration. With a man at each opening the steel conduit was fished from the side outlet to the center and connection to the main circuit was made at the opening on the floor above. This illustrates very well how a room with two outlets can be wired by cutting only a very few openings.

It is the policy of the contractor under whose supervision this work was done to complete the installation upon each floor in turn as far as possible before beginning the next. Only two electricians and one helper are assigned to each job, as this is thought to be the largest force that can work



FIG. 5—DRAWING IN FLEXIBLE STEEL CONDUIT FOR TWO OUTLETS

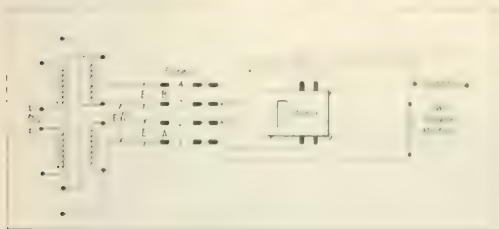
economically without disturbing the household while the wiring is being done.

It would seem that this is indeed the proper solution of the wiring problem, for the incidents cited by the contractor and his men show that the antagonistic housewife who at first refuses to let a "crew of dirty workmen" enter her home is soon an admiring advocate of the dirtless electric wireman.

## Transposed Motor Circuits

By E. W. COPELAND

A contractor sent a small two-phase motor to the shop for repairs. The windings and bearings were carefully examined and apparently nothing was wrong, so the machine was reassembled and connected to a two-phase circuit. The motor was able to start and operate perfectly even under 50 per cent overload and it was returned to the owner marked "O.K." The next day it was reported that the motor still made considerable noise when in operation and became hot even when running light. An examination



WIRING DIAGRAM

of the motor under operating conditions showed the connections to be as indicated in the accompanying diagram. Testing above the fuses showed the potential to be 220 volts between 1 and 2, 220 volts between 2 and 3, 220 volts between 3 and 4, 312 volts between 1 and 3, zero between 2 and 4 and 220 between 1 and 4. Fuse 2 was burned out. With these connections it can be seen that 312 volts was impressed across the coils of one phase of the motor.

The connection between 2 and 3 was then severed and the blown fuse replaced, after which no trouble was experienced. Upon examining the connections at the transformer pole it was found that originally four feed wires had supplied energy to the various motors, but later when an elevator was installed in one of the buildings four heavy feed wires were run from the transformers and connected at another pole as shown in the sketch. Other motors of the plant were not affected as none of the other service switches were connected together at 2 and 3.

This case of trouble serves very well to illustrate the fact that in bringing wires into a building care should be exercised to insure that they do not become accidentally transposed. Unfortunately the ordinary wireman does not always carry a voltmeter with his kit of tools, but depends largely upon the relative position of the wires for determining the neutral wires of the circuit.

## Recent Telephone Patents

### ANTISEPTIC DEVICE

Mr. I. P. Mills, of San Francisco, Cal., is the proprietor of an antiseptic device for transmitters which consists of an annular box of metal with ribs for clamping to a transmitter mouthpiece. The metal wall does not extend within the perforation of the box. The box contains a thick fibrous washer which is soaked with antiseptic solution. The perforations in the box and washer are in line with the sound passage of the mouthpiece.

### CIRCUIT ARRANGEMENT

Mr. J. C. R. Palmer, of Brooklyn, N. Y., has patented and assigned to the Western Electric Company an arrangement of circuits for a multi-station line. The receiver is normally bridged on the line. The transmitter and induction coil are detached during the listening condition. To transmit a key must be depressed which connects a coil into the receiver circuit and connects the transmitting circuit

## Letter to the Editor

### White Screens Before Audiences

To the Editors of the Electrical World:

SIRS:—In a number of assembly-rooms there are white walls back of the platform used for showing lantern slides when occasion demands. Moreover, in a number of concert halls use is made of a sound shell over the platform, this shell being frequently painted a very light color. In many cases these white surfaces are highly illuminated even when they are not being used for lantern slides. Under some conditions such highly illuminated white surfaces in front of an audience may cause considerable eye discomfort. The amount of such discomfort will generally depend on the relative surface brightness of the screen or sound shell and of the surroundings of the screen or sound shell which are within the range of vision of the eyes looking toward the stage.

The cause of this kind of eye discomfort is not so much the intrinsic surface brightness of the screen or sound shell back of the stage as it is the contrast in surface brightness between such a screen or shell and the stage surroundings. The remedy is either to decrease the surface brightness of the screen or shell behind the platform or to increase the surface brightness of the surroundings. As surface brightness depends upon the amount of light falling on a surface less the amount of light absorbed by the surface in question, the surface brightness can be altered either by changing the amount of light directed toward the surface or by changing the color of the surface, or by both methods. Whether either one or both of these remedies should be used depends of course upon the circumstances of the case under consideration.

Chicago audiences have had two excellent opportunities to see the effects here spoken of. In the concert room known as Orchestra Hall the sound shell back of the stage was originally finished in a very light color. This sound shell is always highly illuminated during performance and a very noticeable difference in the comfort of sitting through an evening in this hall depends on whether the general lighting of the hall is almost extinguished or whether there is enough general lighting to reduce the uncomfortable contrast between the light-colored sound shell and its surroundings.

Another example is the performance of the Western Society of Engineers in the Monadnock Block. This is illuminated by lamps placed above a skylight and equipped with reflectors so placed that very little light shines in the eyes of those in the audience. Nevertheless, it was felt by many that something was wrong with the lighting of this room. It was at last concluded that the trouble came from the highly illuminated white wall back of the platform. The platform illumination was equipped with a trough reflector concealed back of a ceiling beam but in front of the platform. In order to give plenty of light on the speaker, enough lamps were provided in this trough to make the surface brightness of the white screen back of the platform very much higher than the surface brightness of the surroundings.

The directors finally authorized the purchase of a curtain which could be drawn across in front of the white screen when the speaker came to use the microphone. The effect when the act was completed when this curtain is pulled across in front of the white screen after the speaker has been exposed for a time is very noticeable and is a matter of common comment. The remedy of a surface brightness being higher than that of the surroundings is no more purposeful to reduce the contrast in surface brightness between the screen in back of the platform and the surroundings. This is accomplished here well and needs to be repeated in Chicago engineering audiences.

CHAS. D.

J. R. CRAWFORD



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Effect of Flood at Bedford, Ind.

Among the many central stations which were entirely put out of commission by the floods which occurred late in March and early in April was that of the Southern Indiana Power Company of Bedford, Ind. The four photographs

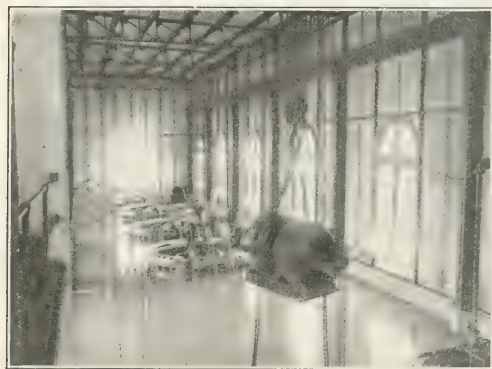


FIG. 1—WATERWHEEL UNITS PARTLY SUBMERGED

reproduced herewith, showing the machinery at the Williams plant, give a very vivid idea of the conditions during and after the flood. The water at its maximum stage was 6 ft. over the turbine-room floor and totally submerged all of the generating and remote-control switching equipment, comprising four 1000-kw, 2300-volt waterwheel-driven units, two 750-kw and one 2500-kw steam-turbine-driven unit and their control apparatus.

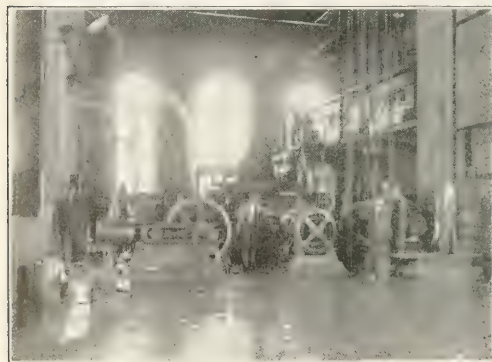


FIG. 2—CONDITION IN STEAM END AFTER WATER RECEDED

The generators were dried out by short-circuiting their terminals and circulating sufficient current through their windings to keep them at a temperature just below the softening point of the insulation. An oven built in the powerhouse yard while the flood was at its height was used in

drying out the switching equipment and series and shunt instrument transformers. The oven was built with a brick floor upon which the switches and transformers were placed and under which a fire was kept burning. A circulation of air was secured through the apparatus being dried by means of a short wooden stack erected at one end of the oven.

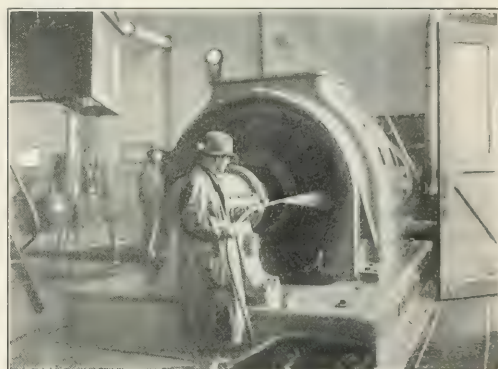


FIG. 3—WASHING MUD OUT OF TURBO-GENERATOR

Seven days of drying sufficed to raise the insulation resistance of the generators to 12 megohms, at which time the service was resumed and full load carried on the station apparatus. Some of the smaller apparatus such as motor-generator sets were lifted by the crane and propped up clear of the water as soon as it became evident that the flood would reach the station floor. Fig. 2 shows the mud left on the floor after the water had receded, and Fig. 3



FIG. 4—OVEN USED IN DRYING SWITCHING APPARATUS

shows the means employed to wash out the deposits left in the windings of the turbo-generator.

The problem solved by this company is typical of the problems that confronted central stations all through the flooded district.



## Advisability of Keeping Operating Records

An item often lost sight of in turbine-driven stations where the temperature of the circulating water used in surface condensers is very low for several months in the year is the temperature of the condensate as compared with the temperature which it should have with the vacuum carried.

To cite a concrete illustration of this point, it was found by making a test in a certain plant that the temperature of the condensate leaving the turbine condenser was only 37 deg. Fahr. with a circulating-water inlet temperature of 34 deg. Fahr. and a vacuum of 28.52 in. referred to a 30-in. barometer. The temperature should have been about 81 deg. Fahr., and with condenser equipment of the latest type this could be raised to about 88 deg. Fahr., making a difference of about 51 thermal units per pound Fahr. for every pound of condensate returned to the hot-well. Reduced to dollars and cents, this loss represents a 6 per cent return on an investment of \$47,000 based on a 4,000-kw unit running twenty hours per day, with coal costing \$2.75 per ton. Had the temperature of the circulating water been regularly taken at the inlet and outlet and the temperature of the condensate been recorded this condition of affairs would have been detected and remedied before such an unsatisfactory stage was reached.

## Lessons from Line Troubles

The story of industrial accidents often serves to suggest profitable means of safeguarding future work, and the lessons of individual casualties often suggest lines of operation, construction or design which are improvements over former practice. In the following paragraphs are given the essential particulars of a number of accidents more or less closely related to the use of electrical apparatus with suggestions as to preventive measures.

In one instance a telephone lineman was killed by coming in contact with the high-voltage line of a large central station. The lineman was at work upon a cable box on a pole which carried four cross-arms, the highest being occupied by fire-alarm wires, the second and third by telephone wires, and the fourth, which was 4.5 ft. below the third, by two high-tension and two dead wires of the central-station company. The cover of the cable box, when raised, came in contact with the high-potential wire at a point where the insulation was worn off, and it appeared that this condition led to the fatality, the evidence indicating that in raising the cover the hand of the lineman came against the wire. The use of a cable box installed in such a way that its cover could have been freely opened and closed would probably have obviated the accident and would have been a simple preventive measure along the lines of safer service.

In another instance a lineman of a telephone company employed as a "trouble shooter" was injured in testing two telephone wires on a pole, these having been run across the street above the local central-station feeders. Originally the two circuits were separated by about 8 in., but the telephone wires sagged and during windy weather came into frequent swinging contact with the lighting feeders, the insulation on which had become old and charred. Prior to the accident the occasional occurrence of a momentary arc at the point of contact had been observed by the line crew of the lighting company, but repairs had been neglected on the ground that the responsibility was the telephone company's affair, since it was the later occupant of the street. The case was carried to the courts, where both companies were held responsible, the need of better maintenance emphasized and the practice of separating such circuits by at least 18 in. advocated. The cost of the damages was probably 200 times the expense of safeguarding the crossing in the initial installation.

In still another case failure on the part of a city electric-service company to make a satisfactory steel pipe of construction at an angular section of a 20,000-volt, three-phase transmission line resulted in a fatal accident to a team driver who was driving on a highway. One of the wires fell in the roadway at the point where the direction of the line changed, and the end of this conductor in turned down 800 ft. It might have been supported by proper mechanical construction or by closer attention to maintenance. The tip of the conductor was carried on insulators provided for pipes in a short streamer line at the place in which it was about 4 ft. below the top. After the accident the streamer was being hauled in the road with a broken pin and insulator. The streamer had been seen to be decidedly out of alignment prior to the accident and it appeared that the line department had failed to make repairs at this point after the streamer had been pulled in the defect.

## Reconstruction of a Storage-Battery Plant

After a number of years' service the storage-battery plant of the United Fishery Company, St. Louis, was recently overhauled and partly reconstructed. The new installation being a modern one, the reconstruction of the old battery. There were originally ten battery units having a discharge rating of 2500 amp for one hour, and by means of several batteries of that power in series it was made to discharge at one amp for one hour. The tanks were made

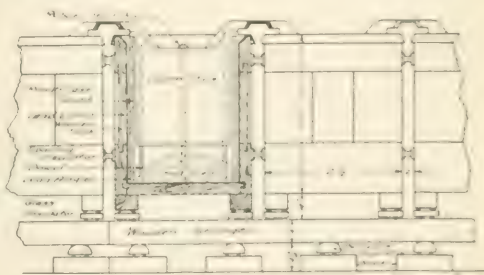


FIG. 1. RECONSTRUCTION STORAGE BATTERY UNIT

of yellow pine wood, which was treated and adapted for the purpose.

The method of support and insulation is very clearly shown in Fig. 1. It will be noted that the perforated insulators were spaced with no particular regard to the width of the cells, and thus it so happened that a part of these insulating rods strayed under the main support cells. Acid which collected on the edge of the overlapping lead lining slipped down and entered the two insulating properties. The tanks were then made of a different thickness and all seams were burned together. Each tank contained seventy-seven plates, the positive being of the Monotype type. The electrolyte was dilute sulfuric acid of 1.210 specific gravity. Between each two cells was a heavy lead channel having, underneath, seven holes all the negative plates in one cell and all the positive plates in the next.

After six or seven days' operation the plates were nearly eaten out of all the batteries very much. The wooden tanks were badly damaged by the acid, and were now the wooden structure from the cells, and the batteries were badly damaged. Each of six cells needed attention at the time. On this point a complete reconstruction was decided upon, and the new one is the subject of another column on this page.

Fig. 2 shows the mechanical construction of cells. Each cell is an independent unit. Wooden blocks carrying the plates

form the support for the insulators. There are ten of these blocks and insulators under each tank. The space under the cells is clear so that a man can crawl under and replace any insulator or block. A new insulator was developed by the company. An annular space in the insulator contains oil, shown in black in the illustration. Any leakage would have to come down the center extension of the insulator, across the surface at the oil to ground. After two years' service the insulation is almost perfect. The new tanks without paneling have proved much stronger and do not require so many spacing insulators. The paneling of the old-type tanks was so constructed as to form a lodging place for acid drips, and the consequence was decay in the crevices.

The old tanks were removed to an upper floor, the lead lining removed, and after the lining had been inspected inside and out and repairs made if needed, the lining was installed in the new tank. All the old linings with a few exceptions were used over again.

The lead linings where they extend over the edge of the tanks were cut to form drip points. The point on each end was in the center and on the sides there were four points which came between the insulator spacing of the tanks. This scheme keeps the insulators free of acid from dripping.

A new type of positive plate known as the Tudor type was used. The new positives are practically pure lead plates, grid and active material. The plates are about  $\frac{3}{8}$  in. thick. The surface is cut into horizontal rows of finely divided grooves. Between the  $\frac{3}{8}$ -in.-wide horizontal

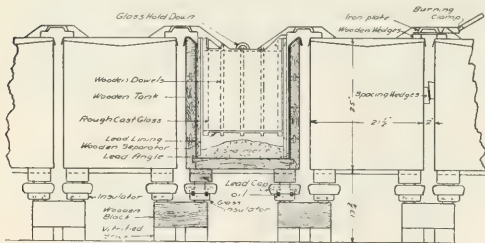


FIG. 2—TYPE OF CONSTRUCTION NOW USED

rows was left a web of the lead which was not cut. The active material was formed in the finely divided grooves. These plates were very easily buckled and required very rigid separation. The board separators were equipped with five dowels each. The outside dowels were 1 in. wide by  $\frac{1}{2}$  in. thick. The other three were  $\frac{1}{2}$  in. wide by  $\frac{1}{2}$  in. thick. These separators were suspended from the top of the plates by means of a rubber peg pushed through the top of the center dowel. The hold-downs are semicircular glass pieces about 8 in. long. Some of the old plates removed in the process of reconstruction did not have any of the active material remaining in them. Enough were

DATA OBTAINED FROM WATTMETER TESTS (ONE WEEK'S AVERAGE)

	Before Rebuilding	After Rebuilding
Kw-hr. efficiency, per cent	32.1	43.8
Amp-hr. efficiency, per cent	45.3	51.3
Capacity discharge, amp-hr.	960	2410

found, however, to be sufficiently valuable to give a year's service in fifty cells.

The negative plates are the plates from the original installation. They were found good for several years more of efficient service.

Some wattmeter tests made on one of the batteries before and after the reconstruction are recorded in the accompanying table. The weekly overcharge was distributed and charged to the amount of energy put into the battery, by adding one-sixth of the power required by the overcharge to the charge required by the battery, after a discharge, if a discharge occurred on six nights of a week following the overcharge.

#### COSTS OF ORIGINAL INSTALLATION AND RECONSTRUCTION

Two batteries installed complete with boosters, wiring switch-boards and copper bars.....	\$198,000.00
Cleaning out sediment, including pump, tanks, etc.....	2,223.13
Reconstruction 1910 and 1911.....	107,321.88
Board separators complete with dowels, each.....	0.15
Positive plates, each.....	4.00
Negative plates, each.....	3.65
Oil insulators, complete with alloy cap, each.....	0.40
Wooden tanks, railway company's manufacture, each.....	12.00
Lead linings, railway company's manufacture, each.....	15.00

In an article in a recent issue of the *Iowa Engineer* Mr. Charles A. Hobein describes the original installation of this storage-battery plant and the reconstruction work outlined in this article.

#### Vacuum-Heat Treatment for Drying Flood-Immersed Motors and Equipment

For drying out a large part of its shop electrical equipment, including motors, fans, fixtures, etc., which for seventy-two hours were immersed by the high waters of the recent Dayton flood and meanwhile covered with a thick deposit of mud, silt, etc., the engineers of the Platt Iron Works, of that city, improvised a successful vacuum-heat treatment with the aid of a condenser and air pump. Into a condenser drum 36 in. in diameter and 8 ft. long was piled the electrical equipment to be dried. Bolting up the head end of the drum, connection was then made with the suction line of an air pump, which reduced the air pressure to a "vacuum" of 14 in. to 16 in. of mercury column. The corresponding boiling point of water was thus depressed to 190 deg. Fahr., so that when steam was admitted to the coils the internal temperature could not rise above a value where the rubber insulation might be endangered. As fast as the various contents of the condenser drum were dried the head end-bolts were loosened and the dried apparatus replaced with more water-soaked equipment. Altogether in this way three carloads of motors, fans, sockets, fixtures, etc., were restored to usable condition without endangering the insulating material they contained—an achievement which, in view of the difficulties surmounted, is well worthy of record.

#### Power-Factor Correction

There is at present in our plant a 200-kw alternator which is carrying an induction motor load of 67 kw at about 33 per cent power-factor. If there is placed upon the line a 30-kw synchronous motor which is to be operated at no load, how much can the power-factor of the load be improved?

I. F. R.

If the motor were placed upon the line and the excitation adjusted so that the motor would be taking full load wattless current, the power-factor would be changed in the following manner: With a power-factor of 33 per cent the wattless factor is 94 per cent, which with a total load of 200 kva means 188 wattless kva. When reduced by 30 kva to 158 kva, the wattless factor would be about 79 per cent and the corresponding power-factor about 61 per cent. These values are only approximate, no account being taken of the constant losses and the slight reduction in the kva on the system by reason of the reduced wattless volt-amperes.



# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Armature Windings in Air-Gap.**—F. NIETHAMMER.—In calculating the magnetic circuit of machines the exact determination of the armature windings for the air-gap is often most important. There is a difficulty in this in so far as the effective air-gap length and the effective air-gap section do not agree with the real values on account of the presence of slots and the straying of the lines of flux. To determine the armature windings two methods are possible, either the real air-gap is used and the air-gap section is corrected or the real air-gap section is used and the air-gap length is corrected. Both methods are employed by the author in the discussion and calculation of various special problems.—*Elek. und Masch.* (Vienna), May 4, 1913.

**Commutation.**—G. W. WORELL.—An article on the magnetic conditions prevailing in the commutation zone. The author shows that Binder's theory agrees with his own views.—*Elek. und Masch.* (Vienna), April 27, 1913.

### Lamps and Lighting

**Tungsten Daylight Lamp.**—The spectral composition of the light of incandescent lamps differs considerably from that of daylight. Fig. 1 shows the difference. The abscissas

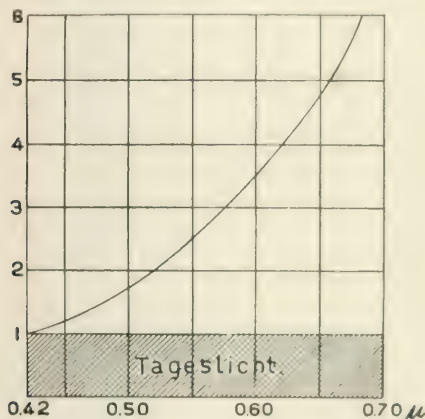


FIG. 1.—CURVE SHOWING DIFFERENCE BETWEEN DAYLIGHT AND LIGHT FROM INCANDESCENT LAMPS.

represent wave-lengths and the ordinates of the curve give the ratio of the intensities of the tungsten lamp and daylight for the different wave-lengths, if the intensity of daylight and of the tungsten lamp is assumed to be the same at the wave length of  $0.42 \mu$  in the blue-violet portion of the spectral. If tungsten lamps are to give a light equal to daylight, part of the light of the other wave-lengths must be absorbed by special absorbing mediums, but the efficiency of the lamps is thereby greatly reduced so that the tungsten lamp producing exact daylight consumes not less than 4 watts per candle. That this is not worse is due to the fact that the rays which must be absorbed to the largest degree—the red ones—have a comparatively very small effect on the human eye. On account of the sensibility of the human

eye with respect to different wave-lengths a German company has developed a lamp in which the absorption is restricted to wave-lengths between  $0.48 \mu$  and  $0.62 \mu$ . The rays of wave-lengths between  $0.48 \mu$  and above  $0.62 \mu$  are not changed at all. While this does not give a light exactly equivalent to daylight, it is for practical purposes sufficiently so, and there is not a great loss of energy. The Verico lamp of the Siemens & Halske Company is built for 100 watts and voltages of 100, 110, 130 and 200 volts. The candle power is from 70 to 75, so that the specific consumption is about 1.4 watt per candle. Colors of 120 nm are used for these lamps. The life is the same as that of the tungsten lamp and the color of the light does not change during life. The lamp is intended especially for silk, color, paper factories, etc., where it is important to distinguish colors as in ordinary daylight.—*Zeit. f. Beleucht.*, April 30, 1913.

**Tungsten-Lampen ohne Glüh.**—A new and a revised German patent (No. 698, 1912) of C. H. Scherer. Fine anhydrous tungstic acid is reduced by a hot current of hydrogen in the presence of a volatile drying agent, for example, phosphorous pentoxide. The crystals of tungsten which are formed are separated out, cooled, pressed into flakes and then agglomerated by pressing and simultaneously heating, into rods, which are then rolled in a machine which applies pressure at more than two points.—*London Elec. Engng.*, May 8, 1913.

**Relative Visibility of the Different Colors of the Spectrum.**—R. A. HOUTSROO.—An account of an investigation carried out by a student society of Glasgow University. Light in the middle of the spectrum is much brighter than light at the ends for the same intensity of radiation in ergs per second per square centimeter. The brightness of any part of the spectrum in candles per square centimeter may be defined as the visibility of that part. To determine the relative visibility of the different parts of the spectrum we must determine the luminosity curve of the spectrum and the distribution of energy throughout it. The results of the tests are given in form of diagrams.—*Light Magazine*, May, 1913.

### Generation, Transmission and Distribution

**Electrically Driven Rolling Mill.**—A. LAMBERT.—An abstract of a paper read before the (British) Iron and Steel Institution on a new form of electrically driven two-high continuous-running reversing mill. The basic line of the new system is that it is a mill with two fully driven rolls, one in each end to make the bottom roll drive roll, and vice versa, then at each reversal of the position of these rolls there will be a pair in the opposite direction. All these pairs of rolls be mounted on a common frame, which are free to rotate in each frame in bearings, this will afford a continuous-running two-high mill, which gives reversals at each pass in the same long strand through an angle of  $180^\circ$  deg.—*Int. J. Production and Distribution Electric.*, May 9, 1913.

**Electricity in Africa.**—L. S. WOODWARD.—A paper read before the South African Institution of Electrical Engineers on details of using the three-phase system in electrical supply installations in some well-known cases in troubles experienced in practice and methods of overcoming them, and with a description of the various controllers in



use. Efficiency is not everything to be desired. Slightly lower efficiency combined with good running qualities, ease of repair and reliability are to be desired rather than higher efficiency, increased cost and difficulties of repair and the constant dread of the rotor and stator laminations touching.—*Transactions South African Inst. Elec. Eng.*, February, 1913.

**Surface Combustion.**—C. D. McCourt.—An illustrated article on the "Bonecourt" process of surface combustion, which consists essentially in passing a mixture of gas and air in the proportions for complete combustion through or over porous bodies. As soon as a certain temperature is reached the combustion proceeds on the porous surfaces, and radiant heat is the result as distinct from flame. The theory underlying this process is explained, and some details are given of the results obtained in practice.—*London Electrician*, May 2 and 9, 1913.

### Traction

**Mountain Railroad Locomotive.**—A profusely illustrated detailed description of the 800-hp single-phase locomotives of the Mittenwald mountain railroad. The motor is directly connected to the axle without gearing. There is no artificial cooling. The emf on the trolley wire is 15,000 volts (frequency 15 cycles per second). The voltage is reduced to 300 at the motor, which is a compensated repulsion machine.—*Elek. und Masch.* (Vienna), May 4, 1913.

**Storage-Battery Cars.**—H. BECKMAN.—The conclusion of his paper read before the Electrical Society of Vienna on modern storage-battery cars and motor trucks.—*Elek. und Masch.* (Vienna), April 27, 1913.

**Industrial Locomotives.**—F. RIEP.—The conclusion of his illustrated article on the principles of design of electric locomotives supplied with energy from a trolley wire, for mines and other industrial purposes.—*Elek. Zeit.*, May 1, 1913.

### Installations, Systems and Appliances

**One Three-Phase Versus Three Single-Phase Transformers.**—WILLIAM NESBIT.—An article illustrated by diagrams discussing the relative advantages and disadvantages of three single-phase versus one three-phase transformer with respect to the disarrangement of service in case of breakdown, cost, efficiency, floor space, weight, insulation failures, etc. The author concludes that there are so many minor advantages and disadvantages applying to each type of transformer that a concrete summary is difficult, but that for feeding energy to motors, rotary converters and motor-generator sets three-phase transformers will in the near future be very generally employed. In an editorial note on the same subject A. B. Bender points out that for general distribution work where the market is to be gradually developed the single-phase lighting load is usually developed first. In this case it is best to install first one single-phase transformer and to add a second and a third unit later.—*Elec. Journal*, May, 1913.

**Safety of Electric Installations.**—G. DETTMAR.—The first part of an article giving data on electrical installations for lighting, power and traction in Germany, with special reference to the question of liability of causing fires, accidents to workmen, etc. A great many statistical data are given covering a long series of years. The article is to be continued.—*Elek. Zeit.*, May 8, 1913.

**Electric Plant at Fusan, Korea.**—J. DOUGLAS COLLIER.—An illustrated article on the new electricity works at Fusan, Korea. The generators are gas-driven and the two main sets have a rating of 300 kw each at 3500 volts, three-phase, 50 cycles. *London Elec. Review*, May 9, 1913.

**Electric Restaurant.**—An illustrated description of a new fashionable restaurant in Kensington, London, in which not only all the cooking operations but also bread-baking, ventilating, heating, refrigerating and time service are to be carried out electrically.—*London Electrician and Elec. Review*, May 9, 1913.

### Electrophysics and Magnetism

**Stability of Residual Magnetism.**—N. H. WILLIAMS.—An account of an experimental investigation in which an oscillographic method was developed for plotting any kind of a magnetic cycle with an alternating current of 60 cycles provided eddy currents and end effects are negligible. The method is applicable when the flux variation is as small as 150 lines of induction, and it may be used for any cycle in which the flux variation is greater than that amount. It was shown that in a given specimen, for any value of residual magnetism, there is a definite elastic limit which is the maximum field that can be applied to the specimen without producing permanent demagnetization, and that if any field not exceeding the limiting field be applied and then removed, the specimen will return to its original condition. Within the elastic limit, magnetic stress and strain are approximately proportional; that is, the demagnetization is approximately proportional to the field intensity that produces it, provided the specimen returns to its original remanence when the field is reduced to zero. The hysteresis as indicated by the area of the curves is small and is approximately the same for soft iron and hard steel. The extreme points of the stable demagnetization and recovery curves lie inside the maximum hysteresis curve. The susceptibility to small demagnetizing fields increases slightly with decrease of residual magnetism, the maximum difference observed being about 8 per cent. The recovery from the effect of a demagnetizing field is greater for low value of residual induction. For hardened steel it was found to be 1960 lines of induction per square centimeter, or 24.5 per cent of the maximum residual induction. For drawn piano wire it was 1200 lines per square centimeter, or 8 per cent of the maximum remanence, and for soft iron it was 600 lines per square centimeter, or 6 per cent of the maximum remanence. These numbers represent the elastic limits for low values of residual magnetism. There is shown to be a well-defined upper limit beyond which the residual magnetism of an open magnetic circuit of steel cannot be made to pass. For hard steel the elastic limit is approximately proportional to the difference between the residual magnetism and the maximum magnetism.—*Phys. Review*, May, 1913.

**The Hall Effect.**—ALPHEUS W. SMITH.—An account of an investigation the chief results of which are as follows: An increase of temperature causes changes in the Hall effect and in the Nernst effect in monel and nichrome which are very similar to the changes produced in nickel, iron and cobalt under corresponding conditions. The Nernst effect and the Hall effect in monel and in nichrome depend on the temperature in essentially the same way. The addition of small quantities of silicon to iron causes a large increase in the Hall effect and a decrease in its temperature coefficient. Under similar conditions there is at first a decrease in the Nernst effect, then a reversal of its direction and an increase to a larger value in the opposite direction. Associated with this reversal of the Nernst effect is the reversal of the thermo-electromotive force against copper. In a transverse magnetic field the resistance of monel and nichrome behaves like the resistance of nickel except that the changes under corresponding conditions are less than in nickel. The influence of tension on the longitudinal change of resistance in a magnetic field in monel and in nickel is the same except for magnitude. Large quantities of occluded hydrogen do not change the Hall effect in palladium. In the neighborhood of 275 deg. C. there is a molecular transformation in tellurium. The Hall effect after this transformation is about double its value before the transformation. The Hall effect has been determined in iron pyrites and galena. In these crystals the Hall electromotive force is proportional to the magnetic field.—*Phys. Review*, May, 1913.

**Absorption of Electric Waves by Air and Steam.**—J. E. IVES.—An account of an experimental investigation the

results of which show that for electric waves about 10 cm long passing through air at pressures ranging from 76 cm to 0.001 cm of mercury, and through water vapor at pressures ranging from 1.50 cm to 0.015 cm, the absorption of the energy of the waves by the air, if it exists, must be less than one-tenth of 1 per cent per centimeter. This was also found to be true when the air was ionized by radium chloride placed in open vessels within the tube. This would indicate that the ionization of the air by radium produces, if any, only a very small effect upon its absorbing power for electric waves about 10 cm long.—*Philos. Mag.*, May, 1913.

**Radio-Activity.**—A paper by A. Fleck on the existence of uranium Y reaches the conclusion that all attempts to confirm the existence of the substance called uranium Y were unsuccessful. A paper by J. A. Cranston discusses the growth of radiothorium from thorium 2. A paper by E. Rutherford and H. Richardson deals with the analysis of the gamma rays from radium B and radium C. A paper by A. van den Broek discusses the quantitative relation between the range of the alpha particles and the number of charges emitted during disintegration.—*Philos. Mag.*, May, 1913.

**Discharge of Electricity from Incandescent Bodies in a Vacuum.**—G. OWEN AND R. HAMILTON.—An account of an investigation in which the nature of the carriers, in a vacuum, of the negative thermionic currents from palladium, pure and commercial platinum and iridium was studied. The carriers consist almost entirely of free electrons. If any of the discharge is carried by heavy ions, then the proportion of heavy ions to electrons is, for all temperatures, certainly less than one part in two thousand and probably less than one part in ten thousand.—*Philos. Mag.*, May, 1913.

**Egg White.**—F. F. NORTHROP.—An illustrated note describing some experiments on the electrical properties of egg white.—*Journal Franklin Institute*, April, 1913.

### Units, Measurements, and Instruments

**Measuring the Degree of Irregularity in the Speed of a Motor During One Revolution.**—H. ARMAGNAT.—At the recent instrument exhibition of the French Physical Society in Paris there was shown a modification of the apparatus of Boncherot for measuring the degree of irregularity of speed of a motor during one revolution, which was described and illustrated in the *Revue Feb. 22, 1913*, page 419. Instead of the instrument shown in Fig. 4 at that place the instrument shown in Fig. 2 is now used. It is a small galvanometer with movable coil C mounted on pivot and provided with a mirror. The directive force is produced by two springs KR which act on the ends of the

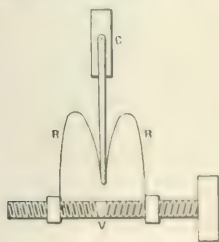


FIG. 2. INSTRUMENT FOR MEASURING SPEED VARIATION.

needle. The tension of the springs is adjustable by means of the screw V, which permits one to change the distance between two nuts. The sensitiveness of the modified apparatus is such that at a distance of 1 m. in the amplitude of the oscillations of the movable spot covers the whole scale with 25,000 ohms in the circuit. When resonance has once been established the tension of the springs is slightly

changed in order to produce surging and the amplitude of the oscillations is varied by changing the resistance in the circuit which can be brought down to about 2500 ohms. The whole measurement depends on the ratio of the resistance. The apparatus is adapted for the mean frequency and permits variations of 10 per cent from its frequency. M. Blondel has found another solution of the same problem. A generator giving an oscillating periodicality in the speed is attached to the motor, and the generated current is used in a resonance galvanometer. It is sufficient to decompose the current by resonance in order to know the frequency of the motion of the irregularities. For the galvanometer there must be made a commutator generator, which must excite in the coil all kinds of harmonics. Blondel uses a uni-polar generator the armature of which is supported on bearings of cylindrical air-gap. Stationary brushes collect the current. The coil is about 0.01 m. in diameter.—*Revue Phys.*, May 2, 1913.

**Reductor for Ballistic Measurements.**—H. ARMAGNAT.—An interesting description of the Armagnat reductor, which is the most successful reduction of the ballistic constant.

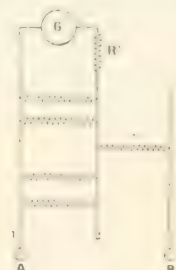


FIG. 3. REDUCTOR FOR BALLISTIC MEASUREMENTS.

Society in Paris. In ballistic measurements it is almost necessary to vary the sensibility of the galvanometer in a certain proportion. It is necessary, first, that the galvanometer be already shunted through the same resistance, and second that the product of the multiplying resistance of the shunt and of the resistance in the galvanometer shall vary in a certain proportion. By the "Méthode" because the shunt consists of a number of resistors in parallel (Fig. 3), one of these resistors being withdrawn from the circuit

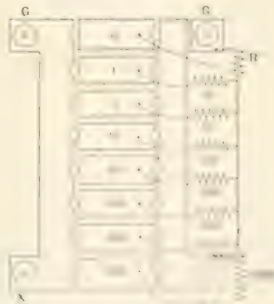


FIG. 4. REDUCTOR FOR BALLISTIC MEASUREMENTS.

connection and connected in series with the internal coil in the case of ballistic measurements, or in parallel with the current through which the current to be measured passes. If K is the resistance between the points of application of the multiplying resistance in the shunt and the current in the galvanometer, and if the terminals of and R are connected to a resistor of small resistance with a potential difference

$U$  between the ends of the resistor, then  $U = Rmi$ . Likewise if  $A$  and  $B$  are connected to a resistor of small resistance which is subjected to a flux variation  $d\Phi$  a quantity of electricity  $g$  will pass through the galvanometer so that  $d\Phi = Rmg$ . It can be easily shown, however, that  $Rm$  is proportional to  $r$  (the resistor in the right-hand branch of the diagram). The shunt is, therefore, made up of resistors having the desired ratios of resistance in the form of a resistance box, as shown in Fig. 4. The coil is connected to the terminals  $XX$  and the galvanometer to  $GG$ . One single plug is inserted at the right, all other plugs at the left. The multiplying factor is then indicated by the number printed on the single plug at the right. An additional resistor  $R'$  is used to regulate the damping of the galvanometer.—*La Revue Elec.*, May 2, 1913.

**Electrostatic Instruments.**—C. C. PATERSON, E. H. RAYNER AND A. KINNES.—A paper in abstract presented before the (British) Institution of Electrical Engineers in which the authors describe the electrostatic instruments now used at the National Physical Laboratory for the measurement of alternating currents, pressure and power. Some applications of the instruments are also given. In addition to the electrostatic wattmeter, the quadrant voltmeter and the Campbell method of measuring large alternating currents are described.—*London Electrician*, May 2, 1913.

**Thermopiles.**—W. W. COBLENTZ.—A note on the construction of thermopiles for monochromatic illuminators. The author describes some tests on the relative sensitivity of bismuth-iron and bismuth-silver thermopiles.—*Journal Franklin Institute*, May, 1913.

**High-Pressure Tests.**—An account of a general discussion before the South African Institute of Electrical Engineers on the value of high-pressure tests on windings, etc., of electrical machinery. What should be the values of the pressures used and for what periods should they be applied?—*Transactions South African Inst. Elec. Eng.*, February, 1913.

### Telegraphy, Telephony and Signals

**Receiving Two Messages by One Antenna.**—H. THURM.—For the reception of two wireless telegrams heretofore two separate antennas were necessary, each of which was connected with a receiver. The Telefunken company has devised a method in which one antenna is sufficient with two receivers for receiving two wireless telegrams at the same time. The antenna is switched alternately from one receiver to the other at such rapid intervals that even within the period of a point in the Morse alphabet either receiver is connected several times to the antenna. The arrangement permits an independent working of the two receivers; the switching arrangement is described and illustrated.—*Elek. Zeit.*, May 8, 1913.

### Miscellaneous

**Consulting Engineers in Germany.**—An editorial note stating that "the position of consulting engineers in Germany cannot be a very happy one, if credence is to be attached to a statement made in the Prussian Diet in the course of the proceedings on April 19 in connection with the second reading of a government bill to authorize the conversion to electric traction of the Berlin City and Circle Railways. As is known, the bill had previously occupied the attention of a commission, whose proceedings were private, although an official report in a brief form was issued at the termination of each day's sitting, summarizing the general course of the deliberations. The commission heard and called for expert evidence on the proposals for electrification of the railways in question, but the names of the witnesses have not been disclosed. The reason, according to the statements made in the Prussian Diet by Herr von Pappenheim, is quite simple, although showing a surprising state of affairs. When the experts were examined by the commission, and were asked to intimate their

opinions, they almost invariably expressed the wish that the attitude they assumed should not be allowed to be made public, and that their names should also be withheld, as they feared that they would have to suffer injury in the further progress of their science and profession from those at the back of the government scheme. Commenting on this statement, a Berlin newspaper remarks that affairs in the electrical industry are such that experts outside of the large undertakings apprehend personal disadvantages if they express opinions which differ from the business interests of these undertakings."—*London Elec. Review*, May 9, 1913.

**Education of Engineers.**—NORMAN HARRISON.—A paper read before the South African Institute of Electrical Engineers on the education and training of engineers. The author discusses successively the following questions: What is required of an engineer? What has been done in the past to provide engineers? What is being done at the present time? He finally gives an outline of a proposed action to be taken in the future. He emphasizes that "it is useless for a single individual to move in a question of this kind, because no matter how carefully he may approach the subject, there is bound to be a tendency to bias the directive effort in the direction of a particular line of business. If, however, the electrical, mechanical and civil engineering societies took up the case jointly, this bias would be eliminated, and it would be easy to arrive at a course of study which would be suitable as a groundwork for all branches of engineering work."—*Transactions South African Inst. Elec. Eng.*, January, 1913.

**Slaby.**—A biographical sketch by Reithoffer of the work of the late A. Slaby.—*Elek. und Masch.* (Vienna), April 27, 1913.

## Book Review

**THE DESIGN OF ALTERNATING-CURRENT MACHINERY.** By James R. Barr and R. D. Archibald. New York: The Macmillan Company. Cloth; 496 pages, 340 illus., 17 working drawings. Price, \$3.75.

Mr. Archibald says in the preface that "This book was written by the late Mr. James R. Barr and was intended to be a companion volume to his book on 'Direct-Current Electrical Engineering.'" Mr. Archibald, who is the head of the electrical engineering department at Dundee Technical College, undertook the revision and the editing of Mr. Barr's manuscripts. The work treats of the theory and design of alternating-current transformers, generators and rotary converters and, as stated in the preface, it is patterned somewhat along the lines pursued by Arnold and La Cour in their theoretical treatise. The book before us deals with the theory of wave form, of insulation and insulating materials, of the fundamental principles of transformers and of the design of transformers. Then follow the chapters on alternators, their theory and design, and methods of testing. The theory of parallel operation is then discussed and the periodic time of free oscillations is given. In connection with this theory the author gives the determination of the proper inertia of the flywheels and the now generally adopted theory that this inertia should be such that the free or natural period of oscillation will not coincide with forced impulses received from the prime mover. Examples of the design of alternating-current generators and turbo-generators are then introduced, with very excellent plates illustrating examples of English practice. The concluding chapter deals with rotary converters, their theory and design, and good plates illustrative of their design are found embodied in the book. The great care and thought bestowed by the authors upon this work, and the accuracy of the treatment, make it a most useful book for the student of electrical engineering.



# New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed  
Manufactured Products of Interest to Electrical Readers

## Pressed-Steel Cable Supports

The design of the guy clamp illustrated herewith is based upon the principle of introducing a slight bend in the cable, enabling it to exert a greater holding power than could be established by means of the friction grip alone. The clamp proper is made from pressed steel in one piece. In applying the clamp it is laid upon the two strands, each fitting into a recess provided on either side and the T-headed bolt turned into the position shown in the cut. The bolt head is then turned at right angles and is pulled down onto the cables by setting up the nut. This gives a slight bend to the cable, which affords a holding power said to be in excess of the strength of the rope.

This method of application avoids the necessity for removing the bolt when the clamp is applied and reduces materially the time and labor required for application. The design shown in this illustration is of the single-bolt type, intended for a pull of 1200 lb. and for 0.25 in. and 5/16-in. wire. The two-bolt unit for 3/8-in. and 7/16-in. strands is provided with a bridge in the center between the bolts to give a double bend to the strand. This gives it a holding strength which in a test has been found to be in excess of 15,000 lb.

A cable bracket, also made of pressed steel throughout, is composed of a slotted rack into which are inserted any desired number of bracket arms. The rack is made in the form of a channel-iron and is furnished with an offset end at the bottom, thus permitting a number of racks to

be pressed into the arm to give it transverse strength as a beam in carrying its load. At the inner end of the arm is electrically welded a headpiece of steel which rests against the face of the post, serving to take the exhaust set up in the pressure of a weight at the end of the arm. The arms are made in 10-in., 7-in. and 4-in.

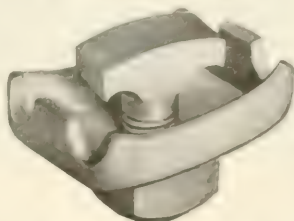


FIG. 2—GUY WIRE CLAMP

lengths to suit different conditions and are wide enough to prevent any condition of lead cable strands resting upon them. The bracket is strong enough to hold a 200-lb. weight on the end of the 10-in. arm.

These cable-line accessories are manufactured by the Barnes & Kobert Manufacturing Company, New Haven, Conn.

## Electric Starter for Automobiles

The electric starter made by the Rushmore Dynamo Works, Plainfield, N. J., operates at 6 volts, which is the standard unit for automobile lighting. The motor is a series-wound machine geared directly to the flywheel. The pinion is keyed fast on the armature shaft and the entire armature moves endwise to engage and disengage the pinion. The shifting gears and ratchet drive are eliminated, and it has been found unnecessary to employ any friction clutch to protect the motor against "back kick" due to advanced spark. This is accomplished by making the motor powerful enough to turn the engine over in spite of a premature ignition.

The engaging and disengaging of the armature pinion with the flywheel gear is accomplished by displacing the armature endwise by means of a compression spring contained in the shaft which is forced below or a distance of 10 in. for this purpose. The spring bears with a pressure of about 15 lb. against the horizontal end of a lever which runs against the end cap of the winding up frame in Fig. 2. In this position the pinion is out of mesh with the flywheel gear. When the button is pushed the belt support rolls upward the armature like the motor of a solenoid, thus working back of with the pinion properly engaged. The armature then starts to turn.

The instant the engine picks up speed the motor is tripped at its head and the spring down. Then the return action ceases and the spring instantly pulls the armature into its old position, ready to engage a ratchet clutch. It remains until the operator releases the first switch. Then the gears unmesh themselves, the battery the engine starts the same motion as before, overcoming a ratchet clutch. At high speed is reached.

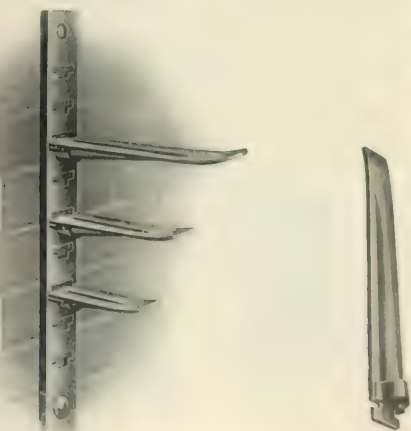


FIG. 1—CABLE BRACKET AND ARM

be placed one above the other to form a continuous beam. There are T-shaped slots in the rack at intervals of 1/2 in. which allows the bracket arm to be set at any desired elevation with a close degree of adjustment.

The bracket arm is made with a T-shaped head, the wings of which catch in the narrow part of the T-shaped slot in the rack when the arm is in place, and a groove

To carry out the detail of the system the switch has two active contacts. The first contact partly short-circuits the armature so that it rotates only enough to allow the pinion to slip into mesh, while a resistance limits the current to that required to excite the field magnet. On the second contact the short-circuit is removed and the resistance cut out and the motor then exerts its full power to turn over the engine. In order that the switch movement shall not be too abrupt it is opposed by a stiff spring. On

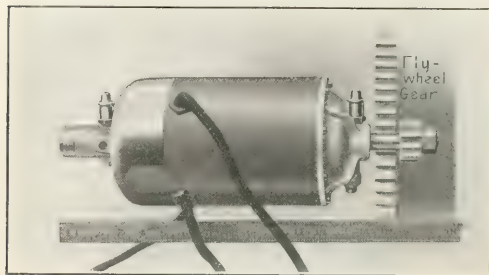


FIG. 1—ELECTRIC STARTER FOR AUTOMOBILES

the release motion the switch arm jumps the armature short-circuiting contact.

The motor is of the ironclad type with four poles and four brushes. The commutator is long enough to provide for the endwise movement. Copper-gauze brushes of low electrical resistance are used. Sufficient oil reaches the commutator from the adjacent bearing to keep it lubricated. It is stated that the commutator, being sparkless and self-lubricated, requires no attention from the user. It is claimed that owing to certain electrical features of design and to the absence of intermediate gears the efficiency from battery to pinion is as high as 75 per cent. This permits the use of a moderate-size battery. The model B starter, 6 in. in diameter and weighing 47 lb. without the switch, will easily turn a 60-hp, six-cylinder engine at 80 r.p.m. while drawing 100 amp from the battery. With a smaller engine the speed may be from 100 to 150 r.p.m., thereby making it possible to start directly on the magneto.

Owing to the extreme flexibility of the series motor, a given winding and gear ratio will cover a very wide range of engine sizes. It is stated that the model B starter develops a torque of about 62 in.-lb. when running at 750 r.p.m., taking a current of 125 amp at 5.75 volts, at which

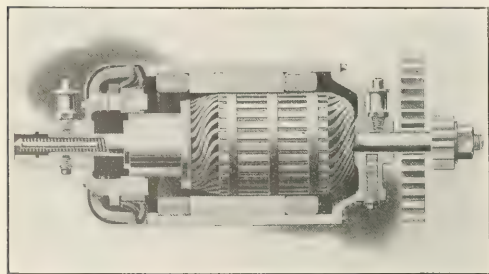


FIG. 2—SECTION OF ELECTRIC STARTER

output it shows an efficiency of approximately 73 per cent. At the instant of starting, the torque may be several times this value.

It is stated that when taking a current of 300 amp with the battery at 5.5 volts the motor will exert a torque of 206 in.-lb. at 440 r.p.m., at which output it shows an efficiency of approximately 65 per cent.

## Single-Phase Motor for Cylinder Printing Presses

The Kimble Electric Company, Chicago, has placed upon the market a single-phase motor for cylinder printing presses and similar machines, which is of the series-compensated type. It has the usual series characteristics, namely, high starting torque, sturdiness, simplicity and

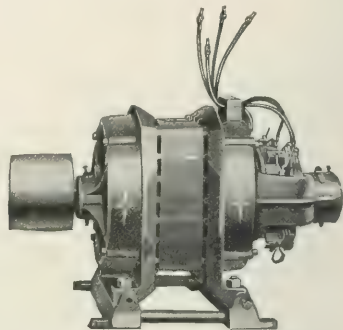


FIG. 1—SINGLE-PHASE MOTOR FOR PRINTING PRESS

wide speed range. On account of the method of control the higher speeds of the range are not attended by a reduction of torque. The motor can exert a constant torque at any speed within its range. Its output in horse-power therefore increases with the speed, which is a feature not possessed by the direct-current motor or induction motor. These features make the motor an ideal form of drive for cylinder presses. The motors range in size from 1 hp to 5 hp.

The speed control is accomplished by varying the impressed voltage by means of an auto-transformer; no resistors are used. The use of the auto-transformer brings about a considerable reduction in the quantity of current required in starting and for all speeds except the maximum. The 60-cycle motor, it is said, will start against 100 per cent of full-load torque, with 60 per cent of full-load current and 29 per cent of full-load power from the line. This result is extremely good, as compared with a slip-ring polyphase motor or a direct-current motor, either of which would take about one and seven-tenths times the current

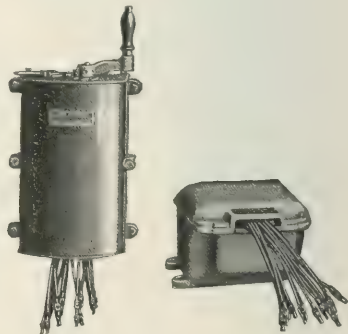


FIG. 2—STARTING DEVICE FOR MOTOR

and three and one-half times the power this motor takes to start the same load.

The 60-cycle motor is able to start under three and two-fifths times the full-load torque, this feature enabling the motor to accelerate promptly.

As evidence of the sturdiness of the motor and controller it is said that the motor may be thrown repeatedly

from full speed in one direction to full speed in the opposite direction, without injury to any part of the apparatus.

This result is partly due to the presence of some reactance in the motor circuits which prevents the passage of an excessive current through the windings, even though full-line voltage is applied with the armature stationary. Under such a condition only about three times full-load current would pass through the windings, and this would not endanger them unless continued for an appreciable time. The commutation is very good even on excessive overloads. This result is attributed to the large number of segments and the resulting small reactance voltage and to the grade of brush employed. No resistance leads are used, and hence repairs can be made outside of the factory by any competent workman. The temperature rise on continuous full load is 38 deg. C.

The controller provides for eighteen forward and eighteen reverse speeds. Each step of speed amounts to 3.5 per cent of the maximum speed. The speed control is flexible and is said to be capable of meeting the exacting requirements of color printing. On the controller are two handles, the main and the auxiliary, so interlocked that only one can be operated at a time. The auxiliary handle is removable, and its removal leaves the controller locked in the "off" position, thus making it impossible to start the press until the handle is returned. This arrangement safeguards both the press and the operator against accidents. Each notch of the auxiliary handle gives a speed change of 17.5 per cent of the maximum, and each notch of the main handle divides this large step into six smaller steps. Three such ranges are obtainable by shifting the position of the auxiliary handle, thus making a total of eighteen speeds. The reverse speeds are obtained by simply throwing the main handle in the opposite direction.

The controller is compact, being 17.25 in. high, 10.5 in. wide, and projecting 6.5 in. from its support. All hinges and contacts are replaceable without disturbing any connections.

The efficiency of the motors at the rated speed is about the same as that of slipping induction motors of similar rating when the latter are operated without external rotor resistance. At lower speeds the single-phase motor has a better efficiency than the induction motor, and the difference is greater the greater the speed reduction. At three-quarters maximum speed the induction motor will consume about 27 per cent more power than the single-phase motor and at half speed about 70 per cent more power. At 68 per cent of full speed the induction motor will consume twice as much power as the single-phase motor. This result is largely due to the avoidance of losses in the control of the single-phase motor.

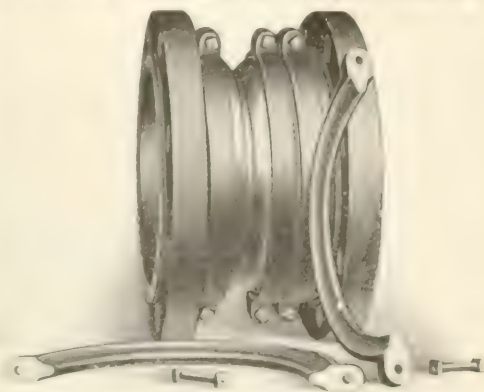
### Self-Equalizing Expansion Joint

The "Badger" self-equalizing expansion joint is a corrugated copper joint having external rings and is designed to take up changes in length of pipe lines carrying steam, water or air. The external rings on the corrugations distribute the strain and by thus bringing many corrugations into service no one of them is called upon to take more than its share of the strain. The rings force a part of the strain to the next corrugation and as each corrugation has only a slight movement the joint is said to last almost indefinitely.

The number of corrugations depends upon the pressure and upon the length of the joint. For high pressures and superheated steam the change in length is considerable and, therefore, more corrugations are used. For very low pressures, as in exhaust piping two or three corrugations are sufficient for the slight alteration in length. There are even some cases where the expansion is small but vibration must be taken up, in which case the joint does not need any

external rings. But in most cases external rings are used both to add strength and also to stiffen the exhaust pipe against collapse.

This joint is made by the C. E. Badger & Sons Company, 617 1/2 Park Street, Boston, it is available in a complete line of sizes for all pressures and with flanges drilled to A. S. M. E. standards, for both high-pressure and extra-



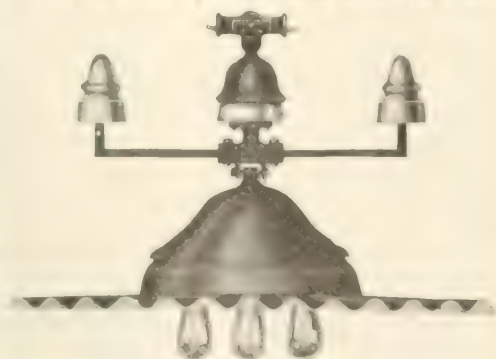
SELF-EQUALIZING EXPANSION JOINT

heavy pressures. These joints are used for making and fitting up to heat exchangers and pipe lines. The expansion work they have been made in sizes up to 6 ft. in diameter and are oval, rectangular, circular and in special forms.

### Outdoor Tungsten Fixture

What is claimed to be the largest one-tungsten fixture made is employed on a new street fixture put on the market by the Time-Materials Company of South Milwaukee, Wis. The fixture, which weighs 150 lb., is made of cast iron and is 4 ft. 6 in. high, weighs 150 lb. and is made of cast iron.

There are several types of outdoor fixtures. For smaller



OUTDOOR TUNGSTEN FIXTURE

suspensions, the fixture and lamp combination, the tungsten suspension and the tungsten suspension, the tungsten suspension and the tungsten suspension. The tungsten suspension thereby insuring the fixture, tungsten and tungsten suspension. The tungsten suspension is made of cast iron and is made of cast iron.

The tungsten suspension and tungsten suspension are made of



ported by a special high-voltage insulator, which protects the series cut-out sockets and other live parts from grounds or leakage of current. It is so designed that even if it should break the fixture will not drop to the ground. For the support of the live wires a steel channel arm is provided, which has the so-called "Hendee" insulator tips. These allow for contraction and expansion and for irregularities in the grooves of the insulators.

### Aluminum for Electric Vehicles

Aluminum possesses a number of most desirable features as a material for automobile bodies. Its extreme lightness is combined with great strength, it will not warp, is unaffected by weather conditions, will never rust and permits the application of a non-cracking satin finish. It also possesses the quality of being easily malleable. For the purpose of shaping the plates special pressing machines and automatic hammers have been designed. In the electric vehicle made by the Anderson Electric Car Company, Detroit, the roof is built of a single plate and each window sash is constructed of one piece, there being no joints to open up, swell or warp. Side panels, fenders and even hub caps on these cars are also made of aluminum.

### High-Tension Disconnecting Switches

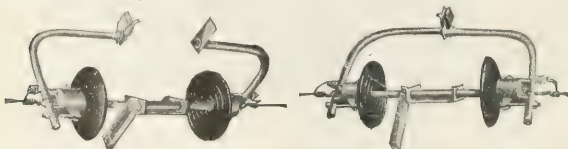
A simple method for sectionalizing high-tension lines is embodied in the disconnecting switch placed on the market by the K. P. F. Electric Company, 37 Stevenson Street, San Francisco, Cal.

Two disk or suspension-type insulators are mounted upon



FIG. 1—DISCONNECTING SWITCH INSTALLED ON POLE

heavy iron pins, one of which is secured to a channel-iron base, while the other pin passes through the flanges of the channel through brass-bushed holes, a wrought-steel lever or crank being connected to the latter, providing means for its rotation. The channel iron base is drilled for two bolts by which it is secured to the cross-arm. The contact-carrying arms of galvanized-iron pipe are bolted to cast-iron caps which are cemented upon the heads of the insulators. The contact pieces consist of a pair of brass jaws or clips on the stationary arm and a blade on the movable arm.



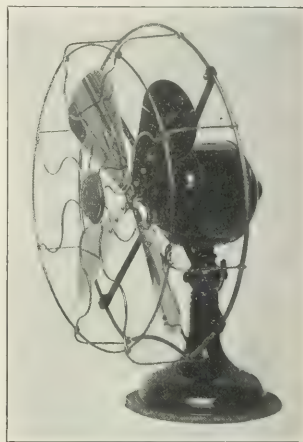
FIGS. 2 AND 3—SWITCH IN OPEN AND CLOSED POSITIONS

For a three-phase circuit three units are belted to the ordinary cross-arm in the pin positions. For opening the switch a wooden rod is attached to the steel lever previously mentioned and by using the pipe clamp as a fulcrum the contacts are pried apart.

The switch illustrated is designed for use on circuits operating at from 6600 volts to 22,000 volts.

### Oscillating Fans

A feature of particular interest in the fan shown here is that the oscillating mechanism is entirely concealed within the rear-end cover. The horizontal over-all dimensions of the fan body are shortened by placing the detachable worm, which operates the oscillating mechanism, between the bearings instead of on a shaft extension beyond the rear bearing. The arc of oscillation may easily be changed while the fan is in motion by means of a knurled-head screw at the bottom of the oscillating disk which regulates the arc in four steps between 90 deg. and zero, at which point oscillation ceases. An automatic safety device has been adapted to the oscillating mechanism which causes oscilla-

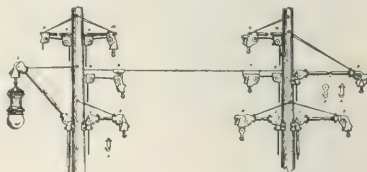


FAN WITH CONCEALED OSCILLATING MECHANISM

tory motion to cease temporarily if the fan body comes in contact with any obstructions which would tend to interfere with its swing. As soon as the obstruction is removed the fan at once starts its oscillatory motion. This fan has been developed for the market in several sizes for various services by the Diehl Manufacturing Company, Elizabethport, N. J.

### Mast-Arm with Safety Catch

A mast-arm for arc lamps provided with a safety device of notable merit is now manufactured by Hickey & Schneider, 227 Fulton Street, New York. The rope for raising and lowering the lamp is inclosed in pipes in order to eliminate trouble from rain, sleet and snow and to increase the life of the rope. Different types are made for use of single or double rope. Owing to the safety catch there is no



MAST-ARM WITH SAFETY CATCH

strain on the rope after the lamp has been hoisted into place. The safety catch is said to be positive in action. Pulleys are installed in both knuckle and safety catch to facilitate the hoisting and decrease the wear on the rope. Some types of cast arms can be set at various angles so as to suit any conditions. Other types are designed always to be set level with the ground however the pole may lean.

### Float-Type Recording Differential Pressure Gage

The float-type differential pressure recorder herewith illustrated has been developed by the Bristol Company, Waterbury, Conn. The construction and principle of operation of the instrument will be readily understood by referring to the sectional diagram, Fig. 2. There are two pressure chambers *A* and *B*, intercommunicating through



FIG. 1—FLOAT-TYPE RECORDING DIFFERENTIAL PRESSURE GAGE

the connection *C*. A cylindrical float *D* in the pressure casing *A* is connected by arms to the shaft *F*, which extends through the casing. The recording arm *G* is directly connected to the end of the shaft *F*.

Connections are made by means of the pipes *H* and *I* between the pressure chambers *A* and *B* and the two pressures the difference of which it is required to record. Mercury or water is employed in the pressure chambers according to whether the differential range to be recorded is high or low.

When the higher pressure is applied to the chamber *B* through the pipes *I* the level of the liquid in this chamber is lowered and that in the float chamber is raised,

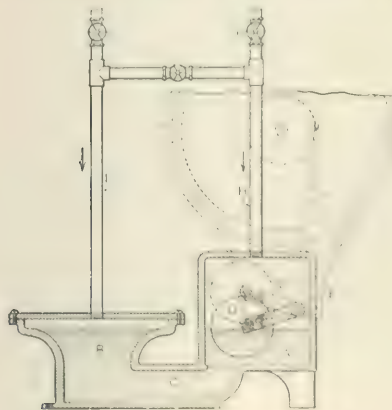


FIG. 2—SECTION OF RECORDING GAGE

thereby carrying the float and the attached recorder arm with it and making a record on a circular chart which is operated at the desired speed by making use of a clock mechanism.

By making the cross-sections of the pressure chamber *B* of certain proportions it is possible to produce a scale the graduations of which are uniform for equal increments of

flow or volume. The Bristol-Durand radii-averaging instrument can therefore be used to determine the total flow or volume from the chart record of the instrument for a period of two or more hours.

As these gages will operate on extremely low differential ranges, they are particularly well adapted for use in connection with Pitot tubes for recording volumes of liquids, air or gases.

This instrument may also be used to record the head of water in tanks under working conditions, or the condenser height of water in steam boilers and condensers. Another special application is that of recording the flow of water through a notch or over a weir, even though liquid is under pressure at the opening.

### Electric Range for Family Use

A new electric range suitable for the needs of a medium-sized family has recently been placed on the market by the Diamond Electric Company, Binghamton, N. Y. It has a flush steel top, 26 in. wide by 21.5 in. deep, with three hot



SMALL ELECTRIC RANGE

plates, two 8 in. and one 6 in. in diameter. The fire at the oven is 20.5 in. by 17.5 in. by 12.5 in., it being large enough to take care of all the baking necessary for a medium-sized family.

The hot plates as well as the oven are equipped for power heat control, the consumption of each device being as follows:

#### CONSUMPTION IN WATTS OF HEATING DEVICES

	Hot Plate	Oven	Grill
Lowest consumption	1,000	750	175
Normal consumption	1,200	1,125	225
Highest consumption	1,500	1,500	300

in the accompanying table. Each burner is independently raised, all being being placed in the heat in the right. It is rarely necessary to employ the "high" heat for the entire process of cooking or roasting, the "medium" or "low" heat being in excess of 90% of the time. The range is made with a full glass door. The height of the stove is 42 in.

# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Power Station for Maine Paper Mills.**—Stone & Webster are building a large dam at Dundee Falls, near Newhall, Maine, from which electrical energy will be furnished to paper mills at Westbrook, 9 miles away.

**Takes Up the Manufacture of Lighting Fixtures.**—The Central Electric Company, Greensboro, N. C., jobber, has undertaken the manufacture of electric, gas and combination lighting fixtures. The products are known as Ceco fixtures.

**Walpole Rubber Consolidates Its Boston Offices.**—On May 24 the Walpole Tire & Rubber Company, Walpole, Mass., consolidated its various Boston offices at one location, 757 Boylston Street, where its general sales offices are now maintained.

**Extending the Use of Telephone Dispatching.**—The Missouri, Kansas & Texas system is equipping approximately 800 miles of its lines with telephone apparatus for dispatching trains. About 218 miles of the work is being done in Texas between San Antonio and Houston.

**Motors for Railroad Shops.**—The Texas & New Orleans Railroad Company has placed a contract with the Richmond Electric Works, Richmond, Va., for thirty induction motors, the total rating of which will be 600 hp. They will be used in the shops of the railroad company at Houston, Tex.

**Hall Signal Company Expanding.**—The Hall Signal Company has acquired the patent rights formerly owned by the General Railway Equipment Company, the United States Electric Signal Company and the Sandwich Electric Company. All of the equipment formerly handled by these companies will be made and sold by the Hall company.

**Lowell Insulated Wire Company Doing Large Business.**—The Lowell Insulated Wire Company, Lowell, Mass., states that it is making additions to its plant as rapidly as possible, and that in spite of the tariff and other pessimistic sentiment it has almost enough business on the books at the present time to keep the plant running day and night for a year.

**New Plants on the Colorado River.**—The Colorado River Power Company has filed water rights on a section of the Colorado River 40 miles north of Austin, Tex., where a large hydroelectric plant will be erected. The same interests are also planning to construct a dam on the Colorado River at Ballinger. This will cost about \$1,000,000 and will be used chiefly for irrigation purposes.

**Lansden Company to Move.**—The Lansden Company, maker of electric vehicles, will move from Newark, N. J., to Allentown, Pa. A portion of the machinery and equipment of the plant is already on the way. A number of Allentown capitalists and investors are interested in the Lansden Company, and the new home of the company will be the plant of the Webb Company and the Mack Brothers Company.

**Enters Electrical Supply Jobbing Field.**—The Alter Light Company, 405 Desplaines Street, Chicago, which has been engaged in the manufacture of gas mantles for the past fifteen years under the direction of Jacob Alter, has broadened its field by becoming a jobber of electrical and gas supplies of all kinds. The manufacture of gas mantles will be continued, but no electrical equipment will be made. The company will move to a new factory within a month or so. The location of the latter has not been decided upon.

**Hydroelectric Development in Italy.**—A recent report on the industrial development of Italy shows that much of this has been along the lines of construction of hydroelectric plants for utilizing the immense water-power resources of

the Alpine provinces. At present there are 7500 hydroelectric generating plants in Italy, aggregating more than 1,000,000 hp in rating. Transmission lines from these are being erected all over the country, as a result of which still further impetus will be given to industrial development in Italy.

**Mica Imports Increased in 1912.**—During 1912, according to the United States Geological Survey, the imports of unmanufactured and trimmed sheet mica into this country amounted to 1,989,132 lb., valued at \$748,973, exceeding those of 1911 by 666,364 lb. in quantity and \$246,810 in value. The total value of mica produced in the United States last year was \$331,806, a decrease of \$23,908 as compared with that in 1911. The production came from eight States—North Carolina, New Hampshire, Idaho, New Mexico, South Carolina, Colorado, South Dakota and New York—named in the order of the value of their output.

**Mexico Northern Power Company Appeals to Great Britain for Protection.**—On account of the threatened destruction of portions of the railroad between Santa Rosalia and Boquilla, Mexico, by the so-called revolutionists, an appeal has been made by the Mexico Northern Power Company to the British government for protection of its property. This railroad, which is about 40 miles long, is used for transporting material and supplies to the power company's construction camp at Boquilla, where a \$6,000,000 dam is being built across the Conchos River. The railroad is owned by the same British syndicate that is constructing the dam.

**New 12,000-kw Turbine for Toledo Station.**—The Toledo Traction, Light & Power Company, which, as noted in these columns March 1, 1913, was in the market for a turbine unit, recently ordered from the General Electric Company a 12,000-kw, 25-cycle turbo-alternator set for its Water Street generating station. With the present extension to the power house there will also be installed four 680-hp boilers and a 250-ft. steel stack, besides a 1500-kw, 60/25-cycle frequency-changer set and a 1500-kw motor-generator set for the Edison downtown network. Encircling the boundaries of the city, the company is also erecting a 33,000-volt belt transmission line, 34 miles long, to supply energy to outlying factories. The circuit will be carried on steel towers.

**Electrical Contracting Work in Chicago.**—Henry Newgard & Company, electrical contractors in Chicago, recently completed the electrical installation in the new Chicago, Burlington & Quincy office building at South Clinton Street and West Jackson Boulevard. Some of the contracts which are being executed at present by Newgard & Company are for the electrical equipment of the Consumers' Building, at South State and Quincy Streets; the Kiper Building, at West Van Buren and South Sangamon Streets, and industrial plants for the Beardslee Chandelier Manufacturing Company, the American Hide & Leather Company and the Franklin Engraving & Electrotyping Company.

**Will Deal in Electric-Railway and Power-Station Materials.**—The Drew Electric & Manufacturing Company, 714 Traction Terminal Building, Indianapolis, which was incorporated in April, has taken over the electric-railway material department of the Indianapolis Brass Company, of which James H. Drew, president and organizer of the Drew company, was secretary and treasurer for the past six years. All of the materials, patents, patterns, trade designs, trade-marks, good will, etc., pertaining to the electric-railway business formerly carried on by the Indianapolis Brass Company have been taken over by the new company. The latter is now doing business, is enlarging



ing its manufacturing facilities and expects to carry a full line of electrical equipment.

**Norfolk (Va.) Jobber to Have New Offices.**—The Atlantic Electric Company, Norfolk, Va., jobber, will move on or about Oct. 1 from its present location, 85 Commerce Street, to a new building which is being erected for it on Granby Street, the main retail thoroughfare of the city. The entire building, which will be 20 ft. by 100 ft. and three stories high, will be occupied by the Atlantic company. The first floor will have a showroom in front devoted exclusively to the display of electric household appliances. The rear will be used as a receiving and shipping room, while the offices will be on the mezzanine tier. The second and third floors will be used as stockrooms. Arrangements are being provided so that manufacturers desiring to exhibit or demonstrate their lines will be furnished with every facility.

**Call for Century Motors Abroad.**—R. J. Russell, of the Century Electric Company, St. Louis, Mo., writes optimistically of the present conditions and immediate outlook in that company's business. He says in part: "The demand for Century single-phase motors is constantly increasing not only for the United States but for foreign consumption as well. We can see nothing on the business horizon at this time that would indicate that we might expect any other than a very active demand in all lines of the electrical industry for at least the next three or four months, beyond which time it is not safe to prophesy in a definite manner. We are building an eight-story reinforced-concrete building as an addition to our present factory, in hope that we shall be able to do away with the night force that we have had at work for more than a year. This new building will practically double our floor space."

**Pacific Gas & Electric Resumes Work on New Stations.**—The Pacific Gas & Electric Company has resumed work on the Lake Spaulding dam and power houses, construction of which was interrupted by the winter weather. More than 1000 yd. of concrete a day is now being poured at the dam. The tunnel leading from the dam to the power house is practically completed, some work having been done upon it during the winter. The Bear River canal is half finished, the steel is up for the power house, and its equipment will begin to arrive within thirty days. Two of the power houses further down the stream have been started. Work on four tunnels has begun, two dams are in process of construction, and two more will be started within a short time. Work on a third power house will be started in the fall. The company has applied to the California Railroad Commission for authority to issue \$5,000,000 of convertible debentures, which, if issued, will bring the total bonded debt up to \$80,838,000.

**Big Station for Canadian Paper Mills.**—The Laurentide Pulp Company is planning to make large extensions to its plant at Grand Mère, Quebec, to cost approximately \$1,000,000. One of the most interesting features from the viewpoint of electrical engineers will be the building of a large new power house capable of developing 65,000 hp. Application has been made to the Department of Public Works for permission to construct a dam across the St. Maurice River at Grand Mère. In the official application permission is asked for the right to use all the water power of the river at Grand Mère, with the exception of such a may be used for sluicing logs over the proposed dam. The dam is to be of concrete with sluiceways and a spillway 1000 ft. long. The power house will have eight main power units with space for two more units when required. It is understood that the application will come before the Cabinet council in the course of a few days and will be granted. Contracts for the waterwheels to be used in this station were awarded recently to the I. P. Morris Company, Philadelphia.

**German Equipment for Largest Chilean Power Plant.**—The largest electrical power plant of its kind in South America is about to be built for the Chile Exploration Company by the Siemens-Schuckertwerke, G.m.b.H., of Berlin. The contract for this important project has just been placed with the New York office of that concern. This contract includes a generating plant on the Chilean coast and a substation at a distance of about 130 miles from the

mines of the Chile Exploration Company. The power plant proper, which will have a rating of 40,000 kva, will consist of four 10,000-kva three-phase synchronous motor-generators coupled with turbines furnished by Escher, Wyss & Company, Zurich. Current will be generated at 5000 volts, and the latter will be stepped up to 110,000 volts by four 10,000-kva transformers and transmitted over a 130-mile transmission line to the substation, where it will be stepped down to 22,000 volts by four 10,000-kva transformers. The substation will contain seven motor-generator sets. Of these there will be three synchronous motor-generators of 22,000-volt and four induction motor-generator sets of the same size. Each of the motors is to be direct-connected to two 1250-kw, 5000-amp, 250-volt direct-current generators. The power plant, as well as the substation, will be delivered by the Siemens-Schuckertwerke, G.m.b.H., complete in every respect, including buildings and installations. The transmission line proper will be built by the Chile Exploration Company. The mining station is located at an altitude of about 10,000 ft. The high-tension side of all apparatus and machinery at the substation and also the greater part of the transmission line will be insulated for a voltage of 150,000 volts under ordinary conditions.

**Imports of Electrical Machinery by Japan.**—An official statement recently concerning the importation of machinery by Japan: "Japan is buying a steadily increasing amount of foreign machinery and equipment, the total for 1912 amounting to \$14,175,989. During the past three years the sale of products of this kind that were manufactured in the United States nearly doubled, the increase being upward of \$5,000,000. Nevertheless it is well known among the export representatives of the various competing companies that in some lines—particularly in cement and paper-making machinery—European manufacturers have recently been securing orders that were formerly obtained by American concerns. In other lines, however, the American manufacturers have steadily increased their exports, as is shown by the fact that their total sales to Japan in 1912 amounted to \$3,442,324, as compared with \$1,114,000 in 1911. The total importations of machinery and equipment into Japan for 1912 may be summarized as follows: Imported from the United States, \$3,442,324; from Belgium, \$60,331; from Germany, \$3,214,700; from Great Britain, \$7,100,000; and from other countries, \$348,342, making a total of \$14,175,989. Of generators, motors and transformers nearly 50 per cent of Japan's total imports in 1912 came from the United States. The competition in this particular line has been decidedly brisk. A summary of the points of the past three years is as follows: Imported from the United States in 1911, 1912 and 1913, \$2,114,000, \$3,442,324 and \$7,100,000, from Belgium, \$10,000, \$60,331 and \$60,331, from Germany, \$100,000, \$3,214,700 and \$3,214,700, from Great Britain, \$1,114,000, \$7,100,000 and \$7,100,000, from other countries, \$200,000, \$348,342 and \$348,342, making a total of \$14,175,989."

**Electrical Instrument Makers Rushed with Orders.**—The Duncan Electric Manufacturing Company, Baltimore, Md., states that its business in direct-current wattless meters has grown to such proportions that for over three months it has been obliged to operate its plant until 9 o'clock for five nights a week and is still obliged to do so. On this account the company found it necessary to double its factory space. Work was commenced several weeks ago upon a new building which is to be four stories high and of the most modern construction. Twenty modern bays along the lines of individual motor drive and efficient lighting, heating and ventilating systems are now being installed in the design of the new plant. There will be a large fire-proof safe in the basement of the building to safeguard such small tools as precision instruments, while to facilitate the handling of large tools a great industrial crane will be built. In addition to the new factory building there is also being built a new testing laboratory which will be equipped with communications, storage batteries and a complete line of modern manufacturing instruments. This building will be a four-story structure and will have a saw mill, crane and mill here a place for an engine set. The entire plant is to be furnished with an automatic sprinkler system and the modern system of heating. All

of the oil and gasoline used in the machine shops, the dip-room and the blacksmith-shop furnaces is to be fed from a central source by compressed air. To increase the motive power of the plant a second 150 Sterling boiler has been purchased, and to safeguard against break-downs, a 100-hp, three-phase motor, to operate upon the central-station service, will be installed and held in reserve. Besides these additions to its manufacturing facilities, the company has been making plans for enlarging its sales force. Within a few weeks it will have agents in twenty of the largest cities in the country, including those which have represented it at Boston, New York and Chicago for many years. Owing to the introduction of a considerable amount of automatic machinery and extensive improvements in its manufacturing methods, the Duncan company made a substantial reduction in the price of its watt-hour meters on May 1, as a result of which a material increase has taken place in the volume of its business.

**May Build Diesel Engines in This Country.**—Charles A. Carels, senior member and chairman of the board of directors of Carels Frères of Ghent, Belgium, builders of Diesel engines, has just arrived in New York. Mr. Carels has come to America to confer with the company's United States representative, W. R. Haynie, 30 Church Street, New York, upon the advisability of building Diesel engines in the United States and will be in this country for several weeks. During this time he will make an extended trip, covering the important industrial centers, and will visit some of the country's large manufacturing plants, particularly the more prominent tool works. Among the latter the plants of Lodge & Shipley, of Cincinnati, and the Niles-Bement-Pond Company, who, as a matter of interest, furnished a large part of the tools in the works of Carels Frères, will be visited. American methods are used to a great extent in the Ghent plant, of which the superintendent is D. G. Baker, an American engineer.

**Bakelite Patent Recognition.**—The General Bakelite Company has issued the following statement: "As a result of negotiations between the General Bakelite Company and the Condensite Company of America, the suits brought by the former against the latter and its customers for alleged infringement of the Bakelite patents have been withdrawn, and the Condensite company, recognizing the pioneer character of Dr. L. H. Baekeland's work, has acknowledged the validity of the Bakelite patents in suit and some others and will pay substantial royalties thereunder. The General Bakelite Company will continue the manufacture of bakelite under its numerous patents, and the Condensite company will manufacture condensite under the Aylsworth patents, as well as under the license just granted for such of the Baekeland patents as are broad enough to cover condensite. This recognition of the force and validity of the principal Baekeland patents by the only other manufacturer of condensation products is a confirmation of the Bakelite company's claims for the broad scope and pioneer character of these patents. There is much that is old in the art of making phenolic condensation products, but Dr. Baekeland was the first to make practical application of what theretofore had been chiefly laboratory experiments."

**Marshall Field & Company's Great Fleet of Electric Vehicles.**—One of the largest users of electric vehicles in the United States—possibly the largest—is the establishment of Marshall Field & Company, general merchants, of Chicago. This great concern, with its wholesale and retail departments, has about 150 electric delivery wagons and trucks in service and has ordered 50 more, so that by the end of this year its fleet will consist of 200 vehicles. The electrics now in use represent an investment of about \$750,000. All were made by the Walker Vehicle Company. Marshall Field & Company have seven garages, with a total rating in battery-charging equipment of about 1500 kw. They have just finished a garage at Forty-seventh Avenue and West Lake Street with a rating of 150 kw. A contract has now been signed for a similar equipment in the garage at Montrose Boulevard and Ravenswood Park. These garages are supplied with alternating current and equipped with motor-generators. In addition, Marshall Field & Company are adding 600 kw in equipment to the large downtown direct-current garage at the

corner of South La Salle and West Van Buren Streets. Electricity is purchased for all garages from the Commonwealth Edison Company. Frederick J. Pearson is the consulting engineer for Marshall Field & Company.

**Ohio Lighting Company Sold.**—The property of the Bellevue (Ohio) Light & Power Company has been purchased by the Lake Shore Electric Railway Company, of Cleveland. The latter will close down the generating station formerly operated by the Bellevue company and furnish energy to that community from its own station.

**Ottawa Company to Improve Its System.**—The directors of the Ottawa Light, Heat & Power Company, Ottawa, Canada, have authorized an increase of \$800,000 in the capital stock of that company. The proceeds will be used for additions and improvements to the system.

**Pennsylvania Telephone Company Will Be Reorganized.**—A plan for the reorganization of the Consolidated Telephone Companies of Pennsylvania has been formulated by a bondholders' committee. This company owns and operates the Lackawanna Telephone Company, Scranton; the People's Telephone Company, Wilkes-Barre; the Lehigh Telephone Company, Allentown; the Honesdale Telephone Company and the Berwick Telephone Company.

**National Telephone Company Sold.**—The National Telephone Corporation of West Virginia has been sold to an Eastern syndicate and its holdings will be split into three new companies in Ohio. The properties controlled by the National corporation were the Pittsburgh & Allegheny Telephone Company, the National Telephone Company of West Virginia, the National Telephone Company of Ohio, the National Telephone Company of Pennsylvania, the National Telephone Company of Monongahela County, the West Virginia Western Telephone Company, the Consolidated Telephone Company, the Union Telephone Company, the Woodfield Telephone Company, the Chartiers Telephone Company, the Pittsburgh & Wheeling Telephone Company, the Beeghler Telephone Company and the Western Central Telephone Company. The syndicate will pay \$1,000,000 for the assets.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND			QUOTATION	
		Per Cent	Period		May 21	May 26
Allis-Chalmers, t. r., 5th pd.	\$19,800,000	.....	.....	7½	7½	
Allis-Chal., pf. t. r., 5th pd.	16,050,000	.....	.....	15½*	15½*	
Amalgamated Copper.....	153,887,900	1½	0	73½	74½	
American Tel. & Tel.....	344,471,400	2	0	128½	129½	
Electric Storage Battery, c.	16,074,425	1	0	47½	47½	
General Electric.....	101,363,600	2	0	138½	139½	
Mackay Cos., c.....	41,380,400	1½	0	82*	82*	
Mackay Cos., pf.....	50,200,000	1	0	68*	67½*	
Western Union Tel.....	99,745,600	1	0	65½*	65½*	
Westinghouse, E. & M., c.	34,496,400	1	0	62	62½	
Westinghouse, E. & M., pf.	3,998,700	1½	0	114*	114*	

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Copper:	May 20		May 26	
	Bid.	Asked.	Bid.	Asked.
Standard, spot.....	15.37½	15.37½	15.37½	15.37½
London, standard, spot.....	2 s d	2 s d	2 s d	2 s d
Prime Lake.....	15.70	15.80	15.65	15.75
Electrolytic.....	15.55	15.65	15.55	15.65
Casting.....	15.40	15.50	15.40	15.50
Copper wire, base.....	17.00	17.00	17.00	17.00
Lead.....	4.35	4.35	4.35	4.35
Nickel.....	40.00	40.00	40.00	40.00
Sheet zinc, f. o. b. smelter.....	7.50	7.50	7.50	7.50
Spelter, spot.....	5.45	5.55	5.40	5.45
Tin, spot.....	47.62½	47.62½	48.20	48.20
Aluminum:				
Prompt delivery.....	25.00	26.00	25.00	25.50
Future.....	25.25	26.25	25.25	26.25

## OLD METALS

Heavy copper and wire.....	14.87½	14.87½
Brass, heavy.....	9.37½	9.37½
Brass, light.....	8.50	8.50
Lead, heavy.....	4.25	4.25
Zinc scrap.....	4.50	4.50

## COPPER EXPORTS IN MAY

Total tons to May 27..... 31,617



## Personal

**Mr. B. F. Wellington, Jr.**, has been appointed assistant Pacific Coast manager for H. M. Byllesby & Company.

**Mr. Carl Felker** has been appointed assistant contract agent of the Toledo (Ohio) Railways & Light Company.

**Mr. C. A. Dow** will assume the position of superintendent of the water and light department of the city of Alliance, Neb., on June 1.

**Mr. H. M. Jones** has resigned as manager of the Lewiston (Idaho) branch of the Pacific Power & Light Company of Portland, Ore.

**Mr. William W. S. Butler**, vice-president and general manager of the Western States Gas & Electric Company of California, Stockton, Cal., since its formation, has resigned.

**Mr. E. T. Scholer** has been appointed manager of the electric light station at Nezperce, which was recently acquired by the Grangeville (Idaho) Electric Light & Power Company, Ltd.

**Mr. C. E. Murray** has been appointed secretary and auditor of the Toledo (Ohio) Railways & Light Company. Mr. Murray was formerly associated with the Doherty interests at Joplin, Mo.

**Mr. Thomas F. Kelly**, sales manager of the Dayton (Ohio) Power & Light Company, has been appointed a member of the publicity committee of the Chamber of Commerce for that city.

**Mr. Howard Murray**, of the Shawinigan Water & Power Company, Montreal, Quebec, has been nominated as the new president of the Montreal branch of the Canadian Manufacturers' Association.

**Mr. W. M. Wood** has been appointed manager of the Lewiston (Idaho) branch of the Pacific Power & Light Company, of Portland, Ore. He was formerly in charge of the company's Sunnyside office.

**Mr. Robert M. Searle**, vice-president of the Rochester (N. Y.) Railway & Light Company, sailed from New York on May 27 for a ten weeks' automobile tour through Germany, France, Switzerland and Italy.

**Mr. E. M. Raver**, superintendent of transportation for the Michigan United Traction Company at Battle Creek, Mich., has resigned and accepted a position with the Lincoln (Neb.) Railway & Power Company.

**Mr. J. P. Moore**, formerly of the Westinghouse Electric & Manufacturing Company, has been made superintendent of power and equipment of the People's Incandescent Light Company of Meadville, Pa.

**Mr. F. W. Hallin** has been elected vice-president and general superintendent of the Arkansas Public Service Company, Little Rock, Ark., a corporation engaged in light and water service in several towns in the State.

**Mr. S. J. Kehoe**, superintendent of the Norwich & Westerly Traction Company of Norwich, Conn., has tendered his resignation, effective June 1, and accepted the post of superintendent of the Norwich (Conn.) Gas & Electric Company.

**Mr. Warren C. Earle**, who has been with similar board in several states and in practical work with several railroads in the United States, has been appointed chief engineer of the California State Railroad Commission, vice Mr. R. A. Thompson, resigned.

**Mr. Hugh L. Cooper**, vice-president and chief engineer of the Mississippi River Power Company, Keokuk, Ia., plans to sail in July for a six months' vacation and tour of Europe, following the completion of construction work on the great water-power plant at Keokuk.

**Mr. Samuel Kahn**, who has been assistant Pacific Coast manager for H. M. Byllesby & Company, Chicago, has been appointed general manager of the Western States Gas & Electric Company of California, Stockton, Cal., as successor to Mr. William W. S. Butler, resigned.

**Mr. R. A. Thompson**, chief engineer of the California State Railroad Commission, has resigned his position to accept a position on the advisory valuation board of the Interstate Commerce Commission just formed to undertake the valuation of the railroads of the United States.

**Mr. F. W. Willcox**, for many years connected with the Harrison Lamp Works of the General Electric Company and now with the British Thomson-Houston Company, London, England, is on a visit to this country. Mr. Willcox will return to England next month, leaving New York on June 14.

**Mr. F. J. Derge** has been appointed manager of light, heat and power for the Eastern Street Railways & Light Company. Mr. Derge was until his removal to Toledo a member of the New York staff of H. I. Doherty & Company, who recently acquired the major portion of the Toledo company's assets.

**Mr. Albert Frank Horton**, who opened the "Electric Shop" for the Commonwealth Edison Company, Chicago, has become associated with the Commonwealth Gas, Electric Light & Power Company of Baltimore, for which company he is arranging an operating supply of domestic devices in the form of an "electric house."

**Mr. Arthur Williams**, of the New York Edison Company, will sail for Europe on the S. S. France on June 3. Mr. Williams will visit Ghent, Paris, Berlin and Munich. He will also spend some time in London and other parts of England. In addition he will pay his respects to the King of Spain, who recently decorated him with the cross of the Royal Order of Isabela la Catolica.

**Mr. Frank Howard**, of Scranton, Pa., has recently been appointed assistant superintendent of the Whiting (W. Va.) Electric Company, which is controlled by the American Gas & Electric Company. For the past four years Mr. Howard has been superintendent of distribution at the Scranton Electric Company. He was manager and superintendent of the companies controlled by I. B. Russell & Company prior to entering the Scranton firm.

**Mr. John R. Wilde** has been appointed chief engineer of power plants for the Detroit Edison Company, succeeding Mr. B. J. Denman, who resigned May 1 to take up executive duties with the United Light & Railways Company at Davenport, Ia. Mr. Wilde has been in the service of the Detroit company for a number of years. Mr. J. A. Parker has also been appointed chief assistant engineer of power plants, sharing with Mr. Wilde the duties formerly discharged by Mr. Denman.

**Mr. H. L. Patterson**, who as first vice-president succeeded to the presidency of the Ohio Society of Mechanical, Electrical and Steam Engineers, following the death, April 25, of President E. M. Adams, that engineer for the Greater Cuyahoga Company, Akron, Ohio, is general manager of the Pennsylvania China Company, Trenton, Pa., manufacturer of porcelain insulators. Mr. Patterson was until recently in the operating field in Ohio, having served for a number of years as general manager of the Mahoning & Shenango Railway & Light Company at Youngstown.

**Mr. F. E. Bowman**, who was announced in the MAY 12 issue, was elected president of the Gas, Electric & Street Railway Association of Oklahoma at the meeting held in Oklahoma City on May 28.

He is also president, treasurer and manager of the Oklahoma Electric & Gas Company. Mr. Bowman was with a Westinghouse plant and entered the electrical field as an engineer and cashier with the Huntington (Ind.) Light & Power Company, where several electrical and mechanical men were interested and satisfied. He advanced through various positions with the company to the office of treasurer. Five years ago he was transferred from the Huntington Light & Power Company to accept his present position as superintendent, treasurer and manager of the Oklahoma Electric & Gas Company. The complete work which Mr. Bowman has accomplished since May, which has a population of 100,000 and the surrounding territory.



MR. F. E. BOWMAN



## Construction

### New England

**CAMDEN, MAINE.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 1, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures, hydraulic mail lift and approaches, of the United States post office at Camden, Maine. Plans and specifications may be obtained at the above office or from the custodian of site, at Camden, Maine. O. Wenderoth is supervising architect.

**GRANITEVILLE, VT.**—The Consolidated Ltg. Co., of Montpelier, expects to erect a new substation at the end of its 13,200-volt transmission line at Graniteville. The building will be built of brick and will be equipped for an output of 2700 kw, which will include transformers and new switching equipment. This substation will distribute electricity to the granite quarries in this vicinity and also for general lighting and heating service to the surrounding territory. Contracts for the purchase of all material will be handled from the office of Charles H. Tenney & Co., 201 Devonshire Street, Boston, Mass., who will also take charge of the work. H. D. Larrabee, of Montpelier, is manager.

**CAMBRIDGE, MASS.**—The Cambridge Gas, El. Lt. & Pwr. Co. expects to erect within the next six months a 12,000-volt, three-phase transmission line, 18 miles long, and to purchase substation equipment, including switchboard, transformers, poles, insulators, one tub transformer, lamps, etc., and a few general supplies with the next six months. G. Lobo is secretary and treasurer.

### Middle Atlantic

**BROOKLYN, N. Y.**—Commissioner George V. S. Williams of the Public Service has authorized the engineering staff to investigate a plan by which the two power houses to be located at the foot of Clark and Montague Streets, to be used in connection with the proposed tunnels under the river, may be operated by electricity.

**BROOKLYN, N. Y.**—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until June 2, for installing heating and ventilating apparatus, temperature regulators and elevators in the Bay Ridge High School, located on Fourth Avenue, at Sixty-seventh Street; also for installing electric ash hoist in the Boys' High School, on Marcy Avenue, between Madison Street and Putnam Avenue.

**BUFFALO, N. Y.**—Bids will be received by the Commissioner of Public Works, Room 5, Municipal Building, Buffalo, until June 3, for miscellaneous annual contract work to be performed and supplies to be delivered at the various school buildings and annexes, police and fire department buildings and other buildings under the control of the Department of Public Works, including keeping in repair the electric bell and telephone systems in the various school buildings and annexes, from Aug. 1, 1913, to July 31, 1914. Plans and specifications are on file and may be examined at the office of the deputy building commissioner, Room 6, Municipal Building, where blank form of proposals may be secured. Francis G. Ward is commissioner of public works.

**BUFFALO, N. Y.**—Bids will be received by the commissioner of public works, Room 5, Municipal Building, Buffalo, until June 4 for the construction of a new four-room addition to the present school building in District No. 7, located on Bailey Avenue, near Clinton Street. A separate and distinct proposal must be submitted on the following divisions: (a) Masonry, cut stone, iron work, plastering, etc.; (b) carpentry, painting, glazing, hardware, etc.; (c) roofing, sheet-metal work, steel ceilings, etc.; (d) electric wiring, lighting fixtures, etc.; (e) heating, radiation, etc.; (f) plumbing, gasfitting, etc. Plans and specifications may be seen at the office of the deputy building commissioner, Room 6, Municipal Building. Francis G. Ward is commissioner of public works.

**BUFFALO, N. Y.**—Bids will be received by the commissioner of public works, Room 6, Municipal Building, Buffalo, until June 5 for construction of a two-story firehouse, to be known as engine-house No. 36 and to be located at the corner of Elmwood and Great Arrow Avenues. A separate and distinct proposal must be made for the following divisions of the work: (a) Masonry, cut stone, iron work, fireproofing, plastering, etc.; (b) carpentry, painting, glazing, hardware, etc.; (c) roofing, sheet-metal work, steel ceilings, etc.; (d) electric wiring, lighting fixtures, etc.; (e) heating, ventilating, radiation, etc.; (f) plumbing, drainage, gasfitting, etc. Plans and specifications may be seen at the office of the deputy building commissioner, Room 6, Municipal Building, where blank forms of proposals may be secured.

**NEW YORK, N. Y.**—Bids will be received by George McAneny, president of the borough of Manhattan, at the offices of the commissioner of public works, Room 1808, 21 Park Row, New York, until June 4, for furnishing and installing an electric elevator in the County Court House, Chambers Street, City Hall Park. Blank forms, specifications and plans may be seen at the office of the auditor and offices of the commissioner of public works, Room 1808, 21 Park Row, New York.

**NEW YORK, N. Y.**—Bids will be received by the Board of Water Sup-

ply, 165 Broadway, New York, N. Y., until June 10 (contract 93) for the construction of a complete telephone transmission line, approximately 65 miles long, along the Catskill Aqueduct, between the Ashokan reservoir, in Ulster County, and the Croton reservoir, in Westchester County, the work to include a submarine crossing at the Hudson River. Pamphlets containing information for bidders, forms of proposal, contract, specifications, etc., may be obtained at the above address upon application, for which a deposit of \$10 will be required for each pamphlet, to be refunded upon return of same. Joseph P. Morrissey is secretary of board.

**PORT JEFFERSON, N. Y.**—The Port Jefferson El. Lt. Co. expects to purchase a few 500-watt Mazda lamp fixtures for street lighting. W. T. Wheeler is secretary and manager.

**AKRON, PA.**—The Akron El. Lt. & Pwr. Co., the Warwick El. Lt. & Pwr. Co., the West Earl El. Lt. & Pwr. Co. and the Ephrata El. Lt. & Pwr. Co., which were recently granted charters, have been consolidated under the name of the Akron El. Lt. & Pwr. Co. with a capital stock of \$40,000. H. Z. Bitner is president of the company and A. N. Wolf secretary and treasurer.

**ASHLAND, PA.**—The Lehigh Coal & Navigation Co., of Lansford, Pa., has purchased the property of the Edison El. Illuminating Co. at Ashland for \$70,000. This is the beginning of a general consolidation of electric plants in this part of the State to be supplied with power from the new plant of the Lehigh Coal & Navigation Co.'s plant at Hauto.

**CONNELLSVILLE, PA.**—Application has been made to the City Council by J. George Kaehler, of Rochester, for a franchise for the Connellsville Pub. Utility Co., which will be capitalized at \$500,000. The company proposes to furnish electricity, steam heat and hot water in Connellsville.

**ERIE, PA.**—The City Council has adopted an ordinance whereby the gas lamps now in use will be replaced with electric incandescent lamps. The Erie County El. Co. has the contract for substituting the lamps.

**HARRISBURG, PA.**—Charters have been granted by the State Department for the following companies: The Eddington El. Co., of Bristol; the West Cain Co., of Philadelphia; the Township of Bensalem Lt. & Pwr. Co., of Bristol; the Stoneboro Pwr. Co., of Stoneboro, and the Sandy Lake Pwr. Co., of Sandy Lake. Each company is capitalized at \$5,000.

**PHILADELPHIA, PA.**—Plans and specifications have been completed for a new power house to be erected for E. F. Houghton & Co. at 240 West Somerset Street.

**PHILADELPHIA, PA.**—A permit has been granted the William Steele & Sons Co. for the erection of a power house (85 ft. by 79 ft.) to be located at Blabon Street and the Reading Railway, for the George W. Blabon Co., to cost \$20,000.

**PITTSBURGH, PA.**—Bids will be received at the office of the secretary of Board of Public Education, Pittsburgh, Pa., until June 2 for furnishing operating supplies, including electrical, steam-fitting, carpenter supplies, etc. Bidding blanks and specifications will be furnished upon application to the superintendent of supplies, 703 Fulton Building, Pittsburgh. George W. Gerwig is secretary of board.

**EAST ORANGE, N. J.**—The finance committee of the City Council has decided to recommend a bond issue of \$20,000 for extension to the police call-box system, to cost about \$10,000, and to install a signal system at a cost of from \$6,000 to \$9,000.

**JERSEY CITY, N. J.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 16 for one electric elevator and one hydraulic lift in the United States post office at Jersey City, N. J., in accordance with plans and specifications, copies of which may be secured at the above office. O. Wenderoth is supervising architect.

**BRUNSWICK, MD.**—The Harper's Ferry El. Lt. & Pwr. Co., of Harper's Ferry, contemplates furnishing electrical service in Brunswick and proposes to build a power station here.

**BERKELEY SPRINGS, W. VA.**—The Northern Virginia El. & Pwr. Co., which recently purchased the property of the Cacapon Pwr. Co., of Berkeley Springs, contemplates the erection of an overhead transmission line between Martinsburg and Berkeley Springs. J. J. Lumley, of Winchester, Va., superintendent, will have charge of the work.

**BEDFORD CITY, VA.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 28 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures and approaches, of the United States post office at Bedford City, Va. Drawings and specifications may be obtained from the custodian of site at Bedford City or from the above office. O. Wenderoth is supervising architect.

**BROADWAY, VA.**—The proposition to issue \$25,000 in bonds for the construction of an electric-light plant will be submitted to the voters.

**CLIFTON FORGE, VA.**—The Virginia-Western Pwr. Co., recently incorporated with a capital stock of \$626,000 and a bond issue of \$1,500,000, contemplates the erection of a transmission line from Clifton Forge to Lexington and enlargement of its present steam plant at Clifton Forge, together with a hydroelectric plant in this vicinity. The company is to take over and consolidate the properties of the Virginia-Western El. Co. of Clifton Forge, the Covington Lt. & Pwr. Co. of Covington, and the Buena Vista Lt. & Pwr. Co. of Buena Vista, Va. W. G. Mathews is president of the company and A. C. Ford secretary and treasurer.





**PARIS, ILL.**—We are informed that no definite action has been taken in reference to the proposed ornamental street-lighting system. The proposed plans provide for the erection of 120 lamp standards, carrying five-lamp clusters (the upper lamp 60-watt and the lower 40-watt), to be maintained by underground wires. The cost of the system is estimated at \$12,000. Archie E. Wood, of Paris, is chairman of the lighting committee.

**PEORIA, ILL.**—The Central Union Tel. Co. has decided to rebuild the entire Peoria-Canton-Lewiston pole line and to string additional copper wire, at a cost of about \$44,000.

**QUINCY, ILL.**—It is reported that J. Delbar Roche, of New York, N. Y., and others are interested in a project to erect a hydroelectric power plant at Falls Creek Gorge, 13 miles south of Quincy.

**RICHMOND, ILL.**—The Village Board has granted the Public Service Co. of Northern Illinois, of Chicago, a franchise to erect and operate an electric-light system in Richmond.

**SPRINGFIELD, ILL.**—The secretary of the Springfield Pleasure Driveaway and Park District has been instructed to advertise for bids for lighting the parks and boulevards. The contract with the Springfield Gas & El. Co. expires July 25.

**SPRINGFIELD, ILL.**—Application has been made to the State Legislature by Secretary of State Harry Woods for an appropriation of \$25,000 for two passenger electric elevators, one freight elevator and an engine and generator to increase the output of the state power plant by 300 hp.

**SPRINGFIELD, ILL.**—The Southern Illinois Trac. Co., with principal offices in St. Louis, Mo., has filed an amendment to its charter with the Secretary of State, increasing its capital stock from \$1,500,000 to \$7,500,000 and making changes in the proposed route as follows: From East St. Louis through Belleville, New Athens and Marissa to Pinckneyville and Duquoin, passing through St. Clair, Randolph and Perry Counties. W. E. Trautman, Frederick Essen and A. W. Morriss are among the directors.

**SUPERIOR, WIS.**—The Superior Wtr., Lt. & Pwr. Co. contemplates improvements to its electric plant and service. New machinery will be installed.

**BREWSTER, MINN.**—There is a movement on foot to establish a municipal electric-light plant in Brewster. The cost of the plant is estimated at \$3,500.

**BUHL, MINN.**—The contract for new apparatus for the municipal electric-light and water-works plant was awarded to the Northern Electrical Co., of Duluth, instead of the Northern El. Co., of Minneapolis, as reported in the issue of May 17.

**DEERWOOD, MINN.**—The Cuyuna Range Pwr. Co., of Deerwood, has closed down its local steam plant and is now securing electricity from its hydroelectric power plant on the Crow Wing River, 10 miles from Brainerd. The plant is equipped with two 600-kva generating units and a third unit will be installed next fall. The company has closed a contract with the city of Brainerd to furnish energy at the switchboard for a period of nine and one-half years. It also has franchises in Deerwood, Crosby, Cuyuna and Ironton and furnishes one mining company about 300 kw continuous service. M. D. Stoner is manager.

**HUTCHINSON, MINN.**—The properties of the Hutchinson Ltg. & Mfg. Co., of Hutchinson, and the Glencoe El. Lt. Co., of Glencoe, have been purchased by Coler Campbell, of Huron, S. D. The combined properties will for the present be operated under the management of Thomas Pitts, formerly manager of the Hutchinson plant.

**STARBUCK, MINN.**—The town of Starbuck expects to purchase within the next two months for the municipal electric-light plant and system one 55-hp boiler (100-lb. pressure), one 30-kw, 225-volt direct-current generator, one 50-hp Corliss engine, smokestack, etc., and within the next four or eight weeks 3000 ft. No. 10 weatherproof wire and 6000 ft. No. 6 weatherproof wire. A. H. Dreyer is superintendent of the electric-light department.

**ALTON, IA.**—Messrs. Mason & Mason are installing an electric-light plant in Alton to furnish electrical service here. Equipment for the plant has been purchased.

**AUDUBON, IA.**—The Audubon County El. Co., which recently took over the local electric-light plant, expects to erect within the next two months a 10,000-volt, single-phase transmission line from Audubon to Hamlin and Exira and expects to purchase 50-kw and 75-kw, 10,000-2300-volt transformers and 2300-220-110-volt transformers (sizes from 2½-kw to 5-kw). Within the next six months the company expects to purchase electrical appliances, including flatirons, etc. The company has already purchased one 250-hp compound Corliss engine, one 150-kw, three-phase, 60-cycle generator, exciter and jet condenser with switchboard and instruments for same. R. E. Wieland is owner and manager.

**CEDAR RAPIDS, IA.**—The trustees of the city water-works are contemplating equipping the main pumping station for electrical operation and the erection of three electrically driven booster pumping stations.

**CENTRAL CITY, IA.**—The Wappisnicon Pwr. Co., of Central City, expects to purchase within the next six months material for 16 miles of transmission lines. The company deals in electrical appliances and supplies. William E. Fisher is secretary and treasurer.

**DECORAH, IA.**—The Interstate Pwr. Co., of Decorah, expects to erect within the next twelve months a central power station (steam turbine), also to purchase equipment for same, and to erect from 90 to 100 miles of high-tension transmission line, substations, etc., also to pur-

chase equipment for same, to serve the towns of the South Dakota division, including Wagner, Armour, Platte, Lake Andes and Scotland. The company recently extended its transmission lines to Cresco, a distance of 22 miles, to furnish energy to its plant there. Preparations are under way to raise the voltage of entire system to 13,200 volts, now operating at 6600 volts (100 miles of high-tension transmission lines in service). The city of Decorah is erecting 78 ornamental street lamp-posts and the city of Cresco is also erecting ornamental lamp standards. J. G. Hardenburgh has contracts for installing systems in both cities. G. W. Welch is electrical engineer.

**DUBUQUE, IA.**—The Union El. Co., of Dubuque, has just completed the installation of a 2500-kw General Electric turbine and accessories. E. M. Walker is general manager.

**LAWLER, IA.**—An election will soon be held to vote on the proposition to install an electric-lighting system in Lawler.

**LENOX, IA.**—The Lenox El. Co. is installing an electric-light plant here. The equipment will consist of one General Electric 90-kw, two-phase generator, one 80-hp Murray-Corliss engine and one 100-hp Murray boiler, contracts for which have been placed. F. A. Thompson is manager.

**PERRY, IA.**—The electric power plant owned by Waterson & Cowherd was destroyed by fire on May 16.

**SIGOURNEY, IA.**—Extensions will be made to the plant of the New Sigourney El. Lt., Ht. & Pwr. Co., including the installation of new boilers, generators and other equipment. The company is now rebuilding most of its transmission lines in the town.

**SIoux CITY, IA.**—Extensive improvements and additions will be made to the Sioux City Service Co.'s plant at Second and Water Streets, which will involve an expenditure of about \$100,000 and include two large new boilers to be added to the present battery of eight, a new air compressor and two new generators, also addition to the power house.

**SPENCER, IA.**—Improvements are contemplated to the municipal electric-light plant, including the installation of a 90-kw or 120-kw alternating-current generator and Corliss engine. Contracts will probably be awarded some time in June or July. Etta M. Smith is city clerk.

**WHITING, IA.**—The contract for construction of an electric light and power plant has been awarded to the Alamo Engine & Supply Co., of Omaha, Neb., for \$10,490.

**ASH GROVE, MO.**—The Ash Grove Milling & El. Co., recently incorporated, is installing additional equipment in its flour mill and will furnish electricity for lamps and motors in this city. M. L. Weygandt is president.

**CAMPBELL, MO.**—The Campbell Mill & Lt. Co. expects to erect 11 miles of transmission lines to take in three small towns within the next six months. T. R. Hutchinson is president.

**DEXTER, MO.**—Benjamin F. Eicholtz, owner of the local electric-light plant, expects to install next September a 125-kw, three-phase, 2300-volt generating unit (belted) and to purchase a complete switchboard equipment. Mr. Eicholtz would like to receive catalogs and literature on electrical appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, etc.

**GAINESVILLE, MO.**—The Missouri Gas & El. Co., of Gainesville, expects to erect within the next three months about 3 miles of transmission lines and to purchase about one carload of white cedar poles, 10,000 ft. No. 8 wire, four transformers and about 50 meters. The company now does house wiring and deals in electrical supplies. L. J. Beauregard is chief clerk.

**ST. CHARLES, MO.**—The city of St. Charles has contracted with the American Lt. & Pwr. Co. to furnish electricity in this city, thereby discharging the municipal plant. The company was also given a contract to light the streets of the city for a period of ten years. Under the new contract arc lamps will be used in the business district and tungsten lamps in the residence section. Electricity for operating the system will be secured from the power plant at the Keokuk dam. The contract goes into effect July 1. Charles H. Kaustein is city clerk.

**SENECA, MO.**—The property of the Seneca Mill & Elevator Co., of Seneca, has been purchased by H. H. Mace, of Mount Grove. The new owner is planning to put the plant in operation and also to install an electric-lighting system, furnishing a 24-hour service.

**SOUTHWEST CITY, MO.**—The local electric-light plant, owned by S. A. Robinson, was destroyed by fire on March 7 and as yet has not been rebuilt.

**WASHINGTON, MO.**—The Mississippi River Pwr. Distributing Co., which recently purchased the property of the Tibbe El. Co., of Washington, contemplates the extension of a transmission line from St. Louis to Washington, Union and Pacific, Mo. Various changes will be made to the local system, including pole-line transformers, lightning arresters, wire, etc. H. D. Hibbeler is local manager.

**BLUNT, S. D.**—The power plant of the Blunt Lt. & Pwr. Co. was destroyed by fire on May 12, causing a loss of about \$7,000.

**ATKINSON, NEB.**—J. Skredla & Sons, owners of the local electric-light plant, expect to purchase within the next two weeks one 60-kw generator and one 3-kw exciter, with switchboard, and one 80-hp oil engine. J. Skredla is manager.

**BROKEN BOW, NEB.**—The Custer El. Co. is planning to establish a day service (one day each week) for domestic purposes and will pur-



chase irons, vacuum cleaners, washing machines, etc. E. P. Steen is manager.

**CRETE, NEB.**—The city of Crete expects to purchase within the next six months a forced-draft system for the municipal electric light plant and an ornamental street-lighting system (probably 20 posts). L. G. Campbell is superintendent.

**FAIRBURY, NEB.**—The managers of the municipal electric light plant expect to purchase within the next six weeks material for distributing system, including wire, insulator pins, cross-arms and braces for series street-lighting system. G. D. Myers is superintendent.

**SILVER CREEK, NEB.**—Bonds to the amount of \$50,000 have been voted for the installation of a combined electric light plant and water-works system here. Bruce & Staden, of Omaha, engineers, have charge of the engineering work. A pressure-tank system will be installed and 7000 ft. of 4-in. and 1000 ft. of 6-in. water mains will be laid. The village already has an electric plant owned by private parties which it proposes to purchase if price is satisfactory, otherwise it will build a new plant. Ivo L. Davis is village clerk.

**STRATTON, NEB.**—The village of Stratton expects to purchase some meters for the municipal electric light plant within the next 12 months. Elmer Martin is engineer.

## Southern States

**SILER CITY, N. C.**—The Siler City L. & Tel. Co. is building a 200 ft. concrete dam across Rocky River, about 4 miles from the town. The company expects to have its plant ready for operation about Nov. 1.

**LOCKHART, S. C.**—The Lockhart Pwr. Co. has accepted the contract for construction of a solid masonry dam 1300 ft. long and 14 ft. high across Broad River, to cost \$150,000, to Willard Hogg & Co., of Spartanburg.

**LAWRENCEVILLE, GA.**—The City Council has closed a contract with the North Georgia Pwr. Co., to furnish electricity to the city for next year. It is estimated that the city will save about \$1,000, yearly, by saving a day service.

**JACKSONVILLE, FLA.**—Bids will be received by the board of trustees for the water-works and improvement bonds of the city of Jacksonville, Fla., until June 4 for furnishing switchboard, instrument and wiring in accordance with specifications, which are on file in the office of the board and at the office of the Seefeld Engineering Co., consulting engineer, Philadelphia, Pa. W. M. Boswick, Jr., is chairman of board.

**JACKSONVILLE, FLA.**—Bids will be received by the board of trustees for the water-works and improvement bonds of the city of Jacksonville, Fla., until June 4, for furnishing and erecting engine, masonry brick work, and ready for pipe connections in transmission tunnel to the city at the new power station, of two 500 hp. horizontal water-tube boilers (for a 200 lb. working pressure), complete with super heaters, fly-belly oil burners, fuel breaching and firing, complete. Plans and specifications are on file in the office of the board and at the office of the Seefeld Engineering Co., of Philadelphia, Pa., consulting engineer. W. M. Boswick, Jr., is chairman of board.

**MONTEREY, TENN.**—The Monterey Fruit & Vegetable Association, which was recently granted a franchise, is planning to install an electric light plant to cost about \$10,000. G. N. Welch, T. E. Gout and F. E. Price are interested in the company.

**SHELBYVILLE, TENN.**—The Duck River L. & Pwr. Co. is making arrangements to increase the output of its hydroelectric power plant at the old Mullins Mill site, 4 miles from Shelbyville, and will build additional waterwheels and generators.

**SPRINGFIELD, TENN.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 2, for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and equipment of the United States post office building at Springfield, Tenn. Plans and specifications may be obtained at the above office or from the architect of site. O. Wenderoth is supervising architect.

**RAY MINETTE, ALA.**—The Commissioners of Calhoun County are considering the question of installing an electric light plant to furnish electricity to light the new rail, coast line, but the question is pending the buildings.

**BIRMINGHAM, ALA.**—Plans are being prepared by the Kelly Co. to construct a power plant at a cost of \$250,000, to supply power to operate a proposed railway, 15 miles long, and also for traction motors in Birmingham. W. F. Kelley is engineer.

**JACKSON, ALA.**—The Bogles L. & Tel. Co. has accepted the contract within the next three months to install a new and improved electric plant, and about 2000 ft. No. 14 wire. John C. Bogles is president and treasurer.

**ROANOKE, ALA.**—The city of Roanoke is contemplating the purchase of a power house and 5 miles of new transmission lines, and also the purchase of two 150 hp. boilers and one 300 hp. engine, one 12-in. steam, one 100 gal. pump, one boiler-feed pump, double driven by electric motor, one switchboard, 12 transformers, 432 cables, about 300 lighting fixtures, 1000 insulators, one oil transformer, one 500 amp. circuit breaker, etc. W. S. Greene is superintendent.

**JACKSON, MISS.**—The Capital L. & Tel. Co. has accepted the contract for its plant. On the 20th inst. the company accepted a contract to install 5 miles of overhead wire. The company expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**WIGGINS, MISS.**—The Wiggins El. Lt. Co. expects to purchase within the next three months a new switchboard, instrument and wiring, and also a new plant, to cost about \$10,000. W. W. Wiggins is president and manager.

**ATLANTA, MISS.**—The city of Atlanta has been authorized by the board of aldermen to construct a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**BATESVILLE, TENN.**—The city of Batesville is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**BENTONVILLE, ARK.**—The city of Bentonville is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**DONESBORO, N.H.**—The city of Donesboro is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**HINTON, OKLA.**—The city of Hinton is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**ALBANY, TENN.**—The city of Albany is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**AUSTIN, TENN.**—The city of Austin is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**DENVER, TENN.**—The city of Denver is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**DECATUR, GA.**—The city of Decatur is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**MOBILE, ALA.**—The city of Mobile is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

## Pacific States

**SPRINGFIELD, CALIF.**—The city of Springfield is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**ST. JOSEPH, CALIF.**—The city of St. Joseph is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

**ST. JOSEPH, CALIF.**—The city of St. Joseph is contemplating the construction of a new plant. The city expects to start a campaign to advance the use of electric power within the city this summer. Frank Johnston is president and manager.

plant in Olympia. Work will soon begin on construction of the proposed plant.

**SEATTLE, WASH.**—A. H. Dimock, city engineer, has recommended to the City Council the acquisition of the Lake Cushman power site offered to the city of Seattle by Joseph E. Wickstrom for \$640,000, the purchase of which was authorized by the voters at the city election held March, 1912. It is estimated that 62,200 hp can be developed at a cost of \$5,063,000, exclusive of the cost of the power site. Two routes are proposed for the transmission line, one, about 78 miles in length, running south to Union City, Allen and Burley and spanning the narrows near Tacoma with a 5800-ft. span. The other route proposed would be about 100 miles long and would avoid this span by going by the way of Olympia, thence to Seattle.

**TACOMA, WASH.**—The citizens recently voted to authorize the construction of a municipal car line from the business district to tide flats. It is expected that the railway will be built, as the proposition is favored by Mayor Seymour and Council.

**TACOMA, WASH.**—G. Sands and J. D. Wheeler, both of Seattle, promoters of the Seattle-Tacoma-Olympia R. R. Co., have been granted a permit to build a temporary monorail system on the tide flats. The company proposes to build a monorail system from Olympia to Seattle, via Tacoma.

**ASTORIA, ORE.**—The ways and means committee of the City Council has instructed Engineer Bergsvik to investigate the feasibility of establishing a municipal lighting plant here. The construction of a dam 53 ft. in length and 60 ft. high, to cost \$300,000, capable of developing 3000 hp, is contemplated.

**COTTAGE GROVE, ORE.**—The Oregon El. Ry. Co., of Portland, contemplates the construction of a hydroelectric power plant on the upper McKenzie River, above Belknap. G. S. Edmundson has been instructed to make investigations and prepare an estimate of the cost of same.

**HAMMOND, ORE.**—W. H. Galvani, engineer, representing the Pacific Pwr. & Lt. Co., of Portland, has applied to the City Council for a franchise to furnish electricity for lamps and motors here. The company has also petitioned the County court for permission to erect transmission lines on the country road from Astoria to Warrenton and as far west as Fort Stevens.

**HOOD RIVER, ORE.**—The Pacific Pwr. & Lt. Co., of Portland, has discontinued construction work on its \$500,000 hydro-electric plant in Hood River, same to be resumed next fall. The company, it is stated, is preparing plans for the construction of a 3500-hp hydroelectric plant on the Natchez River near North Yakima, Wash.

**BEAUMONT, CAL.**—The Southern California Edison Co., Los Angeles, has applied to the State Railroad Commission for permission to construct and maintain a distributing system in Beaumont.

**DURHAM, CAL.**—The Durham Lt. & Pwr. Co. expects to purchase within the next six months 10 transformers, 300 poles, 5000 ft. copper wire, 40 meters and about 100 incandescents street lamps; it also expects to expend within the next 12 months about \$1,000 for electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. J. A. Foster is manager.

**GRASS VALLEY, CAL.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 30, for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior-lighting fixtures and approaches, of the United States post office at Grass Valley. Drawing and specifications may be obtained at the above office or from the custodian of site at Grass Valley. O. Wenderoth is supervising architect.

**HUNTINGTON PARK, CAL.**—Bids will be received by the Board of Trustees of the Huntington Park City School District until June 7 for the construction of a six-room and auditorium school building, to be located on Miles Avenue, near Hoe Street, as follows: (1) General contract, including heating and ventilating, but not including plumbing, wiring, electric fixtures, painting, tinting, sidewalks and blackboards; (2) plumbing and cesspools; (3) painting and tinting; (4) electric wiring; (5) electric fixtures; (6) blackboards; (7) sidewalks, in accordance with plans and specifications on file with and which may be obtained from Train & Williams, architects, 225 Exchange Building, Los Angeles. Orville W. Jones is clerk.

**LAKEPORT, CAL.**—The State Railroad Commission has granted the Mount Konociti Lt. & Pwr. Co. permission to issue \$20,000 in capital stock and a promissory note for \$5,000, the proceeds to be used for extensions to its transmission lines.

**LOS ANGELES, CAL.**—H. E. Huntington is having plans prepared for a 12-story building to be erected at Twelfth and Main Streets, Los Angeles, in the basement of which the Pacific Lt. & Pwr. Corp. will install a substation from which it will distribute alternating and direct current to the business district of the city. It is expected to have the plant in operation in September.

**NEEDLES, CAL.**—The State Railroad Commission has granted the Arizona-California-Nevada Tel. Co. permission to sell its plant to the Needles Gas & El. Co.

**PASADENA, CAL.**—The city of Pasadena requests bids for furnishing and installing 362 ornamental cast-iron lamp-posts with conduits, transformers, etc., on Los Robles Avenue, between the northern and southern boundaries of the city. Herman Dyer is city clerk.

**PORTERVILLE, CAL.**—Rights-of-way are being secured for the high-

tension transmission lines of the San Joaquin Valley Pwr. Co., of Fresno, from Porterville to a substation at Famosa, a distance of 60 miles. A new hydroelectric plant, to cost over \$1,000,000, is being erected in the hills east of here, from which the company will supply electricity to the oil fields of the west side and also for the various industrial plants, etc., in Kern County.

**REDLANDS, CAL.**—The Southern Sierras Pwr. Co., of San Bernardino, has applied to the State Railroad Commission for permission to distribute electricity in the city of Redlands.

**SAN FRANCISCO, CAL.**—The State Railroad Commission has granted the Southern Sierras Pwr. Co. permission to operate in Kern County.

**SAN FRANCISCO, CAL.**—The Pacific Gas & El. Co., of San Francisco, has been authorized by the State Railroad Commission to issue \$5,000,000 in debentures, of which the proceeds of \$3,750,000 will be used for the reimbursement for expenditure from income, the balance to be used for general improvements to its system.

**WATTS, CAL.**—At an election to be held June 17 the proposition to issue \$15,000 in bonds for the installation of a fire-alarm system will be submitted to a vote.

**WILLIAMS, ARIZ.**—The Williams Wtr. & El. Co. expects to purchase within the next 30 days two 25-cycle, 4400-volt generators and one 60-cycle, 2200-volt generator. An engine has already been installed.

**DILLON, MONT.**—The Union El. Co., of Dillon, expects to purchase within the next three months a 360-hp waterwheel operating under a 220-ft. head to replace the old waterwheel.

**LIBBY, MONT.**—We have been informed that the contracts have been awarded and the improvements and extensions nearly completed by the Libby Wtr., El. Lt. & Pwr. Co. It was reported in the issue of May 17 that the work was contemplated.

**ROUNDUP, MONT.**—The Roundup Coal Mining Co. expects to install in its No. 4 mine power house two 150-kw Kerr turbines and equip the entire mine for electrical operation, including haulage, pumping, etc. within the next two months. The company will also install two 300-hp Murray boilers at No. 3 mine and two 300-hp boilers at No. 4 mine. E. L. Rousseau is assistant general manager.

**TYRONE, N. M.**—Phelp-Dodge & Co., owners of the Chemung copper mine in Tyrone, contemplate the construction of a large electric power plant to furnish power to operate the pumps of the mine and for operating the cars through the tunnel that connects the Chemung Mine with the Leopold Mine.

## Canada

**VANCOUVER, B. C.**—The British Columbia Tel. Co., Ltd., will lay a submarine cable across the Saanich Inlet between a point on the east shore of Saanich Inlet and Vancouver Island. Bids for material and placing same will soon be called.

**VANCOUVER, B. C.**—Plans are being prepared by the British Columbia Tel. Co. for extensions to the Nanaimo branch, at a cost of \$20,000, and for laying a submarine cable between Vancouver and Nanaimo, to cost about \$120,000. Improvements will also be made to the telephone service in Nanaimo.

**WINNIPEG, MAN.**—Bids will be received by the chairman of Board of Control until June 5 for furnishing material and constructing an extension to the power terminal station. Instructions to bidders, plans, specifications and form of tender may be obtained at the office of the City Light and Power Department, 54 King Street. M. Peterson is secretary.

**BERLIN, ONT.**—The Dominion Tire Co., which is completing a new plant in Berlin, at a cost of \$300,000, has decided to erect a power plant in addition, to cost \$50,000, on which work will begin immediately.

**CHATHAM, ONT.**—The Hydro-Electric Power Commission of Ontario has submitted estimates to the city of Chatham for furnishing 1200 hp at 13,200 volts. The cost of distributing system for lamps and motors, including substation and transmission line from the transforming station of the commission, is estimated at \$67,308; multiple street-lighting system, including a certain amount of underground work, with lamp standards, \$14,264, and engineering and contingencies, \$8,157, making a total of \$89,729.

**OTTAWA, ONT.**—The directors of the Ottawa Lt., Ht. & Pwr. Co. have authorized an issue of \$800,000 in additional capital stock, the proceeds to be used to build and equip a gas plant in the east end of the city and for extensive additions and improvements being made to the electric-light and power plants in this city.

**TORONTO, ONT., CAN.**—Tenders will be received by Adam Beck, chairman Hydro-Electric Power Commission, Continental Life Building, Toronto, Ont., until June 16 for the construction of a concrete dam and reinforced-concrete power house at Wasdell's Falls, on the Severn River. Plans and specifications may be seen at the offices of the commission and copies of same obtained, for which a deposit of \$5 will be required, to be refunded upon return of plans. W. W. Pope is secretary.

**MONTREAL, QUE.**—The town of La Vallée has granted the Montreal Lt., Ht. & Pwr. Co. a franchise to light the town.







# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 20, 1913.

[Prepared by Robert Starr Allen, 16 Exchange Place, New York.]

- 1,061,992. TROLLEY-WIRE SPlice; W. J. Dukro, Lima, Ohio. App. filed May 24, 1912. Tubular end portions with inclined sleeve extensions in which the ends of the trolley wire are clamped by set screws, the extreme ends of the wires being clamped to a base plate.
- 1,062,000. TELEPHONE SYSTEM; R. C. M. Hastings, Columbus, Ohio. App. filed April 22, 1912. Only two subscribers in telephonic communication at a time, the other subscribers being shunted from the line and a signal being displayed to such shunted subscribers that the line is "busy."
- 1,062,016. PROCESS OF PRECIPITATING ULMIC COMPOUNDS FROM THE BLACK LIQUORS OF SODA-PULP MILLS; N. A. Langlet, Gothenburg, Sweden. App. filed July 30, 1909. Regenerates caustic soda by adding sodium chloride to the liquor, exposes the liquid at not lower than 65 deg. C. to electrolysis to precipitate dissolved organic substances and separates precipitate from the liquor.
- 1,062,017. ARMATURE-LEVER PIVOT FOR ALTERNATING-CURRENT MAGNETS; D. Larson, Yonkers, N. Y. App. filed Nov. 14, 1908. Armature lever is mounted on an elastic pivot rod and said lever is recessed to prevent contact with the rod adjacent to the bearing lugs in which the rod is journaled.
- 1,062,031. ELECTRIC METER; W. H. Pratt, Lynn, Mass. App. filed March 13, 1911. Flux-shifting device between the potential and series poles comprising two S-shaped conducting members superposed and reversed in position.
- 1,062,046. ELECTRICAL APPARATUS; H. B. Smith, Worcester, Mass. App. filed Jan. 10, 1908. Transformer; plurality of cylindrical barriers of bare conducting material separated by fluid insulation are interposed between the winding and core to constitute a series of condenser-capacity condensers.
- 1,062,052. OVERSPED DEVICE FOR DYNAMO-ELECTRIC MACHINES; H. G. Scott, New York, N. Y. App. filed April 5, 1907. Magnetic relay dependent directly upon the weakened field of the dynamo interrupts the direct-current circuit.
- 1,062,058. ELECTROLYTIC CELL; R. Threfall, Birmingham, England. App. filed Feb. 19, 1912. Eventual main electrodes and intermediate electrodes therebetween are mounted in an inner non-conducting tube open to the electrolyte; electrodes arranged at an angle to provide ducts for gases and liquid products of electrolysis.
- 1,062,062. TELEPHONE RECEIVER; E. B. Craft and J. N. Reynolds, Hackensack, N. J., and Greenwald, Conn. App. filed Jan. 2, 1911. Magnet system having a permanently magnetized steel bar and a soft-iron pole piece welded thereto.
- 1,062,083. STORM AND SURGE ALARM FOR TRANSMISSION LINES; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. Small wire running parallel with the line has one end grounded through a coherer which controls a local circuit containing an alarm.
- 1,062,096. CONTROLLER FOR ELECTRIC MOTORS; C. T. Henderson, Milwaukee, Wis. App. filed July 10, 1909. Means responsive at different predetermined voltages for reducing speed of motor and means for causing variations in the voltage impressed upon the first-mentioned means proportional to but wider in range than the variations in the speed of the motor.
- 1,062,111. ELECTRIC HEATER; J. L. Nylander, Seattle, Wash. App. filed Nov. 27, 1912. For administering injections; a heating tube provided with a resistance coil is slidably engaged on the flexible catheter pipe.
- 1,062,136. THERMOSTAT; T. H. Wurnb and R. Baumann, St. Louis, Mo. App. filed May 12, 1910. Pair of thermally operated springs and a fixed contact point, one of the springs having an elastic bifurcated end arranged to "snap" into engagement with the fixed point.
- 1,062,137. ELECTRIC FIRE ALARM; H. Barditzky, Memphis, Tenn. App. filed May 11, 1912. Adjustable highly expansive rod and an adjustable spring-pressed member co-acting therewith, the highly expansive rod having a graduated indicating dial.
- 1,062,139. ELECTRIC-LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Dec. 9, 1908. Cap of the socket has a right-angled boss so that the socket will stand at a right angle to the pipe or conduit to which it is attached.
- 1,062,161. TELEPHONY; I. Kitzee, Philadelphia, Pa. App. filed March 16, 1907. Duplexes the telephone circuit by generating the home impulse in two secondaries of inductances, causing the impulse to enter secondary by being induced into it and causing the impulse of the far-off station to travel through one of the secondaries and receiving device.
- 1,062,168. ARC-LIGHT ELECTRODE; I. Ladoff, Cleveland, Ohio. App. filed Feb. 21, 1912. An inner core of copper having an uncovered arcing surface and elsewhere a covering of iron.
- 1,062,185. ELECTRIC SWITCH; L. J. Pierce, Pittsburgh, Pa. App. filed Sept. 24, 1912. Contact members carry balls which make firm contact with the switch blade pivoted on said members.
- 1,062,199. STEP AND THREAD PLATE; W. P. Stephenson, London, Ontario, Canada. App. filed July 13, 1912. For electric cars; re-arranging surface and thread plate prevent accumulation of ice and snow.
- 1,062,228. INCANDESCENT LAMP LOCK AND SEAL; H. Davies and J. Cooke, West New York, N. J. App. filed July 9, 1912. Sheet-metal band surrounding the socket with its ends riveted together, said band having a groove to receive a wire and a screw and an in-wardly extending flange to engage the plug of the lamp.
- 1,062,240. REFILLABLE FUSE PLUG; F. H. Kaiser, Buffalo, N. Y. App. filed Oct. 3, 1911. Fuse wire has angular bent ends clamped between internal washers and the end caps of the shell.
- 1,062,249. APPARATUS FOR AUTOMATICALLY OPERATING PIANO PEDALS; C. W. Nyström, Karlstad, Sweden. App. filed April 17, 1910. Spring-pressed rod engaging the pedal is normally held inactive by pneumatic means governed by a valve which is controlled by the music strip.
- 1,062,281. FORMING MACHINE FOR TUNGSTEN FILAMENTS; J. W. Howell, Newark, N. J. App. filed May 7, 1908. Plurality of re-

ceptacles for filaments with connections whereby a stream of fluid may be passed through the receptacles.

- 1,062,282. AUTOMATIC CLOCK-WINDING MEANS; M. Karsch, Los Angeles, Cal. App. filed July 31, 1912. Electric winding with cam-operated arms controlling a clutch and circuit through the motor.
- 1,062,292. AUDIBLE SIGNAL FOR DETERMINING THE TEMPERATURES OF SEA WATER; A. McNab, Bridgeport, Conn. App. filed April 25, 1912. Receptacle open to sea water, thermometer therein, signal circuit including the thermometer and manual means for testing to determine the present temperature.
- 1,062,299. ELECTRIC STOVE; C. A. Pfanstiel, North Chicago, Ill. App. filed Nov. 11, 1912. Inner and outer independently heated concentric parts separated by an air space.
- 1,062,305. INCANDESCENT LAMP; C. P. Steinmetz, Schenectady, N. Y. App. filed Sept. 8, 1908. Wire strip or globe of magnesium, calcium or lithium deposited near leading-in wires is vaporized by discharge between the wires, thus absorbing the gases accumulated in the globe and automatically restoring the high vacuum.
- 1,062,344. COOKING AND DOMESTIC UTENSIL HEATED BY ELECTRICITY; J. Mann, Prague, Austria-Hungary. App. filed Dec. 17, 1912. Pottery vessel made in different parts with heating medium engaged in grooves in such parts.
- 1,062,361. GENERATOR OF INTERMITTENT ELECTRIC CURRENTS; M. P. Ryder, White Plains, N. Y. App. filed Jan. 3, 1906. Permanent magnet producing flux in opposite directions through a coil and a reciprocating armature which is detached from the core of the coil to break simultaneously a magnetic circuit of one source through the coil and a magnetic shunt for the other source around the coil.
- 1,062,362. ELECTRIC FURNACE FOR THE CONTINUOUS MANUFACTURE OF GLASS; M. Sauvageon, Colombes, France. App. filed Aug. 5, 1909. A mass of molten glass in a combined melting and refining chamber constitutes a heating resistance and serves to support by flotation a mass of glass-producing material, electrodes being immersed in the molten glass.
- 1,062,380. REGULATOR FOR DYNAMO-ELECTRIC MACHINES; V. G. Apple, Dayton, Ohio. App. filed Oct. 2, 1911. Worm gearing from dynamo rotates contact at greatly reduced speed and by such rotation prevents freewheeling of the vibratable contact therewith.
- 1,062,381. SIGNALING SYSTEM; C. B. Beatty, Binghamton, N. Y. App. filed Sept. 23, 1910. Circuit, including receiving and recording devices, is normally permanently closed through high-resistance paths at the central station so that electromagnetic actuating parts of the receiving and recording devices will normally receive insufficient current flow and will not operatively affect their recording or signaling mechanism.
- 1,062,387. MEASURED-SERVICE TELEPHONE SYSTEM; J. Erickson, Chicago, Ill. App. filed Nov. 22, 1911. Check-controlled system in which it is necessary to deposit two or more coins before conversation can be carried on.
- 1,062,388. METHOD OF CHANGING THE COMPOSITION OF IRON AND STEEL; B. Ford, Philadelphia, Pa. App. filed Jan. 12, 1909. The body of iron or steel is interposed between contacts and is heated uniformly by increasing electrical resistance at or near the contacts to provide heat to compensate for the heat conducted away by both contacts.
- 1,062,408. FLAMING-ARC HEADLIGHT; L. M. McBride, Denver, Col. App. filed June 12, 1911. Pair of magnet poles, terminating one above and one below the ends of the electrodes, with the poles, the center of the arc and the focal point of the reflector all in the vertical plane containing the focal axis of the reflector.
- 1,062,431. METHOD FOR PURIFYING CARBON FOR CARBON FILAMENTS; J. Billiter, Vienna, Austria-Hungary. App. filed Sept. 25, 1911. Obtains carbon containing less than one-tenth of 1 per cent impurities by transferring carbon into colloidal carbon by disintegration and thereafter separating the colloidal carbon.
- 1,062,522. SEPARATION OF SUBSTANCES BY THE WET MAGNETIC PROCESS; G. Ullrich, Magdeburg, Germany. App. filed Dec. 23, 1909. Forms a vertically and downwardly flowing liquid wall in a magnetic field, delivers material to the wall in a direction transverse to the field, and magnetically raises the material, movable particles in the liquid wall and then conveys them out of the liquid wall to a point of deposit.
- 1,062,551. ELECTROMECHANICAL SYSTEM FOR THE PROPULSION OF AUTOMOBILES; H. Pieper, Liège, Belgium. App. filed Sept. 25, 1906. Thermal motor and dynamo mechanically connected as a unit to separate units for the separate drive wheels, with storage battery; dynamos serving both as generators and motors.
- 1,062,555. ELECTRIC FIXTURE; E. L. Simons, Lansdowne, Pa. App. filed Oct. 1, 1912. Socket fixture for autos, etc., which by substitution of parts may be adapted either to a cigar lighter or a trouble lamp.
- 1,062,559. CUSHION FOR DIAPHRAGMS OF TELEPHONIC AND TELETYPE INSTRUMENTS; W. P. Stunz, Lansdowne, Md. App. filed Sept. 23, 1912. A spring-metal loop-formed annulus having undulatory branches bearing against the diaphragm and against the back of the transmitter casing.
- 1,062,571. PROCESS OF ELECTRIC WELDING; C. R. Murray, L. R. Barker, New York, N. Y. App. filed April 13, 1912. An upstanding strip is welded to the face of a plate by engaging the strip at substantially the edge to be welded, engaging a small area of the plate opposite the spot to be welded and passing current between places of contact.
- 1,062,577. TELEPHONE SYSTEM; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed Sept. 8, 1910. Local batteries eliminated; central-station selector generator, selectors at substations and a common telephone battery.
- 13,564. (reissue). APPARATUS FOR THE PRODUCTION OF HIGH-PRESSURE ELECTRIC CURRENTS; D. G. McCaa, Lancaster, Pa. App. filed March 17, 1913. (Original patent No. 1,047,545, dated Dec. 17, 1912.) Pulsating unidirectional current is supplied to primary of transformer by a pole changer interposed between primary of the transformer and a condenser which is in series with the primary and the source of current.

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otherwise will not a variety of kind of widespread interest. The subject of carrying capacity of children is important of wide scope, especially from the point of view of the resources temperature provides in the institutions. It is especially important in all parts of the world except the tropics, that the work and its growth in mid-winter and least in midsummer. During the hottest summer states in a variety of. In assessing the importance of this period and other findings to complete work in the carrying capacity of institutions which means that the temperature outside can be based on the C. higher and a corresponding lower in winter period. It seems that the available range of winter carrying capacity may be confined much rather than institutions. The relative advantage of the institutions in summer months seems that the three main points are fully brought out. It is a matter of great interest in the last part has been papers in Britain for some time. Standard forms of institutions which are the present and solution of institutions will result in the carrying capacity of institutions. It is a matter of great interest in the last part.



### Survey of Protection Conditions

In an interesting paper presented by Prof. E. E. F. Creighton at the N. E. L. A. convention, it was pointed out that in spite of the advantages of the aluminum lightning arrester the multi-gap arrester holds its own in distributing systems operating at about 2300 volts, partly owing to its lower cost and partly because transformers working at this pressure have a factor of safety of five, in regard to voltage, while in high-potential transformers the factor of safety usually falls below three. A noteworthy change has been made in aluminum lightning arresters within the last year or so, the organic electrolyte having been superseded by an inorganic solution. In the electrolyte previously used a vegetable growth occurred which transformed the electrolyte to vinegar, with a detrimental action on the films of the plates. It is curious that a vegetable should be able to undermine the protective powers of the aluminum arrester.

A good practical suggestion for driving an iron earth pipe 8 ft. deep, as given by Prof. Creighton, is well worth remembering. A 4-ft. drive is first made with a pipe somewhat larger than is needed. This first section is then withdrawn and the final smaller pipe put in its place. This brings the final pipe to a depth of 4 ft.—where the top can easily be reached with a sledge hammer without high staking, as only 4 ft. more have to be driven.

### Electricity on the Farm

Two important reports at the N. E. L. A. convention dealt with the rural uses of electricity. It is an unfortunate fact that little progress in the direction of utilizing electrical energy on the farm has been made in the East. In the first place, this section is not a farming country in the sense in which that phrase applies either to the rich plains of the Middle West or to the wonderful country still nearer the Pacific, in which irrigation changes the land from a desert to a garden. In such territory on the Coast the peak load for the year has actually been shifted from winter to summer through the effect of rural distribution, quite largely for irrigation purposes. The consensus of opinion the country over seems to be that great extensions of lines simply for the purpose of serving a rural territory are seldom justified, but where large transmission systems are in operation admirable work can be done in adding up rural load for irrigation, lighting and small motor service. In the aggregate a considerable amount of business has been secured even aside from those territories in the further West where irrigation is greatly in demand.

The field is worth cultivating, but the work must be done cautiously, steadily and with a keen eye for future extensions. One farm is not likely to require any great amount of power, a few kilowatts at the outside, aside from regions where irrigation is important. Yet in a good farming territory the aggregate load which may be connected is considerable, and it is important not only from the standpoint of revenue gain but from that of such service to the community as must inevitably help the cause of general energy transmission. Personal gain from transmission service is highly effective in building up popularity and in smoothing

the way toward the constitution of those great electrical networks which will mean so much for the future. There are scores of purposes to which electricity may be applied in farm service. Most of them are applications for small motors, with lighting and heating as subsidiary uses, and in addition there are the various chances for using electricity in the farmhouse in the line of ordinary domestic service. With proper arrangement of the apparatus it is possible to employ a single motor for a wide variety of uses which will greatly cut down the fixed charges on the equipment. These are liable to be high owing to the intermittent conditions of use. To acquire a rural load of any magnitude is not an easy task in most parts of the country, but it is well worth trying to introduce a motor here and a motor there for the purpose to which it can be economically applied and to follow up steadily the development of the work.

### Prime Movers

The report of the N. E. L. A. committee on prime movers is this year, as always, one of the most interesting and valuable presented. It takes up in succession the improvements made in water-power, in steam-power and in gas-power, all tending to simplification of the plant and lower operating expense. Even in water-power, which has sometimes been supposed to be a fair subject for standardization, there have been some notable minor improvements, particularly in the development of thrust bearings suitable for use with vertical-shaft turbines where these are desirable. Incidentally it is worth mentioning that some extremely high efficiencies have been obtained during the past year in large turbine units, thus showing plainly that the last word has not been said on waterwheel design. Steam turbines, too, have been the subject of material improvements. The drift of design has been in the direction of horizontal machines worked in many stages and at specially high superheat. One of the very interesting developments is the ingenious turbine of Dr. Farranti, the principle of which is continuing the superheating so as to keep the steam in a perfectly gaseous state in its travel through the turbine, re-superheating taking place between the stages. A consumption of steam as low as 6 lb. per hp-hr. is mentioned as within reach of turbines of this construction, the thermo-dynamic efficiency being as high as 24 per cent.

Concerning oil engines the report gives some extremely interesting details. There are now some 75,000 hp in engines of the general Diesel type in sizes up to 1000 hp. One report from an electric-light company using engines of this type gives the consumption of oil per net kw-hr. as 0.13 gal., which, with oil at 3.5 cents per gallon, brings the fuel cost down to the excellent figure of 0.455 cent per kw-hr. As compared with the results obtainable with five-dollar coal, this result means a considerable saving. The maintenance estimated is at least 50 per cent higher than that of a steam plant of the same output rating. Conditions indicate that a larger reserve plant must be carried with oil engines than under ordinary circumstances. The gas turbine is reported as not yet having reached a commercial stage, although some promising experiments have been



tried and are under way. Nothing, however, is as yet past the experimental stage so that this prime mover cannot now be considered seriously. The report is exceedingly well worth study as a résumé of the present status of prime movers.

### Unified Control of Electrical Systems

In our issue dated May 31 appeared articles relating to the systems supplying energy in Chicago and throughout Central Illinois territory. The present issue contains articles dealing with the generating, transmitting and distributing systems of the Public Service Company of Northern Illinois and the Illinois Northern Utilities Company. The history of the development of these companies contains many interesting facts. The North Shore Electric Company, which was organized a number of years ago for unifying the electric service in the suburban districts of Chicago, was merged comparatively recently into the Public Service Company of Northern Illinois, which took in also the Economy Light & Power Company of Joliet, the Illinois Valley Electric Company and other companies in Kankakee and elsewhere. This company now serves a large area in northeastern Illinois, consisting of the suburban districts roundabout Chicago, a number of smaller cities and towns such as Evanston, Joliet and Kankakee, and a wide extent of rural territory. It has a considerable number of farmers among its customers.

The Middle West Utilities Company was organized in May, 1912, to acquire public-utility properties, particularly in the smaller cities and towns, and to organize and own subsidiary state companies to take over and operate the properties acquired in different states. This plan of operation has been developed by the Middle West Company, to a greater or less extent, in the States of Illinois, Indiana, Kentucky, Michigan, Oklahoma, Missouri and some of the New England States. The total number of communities served by this young giant of an organization, which has been in existence only a year, is about 280. Prominent among its state subsidiary organizations is the Central Illinois Public Service Company, with operating office in Mattoon, which serves about 125 communities. In the northwestern part of the State the Illinois Northern Utilities Company has been, or is about to be, affiliated with the Middle West Utilities Company. This company serves about fifty communities. The Public Service Company of Northern Illinois and the Illinois Northern Utilities Company are operated in close harmony, and the system of the former is also physically connected with that of the Commonwealth Edison Company of Chicago. The system of the Central Illinois Public Service Company is operated more independently in a physical sense, but all the companies named are directed from common Chicago headquarters.

The idea of syndicate operation of public utilities is but from new, but the plan of neighborhood grouping has been carried out more extensively in Illinois perhaps than anywhere else, unless exception be made in favor of the extensive systems of the Pacific Gas & Electric Company, operated from San Francisco. Many well-informed men declare that monopoly is an economic necessity in the

electric-service industry. Competition does not make for cheap energy; it has been regulated by laws or municipal regulation to a very great extent. It seems fair to assume that the regulation of monopolies for the community is more in accord with scientific methods than regulation by unrestrained competition. Unified operation renders practicable the massing of production and the utilization of the diversity-factor, making it possible to sell electrical energy more cheaply to all classes of consumers. In general, it is contended that the best method of supply is economical and the small-individual-community method is not. Cheap energy means better homes, sustained by heat, light, and it should mean also betterment of treatment of life, and labor, and it should reduce the cost of transporting passengers and merchandise. Indeed, the possibilities of cheap energy are of great and great numbers. It is predicted that the time will come when there will be a massing of transmission and distribution lines, because the Mississippi River and the Atlantic Ocean will have generating stations at points where it is found most economical to produce electrical energy. In that case will the energy be distributed at the minimum of cost to the maximum number of users.

### Developments in Protective Apparatus

The thermally-actuated high-tension tripping mechanism yearly into higher currents as well as voltages, and calls for more powerful automatic apparatus capable of protecting the generating plant. Circuit-breakers are called upon to rupture an air current as great as 25 kilovolt at 1500 volts in railway service and to rupture in air 600 amp at 120 kv or more. Lightning arresters are called upon to provide safe paths for voltages as excessive as 100 kv. In his N. E. E. A. paper on recent developments in protective apparatus, Mr. J. W. MOWERY describes some of the improvements lately made in the operation of such devices. It is reported that alternating-current generators when suddenly and violently short-circuited may develop from five to fifty times the normal load current for the first second or two, after which time the current falls to the "sustained short-circuit current," that may be only two or three times the rated load current. Consequently, in order to protect such generators from the high kinetic mechanical stresses incurred in the first moments of a nearly short-circuit, either permanent features may be secured in the circuit near the generator or the may be made of automatic circuit-breakers of the synchronous type. Some of the latest ones rupture the circuit in a fraction of a second after the short-circuit has been established.

The very high currents and momentary pressures are now absorbed by the synchronous generator itself, and the circuit-breaker is no longer essential. It is also becoming frequent to find synchronous generators and switches out of duty, being unable to handle momentary surges to the large extent of about four times and the consequence of such construction. The water-cooled air blast, lightning arrester seems to have displaced all others, especially for high voltages. It is now recognized as best to reduce such lightning currents and, as a precaution against the resulting surge of the protective flow.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### New York State Hydroelectric Bill Vetoed

Governor Sulzer of New York on May 27 vetoed the Murtaugh-Patrie bill favored by the New York Conservation Commission and having for its object the development and distribution of electrical energy under state ownership and management, somewhat after the scheme which now obtains in the Province of Ontario in Canada. A detailed account of the proposed legislation was published in these pages on Jan. 4. In his memorandum the Governor stated that for the general welfare he intends to appoint a commission of experts and disinterested citizens, more or less familiar with the whole subject matter, to investigate not only the project vetoed but the Long Sault water-powers, the Niagara water-powers, the Genesee water-powers and others, with a view to determining what is the best thing to do ultimately for all concerned. The commission is to report its conclusions with appropriate bills for the consideration of the next Legislature.

A résumé of the proposals of the New York Conservation Commission in this connection was published on page 33 of our issue dated Jan. 4, 1913. Much public interest was aroused by the proposals, which were frequently discussed in the daily papers. News items and comments on the situation appeared in our columns as follows: Jan. 11, page 81; Jan. 25, page 176; Feb. 1, page 235; Feb. 8, pages 277 and 280; Feb. 15, page 336; March 15, page 555; March 22, page 601; March 29, page 659; April 5, page 711; April 12, page 760, and May 10, page 968.

### Pennsylvania Department of Labor and Industry

On June 2 Governor Tener of Pennsylvania approved a bill creating a department of labor and industry and appointed Prof. John Price Jackson, dean of the School of Engineering of the Pennsylvania State College, as the commissioner. In accordance with this bill there will be created three bureaus, known as those of inspection, statistics and arbitration. The bureau of inspection will take over the duties and powers of the former department of factory inspection. The bureau of statistics will handle industrial matters and will collect statistics relating thereto. One of the duties of the bureau of arbitration will be to mediate in cases of strike.

### Dinner to President-elect Mailloux

Past-president Gano Dunn of the American Institute of Electrical Engineers was the host and toastmaster at a dinner given to President-elect C. O. Mailloux at the University Club, New York, on May 28. The personal and professional qualifications of Mr. Mailloux, which for years have caused him to be looked upon as a future president of the A. I. E. E., and the conditions with reference to the preparations for the forthcoming International Electrical Congress which make this the logical time for him to become president, were set forth in brief addresses by Past-presidents Bion J. Arnold, Dugald C. Jackson, John W. Lieb, Jr., and Henry G. Stott. Among those who were called upon for remarks on the past, present and future affairs of the Institute were Messrs. A. Aaron, H. H. Barnes, Jr., J. J. Carty, Bancroft Gherardi, A. S. McAllis-

ter, W. S. Murray, Farley Osgood, M. I. Pupin, D. B. Rushmore and C. W. Stone. The dinner was characterized not only by elegance in arrangements but also by a striking display of harmony in spirit and unity in purpose of the various well-wishers of the Institute.

### Convention of the National Electrical Contractors

Although most of the sessions to be held in connection with the annual convention of the National Electrical Contractors' Association at Chattanooga, Tenn., will be solely for members, yet there will be several open sessions to which visitors will be admitted. On the morning of July 16 there will be an open session at the Hotel Patten, at which several subjects of general interest to the trade will be discussed. In the evening of this day, beginning at 7 o'clock, there will be a lecture on illumination. Following this lecture, beginning at 8 o'clock, there will be a reception and dance for members and guests. On the afternoon of July 16, on the morning of July 17 and during the morning and afternoon of July 18 business sessions will be held for members only.

### Pennsylvania Utilities Bill

The public utilities bill which was passed by the Pennsylvania Senate has been recommitted to the corporations committee. It is expected that several amendments will be made but that none will tend to weaken the legislation.

### Electrical Supply Jobbers' Meeting

Economical methods of conducting an electrical jobbing business, made imperative by the present legislation regulating business enterprises, were discussed in executive sessions at the spring meeting of the National Electrical Supply Jobbers' Association, held in Chicago on May 26, 27 and 28. Mr. Frank Overbagh, of Chicago, secretary of the association, presided. Mr. Norman Webster, representing Niles & Niles, accountants in New York City, spoke on the "Proper Methods of Classifying Accounts."

During the open meetings, which were held on Tuesday afternoon and Wednesday, short talks were given by Mr. W. E. Robertson, of Buffalo, vice-president, and Mr. J. M. Wakeman, of New York, general manager of the Society for Electrical Development, Inc. Mr. Wakeman confined his remarks to the organization and aims of the society which he represents. Traveling electrical demonstration shows and moving-picture films were mentioned as means which would be used by the society in educating the public to the necessity of electricity. A chart was shown by Mr. Wakeman which classified members of the society according to their annual estimated business income. Following the talk of the society's general manager, application blanks for membership in the Society for Electrical Development were distributed. Before the meeting was over twenty-two of the applications were signed and handed in, making a total of about thirty-five applications which have been made by electrical jobbers so far. The meeting closed with an executive session. About 150 attended the convention.

### A. I. E. E. Convention Arrangements

### A. I. E. E. Pacific Coast Convention

[illegible]



## Convention of the National Electric Light Association

The thirty-sixth convention of the National Electric Light Association was held at El Medinah Temple, Chicago, June 2 to 6 inclusive. The exercises of the convention began on Monday night with a reception to President and Mrs. Frank M. Tait and the opening of the exhibition made by Class D members, following which there was dancing and light refreshments were served. A brief description of the exhibition hall in the basement of the temple, together with a list of the exhibitors, is given elsewhere in this issue. The real work of the convention began with the first general session on Tuesday morning and did not end until sundown on Friday afternoon. In all, eighteen sessions were provided, the general and public policy meetings being held in the main auditorium, the technical, commercial and transmission sessions either in the auditorium or in a large tent on the lawn west of the temple, and the accounting sessions in the reception room on the south side of the main floor. For convenience the papers presented at the various sessions, together with the discussions on them, are grouped under distinguishing heads and published in another section of this issue.

The total registration at the close of the convention on Friday, exclusive of Class B members of Illinois, was 1895. The Class B membership of Illinois numbered 2182, making a total registration of 4077.

### WELCOMING ADDRESS

Mayor Carter Harrison of Chicago being unable to be present, the association was greeted by the Controller of Public Works, Mr. Lawrence E. McGann, who expressed the hope that the convention would result in great good not only to the fraternity but to all the people. The desire for the utmost economy in lighting, he said, is particularly great on the part of the officials having responsibilities in great municipalities, because to the extent that lighting service is cheapened so will residence in great municipalities be more desirable, more pleasant and more safe. In his judgment a private business policy can be better promoted by a reasonable consideration of public service and relations with the public than by a narrow, obstructive service. To this end he suggested that a voice be given to public representatives in the question of rates, as is now done in Chicago, because such a policy will go a great way toward encouraging the extension of lighting systems.

### ADDRESS OF PRESIDENT TAIT

In his presidential address Mr. Frank M. Tait, Dayton, Ohio, stated that during the past five years the membership in the association has increased from 1327 to 12,442. He concurred with Past-president Freeman in the belief that the membership in time will reach 25,000 and expressed the opinion that the conventions of the association with the increased attendance are likely to prove unwieldy and hard to handle in their present form.

In order that the association's affairs may be conducted properly and the responsibilities more widely distributed, President Tait suggested that the number of vice-presidents be increased from two to four. He suggested also that plans be laid for greatly increasing the association's yearly income.

In commenting upon the aid which the association offered spontaneously to member companies in distress by reason of the recent tornadoes and floods, Mr. Tait remarked that it is a great tribute to the individual resources of the various companies affected that not one of them called for help. He expressed the hope that the companies will be permitted by the public service commissions to fund the expense for repairs from capital account rather than be compelled to pay the cost out of surplus or earnings account.

Of the numerous activities of the association none has attracted more widespread and favorable attention than that

in connection with the publication of the resuscitation rules. Over 100,000 copies of the chart and booklet have been issued to date, and several governments have adopted the recommendations as their official guide.

On motion of Mr. Arthur Williams, of New York, the address was referred to a committee consisting of Messrs. J. F. Gilchrist, of Chicago; W. W. Freeman, of Birmingham, and W. C. L. Eglin, of Philadelphia.

### PRESENT MEMBERSHIP

The committee on the organization of the industry, of which Mr. H. H. Scott, of the Doherty Operating Company, New York, was chairman, gave statistics on the present membership of the association. The present membership of 12,442 is apportioned as follows: Class A (operating companies), 1093; Class B (employees of operating companies), 10,256; Class C (individuals), 53; Class D (manufacturing companies), 242, and Class E (associate members), 798. Up to the time of the convention there were forty-two company sections with an approximate membership of 8400, as compared with thirty-seven company sections last year with a membership of 7700. During the year new sections were formed in San Francisco, Cal.; Dixon, Ill.; South Bend, Ind.; Roanoke, Va., and Ottawa, Ont. Nevertheless, out of 105 cities in the United States with a population of 50,000 and more there are only thirty-two company sections, and there are only four company sections in cities with a population ranging from 25,000 to 50,000, out of ninety-seven cities falling in that class. The Class A membership shows a falling off of forty-three from last year, not enough new members having been obtained to offset 118 resignations received during the year because of consolidations of properties.

### REPORT OF SECRETARY

The enormous amount of detail work handled by the association was outlined in the report of Secretary T. C. Martin, and some idea of the work of the association may be had from the fact that out of an income of \$100,000 more than 50 per cent was spent in publications. There were printed 18,650 volumes of the *Proceedings* and 156,000 copies of the *Bulletin*, and 30,000 copies of miscellaneous publications were sold or distributed, exclusive of 4000 copies of the "Electrical Solicitor's Handbook," 1100 copies of the overhead-line construction committee's report and a large number of copies of the classification of accounts and the Question Box revision. Almost 3000 copies of the "Meterman's Handbook" have been sold, and since the publication work of the Commercial Section was taken over the office of the secretary has handled the sale of over 200,000 copies of publications for the section. The chart and booklet on resuscitation from shock has brought renown to the organization, and it is difficult to estimate the extent of publication which these invaluable documents have received. The rules have been translated into several languages, notably Japanese and Spanish. Other activities of the home office of the association, such as the lecture bureau, the compilation and distribution of statistics relating to certain branches of work in the industry, etc., were also mentioned. A new edition of 1000 copies of the meter code and a limited edition of the proposed revision of the classification of accounts were prepared for the convention in addition to the fifty reports and papers.

### CHAIRMAN RYERSON'S ADDRESS BEFORE HYDROELECTRIC SECTION

Mr. W. N. Ryerson, of Duluth, Minn., in his address as chairman of the Hydroelectric and Transmission Section called attention to the fact that during the past year there was a departure from the "do-nothing" policy of the national government, when Secretary Fisher issued permits for the use of government lands by power companies and promulgated rules defining to some extent the general policy of the Department of the Interior toward hydroelectric

and transmission enterprises. Unfortunately, however, the change in government makes it impossible to predict what may happen in the future, and lack of harmony between the advocates of centralized government control and states' rights does not improve the outlook. Nevertheless, the educational work carried on by public-service corporations and right-thinking citizens is doing much to mold public opinion in the right direction. Public service commissions have also helped to rend the veil of secrecy which shrouded the workings of hydroelectric companies and have thus brought true facts to light. The speaker announced with much pleasure that the Governor of New York had vetoed the scheme of a state-wide electrical development under governmental auspices, so that the Empire State will not emulate the Province of Ontario for the present at least. In connection with public sentiment and the vital relation it bears to the industry, Mr. Ryerson sounded a note of warning against over-capitalization, claiming that it is not an evil of the past, but is unfortunately seen at present in the consolidations of separate properties under holding companies. There is danger, he said, in any attempt to ignore or to minimize the effects of over-capitalization on

the industry, of which \$1,000,000,000 is invested in bonds and the remainder is in cash.

#### Public Policy Report

As was to be expected, the meeting on Wednesday evening was the gala event of the week. Up to the beginning of the evening the topic discussed at the Commonwealth Edison Company played numerous selections, and during the rest of the evening some was interpreted between the speakers on the forum. The public policy committee's report was read by Mr. Samuel Insull, of the Commonwealth Edison Company, at the instance of the chairman of the committee, Mr. Arthur W. Belmont, of New York, who is now on a tour in Europe. The report itself is given in abstract structure in this issue, by concentrating on the most of the questions and ideas of the general trend of the industry. Mr. Insull reiterated much of what he had already said in connection with the report of the same committee at Boston in the presence of the committee and the capital representatives. He also enlarged upon the theme of consolidated generation of electricity and its distribution, if it is to be really beneficial to the economic of the nation.

In Mr. Insull's estimation, not less than \$1,000,000,000 is spent yearly by the electric industry in direct or indirect work, the only source from which is the physical, mental and moral betterment of the employees of the industry—a very valuable asset to the community. Regarding regulation, Mr. Insull was satisfied it is good as tending to insure the stability of public utility companies, lower the cost of electric energy for developments and provide for a fair return upon the investment. Much is needed in municipal operation of public utilities and as heavy taxpayers, much more than tried with natives, the central stations should have a lively interest in developing rather than in that field. He reiterated the fact that the electric business should be made profitable and that as such it should be subject to a reason-



PRESIDENT-ELECT J. B. MCCALL

able amount of regulation by properly constituted commissions.

#### RESOLUTIONS HAVE SHOWN

Following the presentation of the report of the public policy committee at Wednesday night's session, Mr. W. C. L. Eglin, of the Philadelphia Electric Company, presented the report of the committee on pneumonia, from electrical shock, stating that it represented almost wholly the work of the American Medical Association. The committee itself is distracted attention to this point and is directed largely to the work of the committee during the year in investigating pneumonia, looking for means of artificial respiration. Mr. Eglin discussed at length the action of the lungs, which attributed to the great atmospheric method of respiration. He showed the proper method of using the artificial pressure method to a certain extent. A sample of the committee's report by the Medical Association at the convention, which was the subject of the discussion, was presented by one of the other members on the speaker's platform.

#### ADDRESS BY TAYLOR

Mr. J. B. Taylor, of the Pacific Gas Transmission Company, of Portland, read the address on electric

#### MEMBERSHIP OF HYDROELECTRIC SECTION

Chairman R. J. McClelland, New York City, stated that the country has been divided into sections headed by a vice-chairman, including the Pacific Coast, the Northwest, Central West and East. Mr. E. M. Gilbert, of the Central Colorado Power Company, Denver, Col.; Mr. G. H. Bragg, of the Pacific Gas & Electric Company, San Francisco, Cal.; and Mr. D. F. McGee, of the Pacific Power & Light Company, Portland, Ore., have consented to act as vice-chairmen in their respective districts. At the beginning of the membership campaign late in 1912 it was found that of 450 hydroelectric power companies of some greater output less than 200 were members of the association and less than fifty were represented in the hydroelectric and power transmission section. An active campaign of membership solicitation is now in progress.

#### REPORT OF TREASURER

According to the abstract of the report presented by Mr. W. W. Freeman, of Birmingham, Ala., the revenue of the association for the fiscal year of 1912 was \$142,731, of which \$83,443 was received as dues, \$26,412 for publications and \$22,300 for convention expenses. The general expenses exclusive of the cost of the convention were \$81,220, and the convention expense was \$31,913, making the total \$113,133 and leaving a surplus of \$29,598. At the end of the year the gross assets of the association were \$50,331 and its liabilities \$28,430, leaving a balance of \$21,901.



with an illustrated lecture on accident prevention. Common hazards about utility and other plants were depicted on the screen and the simple means required to eliminate sources of accident were described or illustrated. The various safety mottoes, devices, buttons, etc., used especially by the United Gas Improvement Company were shown, and some account was given of the savings with respect to the money costs of accidents which their use as well as the use of preventive measures has accomplished.

#### THE ELECTRICAL DEVELOPMENT MOVEMENT

Mr. Henry L. Doherty, of New York, who returned from Europe on June 5, made a hurried trip to Chicago to address the association, on Friday morning, June 6, on the work of the Society for Electrical Development, of which he is president. He yielded, however, to Mr. James M. Wakeman, general manager of the society, who explained clearly the aims and plans of the organization. The whole object is to promote and increase the use of electrical energy by unified effort. Mr. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company, commended the movement heartily. All electrical manufacturers and operators should subscribe something. The campaign must have universal support and the expense should not be borne merely by a few large interests. He stated that the public-utility corporation is not understood in this country. Mr. Herr made a stirring appeal to central-station men for earnest co-operation.

Mr. Doherty, like Mr. Herr, was warmly applauded when he mounted the platform. He said that it would have been impossible for the National Electric Light Association to have undertaken the work which the Society for Electrical Development has essayed. In a few scattered places intensive development work is being carried on in this country, but these centers are not numerous. No central station is free from the effect of the development work of other companies. For instance, such work as that of Mr. Insull in Chicago benefits outside cities to which journals and newspapers go. It is surprising how many companies are doing nothing at all in this intensive development. Most of them do not know how to start. Here is where the new society can be useful. The success of the movement is assured, but the degree of success depends on the men represented in the National Electric Light Association. For every dollar collected and expended by the Society for Electrical Development the industry as a whole will receive back at least ten. The possibilities of the movement are boundless. Every family in the United States has an average latent capacity of spending \$30 a year for electricity. The very considerable demand for the electric self-starters of gasoline cars was cited by Mr. Doherty as one of the possibilities of to-day. Give the little fellows a chance to come into the movement, said the speaker, and they will do so. In conclusion Mr. Doherty said to those who have faith in his work that he would promise that they would not regret it if they joined in the co-operative movement.

#### CONSTITUTIONAL AMENDMENTS

Four vice-presidents are now available at the right hand of the association's chief executive, a constitutional amendment adding two of these important officers to the executive staff having been passed at the final session. This insures enough executive officers to preside at all the various section meetings of the annual convention and provides a needed relief for the president in the performance of his duties.

An important constitutional amendment was also carried, dividing the association into seven classes, the change from the old order being made to permit the organization to take into membership individuals or companies outside of North America who may desire to keep in touch with association affairs. The dues are \$20 per annum.

An amendment was also passed which is designed to

secure to the *Bulletin* second-class postage rates, permitting either an increase in the size of this publication or reduced mailing expenses.

#### THE EXHIBITION COMMITTEE

In selecting members for the exhibition committee, Mr. Charles Blizard, of Philadelphia, was named to succeed himself. Mr. J. W. Perry, of New York, was likewise put in nomination as his own successor, and Mr. John Mustard, of Philadelphia, was named to succeed Mr. F. N. Jewett, of St. Louis. In his annual report as chairman of the exhibition committee, Mr. J. C. McQuiston referred to the difficulties encountered by the exhibition committee in the basement of the Medinah Temple. At Seattle last year there were forty exhibits, covering 8000 sq. ft., while at Chicago there were sixty-two exhibits, covering 11,000 sq. ft. During the year Mr. Walter Neumuller resigned his position as secretary and treasurer of the committee. Mr. McQuiston devoted some attention to the representation of the electric industries at San Francisco in 1915, and said that he hoped some plan would be worked out whereby the various electrical societies may determine upon dates for holding conventions in 1915 which will make it necessary for many electrical men interested in more than one of the national societies to make only one trip.

The discussion at the meeting held by the Class D members on Thursday related principally to the 1915 exhibition. Messrs. James I. Ayer, of Cambridge, Mass.; H. I. King, of New York; H. G. McConaughy, of New York; S. E. Doane, of Cleveland; C. P. Frey, of New York; George F. Parker, of New York; John F. Gilchrist, of Chicago, and others spoke on this subject. Mr. Ayer offered a resolution which was adopted, presenting the sense of the meeting that there should be a separate electrical building at the Panama-Pacific International Exposition in San Francisco in 1915. In relation to the grouping of dates for the electrical convention at San Francisco in 1915, Mr. Gilchrist was appointed a committee to take up the subject with other societies.

#### AWARD OF DOHERTY GOLD MEDAL

In its report at the closing session on Friday, the committee on award of the Doherty gold medal, of which Mr. W. F. Wells, of the Edison Electric Illuminating Company of Brooklyn, N. Y., is chairman, stated that during the year seventeen papers were submitted by six company sections, whereas the number presented last year was eighteen and the year before forty-six. The awards were as follows: The Doherty gold medal to Mr. P. F. Bludworth, Jr., of the New York Company Section, for his paper on "Adaptability to Service"; the Harriet Billings silver medal to Mr. Fred Willoughby, of the Denver Company Section, for his paper on "Contractual Relationship of Company and Customer," and a third prize of \$25 to Mr. A. D. Bailey, of the Commonwealth Edison Company Section, for his paper on "Human Engineering." The prizes will be presented to the winners at the meetings of the respective company sections.

#### EXECUTIVE OFFICERS OF NATIONAL BODY

On recommendation of the nominating committee, consisting of Messrs. Samuel Insull, of the Commonwealth Edison Company, Chicago; E. H. Davis, of the Lycoming Edison Company, Williamsport, Pa.; T. G. O'Dea, of the Erie County Electric Company, Erie, Pa.; Paul Doty, of the Edison Electric Light & Power Company, St. Paul, Minn., and Samuel Scovil, of the Cleveland (Ohio) Electric Illuminating Company, the following officers were elected at the closing session: President, Mr. Joseph B. McCall, Philadelphia Electric Company; first vice-president, Mr. John A. Britton, Pacific Gas & Electric Company, San Francisco, Cal.; second vice-president, Mr. H. Scott, of H. L. Doherty & Company, New York; third vice-president, Mr. E. W. Lloyd, Commonwealth Edison Company, Chi-



ago, Ill.; fourth vice president, Mr. E. C. Deal, Augusta Railway & Electric Company, Augusta, Ga., and treasurer, Mr. W. F. Wells, Edison Electric Illuminating Company, Brooklyn, N. Y. The personnel of the executive committee is as follows: Messrs. W. C. L. Eglin, Philadelphia Electric Company, Philadelphia, Pa.; W. N. Ryerson, Great Northern Power Company, Duluth, Minn.; R. S. Orr, Duquesne Lighting Company, Pittsburgh, Pa.; H. C. Abell, American Light & Traction Company, Madison, Wis., and A. C. Einstein, Union Electric Light & Power Company, St. Louis, Mo.

## THE PROSODY BOOK

Mr. Joseph Benton McCall, the newly elected president of the National Electric Light Association, is and has been for years president of the Philadelphia Electric Company. He was born in New York City in 1859 and shortly afterward his parents moved to Philadelphia, where he received his education in the public schools and where afterward he began his business career in the law office of Ralph H. Shapley. His spare moments were spent in learning stenography and the rudiments of law. At the age of sixteen he entered the employ of the Pennsylvania Gladiolus Light Company, owned by the Elton D. Van Winkle syndicate. In a few years he became the company's secretary. Mr. McCall helped to organize the Pennsylvania Electric Light & Power Company, formed in 1890, by Messrs. W. L. Elton and Martin Maloney, and was its secretary and treasurer. The company was afterward absorbed by the Pennsylvania Manufacturing, Light & Power Company, of which Mr. McCall was made president, and when in 1901 that company was absorbed by the Philadelphia Electric Company, in 1899, he became executive head of the new corporation. He has devoted almost his entire attention to business in the great property, declining to take part in any outside organizations except in the case of the Light House and Bank of Philadelphia, of which he has been a director for several years, and the remarkable success of the Philadelphia Electric Company speaks volumes for his able management. Mr. McCall's judgment, business acumen and social ability are of a high order, and his pleasant and democratic manner insures pleasant relations with all with whom he comes in contact. He is a firm believer in organization, a friend and counselor to his employer and a supporter of excellent *esprit de corps* by promotion from within rather than by additions from without when vacancies occur. Mr. McCall was president of the Association of Edison Illuminating Companies from 1904 to 1907 and is a member of the American Institute of Electrical Engineers, the Franklin Institute and many of the prominent clubs in the Greater City, namely, the Country, Racquet, Mason, Cricket and Associates of Philadelphia. He is also vice president of the Union League Club.

## HYDROLYTIC AND TRANSMUTATION SPECTRA OF URANIUM

At the session of the Hydroelectric and Thermoelectric Section on Friday morning the following officers were elected: Mr W. W. Freeman, MD, as President, Chicago, Ill.; Birmingham, Ala., chairman, Mr. M. R. Blum, H. J. Doherty & Company, New York, first vice-chairman, Mr. I. B. Foote, Commonwealth Power Company, Boston, Mich., second vice chairman, and Mr. S. A. Small, N. E. L. A. headquarters, New York, secretary. The executive committee consists of Messrs. P. C. Condit, A. B. Leach & Company, New York; P. J. Hanson, Great Western Power Company, San Francisco, Cal.; D. J. Brown, Washington Water Power Company, Spokane, Wash.; J. A. Lightfoot, Southern California Edison Company, Los Angeles, Cal.; D. B. Robinson, Central Electric Company, Schenectady, N. Y.; J. C. Young, Sturges & Webster, Boston, Mass.; A. S. Conner, J. C. White & Company, New York; R. D. Marshon, New York; F. B. H. Brown, Niagara, Lockport & Ontario Power Company, Buffalo, N. Y.; H. T. Porter, Sanderson & Pomeroy, New York; and P. A.

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At the annual meeting of the Connecticut Association of Electric Light and Power Companies, held at the Hotel Hamilton in New Haven, Conn., on Monday, Nov. 10, 1908, the following officers and directors were present and elected: Chairman, Mr. T. I. Jones, Edison Electric Illuminating Company, New Haven, Conn.; Vice-Chairman, Mr. E. C. Sullivan, H. M. Hyattson & Company, New Haven, Conn.; Secretary, Mr. Douglas Bennett, Connecticut Electric Light & Power Company, Baltimore, Md.; Treasurer, Mr. J. T. Deane, United Electric Light & Power Company, Middletown, Conn.; and inspectors, Mr. Charles Partridge, Mr. C. C. Headquarter, both of New York. The directors are: Mr. W. Lloyd Garrison, 441 Edison Company, Chicago, Mr. T. I. Jones, My George Bennett, Mr. J. T. Deane, Mr. E. C. Sullivan, Mr. C. A. Smith, New York Edison Company, New York, Mr. J. C. McGuire, Wallingford Electric & Manufacturing Company, Torrington, Mr. F. A. Gale, General Electric Company, Schenectady, Mr. J. R. Dodge, Westinghouse, New York, Mr. H. J. Ellis, Yale School of Electric Light & Power Company, New Haven, Mr. H. M. Jones, United Gas & Electric Company, New York, Mr. E. F. Wallace, Edison Electric Illuminating Company, Boston, Mr. Doug. Deane, Middletown Electric Company, Mr. C. A. Smith, Torrington Electric Light & Power Company, Torrington, Conn., Mr. E. S. Harrison, National Electric Lamp Association, Detroit, Mr. A. C. Robinson, Buffalo, N. Y., representing the National Edison Association, and Mr. J. A. McQuay, Detroit, Mich., representing the National Electrical Contractors' Association.

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## Southwestern Utilities Convention

Abstracts of several of the papers presented at the convention of the Southwestern Electrical & Gas Association, held in Galveston, Tex., on May 21, 22, 23 and 24, were given in our issue dated May 31. Other papers and discussions are outlined below.

### ELECTRIC RAILWAYS

The opening session was devoted largely to electric railway matters. A paper entitled "A New Type of Concrete Track Construction" was presented by Mr. W. M. Archibald, of the Houston Electric Company; one on "The Use of Traffic Charts in Rush Service" was read by Mr. P. L. King, of the San Antonio Traction Company; Mr. C. O. Birney read his paper on "Old and New Ideas in Car Designs," and Mr. David Daly, of the Houston Electric Company, discussed the subject of "Street Railway Planning for Growing Cities."

### CIRCUIT PROTECTION

Beginning with the Thursday morning session of the association, all papers and discussions dealt with subjects of especial interest to electric-service companies. The first paper to be read was that by Mr. E. E. Nelson, electrical engineer of the Northern Texas Traction Company, on the erection and protection of high-tension lines, which was abstracted last week. In reply to an inquiry, Mr. H. Jalonick, new-business engineer of the Texas Power & Light Company, Dallas, stated that men working on his company's 60,000-volt transmission lines were first required to ground the dead lines by means of chains. Replying to another question, he said that no special effort was made to ground the steel towers carrying this line. The tower legs were buried 6 ft. in the ground and set on concrete footings. The structure itself is a good conductor, being galvanized iron cold-riveted.

A question was asked as to the advisability of stepping down the voltage in high-tension lines within cities and increasing the size of the copper conductors. Mr. Nelson replied that objection to high-voltage lines in city streets is more a question of mind than one of fact. They will not kill a person any more quickly than the arc-lamp circuits and probably are safer, as partial leaks in high-voltage lines will clear themselves.

Mr. W. L. Wood, superintendent of the Texarkana Gas & Electric Company, emphasized the importance of the points brought out in the paper concerning switchboard wiring. The small operators should pay especial attention to this, particularly as regards the separation of various lines on the board. Crowded and improperly laid-out switchboards have been the direct cause of the destruction of entire plants. He said the faulty design is often due to the small operator's lack of competent engineers. In further support of Mr. Wood's suggestion, Dr. A. C. Scott, of the Scott Engineering Company, Dallas, said that too much stress cannot be laid on proper switchboard design. Conditions exist in many small plants that are very bad, but since no accidents have occurred no alterations have been made. As additional instruments and switchboard apparatus are required with the growth of the property, they have been added to the old panels, thus complicating the wiring and adding hazards to the board. Many boards

are too close to the wall, making it practically impossible for a man to work behind them. A distance of 5.5 ft., in his opinion, is too close. It would be better to build an addition to the station than crowd the board.

Dr. Scott then took up the question of ground wires in high-tension circuits. He said that these wires can be placed too close or too far away from the transmission lines to accomplish the desired results. Further, he said it is a serious problem to protect against lightning discharges, which are notoriously freakish. The exact value of a ground line is unknown and proper insulation is most important. He said he would like to see something more done with glass insulators. Glass is more homogeneous than porcelain, which depends almost wholly on the glaze as an insulating medium.

### RATE MAKING

"The Proper Basis for Rates for Electric, Gas and Water Public Utilities in Texas" was the subject of a paper by Mr. W. J. Norton, as abstracted in our issue last week. In reply to a question by Mr. W. B. Head, assistant general manager of the Texas Power & Light Company, as to the possibility of doing away with the demand rate, the author stated that he felt sure that the demand rate is equitable, but there is some question as to how far refinements should go in lighting. He said further that all companies should eliminate special rates. All rates should be fixed and published to obtain the best results.

### OIL-ENGINE OPERATION

In the discussion of the paper by Mr. A. L. Chase on "Oil Engines for Light and Power Plants in Small Towns and Cities," abstracted last week, it was stated that the operating cost and depreciation per kilowatt with oil engines is quite low. Mr. Chase stated that unless an accident occurs the cost of maintaining an oil engine is considerably less than that required with a steam engine. Dr. Scott stated that the period of obsolescence is about the same as with other machines, 3 per cent being applied. As to the operators, no more intelligence is required to run an oil engine than a steam engine. It is merely a question of proper training.

### OFFICERS

At the general session Saturday morning the business of the association was transacted. It included reports of various standing committees and of the secretary and treasurer and the nomination and election of officers for the ensuing year. The newly elected officers for 1914 are as follows: President, Mr. G. H. Clifford; first vice-president, Mr. D. G. Fisher, assistant general manager Texas Traction Company, Dallas; second vice-president, Mr. W. L. Wood, Jr., general manager Texarkana Gas & Electric Company; third vice-president, Mr. C. W. Kellogg, general manager Beaumont & El Paso Railway Companies; treasurer, Mr. J. D. Walker, auditor Dallas Electric Light & Power Company; secretary, Mr. H. S. Cooper, Dallas.

The executive committee is composed of the following: Messrs. C. H. Clifford, Fort Worth; D. G. Fisher, Dallas; W. L. Wood, Texarkana; C. W. Kellogg, El Paso; F. M. Lege, Galveston; H. S. Cooper, Dallas; David Daly, Houston; F. J. Storm, Amarillo; F. B. Slater, Dallas, and W. B. Tuttle, San Antonio.



PRESIDENT-ELECT G. H. CLIFFORD



The newly-elected president of the association is vice-president and general manager of the Northern Texas Traction Company, Fort Worth, Tex., and general manager of the Fort Worth Southern Traction Company and of the Arlington Light & Power Company, which is engaged in the water, light and ice business at Arlington, Tex. He was born at Fort Worth in 1881. He graduated from the public schools and attended Weatherford College. After leaving school he worked as a stenographer for several companies until 1901, when he entered the service of the Northern Texas Traction Company as secretary to Mr. F. M. Haines, who was general manager of the company, owned by the Bishop and Sherwin syndicate, Cleveland, Ohio. In 1903 Mr. Clifford was made secretary and treasurer of the company, which position he held until 1905, when the property was purchased by Stone & Webster and he was made general superintendent.

#### ENTERTAINMENT

Friday afternoon was taken up with a boat ride excursion to Galveston jetties and Bettison's Pier, where a fish supper was served by the supply men who are members of the association. Friday night was set aside for the Jovian parade, full rejuvenation supper and speech, and a class of ninety new members was initiated at the Scottish Rite Cathedral. Fred Johnson, Wagner Electric & Manufacturing Company, St. Louis, acted as toastmaster, and the speakers of the evening included F. E. Watts, reigning Jupiter, New York; W. B. Head, Dallas, and Sam A. Hobson, Chicago.

Other entertainment features included surf bathing, free tickets being provided, a band concert and parade of United States troops at Fort Crockett, an operatic concert and dance at the Garten Verein, a German club, luncheon for the ladies at the Oleander Country Club, a boat ride in Galveston harbor and an auction bridge party for the ladies.

### Merger of Louisville Public Utility Properties

By far the most important happening in electric circles in Louisville during the past week, not to mention the interest felt in the matter by the general public, was the handing down of the decision of the Kentucky Court of Appeals to the effect that the merger ordinance recently passed by the Louisville City Council permitting the consolidation under one ownership of the various electric and gas companies doing business in Louisville was legal and valid and that the consolidation could proceed.

This decision removes the last obstacle in the way of the proposed merger, which is to be accomplished by the Byllesby interests, and all that remains now is to perfect the details, which, of course, are considerably involved in view of the number of plants to be taken over and the various rearrangements which will be necessary in order to get the new organization into working order.

As heretofore indicated, the principal reason for the city's willingness to concede a practical monopoly in the light and power field in Louisville was the promise of the Byllesby company to bring natural gas from West Virginia to the city and sell it to consumers at low cost, and the ordinance was passed with a provision to this effect, fixing rates on a sliding scale and providing that when the natural gas became exhausted the Council should fix the rate on manufactured gas.

Other provisions were inserted in the ordinance for the protection of consumers, which, under the Kentucky law, merely provided for the sale of a franchise to the highest bidder. The prevailing low rates in the city as a result of the keen competition prevailing between the Louisville Lighting Company, controlled by the Byllesby interests, and the Kentucky Electric Company, which is to be taken over by them, could not last, and this was generally realized.

The prices asked would be sufficient, providing for the sale of new franchises regulate the matter in a manner satisfactory to the city and fair to the company.

It is planned to organize an independent utility corporation to take over the various plants which will be included in the Louisville Gas & Electric Company, as the consolidated concern will be called. So far the only officers announced are General George H. Harvey, now chief of the Louisville Lighting Company, as president, and Mr. Donald McDonald, president of the Kentucky Heating Company, as vice-president and general manager. Other officers will be announced later.

### Public Service Commission News

#### CHICAGO & NORTHWEST

The Chicago Gas & Electric Company has appeared before Railroad Commission for a settlement of public convenience and necessity for the construction of three additional power plants on the extension of their present power plant, and the construction of a transmission line from the Blue River development to Nicolaus, in the Sacramento Valley. The applicant stated that the construction would permit for 35,000 hp, at a cost of \$4,000,000.

A supplemental decision was rendered by the Railroad Commission on May 14 providing that the Northern California Power Company should make contract for its surplus at all times as required, according to prices on the established rates.

#### NEW YORK CONTRIBUTIONS

The Public Service Commission for the State District has dismissed the complaint of Frankel Brothers against the New York Edison Company. Frankel Brothers maintain a private electric plant and have a contract with the New York Edison Company to provide break-down or auxiliary service at times when their private plant is either out of operation or unable to supply all the energy needed. After this contract was made Frankel Brothers began to supply energy from their private plant to the Phipps tenants, a building immediately south of their building. The Phipps Tenements discontinued the Edison service in order to take the service supplied by Frankel Brothers, which was provided at rates 15 per cent lower than the charges of the Edison company. The Edison company then amended its contract for break-down service with Frankel Brothers. The latter immediately filed a complaint with the commission asking that the rate paid be required to assume the service. The commission found that the Edison company's contract with Frankel Brothers provided that the installation should not be increased beyond the original amount of the company; that no consent had been obtained, and that therefore the company could not be compelled to continue the service.

#### INDIANA CONTRIBUTIONS

The Indiana Public Service Commission has been asked to arbitrate the sale of the Capital Light & Heat Company of Indianapolis to the Merchants Trust & Loan Company of Chicago and to grant the same company authority to increase its bonded stock from \$1,000,000 to \$1,500,000 and to issue \$500,000 of 7 per cent bonds. The commission asked for the Merchants company's proposal. The company has in the last few months been asked by the American Public Utilities Company, which also owns the Merchants company, to buy its stock and bonds and to turn it into little more than a mere instrument of company organization. The Merchants company has been paying dividends to the New York company \$100,000 a year, but in May of the latter year withdrew \$25,000. The last year period the controlling interest was \$100,000 and the net earnings \$25,000.



## Current News Notes

**MUNICIPAL ICE MAKING.**—Serious consideration is being given to the proposal that New York City enter into the manufacture of ice not only for the municipal departments but also for distribution at cost in the crowded districts. Omitting such items as building rental, taxes, overhead charges and salaries of officials, it is estimated that ice can be produced in connection with the generating plant at the Hall of Records for \$1 per ton. An appropriation of \$40,000 has been approved for purchasing refrigerating apparatus for the experiment.

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**WIRELESS TELEGRAPHY FOR PENNSYLVANIA RAILROAD.**—According to newspaper reports, the Pennsylvania Railroad Company is planning to supplement its present system of communication with a system of wireless telegraphy for use whenever the aerial lines are out of commission. Doubtless the basis for these reports is a proposition made by the Marconi Wireless Telegraph Company to install without charge wireless apparatus in stations erected by the railroad company with a view to determining the possibilities of wireless telegraphy in railway service. It is expected that an appropriation will be made for carrying on the initial experimental work.

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**THE LADY MANAGER FROM ARKANSAS.**—Among the delegates to the Chicago N. E. L. A. convention was Mrs. La Salle Stoops, general manager of the Stuttgart (Ark.) Water & Electric Light Company, who has the distinction of being one of the few women operators of electric-lighting plants in the world. Mrs. Stoops has active charge of all matters of operation, purchases, contracts, etc., in connection with her 200-kw station, which supplies the city of Stuttgart with both its electricity and water. At the recent Little Rock convention of the Arkansas Association of Public Utility Operators, before which she read a paper on her experiences as a manager, Mrs. Stoops was elected special delegate to the national convention with all her expenses paid.

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**COPPER PLAQUE TO MR. WALTER NEUMILLER.**—At the business meeting, June 5, of the Class D members of the National Electric Light Association who had exhibits at the Chicago convention a handsome copper plaque was presented to Mr. Walter Neumiller, of the New York Edison Company, in token of the exhibitors' appreciation of his important services in past exhibitions as secretary of the exhibit committee. Following is the inscription on the gift tablet: "As an expression of our sincere and lasting appreciation of the unceasing efforts on the part of our secretary, Walter Neumiller, which have given the annual exhibits of the Class D members a new and broader significance and an increased value to the membership at large, this testimonial is presented by the exhibition committee of the National Electric Light Association."

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### SOCIETY MEETINGS

**ELECTRIFICATION AND CITY PLANNING.**—Electrification of railway terminals was shown to conform with the "Chicago Plan," by Mr. Eugene Taylor, of the Chicago Plan Commission, in a lecture delivered at the Electric Club of that city on May 29. Mr. F. A. Delano, president of the Wabash Railroad, will speak on city planning at some future meeting of the club.

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**NEW YORK ELECTRICAL SOCIETY.**—A meeting of the New York Electrical Society was held in the Academy Room of the American Museum of Natural History on May 30. Prof. Harry Fielding Reid, Johns Hopkins University, lec-

tured on "The Seismograph and Its Revelations." The lecture was illustrated with lantern slides and practical demonstration of the working of the seismograph belonging to the New York Academy of Sciences.

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**METER COMMITTEE OF OHIO ASSOCIATION.**—At Dayton, May 22, the meter committee of the Ohio Electric Light Association held its final meeting before the Cedar Point convention, July 15 to 18, where it will present a comprehensive report on meter practice. During the last year the meter men's section of the association has been holding informal meetings at intervals in various Ohio cities. All meter men within a radius of 50 miles are invited to attend these sessions and to take part in the practical discussions which characterize them.

\* \* \*

**PHILADELPHIA COMPANY SECTION, N. E. L. A.**—The following men have been elected officers of the Philadelphia Electric Company Section of the National Electric Light Association for the ensuing year: Mr. Joseph B. Seaman, chairman; Mr. William B. Ahern, vice-chairman; Mr. Frank A. Birch, secretary, and Messrs. B. Frank Day, H. R. Liversidge, James T. Maxwell and Fred Zoller, executive committee. Mr. Louis A. Schulze has been elected chairman and Mr. Joseph G. Johnson secretary of the meter department branch of the section; Mr. John F. Fork is the new chairman and Mr. Francis Jones the new secretary of the accounting department branch, while Mr. George G. Findley is the newly elected chairman and Mr. Edward J. Walsh has become the secretary of the commercial department branch.

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**EASTERN NEW YORK SECTION, N. E. L. A.**—At a meeting of the Eastern New York Section of the N. E. L. A. held at Poughkeepsie on May 28 the subject of rural installations, switching and protection was discussed by Mr. E. B. Merriam, who dealt with farming and dredging equipments, harvesting machines, etc. Prof. E. E. F. Creighton spoke on the subject of protection, showing by means of lantern slides the various types of lightning arresters, arcing ground suppressors and other devices particularly suitable for substations for rural distribution. The two papers were discussed by Mr. A. T. Throop, of the Utica Gas & Electric Company; Mr. Leon Scherck, of the Central Hudson Gas & Electric Company; Mr. H. W. Peck, of the Schenectady Illuminating Company, and others. At a meeting of the executive committee plans for a midsummer annual meeting were discussed, and arrangements will probably be made for a meeting in July or August.

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**SPOKANE A. I. E. E.**—At the regular May meeting of the Spokane (Wash.) Section of the American Institute of Electrical Engineers, held in the Hotel Spokane, officers for the ensuing year were elected as follows: Mr. J. B. Fiske, chairman; Mr. J. W. Hungate, vice-chairman; Mr. H. B. Peirce, secretary-treasurer; Messrs. S. C. Gates, C. F. Udden, L. N. Rice and V. H. Greisser, executive committee. A paper was read by Mr. Ray Plank, of the Home Telephone Company, on "Small Magnet Winding, Theory and Practice," and Prof. H. V. Carpenter, of Washington State College, presented a paper entitled "An Exact Formula for Determining the Regulation of Long Transmission Lines." The last paper of the evening was by Mr. R. F. Robinson, of the Pacific Telephone Company, on "Transposition of Telephone Lines." Each paper was fully discussed by a number of speakers, it being the aim of the section to have relatively short papers followed by ample discussion. During the summer the entertainment committee will make arrangements for a series of trips to points of interest in the city and to plants in the vicinity, regular meetings being discontinued.

## N. E. L. A. Convention Papers and Discussions

Abstracts of addresses made and reports and papers read  
at the thirty-sixth annual convention, held in Chicago  
from June 2 to 6, 1913 Exhibit by Class D member.

**O**N a preceding page is an account of those features of the thirty-sixth convention of the National Electric Light Association, held at Chicago, June 2 to 6, which are of general interest from the point of view of their news value. Below and on the following pages are given abstracts of the papers and committee reports presented during the convention, together with an account of the discussions which they occasioned. These abstracts and discussions, it will be noted, are arranged according to subject matter, without regard to the order of their presentation in the sessions or the sections of the association before which they were discussed.

## PROBLEMS: Review

In his report as the committee on progress, General Secretary T. C. Martin paid considerable attention to the unification of supply of energy over large territories, and to legislation and commission rulings that have been made in recognition of the changing conditions in energy-supply undertakings. Relations between the central stations and the public, and between the companies and their customers, were well discussed. Among the newer fields of activity to which attention was particularly directed were the electric vehicle, refrigeration and agriculture. Many of the data presented related to the recent work around Chicago, in which city the association was organized thirty years ago.

## Private Pensions

The report of the public policy committee, signed by Mr. Arthur Williams, as chairman, and by Messrs. N. F. Baily, Everett W. Burdett, H. M. Rylands, Horace E. Doherty, Charles L. Edgar, W. W. Freeman, George H. Harries, Samuel Insull, Joseph B. McAlister, Thomas E. Murray, Samuel Scovil, Charles A. Stone and Frank M. Tall, ex officio, is in itself compact, but added to it are appendices relating to: (1) the service company plan of the Edison Electric Illuminating Company of Boston, (2) a full review of the work of the Public Service Corporation of New Jersey, (3) decision of the Supreme Judicial Court of Massachusetts in the case of the Fall River Gas Works Company versus the Board of Gas and Electric Light Commissioners, and (4) the decision of the Railroad Commission of Wisconsin in relation to electric service rates at Milwaukee.

The committee believes that where a given business is occupied by an electrical corporation rendering such service at fair prices, treating its employees fairly and otherwise holding itself in alignment with the public interest, it should be protected against "raiding" or destructive competition. The natural and proper tendency of the industry is toward a regulated monopoly. The object of the regulation in this case is a unified system of enhanced capacity, which as a result is capable of rendering better and cheaper service. Anything which seeks to disturb this condition is not in the interest of the public, either as a customer or as the corporation or that holding its securities.

As in earlier reports, the committee reports its gratification that the National Electric Light Association and the industries it represents have been leaders in welfare work

So far as the committee can learn, the plan for minimum wage has been carried out without complications or labor disturbance or seriously objectionable increase in the cost

remanufacture. The report states the Kyoto Protocol "conditions and the committee expects that the industry must make it its business to independently accommodate. It expects the rate of employment in industry manufacturing and assembly nothing to prevent a heavily concentrated and individualized business organization in a public utility industry should be left unregulated."

A frequent criticism that can be leveled at the attitude of the industries toward questions of safety and sanitation. Associations entail one after the other, as well as have the company and its employees, only in the case the present policy of cost of all industrial accidents. In countries in which the the committee passed but the fact that not all working persons drinking water is a known phenomenon. This is because as is generally known, the majority of working is confined to factories, the industry followed the course of the industry corporations in suffering from all industrial employees. It is noted that members using this resource still themselves as to it that their government provides fair treatment. Also the industry the committee said. Furthermore a great deal of present-day and past, toward equal as the part of industrial workers and a large percentage of the public is due to the large number of the so far, sometimes even for members in which inferior conditions and those independent have been supplied with the compensation in which they were really entitled. This money should be regarded as any cost.

Under the Anti-Injunction Provision and Case Decision, the committee said the recent economic distress in New Jersey is related to the issue of the Public Service Law Company. The New York-based utility company's decision to sue the state of New Jersey for relief against the state's restructuring committee, reducing rates to 10 to 20 per cent, the decision at the first District court in New York raising the rates at the Kiewit Construction Company. On this case, the Appellate court has reversed the order of the court. The District court was the subject of the Maryland Public Service Commission ruling over the District company, and one of the most important, the case of the Supreme National Court at Massachusetts in the case of the Fall River New Works Company against the state of New and Liberty Light Construction. The case decision is expected to fall in the near future. A decision of the Appellate court is expected to be made in the near future. The Appellate court is expected to be made in the near future.

A reminder of the tradition might prompt a serious and objective analysis of public opinion, some measure of the judgment of the community. The Socialist party is having some doubts in this direction, and whose doubts are connected with a comparison of two theories: they are eager to go to London, such with the efficacy of its action here. In relation to the economic scheme of hygienic workhouses in New York, the committee was that it is "striking the most direct and constructive activity at the moment." The bill providing that man was passed by the Legislature was based on the Government, the public police committee, which was in an emergency state of emergency.

state of public unrest here and abroad. Much good, it says, will be accomplished in continuing the policy of the past of approaching these problems in a spirit of earnest interest, fair play, good will and sincere regard for those associated with the central-station interests in the conduct of the industry.

#### RESUSCITATION FROM ELECTRIC SHOCK

The report of the commission on resuscitation from electric shock, presented by Past-president W. C. L. Eglin, reviewed exhaustively the work of the commission, with a discussion of the relative merits of the Silvester and Schaefer manual methods of artificial respiration. An important feature of the report was a critical analysis of the claims made for the pulmotor as an efficient mechanism for reviving unconscious subjects and an outline of the mechanical method of artificial respiration by pharyngeal insufflation as developed by Dr. S. J. Meltzer, head of the department of physiology and pharmacology in the Rockefeller Institute for Medical Research.

The commission concedes that the Schaefer method is superior to the Silvester through its greater simplicity and ease of performance, absence of trouble from the tongue falling back and blocking the air passages and reduced danger of injuring the liver or breaking the ribs in the application of pressure. Observations indicate that, so far as the amount of ventilation of the lungs is concerned, the Schaefer method, reinforced by the extension of the arms forward, is decidedly better than that suggested by Silvester. This advantage, taken in conjunction with its greater simplicity and safety, caused the commission to vote unanimously in favor of the prone-pressure method of artificial respiration as an effective means of giving immediate aid. Reference was made to the commission's booklet on resuscitation, which has been prepared as the outcome of the work.

Even a relatively poor method of artificial respiration, if begun immediately, may maintain life and permit ultimate recovery in cases in which an ideal method, with all the resources of the laboratory and hospital, would be ineffective after a few minutes. In order to test the action of devices now being advocated, a sub-committee, with Dr. Meltzer as chairman, was appointed. The apparatus examined was used according to directions, and the effects were demonstrated before the members of the committee. At least four machines for performing artificial respiration are now in the market—the pulmotor, the Du Brat apparatus, the "lungmotor" and the "salvator." The last two devices were not examined. The apparatus of Du Brat seems never to have become a successful commercial article. The committee emphasizes the wide publicity which the pulmotor has received through the daily press, but points out at length that the pulmotor has lacked scientific, surgical and medical sponsors. Efforts to obtain scientific details and other reliable information bearing upon specific cases in which the pulmotor has been used lead to the conclusion that the cases available to the committee do not furnish convincing proof of the necessity or exceptional value of this apparatus. The committee agrees that the instrument is probably capable of creditable performances and doubtless has in some instances favored the restoration of normal breathing. Its present vogue, however, is not supported by a critical examination of the principles involved in its mechanism or of its effect when used for long periods. No well-considered testimony as to its action is to be found in medical literature, and in this country at least its loudest sponsors are the newspapers, which have spread the impression that the pulmotor is a perfect resource when inspiration is suspended. In view of the facts obtained by study of the Du Brat apparatus and the pulmotor, the members of the sub-committee agreed upon the following suggestions: In cases without any respiration the pulmotor should be used only when guided by hand and then not

faster than twelve to fifteen complete respirations per minute; when left to run automatically it is liable to be inefficient and dangerously deceptive. Because of suction on the lungs neither the pulmotor nor the Du Brat should be used for more than five or six minutes at a time, and if nothing better is available should be alternated with the Schaefer method combined with oxygen inhalation. In cases of slow and stertorous breathing, however, both machines can probably be used for a longer time with benefit and without danger.

The remainder of the report describes the mechanical method of artificial respiration used by Dr. Meltzer, based on pharyngeal insufflation. The apparatus which Dr. Meltzer has devised has the following commendable features: (1) Its positive action is determined by the operator and not left to a mechanism which may fail to work; (2) it is free from a sucking action during expiration, as the latter results from the natural recoil of the disturbed parts; (3) it is light; (4) it is relatively inexpensive; (5) it is simple, and (6) it embodies in a form which can be used by laymen a method of artificial respiration which has been employed for many years in scores of laboratories and on thousands of animals and is known to be effective and free from danger. The commission recommends this apparatus as a satisfactory means of continuing artificial respiration and suggests that in cases of suspended breathing the modified prone-pressure method be supplemented as soon as possible by the use of the apparatus.

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## Generation and Transformation

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### PRIME MOVERS

The committee on prime movers, through Chairman I. E. Moulthrop, of the Edison Electric Illuminating Company of Boston, submitted a 100-page report covering the development of water, steam and gas units during the past year. It was stated that there has been no striking development in any of the various forms of prime movers applicable to central-station use. However, much thought has been given to improving the efficiency of waterwheels and steam turbines, and an earnest effort has been made to develop an internally fired heavy-oil engine. Considerable attention has been devoted to boilers and boiler rooms with a view toward raising their efficiency.

Of the water-power units the vertical turbines seem to be most in favor at present owing in large measure to the improvements made in thrust bearings. The Kingsbury thrust bearing and the combined oil-pressure and roller form of bearing have been reported to give excellent results in operation. Optimistic letters from the General Electric Company and the Westinghouse Machine Company published in full in the report show that the trend of rotative speed in steam turbines is upward and that the several minor changes that have been made in design have helped to improve the efficiency. Steam turbines for driving station auxiliaries are reported to be bidding fair to supersede all other competitive apparatus. Curves submitted in the report show the relative steam economy of this type of auxiliary as compared with the high-pressure reciprocating steam engine. In connection with high-pressure turbines the committee called attention to the statement of Dr. S. Z. Ferranti, who has said that he expects soon to be able to produce a high-superheat turbine capable of operating on less than 6 lb. of steam per steam brake-horse-power-hour.

Reports from manufacturers show that at present there seems not to be a sufficiently active demand in this country for the high-efficiency, self-contained steam units, such as the Lentz, Wolf and Locomobile types, to warrant their construction.

Condensers are sometimes built following the design of



a steam boiler, the designer apparently being under the impression that the greater the number of times the steam in its passage through the condenser can be brought into contact with the tubes the greater will be the amount of heat extracted. It was the suggestion of the committee that when designers realize that exhaust steam has not the same characteristics as flue gas, and that a condenser should be designed to get the steam to and not through the cooling surface, condenser tubes will be located far enough from the last row of buckets to permit the steam to free itself from the last row of blades without encountering a decided back pressure at that point.

In answer to a circular letter sent out by the committee information of general interest was obtained bearing on the following subjects: new methods and devices, flow meters and forced draft, feed-water heaters and feed-water heating, deterioration of steel stacks, and trouble with turbine blades. The statistics obtained from the answers to the letters were given in full in the report.

The question of adequate opening for admitting air for draft to boiler houses led to calculations with rather startling results. It was stated that if it is an assumed boiler room containing twenty 500 hp boilers the air for the draft was compelled to enter through a 7 ft by 7 ft doorway the velocity of the blast would reach 50 miles an hour. These figures were presented as an argument for adequate draft opening both in winter and summer.

The data which the committee has been able to present on the operation, accuracy and value of apparatus for determining flue gas composition seem to indicate a wide divergence of opinion among the companies using the apparatus. It is the opinion of the committee that a flow meter can perform essentially all of the functions claimed for the  $CO_2$  meter.

Because of the high calorific value of petroleum oil and its great adaptability to boiler work it is almost the ideal fuel. The comparatively recent discovery of oil fields in Mexico is looked upon as an important factor in the production of this fuel. It is of interest to note that steam atomizer burners have now been so developed that they will operate on from 1 per cent to 2 per cent of the amount of steam generated by the boiler which they serve. The rating of a good steam atomizer burner is now placed at 400 boiler hp and it is possible with such burners to operate a boiler at from 200 to 450 per cent of its rating.

A recent type of stoker combining the best feature of inclined underfeed and overfeed stokers and shaking grates is claimed to have developed from 200 per cent to 250 per cent boiler rating with an efficiency of from 75 per cent to 77 per cent. The power required to operate the stoker was 1.5 hp, and 20 hp was used for driving the blower.

The committee in presenting for discussion the term "myriawatt" in an effort to get rid of the term boiler-horse-power suggested that the question of adoption of such a unit be put into the hands of the national engineering societies.

In the report on gas power it was stated that the market for gas and oil engines had been unusually quiet in the past twelve months and this was attributed to the great trend toward the centralization of generating stations. Owing to the relatively large investment and maintenance cost even the smaller units have suffered a loss of the prestige accorded them by the hydroelectric a few years ago. There were included in the report interesting statistics regarding the general oil supply and a review of prices here and abroad. There are approximately 300 installations of medium and heavy-duty oil engines, aggregating 75,000 hp, in operation in the United States, indicating that the oil engine has assumed a definite part in the production of electricity in this country.

Although no gas turbine has yet been developed, engineers engaged in the development of the internal combustion engine have long realized the advantage of sub-

stituting rotary movement for reciprocating motion. So far practical difficulties have not been overcome. Some useful knowledge, however, has been obtained by able experimenters and some more substantial experimental work will be done in the future. The committee will be concerned afresh.

A paper by Lieutenant W. W. Moore, United States Navy, appended to the report gave a general description of the King very three headed and a more particular description of the three headed on the *U. S. S. Yeffe*, which is of the type. An appended paper by the Altko Chalmers Company, signed by Mr. W. M. Peck, gave a description of the company's practice in the construction of waterwheel runners. A letter from the J. C. Morgan Company, signed by Mr. H. L. Turner, described the construction of the built-up waterwheel runner. Vialle, Blackwell & Buck, through Mr. E. C. Blackwell, stated in a letter that waterwheel runner material that in general it is evident that runners of bronze and cast steel are not as satisfactory as cast iron, that bronze and cast steel have the advantage of giving better casting properties and that there was show little choice between bronze cast steel and cast iron as far as casting time and cost are concerned. Mr. J. C. W. Lamer, of the Wellman-Security Morgan Company, discussed at some length the advantages and disadvantages of the built-up runner and recommended some of the qualities of different runner materials.

A letter from the Cornum-Pines Company, signed by Mr. V. G. Cornum, stated that in the *WPA* it appears that medium and high heads bronze runner gave the best service. A paper by Prof. C. M. Allen, of the Worcester Polytechnic Institute, published in Appendix F of the committee's report, gave a good and complete description of water wheels after installation.

Appendix D contained a letter from the Wellman-Security Morgan Company, in which the following type of water wheel was described and illustrated. Mr. Arthur D. Pratt, of the Hubert & Wilson Company, presented an interesting paper which was appended to the report on the use of the internal combustion engine. In this paper the relative merits of various oils were given and the advantages of oil and oil were compared. Oil burners were described and also types as to their operation.

Specifications for internal-combustion engines have been printed in Appendix F. The data were previously reported from the writings of Mr. Irving C. Allen and Dr. Rudolph Diesel and from the journal for Production from at Essen-Kruse. The gas engine section in Europe was discussed in a report by Mr. H. L. K. Fritze, construction engineer for the Altko Chalmers Company, in which at this report being included in Appendix E.

#### Obituary

Mr. W. L. Allen, of the Cornum-Pines Company, Chicago, addressed to the members of the association steam turbine for the company arrived at the rapid progress of the art even in the brief interval since the prime mover committee report was printed about three months before.

Mr. J. E. Mather, of Boston, Mass., read the introduction of this paper to reading a letter from the General Electric Company which outlined the making of the turbine displacement turbine mentioned in this paper was not due to their having been not in such high the displacement to the best time in per cent used and was used in the partitions. Instead of 95 per cent used in the turbine. Where the turbine made use of turbine and the percentage of turbine is shown in the partitions. A removable nozzle has been developed for some of this manufacturing turbines and it requires some work and changes the turbine. The turbine has been improved where the turbine and considered this turbine as an additional paper.

## OPERATION OF WATER-POWER SYSTEMS

The committee on operation of water-power systems, the chairman of which was Mr. David B. Rushmore, of the General Electric Company, presented an exhaustive report on its investigations. The general layout of systems received considerable attention and separate sections were devoted to each class of apparatus employed in the operation of hydroelectric systems. The committee contended that in order to be able to furnish reliable service consideration should be given to the cause of disturbances and the means for minimizing their effects, and its report contained recommendations to that effect.

The planning of a hydroelectric system begins with the consideration of the proper number of generators, transformers and outgoing lines, and when deciding on these the methods of operation of the system as a whole should be kept in mind. With units of large capacity and with several power stations tied into the same system, unusual precautions must be taken to prevent the concentration at points of trouble of too great amounts of energy, and thus the use of artificial and inherent power-limiting reactors becomes an important factor. By a large majority high-voltage systems are really distributing rather than transmission systems, so that one of the principles involved is to localize the disturbance and isolate it quickly.

No hydroelectric development should be provided with an equipment of apparatus above the rating at minimum stream flow unless there is an auxiliary steam station. The steam station may serve any one or all of three purposes—first, that of an auxiliary station to be used at periods of low water; second, that of a reserve in case of interruptions, and third, that of a regulating station to take care of the variations in the load with a hydroelectric plant run at constant output.

In the several chapters of the report treating of different classes of apparatus such as waterwheels, generators, exciters, transformers, etc., reference was made to the latest developments within each particular field and there were recommendations in regard to different types to be used under various conditions.

The transmission and distribution lines had very careful consideration by the committee, this part of a system being considered the weakest link in an installation. It is not considered wise to depend entirely upon a single circuit to transmit the output from an important station. The same weight of copper divided into two circuits and supported by slightly modified towers would considerably reduce the chance of shut-down with only a moderate additional cost for towers, a second set of insulators and labor for erecting the second circuit. The overhead ground wire is considered of undoubted value for lightning protection, and better results may be expected from two circuits than with one. These wires should be placed as far above the transmission lines as practicable and with a minimum shade angle of 45 deg.

For high-voltage transmission lines suspension insulators are now used exclusively, the practical limit of the pin-type insulator being approximately 60,000 volts. For transmission voltages higher than are used at present the design of the suspension insulator must necessarily be modified so that the potential along the string can be better distributed. A liberal factor of safety should be allowed in selecting line insulators, as they form only a small part of the total cost of the line and are the most vital factors in its success. With great improvements in high-tension insulators the patrol of transmission lines has been very much reduced and a greater importance should be attached to the ability to locate the particular points of the line in trouble and to repair them there at the earliest possible moment.

Line inspection at night has also been made possible by the use of searchlamps. Arrangements are often made with residences near the lines for reporting trouble. It seems to be the general belief that as a general rule rewards

should not be offered for such services. Such services should, however, always be acknowledged by a letter of thanks or otherwise.

## Discussion

Mr. F. B. H. Paine, of the Niagara, Lockport & Ontario Power Company, suggested the desirability of utilizing hydroelectric plants for auxiliary service on peak loads, especially where the water supply is limited and the cost of development is not far from \$70 per kilowatt.

## ELECTRICAL APPARATUS

In a forty-eight-page paper the committee on electrical apparatus, of which Mr. L. L. Elden, of the Edison Electric Illuminating Company of Boston was chairman, reported upon the progress made and the tendency of developments of electrical apparatus for use in central-station service. It was stated that more attention than ever before is being given to details that will insure satisfactory operation. With the continuation of the tendency of manufacturers toward units of greater rating, higher relative speeds are being adopted, thereby necessitating the use of improved types of insulating materials suitable for withstanding high temperatures and severe mechanical strains. As is to be expected, sizes and ratings of switching units and other station accessories are growing apace with the generating units. In the appendix to the committee's report the various electrical apparatus applicable to central-station work were treated. A general summary of these topics is given in the following paragraphs.

The past year has been marked by progress in the design of turbo-generators and it was reported that several companies have placed orders for 25,000-kw units. Manufacturers now indicate their ability to build large high-potential generators without employing auto-transformers.

Reactors are used for protection against high-frequency disturbances, for voltage regulation and synchronizing machines, and to limit current rushes into a short-circuit. With the latter class practice is still somewhat in the evolutionary stage with respect to standards, but their use with such apparatus as generators and transformers, for insertion on busbars of substations and in feeders is becoming more widespread.

With regard to the higher speeds of rotative apparatus instances were cited in which 5000-kw units operate at 3600 r.p.m., 19,000-kw units at 1875 r.p.m. and 20,000-kw units at 1500 r.p.m., and it is apparent that the final limit has not yet been reached. The adoption of commutating poles has assisted materially in making it possible to develop high-speed apparatus, and 25-cycle machines of recent design are now operated at approximately twice the number of revolutions of the old non-commutating-pole designs, although peripheral speeds have not increased in the same proportion.

There seems to be a tendency at present to equip generators with directly coupled exciters. Chief among the advantages of this idea are: simplicity, economy and elimination of wiring and switching connection.

In spite of the fact that the rotary converters of recent date show greater speeds and increased outputs due to inauguration of commutating poles, the committee believed that proposals to change over existing rotary converters should generally be discouraged. Only in special cases should the change be considered and then with due regard to cost and complications to be overcome. In summing up the situation the committee recommended the use of 60-cycle machines for railway service.

A table of comparisons, which shows at a glance the relative merits of the motor converter, a device for the conversion of alternating current to direct current, rotary converters and their transformers, and motor-generators, indicates that the motor converter may in the future be an active competitor in the converter field.



The use of synchronous converters for securing better regulation on transmission lines and for correcting the power-factor on distribution systems was commented upon, and although in the former case installations have met with much success, it was the opinion of the committee that other methods should be employed for power-factor correction.

Recommendations have been made by the committee to the A. I. E. E. committee on standards with regard to the quality of insulation. Upon the completion of the A. I. E. E. committee's exhaustive study of this subject it is expected that some definite recommendations will be made which will serve as a guide to both manufacturers and operators.

Improvements in the construction of rheostats were discussed by the committee with special reference to operating troubles occurring with this type of apparatus among the companies during the past year.

The data concerning the application and operation of types of brushes on commutating apparatus which were presented were said to be authoritative and accurate. The hard-carbon brush, treated hard-carbon brush, graphite brush and copper graphite brush were mentioned in connection with the class of operation to which they are best suited.

Investigation of the merit of outdoor transformer installations reveals certain advantages and disadvantages compared with the indoor station. The advantages of the outdoor station are lower first cost, extension made at less cost, reduction of fire risk and more efficient cooling of air blast transformers. The disadvantages are trouble from moisture, interference from outside parties and difficulty in repairing and handling apparatus in bad weather. The committee recommended careful consideration of the means of supplying economical service under favorable conditions. Oil switches, feeder regulators, electrolytic lightning arresters and other auxiliary apparatus commented upon show improvements in details which add to the efficiency and reliability of the plant in general.

#### Discussion

Mr. R. F. Schuchardt, Chicago, said that the 30,000-kw generator for the Commonwealth Edison Company will operate at 1,500 r.p.m., delivering energy at 9,000 volts with auto-transformers. About half the reactance will be in the machine itself and half in external coils, an arrangement which tends to increase the efficiency about two-thirds of 1 per cent. In the near future the limit of generating capacity per section of the Chicago central-station system will probably be raised from 60,000 kw to 100,000 kw. Regarding noise in substations, Mr. Schuchardt cited the replacement of a frequency changer with transformers as an effective measure. He also mentioned the tendency to supply an exciter on the generator shaft in large units for central station service.

Mr. Philip Torchio, New York, favored the use of external reactance coils in connection with large turbo units. The bus tie reactances mentioned in the report should have the full carrying capacity of the switch between bus sections. Reactances between parallel operating stations are as important as between bus sections.

Messrs. I. E. Moulthrop, Boston, Mass.; E. A. Lof, Schenectady, N. Y.; E. P. Dillon, Pittsburgh, Pa.; J. P. Kearns, Schenectady, N. Y.; A. D. Fishel, Pittsburgh, Pa., and J. Durfee, Rochester, N. Y., also spoke briefly. The exciter arrangements at the Keokuk plant were described and the advantages and drawbacks of the motor generator were outlined. The opinion was advanced that the design of a practically useless machine for substation service is possible if the purchaser is willing to meet the expense.

#### SWITCHBOARD INSTRUMENTS

In an interesting paper entitled "Switchboard Instruments," by Mr. Paul MacGahan, of the Westinghouse Elec-

tric & Manufacturing Company, alternating-current and direct-current indicating switchboard instruments and new forms of alternating-current protective relays were described. It was stated that errors in switchboard instruments may be divided into three classes, namely electrical, mechanical and observational. Because the mechanical defects affect the life of the instruments and increase with time they are, generally speaking, of more importance than the electrical errors in the instrument of today. For central-station work high initial accuracy is not deemed necessary. A study of leading American meters shows that for operating purposes they are satisfactory with regard to temperature coefficient, and phasing errors, but that errors resulting from magnetic and electric induced magnetism and the wave-form of rectified direct current are too large to be ignored.

The mechanical sources of error are excessive weight of moving element, insufficient ruggedness of moving element, insufficient controlling force, and insufficient insulation. A table cited by the author gives the weight and torque of meters of three American instrument makers. A bright future is predicted for the 7.5-in. round-type switchboard meter, which the induction principle has made possible, as the scale in this instrument is easily direct and more legible than that of the former type. It is suggested that in order to obviate the trouble occurring with direct-current instruments due to stray magnetic fields in the vicinity of busbars the instrument of this type should be mounted so that the direction of the busbar field is at right angles to the permanent magnet, as a demagnetizing field passing through permanent magnet at right angles to the direction of the permanent magnetic flux has little or no effect upon the magnet. This method has been found much more successful than that of employing iron shields for instruments, especially where short-circuits produce excessive current in the busbar.

In the new alternating-current protective relays the inverse time-element characteristics are obtained by the action of a permanent magnet upon a disk. These relays are made in the following types: (1) current or overload inverse-time element, operating instantaneously at heavy overloads; (2) current or overload inverse-time element operating non-instantaneously at heavy overloads, the minimum time-element for any overload being adjustable; (3) overload and reverse relays, inverse-time-element, tripping on heavy loads in the normal direction or light loads in the reverse direction, provided the voltage or the power-factor does not fall to a low value; (4) reverse-power, positive-type relays, operating on reverse power but having a selective watertight circuit in the same case as provided to keep the trip circuit open whenever energy flows in the normal direction.

It is suggested by the author that relays located at the substation terminals of transmission lines should be arranged so that tripping can never take place because of energy flowing into the station. Likewise they are the reverse relays designed into the condition of emergency, so that the station will not allow voltage and power to flow back into the station after a fault. They are particularly useful in the running of all transmission lines.

#### Discussion

The discussion turned upon the greater reliance to be placed on the type of instrument used, such as direct or indirect, and the use of the direct-current principle. Mr. C. P. Davis, of the Central Electric Lighting & Light Supply Company, the host and one of the speakers, stated that the use of alternating-current circuits. Mr. H. H. Brown, of Pittsburgh, said he believed in direct-current protective relays, but that he was not an advocate of direct-current relays in general.



### USE OF TELEPHONES BY CENTRAL STATIONS

Mr. Angus S. Hibbard, of the American Telephone & Telegraph Company, New York, in a paper entitled "Telephonic Communication the Means of Control of Central Stations," shows what wide uses are made of the telephone in the central-station business, especially by the larger companies. With centralized generating stations, it is necessary that one man, the system operator, control the distribution of the energy generated. The extent to which the telephone is employed by the system operator of the New York Edison Company in transmitting orders about the stations and between the stations and substations was described in detail, as were also the systems in use by the Commonwealth Edison Company, the Boston Edison Company, etc. Attention was directed to the diversified uses made of the telephone outside of the purely operating end of the business, such as between branch offices and between the general and branch offices and the public. The New York Edison Company has 24 branch exchanges, 750 telephone extensions, 161 trunk lines, 66 tie lines, 446 miles of telephone circuits, 25 direct exchange lines and a traffic running to about 20,000 calls a day. Traffic reports show that about 17,000 messages are handled daily by the Commonwealth Edison Company.

#### Discussion

Vice-chairman W. L. Abbott, of Chicago, in discussing the paper emphasized the interdependence of central stations and local telephone companies and advocated the avoidance of apparatus not connected with exchange systems. Mr. A. S. Loizeaux, of Baltimore, emphasized the convenience of multiple conversations in connection with load dispatching.

### DESIGN OF DISTRIBUTING TRANSFORMERS

The importance of a proper selection of insulating materials and of scientific methods of applying them was emphasized in a paper by Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company, on the design of 2200-volt distributing transformers. The insulation problem was stated to be divided naturally into three parts—that is, between the turns and layers of the winding, between the high-tension and the low-tension windings, and between the windings and the metallic parts of the transformer. It was stated that the requirements in the first case are mainly that the material shall be able to withstand the mechanical stresses of bending and the effects of high temperatures, since usually the potential difference between adjacent turns or layers is comparatively small. For effectively insulating the high-tension from the low-tension windings the author mentioned as the latest development a formed sheathing of paper and mica which has very great dielectric strength. This same material was explained to play a very important part in effectively insulating the windings from the metallic parts of the circuit. In closing, the author made a short reference to the allied problem of maintaining an oil circulation and spoke of the reduction of losses through recent improvements in transformer design.

#### Discussion

Mr. A. D. Fishel, of Pittsburgh, spoke briefly, paying particular attention to the influence of the life of materials on transformer design, the efforts to secure durability being regarded as of extreme importance by the manufacturing companies.

### TRANSFORMERS FOR ENERGY TRANSMISSION

The essential feature of a paper by Mr. H. H. Rudd, of the Westinghouse Electric & Manufacturing Company, was the strong appeal made for more uniform standards of transformer design. It was urged that in the future, as the small generating plant gives way to the substation of the large central generating plant, the question of transformer

design will become of increasing importance. Owing to the diversity of voltage requirements on different classes of load, and also to the great difference in the lengths of distributing lines, transformer design is handicapped by the demand for multiple high-tension and low-tension windings, capable of various series-parallel arrangements, and for a large number of taps. The natural flexibility of the transformer was explained to have adapted it readily to these special design requirements, but at the same time the lack of more standard requirements has increased the cost of manufacture. It was suggested that some middle ground be fixed between the manufacturers' desire for a few rigidly simple and comparatively inflexible designs which can be made and sold cheaply and the users' demand for a large variety of designs so special that their cost would be proportionately very high. Standardization of transformer design at some point between these two extremes would, according to the author, prove of mutual advantage, in that cost would be reduced and performance improved.

## Transmission and Distribution

### DIRECT-CURRENT TRANSMISSION

In addition to giving outlines of numerous hydroelectric equipments installed recently both in this country and abroad, the report of the committee on progress submitted by Mr. T. C. Martin contained a general survey of the conservation movement and a discussion of certain state ownership plans, including the New York State hydroelectric development bill just vetoed by Governor Sulzer. Special attention was called to the recommendation of official Swedish engineers to use the direct-current rather than the three-phase system for a 200-mile line from Trollhättan Falls, Sweden, to Copenhagen, Denmark.

#### Discussion

Commenting upon the recent hydroelectric situation in New York State, Mr. Martin affirmed his belief in the wisdom of the public policy committee's work in endeavoring to prevent the passage of injurious hydroelectric legislation committing the State to large developments certain to be ruinous to private initiative and to existing plants. Mr. D. B. Rushmore, Schenectady, N. Y., voiced the need of a better understanding of the purposes of the association on the part of the public.

At the suggestion of Secretary Martin, Dr. C. P. Steinmetz, Schenectady, N. Y., then discussed the economic aspects of direct-current, high-voltage transmission, compared with three-phase, high tension practice. Dr. Steinmetz said that he had had no opportunity to go over the details of the Trollhättan Falls (Sweden) proposed high-voltage direct-current transmission, but that the investigation of many transmission projects elsewhere had never disclosed to him a single instance where direct current was the proper solution of the problem. The choice is largely an economic question. Where it is necessary to cross the ocean bed in a very long and high-pressure transmission it may in some cases be desirable to use direct current. One will get inductive line disturbances from lightning regardless of the character of current used. Direct-current generators are less economical and flexible. He pointed out in conclusion that the use of constant alternating current is a possibility of the future, but that experience favors three-phase, high-tension transmissions.

Mr. E. A. Lof, Schenectady, N. Y., brought out the point that high-voltage, direct-current transmission is less desirable from the operating standpoint. Its selection for the Trollhättan-Copenhagen scheme was largely due to the inability of manufacturers to offer submarine cables—one and a half years ago good for over 90,000-volt service.

Messrs. Arthur Wright, London, England, and F. B. H.

Paine, Buffalo, N. Y., closed the discussion, the former bringing out the absurdity of considering machines as small as 1500-kw rating for large transmission work. This is about the limit of successful commutation, and it is a fatal objection to high-tension direct-current transmission.

## OVERHEAD-LINE CONSTRUCTION

The committee on overhead-line construction, of which Mr. Farley Osgood, of the Public Service Electric Company, Newark, N. J., was chairman, submitted a report covering its work since the last convention. Final action on the recommendation for changes in the report resulted in a number of changes which simplified the wording of the report in several instances, making it easier on clear interpretation. The committee strongly recommended that the specifications be accepted in the form in which they were presented. On account of the many questions pertaining to construction requirements where conflicting lines do not actually cross but are in close proximity with one another, the committee recommended that the existing specifications be supplemented with further specifications covering this special case.

With a view to broadening the scope of the overhead-line committee, it was suggested that the title of the committee be changed to the national joint committee on overhead-line construction. It is thought that this will have a tendency to relieve any one society of sponsorship for the committee and will make its organization stronger and its personnel more general. It was stated that owing to the lack of time no definite plan had as yet been evolved, but authority was asked to form such a committee.

Letters appended to the report indicate that the specifications as presented by the committee have the approval of the larger telephone and telegraph companies.

## Discussion

Messrs. F. B. H. Paine, Buffalo, N. Y.; D. W. Metcalf, Portland, Ore.; D. W. Roper, Chicago, Ill.; C. Stevenson, New York; R. D. Coombs, Philadelphia, Pa.; C. A. Savin, Newark, N. J.; R. J. McClelland, New York, and E. H. Davis, Williamsport, Pa., commented on the report, the consensus of opinion being that the proposed specifications should not be taken as arbitrary. Mr. Metcalf touched upon the efforts now being made in the State of Washington to standardize and safeguard overhead high-voltage line construction, through co-operation with the engineers of the Public Service Commission. Closing, in the absence of Chairman Farley Osgood, Mr. Paine urged the vital importance of safeguarding telephone lines in territory occupied by dangerous distributing circuits.

## TRANSMISSION-LINE CONSTRUCTION

A paper by Mr. R. D. Coombs, of R. D. Coombs & Company, New York, gave an outline of the author's views relating to lines designed for operation at 2300 volts or more and discussed the structural features of tower and pole lines. In regard to clearances it is the author's opinion that at present many of the lines being erected are using poles that are too high. It is far better, he thinks, to trim a few scraggly trees and lower the telephone and low tension wires than to try to acquire the proper clearance with 60-ft. or 70 ft. poles. Co-operation between existing companies with a view to securing joint ownership of pole line should surely be encouraged.

Although it is admitted that the loading in the worst times exceeds that assumed in the specifications of the joint committee, yet these specifications for loading are thought to be sufficiently rigid. Just as bridges and buildings are not designed to withstand tornadoes, so the transmission lines do not need to be absolutely immune from all such factors as the factor of safety will eliminate nearly all the future due to ordinary manipulation and provide for a reasonable variation in the assumed load and for such deterioration as may

be assumed in the material, it has served its purpose. Any decrease in such a factor would be dangerous but an increase would be extravagant.

Owing to the varying conditions of different soils the depth to which foundations for towers must be placed cannot be determined accurately and readily by a mathematical formula. The designer must select the depth of foundation on the basis of soil conditions for a long transmission line, it is necessary either to have two standards or to design a single foundation which will provide safety for ordinary variations in the soil. Although foundation cost in wide-base structures is comparatively high, the insurance value of a good foundation makes it well worth its cost. Results obtained from tests have shown that foundations are sometimes deceptive. A horizontal movement at the ground line may induce stresses not foreseen by the designer. The relative merits of galvanizing and painting can be discussed only as a local issue, since the weather and atmospheric conditions determine largely which should be used. The practice of installing a ground wire at the base of a tower is a local question about which considerable controversy has been conducted. The use of a small U-bolt or hook bolt which bites into the ground wire and causes failure should be especially discouraged as the failure of the ground wire is certain to cause failure of the circuit beneath it.

Between the limits of 5000 volts and 20,000 volts it is believed that wooden cross-arms will find favor, but for the higher potentials the metal arms, which are now more common, are probably preferable.

Despite the small size, which can be obtained by attributing to the wooden pole as a transmission-line support, the day has not yet come when it could be considered as economical. In the transition which transmission structures are undergoing from wood to metal the excellent record of wooden poles in the work world can be overlooked in the analysis as their basis is well worth discussion. The more permanent types of support may be divided into the rigid under base steel tower, the semi-rigid pole made either of steel or of reinforced concrete, and the flexible steel pole or frame. The subject of any comparison of poles over the others, apart from their relative cost for any given line, should be made upon the basis of adaptability. It is the author's opinion that the wooden tower and the semi-rigid pole offer primary structural service the maximum security against serious interference. The greater strength possible in such structures allows the use of larger spans with a consequent reduction in the number of insulators and hence in the number of man-hours required.

In conclusion, the author appended reference to those on desirable detail requirements in order to promote the current upon proper line construction, the potential in excess of 600 volts.

## Discussion

The paper was discussed in Atlanta, E. A. Hall, Louisville, Ky.; N. Y. T. & H. Jaffe, Buffalo, N. Y.; C. E. Connelley, New York City; A. H. Richardson, Kansas City, Mo.; and C. P. Gehrung, Portland, Ore. The discussion of analysing the length of the readily seen in suspension and the time as a function of the square of the time was brought out. To see how much time had elapsed from the instant an individual becomes conscious was not considered by attending speakers, the speaker thought that at a practical level this is the time of conscious awareness was also ignored. Mr. Gehrung asked questions of the speaker as to how long it took in Olan, the time for which had not been directly addressed. A positive source of activity is a highly aroused state; anyone can be brought to a state of arousal of the state.

### How Taxes Influence Funds

The committee on underground construction, of which Mr. W. L. Aldatt, of the Consolidated Tissue Company,



Chicago, was chairman, confined its annual report to the subject of high-tension transmission cables. Practice regarding the periodical high-potential testing of such cables was shown to vary considerably. Several companies were said to be installing apparatus with a view to making such periodical high-potential breakdown tests on all of their transmission lines, while other companies already having the necessary equipment have abandoned the practice of making these tests periodically. It was thought by the committee that in general these tests increase the liability to subsequent break-downs and often do not disclose existing points of weakness. The majority of the companies report that such tests are not applied.

In this report more space was given to the discussion of carrying capacity of cables than to any other subject. It was shown that hardly any exact information is possessed by central-station operators as to the safe limits of loading under various operating conditions. The carrying capacity of a cable was stated to be limited by the temperature of the insulation, and the life of the cable to vary in inverse ratio with this temperature. Hence the three factors to be considered in determining the safe current load of a cable are temperature of inclosed conductor, temperature of surrounding air and objects, and heat generated in the insulation itself due to current leakage through the dielectric. The committee recommended that a very decided increase be made in the rating during the winter and also that the current rating be varied inversely with the voltage on account of the heating of the insulation due to leakage of current.

From the well-known fact that the potential gradient of insulated wires is much higher in that portion of the insulation near the conductor than in the outer layers and the equally well known law that the fall of potential across a series of insulators of varying specific inductive capacities is inversely proportional to their capacities, the committee stated that use might be made of a graded paper insulation formed by saturating successive sections with oils so chosen as to give specific inductive capacities varying in the proper proportions. Such a step, it was explained, would allow of a smaller diameter of cable with the same factor of safety, or of a higher voltage, the diameter and factor of safety remaining the same.

With the increasing size of rotary converters and with the resulting increase in the size of the conductor, in order that a line may have sufficient capacity for one converting unit, some companies have reached the maximum size of three-conductor cables (with round conductors) that can be installed in a duct nominally 3 in. in diameter. The paper stated that, in order to meet this condition and to secure a cable with larger copper cross-section or thicker insulation, or both, cables have been developed with conductors of clover-leaf or sector form. As to the installation of current-limiting reactors, the committee found that these are necessary on generators where the load on one bus exceeds 50,000 kw. One company has found it expedient to divide the bus into several sections and interpose between them current-limiting reactors, and one company has installed such reactors on each of its high-tension feeders. All of the above-mentioned companies are operating an ungrounded system, and none of the companies operating with a grounded neutral has found it necessary to install these reactors.

Some attention was given in the paper to the discussion of methods for protection of cables in manholes. The advisability of running parallel routes was also treated, the advantage being an increase in reliability of service, since in case of accident to one circuit the other would be able to handle the traffic temporarily until repairs could be made. Among other things, the report touched upon the subject of trouble reporting and showed a uniform report sheet recommended for this purpose. Practical hints were given on the installation of cables in ducts. In closing, the author

suggested standard form specifications for paper-insulated high-tension cable and for rubber-insulated, lead-covered cable for pressures in excess of 2000 volts.

#### Discussion

Mr. C. W. Davis, of the Standard Underground Cable Company, Pittsburgh, Pa., praised the report, but pointed out a few particulars in which the practice of his company differed from that of the committee. One of these relates to the safe loading of cables. Mr. Abbott told of a remarkable accident by which a man was killed from electric shock when holding the end of a 40-ft. dry manila rope which was in contact at the other end with a high-voltage circuit. The fatality was inexplicable until the rope was cut, when it was found that the manufacturer had stranded into it very fine steel wire.

#### LIGHTNING ARRESTERS

Although normally a survey of the conditions of protection, the paper by Prof. E. E. F. Creighton, of the General Electric Company, was largely devoted to the subject of lightning arresters, their operation, application and latest developments. The multi-gap arrester was said still to hold a predominant position in distribution work at or about 2300 volts, because of its lesser cost and of the fact that it can be made insensitive to arcing grounds and at the same time sufficiently sensitive to protect transformers. No material technical improvements have been made in the multi-gap arrester during the past few years. It has been learned that in order to get a high degree of protection for lighting transformers an arrester should be placed at each one, since if it is located only a few poles distant it will be ineffective against the concentrated and localized potentials due to lightning. In order to supply this increased demand and at the same time reduce the cost of the arrester, there has been developed a self-housed, self-contained form of the multi-gap known as the compression-chamber lightning arrester. In this type the shunt resistor has been discarded and more series gaps have been added, thus giving it better arc-extinguishing qualities.

Turning to the subject of aluminum arresters, the author said that a careful study of the conditions has revealed the fact that the charging resistor represents a good investment. The qualities which make the aluminum arrester a good discharger for lightning make it take a heavy current if the films are not in good condition. It is possible to place in series with such an arrester a resistor of considerable resistance without preventing it from taking its full charging potential, and this solves the problem of limiting the charging current to a reasonably small value, even though the films are badly dissolved. Another measure found advisable, in order to prevent arcing across the horn-gaps while charging, is the use of spring clips. Previous to January, 1912, an organic electrolyte was used in which a fungus growth was apt to appear accompanied by the formation of vinegar which had a deleterious effect on the film. Since that date the operation of this type of arrester has been greatly improved by the use of an inorganic electrolyte. Oscillograms of current and voltage conditions during arrester discharges were shown and discussed.

Speaking of the grounding of apparatus, Professor Creighton stated that ordinary pipes driven into earth well salted will give as good a ground connection as can be obtained. Most of the resistance of an earth connection lies in the immediate neighborhood of the pipe. Moisture is necessary to reduce the resistance, and the salt supplies this conducting moisture. In conclusion mention was made of the opportunity for developing a good system of overhead grounding.

#### Discussion

Mr. H. W. Hough, of Cleveland, favored water-pipe grounds, pointing out that earth-pipe grounds, even when salted, vary greatly in resistance. Mr. D. W. Roper, of



Chicago, instanced a lightning stroke on a suburban line at a point 1000 ft. away from an aluminum-cell arrester which jumped across a 3-ft. wire spacing without showing a trace of its presence in the arrester record, although the gap was but  $\frac{1}{4}$  in. The importance of placing arresters as close as possible to the danger point was emphasized. Mr. E. A. Lof and Professor Creighton also spoke briefly, the latter voicing the value of the Alexanderson 200,000-cycle alternator in testing insulators on high frequencies. By this means resonant points in transformer windings can be artificially determined.

#### SUSPENSION INSULATOR DESIGN

Instead of the large factor of safety which would naturally be expected in an insulator, Mr. A. O. Austin, of the Ohio Brass Company, New York, stated in a paper on suspension insulators that it is abnormally small. Even a very slight increase in this safety factor means, he said, an appreciable gain in reliability and, because of the enormous investment that depends upon the operation of the transmission line, it is worth while spending a considerable amount of money to obtain an increase in reliability. The ordinary insulator under load was compared by the author to a steel spring, working near its elastic limit on a fluctuating load. The author showed that there is a very close relation between the electrical and the mechanical stresses in an insulator of this type and gave a mathematical treatment of the design problem.

The factors spoken of as exercising an influence in the puncturing of insulators were the suddenness, frequency and amplitude of the surge or disturbance, the physical proportions of the insulator and the dielectric strength of its material, and finally the mechanical strain on the insulator. Some attention was given to the proper design methods to care for these factors. Testing was advocated as an effective way to eliminate weak insulators, and it was suggested that the tests be carried to the point where "spilling over" occurs. A diagram was shown of a suggested apparatus for subjecting the insulators to very sudden stresses. The effect of time lag on puncture was shown, and a report was given of an investigation made of the distribution of the stress in a series of insulators of the suspension type. Some attention was also paid to the subject of protective air gaps.

#### Discussion

Prof. E. E. F. Creighton expressed his satisfaction at the author's variable-frequency tests and briefly outlined the creepage effects in a three-peticoat insulator accompanying frequency increases. Mr. L. C. Nicholson, of Buffalo, said that a greater factor of safety is obtained by placing the insulator disks as closely together as possible. The problem is largely a function of the rate of dielectric puncture to dry flash-over between terminals. Tests conducted by the speaker indicate that increased mechanical strains tend to hasten electrical failures, although in practically no case has a disk failed immediately after passing the flash-over voltage. The action appears to be molecular in character. The same percentage of failure was obtained after as during the imposition of a mechanical strain. In closing the discussion the author said that the effect of combined electrical and mechanical stresses is serious with slight flows under mechanical loads.

#### GROUNDING OF SECONDARIES

The report of Mr. W. H. Blood, Jr., of the Stone & Webster Engineering Corporation, Boston, as chairman of the committee on grounding secondaries, was a short review of the committee's work since its appointment six years ago. The committee has succeeded in having the National Electric Code revised, and a rule bearing upon this subject now requires the grounding of secondary currents up to 150 volts and leaves the grounding optional above that voltage. The committee recommended as the best ground a solid connec-

tion to underground metallic piping systems, making these connections at each service entrance or at other places where the piping can be reached and the connections periodically inspected. The committee believed that it had fulfilled its mission and asked to be discharged.

#### Discussion

The report was presented by Mr. W. H. Blood, Jr., chairman. There was no discussion, but at the suggestion of the committee the session voted unanimously in favor of its being discharged from further duties.

#### POLES AND PILE PRESERVATION

A paper by Mr. Russell A. Griffin, of the Western Electric Company, Chicago, on poles and pile preservation gave some statistics on wooden poles used by the telegraph, telephone, railroad and electric-lighting industries. The author discussed the subject of wood decay, dealing with brief descriptions of the various methods now in vogue for preserving timber in order to insure maximum life at minimum investment. According to Mr. Griffin, the demand for wooden poles is now approximately 4,000,000 a year, which at an average cost of \$4 each represents an annual investment of \$16,000,000. Of these about 50 per cent are used in the electric-lighting industry. It requires about sixty years for a pole to attain a growth suitable for poles and production is about one-fifth the rate of consumption. Untreated electrical and cedar poles have a life ranging from twelve to fifteen years. The latter are used most extensively, supplying about sixty per cent of the demand while 20 per cent of the poles in use are chestnuts. In the opinion of the author, the best method is the best timber preservative. The various systems of preservation, such as charring, concrete or loose-stone setting, tar or asphalt coating, painting and creosoting by the closed-tank pressure method, open-tank method and by brush treatment, were described briefly.

#### Preservation

In reply to several questions the author said that the imported carbolineums are giving excellent service, particularly in cold applications. Any of the similar preservatives passing the association's specifications, whether of domestic or foreign make, can be used successfully. With the brush treatment it is necessary merely to treat a 3-ft. above and 2 ft. below the ground line. On any 3-ft. pole two coats of oil, containing about 10 gal. or a 100 gal. of oil are sufficient for this treatment. The inner bark should always be taken off in applying preservative preservative.

#### Discussion (Continued)

Unusually broad suggestions were attached to the paper "distributing lines" in the report of the committee on distributing lines of which Mr. J. M. Downing, of the Pacific Gas & Electric Company, San Francisco, was chairman. In this report two were chosen as all those from which a general distribution serving in general requires of a minimum. The author dealt particularly with Western and Pacific Coast conditions, and the latter situation in that they have been with them, and seemed that having found that there has been a big change in the method of transmitting and distributing electrical energy. The main thing the changes noted was that in voltage, the railroad being made into transmission voltage and have increased in transmission to 100,000 volts and in distribution voltage raised to a third of a half of the voltage formerly used for transmission. The question of transmission, name and insulator equipment for these high-voltage distributing lines was gone upon briefly. Stress developments in alternating-current apparatus and in high-voltage switch-gears thought by the committee to have made alternating-current service almost as satisfactory for distribution as for transmission as direct-current service. The committee on groundings was favored up to 150 volts and the distribution was

given that many companies prefer the delta connection. The type of line construction was thought to have stayed fairly constant during recent years, although improvements in insulators have been rapid. Pin-type insulators were considered better for low voltages, and suspension type for voltages of 60,000 or over and for special climatic conditions. It was stated that there are portions of the Pacific Coast where salt fogs and dust storms combine to form conducting films on the surfaces of insulators. For such cases the suspension type of insulator was recommended; these must be wiped clean at certain intervals. Economic considerations in the extension of lines and fixing of development rates were mentioned in closing.

#### Discussion

Mr. F. G. Hamilton, Visalia, Cal., said that in the San Joaquin Valley the distributing pole line has a spacing of from 300 ft. to 400 ft. Poles 30 ft. long are used on the shorter spans and 35-ft. and 40-ft. poles are employed on the larger ones. At highway crossings the poles are 5 ft. higher than elsewhere. In closing the discussion, Mr. L. A. McArthur, of the Pacific Power & Light Company, Portland, Ore., pointed out that 30-ft. poles are too short for Oregon and Washington conditions, where the alfalfa stackers are liable to hit the lines if the farmers are careless.

#### CIRCUIT-BREAKERS' AND LIGHTNING ARRESTERS

A paper by Mr. J. N. Mahoney, of the Westinghouse Electric & Manufacturing Company, summarized the standards of design and operating practice at the present time in the matter of circuit-breaker and lightning-arrester equipment. He said that because of the modern tendency toward very high voltages, large outputs and long lines, arising from recent consolidations of numerous distributing systems, the manufacturers have been forced to do a great deal of research and development work in developing protective apparatus.

Three factors were presented as of controlling importance in the construction of oil circuit-breakers: (1) They must be insulated for the voltage at which they are rated; (2) they must have sufficient carrying capacity for their rated current, and (3) they must have sufficient circuit-breaking capacity to meet the conditions at the point where they are applied and to suit the character of the service. Extensive treatment of the last requirement was given embracing the various classes of oil circuit-breakers. The same points were also considered in regard to carbon-break circuit-breakers.

Details of the electrolytic type of lightning arresters were given at length, and the author favored the use of this class of arrester wherever the value of the apparatus to be protected would warrant it. Recent investigation of the effects of daily charging were explained to have resulted in producing a great improvement in operating characteristics. These arresters are at present available for use with voltages up to 165,000, the highest thus far adopted commercially.

#### Discussion

In answer to questions, Mr. Mahoney said that additional protection against lightning is being secured in oil switches by placing porcelain barriers between the terminals and by installing porcelain tubes over the terminals. The reactance type of breaker, in which a fairly heavy inductance is cut into the circuit for a few cycles prior to the final circuit opening, renders possible an equalization of conditions in the adjacent line with little danger of surges.

#### RECEIVING APPARATUS

Mr. M. R. Bump, New York, chairman of the committee on receiving apparatus, presented a report which criticised the lack of interest among member companies in supplying information to the committee. He pointed out that here

is an important field for research work, and said that until the association is prepared to spend something on investigation in this direction the committee cannot show the results which it would like to bring out for the benefit of the industry.

## Lamps and Illumination

#### FLAME-ARC-LAMP DEVELOPMENTS

As a result of the growth and development of our cities and of a broader general understanding of the principles of prosperity, the increasing demand for more and better light has become an important factor in our community life. The lighting industry has kept pace with this demand, and the result is shown in the perfecting of the long-burning flame-arc lamp. Dealing in his paper with the subject of this lamp and the development in its design, Mr. W. A. Darrah, of the Westinghouse Electric & Manufacturing Company, outlined the four essential requirements in its construction. These were given in order of their importance as reliability, minimum demand for attention, economical performance and satisfactory illumination. To meet the first two conditions, the lamp must be absolutely weatherproof, all parts must be of material not subject to rapid deterioration under service conditions, and friction must be kept to a minimum, initially and after severe service. Design problems in connection with these lamps were explained to fall under two classifications, statics and dynamics. Under the head of statics, the author treated the selection of materials and proper design of the lamp case for greatest strength and accessibility, and in this connection it was explained that no small part of the problem is the production of a pleasing appearance. The methods for eliminating both initial and progressive friction were explained under the head of dynamics. Regulation of the feed so as to produce a smooth steady light was the last point touched upon, and curves were introduced to show the various controlling factors in this problem.

#### Discussion

Mr. A. S. Loizeaux, of Baltimore, Md., commented on the troubles experienced in using flame arcs on 25-cycle circuits. With present types of lamps such operation, he said, is quite unsatisfactory. If smooth lighting at 25 cycles can be obtained, it will be a great help to the arc-lighting industry. Mr. Darrah said that the flame arc is materially better than the inclosed arc on low-frequency circuits in the matter of flicker. At 25 cycles the flicker is, however, appreciable.

#### INCANDESCENT-LAMP DEVELOPMENTS

Instead of holding its findings and important data for presentation at the annual convention, the lamp committee, of which Mr. F. W. Smith, of the United Electric Light & Power Company, New York, was chairman, announced in its report that it had felt that the interests of the members would be served better by the disseminating of information as soon as collected and arranged, and hence it had published in the *Bulletin*, at various times between September, 1912, and April, 1913, four articles on the following subjects: "The Passing of the High-Wattage Carbon Lamps," "The Increasing Importance of Sign Lighting," "The Tungsten Lamp in Residence Lighting," and "Incandescent Lamp Developments Since the Last Lamp Committee Report." These articles were reproduced in the report as an appendix, and there was given in the paper proper additional information of importance. It was shown that during 1912 the sales of tungsten and metallized-filament lamps increased 14.6 per cent of total sales, while during the same period carbon-lamp sales decreased 27.4 per cent of total

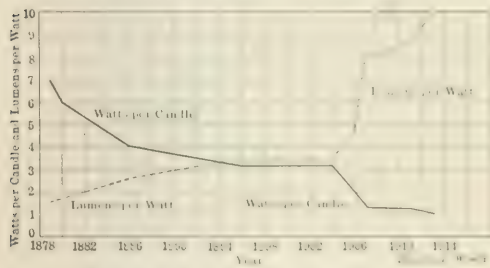


sales. Another point investigated by the committee was the policy of central stations with regard to the supply and renewal of incandescent lamps. There seemed to be no fixed or general practice in the matter. Some companies give the first installation free and renewals at cost, some furnish free renewals on commercial service but not on domestic service, still others charge for the first installation and give renewals free, while some do not supply lamps at all.

The past year was said to have witnessed a more rapid development in the tungsten-filament lamp than previous years. Improvements and economies in manufacturing processes made during the year have enabled the manufacturers to put into effect reduced schedules of prices on tungsten lamps. Developments have also improved the quality of the lamp, and a constant increase in efficiency has been possible, while the life of the lamp has been maintained at a point most suitable for commercial service and the life is now guaranteed. The sign business was indicated as a very promising field for future development, and the committee stated also that the central stations might do more toward raising the standard of residence lighting, with profit to themselves and with no inconsiderable benefit to the public.

#### PROGRESS IN LAMP MANUFACTURE

Messrs. J. E. Randall and Evan J. Edwards, of the National Electric Lamp Association, Cleveland, presented a paper on "Recent Progress in the Art of Lamp Making." No spectacular changes in the manufacture of the regular incandescent lamps have taken place during the year, according to the authors of this paper. The rated specific consumption is, however, still being improved. The accompanying diagram is of a great deal of interest in showing the improvements graphically from the earliest days of incandescent lamp making. The improvements of the past year are credited to the use of chemicals which retard the black-



INCREASING EFFICIENCY OF LAMPS

ening of the bulb. This plan has made it practicable to employ smaller bulbs for a given wattage, notably in the case of 40-watt and 60-watt lamps.

The most striking new development is considered to be in the use of filament wound into a helical coil, which coil may be mounted on supports in various ways or even itself wound into a coil to obtain greater concentration. The coil construction allows a great length of filament to be put into a small space without appreciable leakage between adjacent turns. This makes it possible to construct lamps to focus closely, as is required for small stereopticons, sidewalk projectors, street-railway and electric-vehicle head-lamps, and the like.

The coiled filament may be mounted on small supports of the regular spider type and placed in miniature bulbs of the various candelabra and decorative types. It may be placed in a tubular bulb to make a showcase lamp, which consists of a single straight section of coiled filament carried through the middle of the bulb, the return circuit being made through the heavy wire support.

#### Discussion

Mr. John W. Howell, Harrison, N. J., said that 60-watt and 100-watt tungsten lamps now give double the life for the same efficiency as the products of a year ago, through the use of chemicals known as "vacuum getters." Even at present the lamp manufacturer does not know how to apply the chemical method to lamps with more than 100 filaments, although progress is being made. The 10-watt lamp is five times as good as a year ago owing chiefly to learning how to prevent coarsening of the filament. The tendency of prices is downward as they grow more up. Lamps are now made with great accuracy as regards voltage or current rating, and the time is approaching when great savings will be made in apparatus cost through the feasibility of establishing a uniform distribution voltage. Series lamps for street lighting are now being standardized at 6.6 amp rather than standardized with a range from 6.2 amp to 6.8 amp. More than fifty research experts are working with more than sixty trained assistants in four General Electric laboratories to make lamps better and cheaper.

Mr. Norman Macbeth, New York, stated that the total light output and not the commercial candlepower, should be the criterion by which lamps are rated.

Mr. F. W. Williams, New York, who has lately returned from a two-year sojourn in England, reviewed the development of tungsten-lamp applications in Great Britain and expressed the conviction that American methods of aggressive cooperation might be utilized in the British Isles. The conditions there are different from those prevailing in this country on account of the fact that over 65 per cent of the installations are of 250 volts. There is no question that the tungsten lamp has stimulated the growth of the electrical industry abroad.

#### STREET-LIGHTING CONTRACTS

The committee on street lighting, of which Mr. I. W. Lieb, Jr., of the New York Edison Company was chairman, reviewed the developments in street-lighting specifications during recent years and incorporated an excellent historical sketch on the subject in its report. It then discussed briefly the various methods for measuring the illuminating power of street lamps which have been proposed from time to time and made recommendations regarding a contractual basis for street lighting. The measures of street lamps and street lighting include both those which have been adopted in certain instances and others which have been proposed. Those based upon tests of lamps include meridional light intensity, rating by light intensity in a particular plane, rating by mean intensity throughout a particular zone, watts and miscellaneous, while those based on tests of illumination cover the normal illumination, height varying from 3 ft. to 6 ft. above the street level, normal illumination, illumination on a vertical plane at an angle of 45 deg. and horizontal illumination. Among the principal features are an official pronouncement in Germany and tentative recommendations now under discussion in England. Neither of the latter measures represents the unanimous conclusions in either country. The committee focused attention on the committee that has been formed at studying street illumination and arriving at the proper illuminating value of two different installations is not necessarily the best method of specifying the street-lighting service which the municipality agrees to purchase. It did not recommend street-lighting specifications covering the subject of street illumination, but, because it did not make the needed pronouncement, it was not able to give them any sanction. It is a decision that has been reached as to the type of statement to be used, the committee proposed the following procedure in drawing the street-lighting contract:

(1) Describe the lamp which is proposed, according to the description electrical values (volts, amperes and watts) and total light flux (lumens) or mean spherical candle-



power, employing well-authenticated conservative values representative of the performance of the lamps under the conditions of service contemplated. (2) Describe the equipment to be supplied with the lamps, including type of globe, reflector, if any, etc. (3) Specify reasonable average limits to be allowed above and below the representative values of light flux given in the description to allow for inherent variables and test inaccuracies which are beyond the control of the contracting company. (4) Provide for basis of substitution of other types of illuminants for those specified, either lamps of equivalent illuminating value having other characteristics or lamps of different illuminating values, in order to provide for progress in the art during the term of the contract. (5) Prescribe the method of test of the circuit while in actual operation to determine the conditions of energy supply as found under actual operating conditions on the system. (6) Prescribe procedure for proving fulfillment of contract in respect to illuminating qualities of lamps, including therein the selection for testing in a properly equipped testing laboratory and under the operating conditions as found of a reasonable number of lamps taken from the system and a test procedure which will assure expert methods, approved apparatus and fair evaluation of the lamps.

#### Discussion

Mr. J. R. Cravath, of Chicago, Ill., spoke of the silhouette effect in street lighting. Something simpler than the 1907 and 1908 N. E. L. A. specifications for street lighting is needed, he added. The present recommendations of the committee would make the interpretation of contracts much easier.

Dr. Gardner, manager of Association Island in Lake Ontario, explained the advantages of that locality as a meeting place for electrical bodies. The island is to be thrown open as a rendezvous for all accredited electrical men, so that committees of 30 to 150 can be accommodated from July 5 to Sept. 1.

#### INTERIOR VOLTAGE DROP AND CENTRAL-STATION REVENUE

In a paper on "The Relation of the Incandescent Lamp to Lighting Service," by Messrs. M. D. Cooper and Robert C. Campbell, of the National Electric Lamp Association, Cleveland, attention was called to the importance of proper voltage selection of incandescent lamps and accessory energy-consuming devices as most essential in order to obtain economical and satisfactory service. The authors made a careful investigation of the amount of voltage drop between the service switch and the customers' sockets in industrial, commercial and residential service. The results obtained, as shown in the accompanying table, which is a summary of all the data collected, seem to indicate that a conservative estimate would place the average amount of interior voltage drop at 2 volts.

SUMMARY SHOWING APPARENT GAIN IN PERCENTAGE BY ELIMINATING EFFECT OF VOLTAGE DROP

Service	Average Load, Kw.	VOLTS DROPPED		GAIN IN PERCENTAGE	
		Maximum	Average	To Customer in Candle-power	To Central Station in Revenue
Industrial	5.10	3.02	2.94	10.4	4.4
Commercial	10.00	3.94	3.03	10.8	4.6
Residential	0.55	2.08	1.57	8.1	2.3
Grand average		3.68	2.50	8.9	3.8

Accordingly, the central stations are losing about 4 per cent of their lighting revenue and the customers about 9 per cent in candle-power. Aside from loss the customers experience a variation in brightness in light.

No general recommendations were made as to methods for eliminating the losses of candle-power and revenue, attention merely being called to the great benefits that would accrue from taking this drop into consideration.

#### Discussion

Mr. Preston S. Millar, New York, expressed appreciation of the authors' work, and Mr. K. H. Hansen, St. Louis, Mo., voiced the need of closer co-operation with architects in laying out wiring installations in residences so as to provide ample capacity for the use of appliances. Replying to an inquiry, Mr. Cooper said that the load conditions in general are approximated in the paper for all-day service and not for the peak load.

#### WIRE FOR OVERHEAD DISTRIBUTION CIRCUITS

Referring to the several kinds of wire commercially available for overhead distribution circuits, Mr. T. K. Stevenson, of the Duplex Metals Company, stated that copper-clad steel wire excels for certain classes of service. This wire is made by dipping a steel billet into a bath of supermolten copper which is so hot that it heats up the billet to a point where it actually absorbs a certain amount of copper. When the surface of the steel begins to melt, the billet is withdrawn and this surface is wet down with a copper-iron alloy. The alloy-coated billet is then placed in a mold and a coating of copper cast around it, the copper welding to the copper-iron alloy. By this process there is no surface contact between the pure copper and pure steel, the former grading into the latter through a series of copper-steel alloys. Three varieties of this reinforced wire are made, having conductivities of 30, 40 and 47 per cent that of pure copper.

Wire of this kind finds its field of usefulness in those cases where fair electrical conductivity has to be combined with great mechanical strength and resistance to corrosion. Weatherproof aluminum wire is more expensive than weatherproof copper wire per unit of conductivity, has low tensile strength and requires special care in handling. Weatherproof iron wire is open to the same criticism as to conductivity and is if anything a little weaker than hard-drawn copper wire. From the standpoint of conductivity copper is the ideal conductor but it lacks the mechanical strength for some classes of service. Estimates of comparative costs of copper and of copper-clad steel wire installations given by Mr. Stevenson favored the latter product.

#### Discussion

Mr. Stevenson's paper was discussed briefly by Mr. O. C. Mason, of Baltimore, Md.

### Soliciting and Utilization

#### SELLING ELECTRICAL APPLIANCES

To present a policy and some methods that might be advantageously utilized by central stations in the sale of electrical appliances was explained to be the object of the report of the merchandising committee, under the chairmanship of Mr. T. I. Jones, of the Edison Electric Illuminating Company of Brooklyn. It was noted that in the introductory stage of this development goods were frequently sold at cost or less, but now that this stage has passed the committee thought that better co-operation between the central stations, manufacturers, contractors and supply houses can be obtained by placing this part of the central station's business on a strictly merchandising basis. The proposed methods were discussed under three headings: buying, selling and accounting. It was stated that the initiative for purchase of appliances should come from the sales department, requisitions being issued through the pur-

chasing department. The question of whether or not more than one manufacturer's goods should be handled was said to depend largely on local conditions. From the sales standpoint, the advantages of an adequately equipped exhibition room in a central location were emphasized. One of the tricks of the trade was said to be the placing of the application desk and cashier's booth at the rear of the appliance salesroom so that customers in calling to arrange for lighting service or to pay their bills would be forced to notice the exhibit, if only casually.

From the replies to a large number of inquiries, the committee decided that the average cost of carrying on a retail appliance business is about 22 per cent of the gross sales receipts, and the paper advised that, in order to care for this expense and to provide for a fair net profit, an average gross profit of 33 1/3 per cent should be realized on retail sales. The sale of appliances on the instalment plan was said to be a growing practice among central stations, but their methods in the matter were found to vary greatly, some charging the same prices as for cash sales, others making the cash sale standard and charging an extra percentage on sales by the instalment plan, while still others make the latter plan the standard method but offer a discount for cash. The issuing of appliances on trial was found to have been tried by a number of companies, but the committee after investigation recommended that this practice be limited to electric irons. Suggestions were offered for increasing the sales by proper co-operation between the central station and the contractors, and some attention was given to the subject of advertising. In closing, recommendations were made for a simple accounting system to cover this branch of central-station business.

#### Discussion

Referring to a recent toaster campaign mentioned by Mr. Jones, during which a certain toaster was sold for one day at half its regular retail price, Mr. L. H. Scherck, Poughkeepsie, N. Y., declared that such practice was not only a bad scheme for the central-station but involved poor business principles. While perhaps a good thing for the manufacturer, this price-cutting would surely injure, he insisted, the interests of the central station. He then described his own experience in selling some vacuum cleaners originally priced at \$90. In order to aid sales, these devices were offered for several months at \$60, but only a few were sold. Later the price was restored to \$90 and fifty were disposed of in less time than had been required to get rid of the preceding small lot.

Mr. M. S. Seelman, Brooklyn, N. Y., explained that in the Brooklyn one-day toaster campaign referred to by Mr. Scherck all of the local contractors were offered the same terms and proposition as accepted by the central station.

Mr. M. O. Dell Plain, Syracuse, N. Y., advocated the policy of central-station companies' handling appliances for the public, he said, looks to the company to popularize these devices and to give advice concerning their use. Prices should be maintained, he insisted, in order to protect the contractors and dealers, for the latter usually lack the organization and selling staff of the utility corporation. In closing, Mr. Dell Plain made a strong plea that the association and its Commercial Section accord greater representation and attention to the small central stations who are in the greatest need of the help it has to offer.

As evidence that price alone does not determine sales, Mr. A. C. McMicken, Portland, Ore., told of various selling schemes to which he had resorted in trying to dispose of an overstock of a certain make of electric iron. To accelerate sales, the price of these irons was set so cents below that of two other standard makes. But to his surprise most of the people preferred to buy the more expensive irons because they assumed they must be better. As a check, Mr. McMicken then interchanged prices, and at its new 10-cent higher price the overstock of special irons disappeared

rapidly, while the standard lot which was formerly so popular moved only slowly at the lower price.

As a practical matter of committee work, said Mr. E. W. L. Jones, of Chicago, the committee must cooperate for men of the smaller companies to attend committee meetings, and for this reason the committees have usually been made up of the large-company representatives, although without intention to slight the interests of the numerous small properties.

Mr. M. C. Osborn, Spokane, Wash., spoke of the importance of keeping the appliances handy after a fall season sold. His own company made three iron toasters during last year at an average cost of 6 cents per job. As the cords of electric irons are their most vulnerable part, he recommends that his customers buy two cords, thus always having a reserve on hand in case of the breakdown of the first.

Mr. Douglass Burnett, Baltimore, Md., suggested appointment of a Commercial Section committee on "the needs of salesmen." In arranging campaigns, he said, local conditions must be studied. He recommended more electric storerooms in which to sell goods rather than to display them. Many companies make the mistake of showing too much red tape about the present or future customer. The advantages to be gained by numerous detailed inquiries on blank application forms, etc., are usually so slight that it hardly pays to "muddy up," as he expressed it, the cordial relations which should prevail between customer and corporation. Let the central-station man, he said, take the customer's viewpoint in analyzing his own methods, and "attend to business in a business way, forgetting that he is a central-station man!"

Mr. T. I. Jones, chairman, said that the majority of the committee on electrical merchandising feels that the central station should engage in the sale of appliances to customers at a profit. It is a fallacious view, he added, that such sales should be confined to contractors and dealers; and he expressed approval of the plan of cutting prices to introduce devices to the market.

#### RATE RESEARCH

An elaborate and highly instructive report was submitted by the rate research committee, led by Mr. E. W. Lloyd of the Commercial-Union Electric Company, Chicago, was chairman. Of the 108 pages composing the report 93 pages were devoted to existing rate schedules of some of the larger member companies. No two of these schedules were alike, yet the committee was enabled to show that, although differing widely, yet the schedules can be arranged in an absolutely uniform manner and so clearly and simply that there can be no misunderstanding as to the actual rate.

#### THE ELECTRICAL SALESMAN'S HANDBOOK

A very brief report from the committee on the "Electrical Salesman's Handbook," Mr. E. L. Giddens, of H. M. Bollsley & Company, chairman, outlined what had been accomplished during the past year in collecting and arranging this book. The object of the work was explained to be the accumulation in a systematic way, and the placing in the hands of commercial men, of accurate and reliable information which will assist them in the sale of their valuable business. The book gives facts about the practical operation of plants under existing conditions and in no case under test conditions. Suggestions for the handling of the work in developing areas were offered, and a request was made for information along various lines not yet covered.

#### Discussion

With a complimentary reference to the large amount of useful work accomplished by the committee as evidenced by its report, Mr. E. H. Hall, Schenectady, N. Y., moved that the thanks of the association be tendered it. The motion was carried unanimously.



Mr. Norman Macbeth, New York, urged that more attention be devoted to data on lighting installations. It is the general conception among central-station men, he declared, that their lighting business, the very staff of the industry, needs only to be waited for, and that its fullest development will come without especial effort. Mr. Macbeth proposed that separate sheets be used for illumination data.

In answer to a suggestion from Mr. M. C. Osborn, Spokane, Wash., that as an aid in figuring prospective customers' rates the figures for maximum demands of installations be inserted in the data sheets, in addition to the connected loads now given, Mr. E. W. Lloyd pointed out that most operating companies are not equipped with suitable instruments for determining such loads.

#### THE FIELD FOR SMALL CENTRAL-STATION DEVELOPMENT

To-day there are in successful and fairly profitable operation in the United States about 8000 plants with a combined equipment rating equivalent to over 100,000,000 16-cp lamps. The earlier plants were forced to locate in centers of considerable size in order to get sufficient custom to make them pay, and the developments and extensions of central-station service in the larger towns and cities have been so rapid that they have had a tendency to hold men who under other circumstances might have become promoters of central stations in the smaller communities. In a paper by Mr. J. E. Kearns, of the General Electric Company, attention was called to the development of the small station by serving a group of villages in more or less close proximity. He said that the time has come for such extension of central-station service, and he dealt at some length with the problems involved.

Of primary importance, it was explained, is the development of a high diversity-factor, its threefold advantage being that it allows of meeting the requirements of a large number of consumers with a moderate investment in equipment, that it results in lower cost of production because, by proper distribution of demands, the generating units can be operated at nearer to their most efficient loading more of the time, with the corresponding saving in labor and fuel costs per unit of energy generated, and finally, that it improves the load-factor of the station. In locating small central stations the most important items to be considered are the method of driving the generators, the proximity of fuel supply, pure water supply, railroad facilities and the possibility of later expansion of the plant; also the topography of the country as affecting the distributing system.

A valuable feature of Mr. Kearns' paper was a portion devoted to an analysis of the equipping and operating expenses and of the revenues of a small central-station system delivering energy for lighting and motor service to a group of small villages in the northwestern portion of New York State. Details were given in itemized form of the various pieces of apparatus for the main station and for the substations, located one in each village. Useful information was given on those parts of the generating, control, distributing and consuming equipment which are most apt to prove troublesome.

Mr. Kearns advocated improving "seasonal diversity-factor" by equipping the central station with ice-making machinery for use in the summer months and by using exhaust steam in the winter months for steam-heating service. A brief mention was made in closing of the value of farm loads for improving the diversity-factor in the daytime and of bakeries for the same purpose at night.

#### WIRING COSTS AND METHODS

Under the chairmanship of Mr. R. S. Hale, of the Edison Electric Illuminating Company of Boston, the committee on wiring of existing buildings presented an exhaustive report advocating a standard price list for wiring service in existing buildings. The committee believed that the advertising and soliciting of business as well as the consultation with

the prospective customer as to his particular needs should be undertaken by the central stations but that the actual wiring should in general be turned over to contractors. The advantages of a standard cost list with various changes and discounts to suit local conditions were emphasized. The several items entering into this class of wiring were investigated and estimates of cost were obtained from a large number of contractors in various sections of the country. An attempt was then made to arrange these figures so that they would represent average prevailing conditions and a standard list, in which provision was made for a 50 per cent discount, was offered for criticism. Specifications for various classes of wiring were proposed, and an appeal was made for co-operation from the Underwriters in the matter of preventing large energy-consuming devices from being connected to lighting circuits.

#### Discussion

The paper was discussed by Messrs. R. E. Campbell, of Cleveland; M. S. Seelman, Jr., of Brooklyn; M. C. Osborne, of Spokane; T. I. Jones, of Brooklyn; W. A. Donkin, of Pittsburgh, and J. Lyon, of Chicago. Mr. Campbell drew attention to the drop as affected by poor wiring in buildings and showed how it militates against proper performance of apparatus and lamps rated at standard voltages. Mr. Seelman told of the plans followed in Brooklyn of getting old houses wired and on the Edison circuits. A "forty-nine-dollar" campaign was started, this including the cost of wiring, fixtures and lamps. No attempt was made to wire entire houses because the price was not high enough, but the living rooms were wired and deferred payments were accepted. In this manner many houses not otherwise procurable were connected to the company's circuits. As Mr. Jones afterward explained, the "forty-nine-dollar" propaganda was only a means of creating an interest, because inquiries were what the company desired. Solicitors and wiring contractors then suggested increases in equipment and outlets, with the result that 91 per cent of the inquiries resulted in wiring contracts, the average cost of which exceeded \$100. Mr. Osborne said that the Washington Water Power Company by means of a cheap wiring campaign had connected up 750 houses, the average cost of the wiring being \$15 with seven lamps connected. Fully four-fifths of the houses in Spokane are equipped with electric lamps. Mr. Donkin claimed that the Duquesne Lighting Company succeeded last year in wiring 1500 homes, of which 850 were cheap classes of dwellings and the average cost was \$14 per installation, paid for in installments.

#### ELECTRICITY ON THE FARM

As a portion of the report of the committee on electricity on the farm, the committee for the Eastern States under Chairman John C. Parker, of the Rochester Railway & Light Company, submitted an interesting account of the possibilities and progress made in the rural districts in the East. It was stated that of the Eastern States, New York, New Jersey and Connecticut, on account of their population density, are conceded to offer the most promising field for exploiting electricity in the rural districts. In these States, where intensive crop developments obtain and where the truck grower and the orchard owner find a large market close at hand, the opportunity for extending the transmission lines to supply energy for the various wants of the farmer is thought to open a field which will primarily concern the smaller companies. Owing to the relatively large number of small farms in the East, developments will consist in the service of small units, making it essential that the investment made by the station per customer be kept to a minimum. The introduction of the more efficient protective devices and of bi-metallic wire, making possible longer spans, give considerable encouragement along this line.

The installations on the farms themselves should be



rugged and precaution should be taken to make them as "foolproof" as possible. In this connection the polyphase induction motor is thought to offer the best solution of the problem, because it is low in first cost and gives comparatively little trouble in operation. Technical efficiency should be considered as secondary to convenience, reliability and low cost.

A central-station company in inaugurating a campaign among the farmers of its district should be very careful not to arouse enthusiasm and create a demand for electric service in communities where it is unable to meet the demands immediately. Circularization of the immediate vicinity in which it has been determined to exploit the service is thought to be the correct way to bring to the attention of the rural residents the intentions of the company to establish the service. The use of a trial installation at the expense of that company and the services of a good wide-awake motor-service solicitor who is able to follow up the work launched by the circulars and close the contracts while the results of the trial installation are still fresh in the minds of the community will be found to add greatly to the success of the campaign. Too much attention cannot be given to the selection of the man who will have charge of this work; for he must be able to talk to the farmer on a dollars and cents basis as the farmer of to-day is a wide-awake business man.

The value of the farm district load to the central station is a point which will arrest the attention of all who study the difference between their summer and winter load curves. As an instance it may be cited that a Western plant which is now serving a farming community has actually been able to transfer its period of maximum demand from the winter to the summer months.

At the last two annual conventions optimistic reports have been presented upon the subject of electricity in rural districts. The sub-committee for the Central States of the committee on electricity on the farm, of which Mr. C. W. Pen Dell, of the Public Service Company of Northern Illinois, was chairman, has made a less optimistic report, an abstract of which is given below.

As a rule the income to the central station from the farming business alone as developed in the Central States at present does not justify the expense necessarily incurred in securing the farm load. It follows that some reason other than the farming business must be found for extending lines across the country and the farm business must be considered as a by-product. Data collected upon the application of electrical energy to the work of the farmer show that in practically every daily task there lies the possibility of a motor installation. Cost of production and the time necessary for getting crops upon the market may be reduced to a considerable extent when manual labor is as nearly dispensed with as possible. The data on cost of motor operation in different duties on the farm shed much light upon the feasibility of the idea from the farmer's point of view.

Besides farming itself there are other industries prevalent in the rural districts which deserve attention. Chief among these are irrigation and drainage projects, coal mines, stone quarries, brick and tile works and cement plants. Although it is appreciated that all central stations do not have these industries in their territory, each company has some of them or still others more promising. The data gathered by the committee show that in each of these industries lies an opportunity for an installation of 500 kw. or more.

The problem of obtaining the heavy capital investment necessary to acquire farm business may be met in one of several ways. In some communities the farmers have financed local distribution systems of considerable size, taking energy from a cross-country transmission line and retailing it among themselves. In other places farmers have willingly paid the whole or a part of the cost of erecting

the distribution circuit. In still other instances the central-station companies require a yearly minimum guaranteed income which is commensurate with the cost of the necessary extension. Outdoor substations and copper-clad steel wire are admittedly large factors in reducing the cost of rural extensions.

In spite of the various means which have been resorted to in order that a part of the investment cost may be shifted from the central station, it is the opinion of the committee for the Central States that the farming business as developed at present does not furnish returns commensurate with the capital investment.

The report of the committee on electricity on the farm for the Western States, of which Mr. S. V. Walton, of the Pacific Gas & Electric Company of San Francisco, was chairman, indicated that there is a wide use of electricity for irrigation and other farm purposes in Washington, Oregon and Colorado. The same method of distribution obtains in all three States, there being a primary line feeding energy over the district at 11,000 volts. Previously the practice was to have the customer furnish the transformer and pay for the costs of the line used in reaching him, but now he is asked to pay for the power only. This has resulted in making electricity popular. From the returns to the questions asked by the committee it developed that there is a very wide difference in the rates for this service. The irrigation and pumping loads extend from April to October, and the committee recommended that the smallest installation be made so that it will be required to operate over many hours. In this way the demand is kept down and the load factor is increased, without any loss in economy of pumping.

#### Discussion

The reports by Messrs. J. C. Parlier, C. W. Pen Dell and Stanley V. Walton were presented consecutively and discussed together. Supplementing Mr. Walton's report Mr. S. M. Kennedy, of the Southern California Edison Company, Los Angeles, gave an account of the wide use of electricity in rural communities in California. The principal load comprises pumping for irrigation, there being no rain in California for six months of the year. The rating of the transformers used is for the most part a low one and the reduction from 22,000 volts to 240 volts is made in one step. The rates charged for energy are the same as those which obtain in the city.

In displacing the gas engines previously used for pumping service the company found it expedient to purchase and dispose of them through a subsidiary company for about as much as it paid for them. In this way 750 hp. of gas engines was sold last year, and this year it is estimated that 1000 hp. in oil gas engines will be similarly disposed of. Mr. M. C. Osborne, of the Washington Water Power Company, Spokane, said that this company extended its lines into sparsely settled rural communities by making long-term contracts with the farmer. As the lines are used before the extensions are completed so that the load can be closely apportioned. An experiment is now being tried with the object of substituting the use of the service to the company by a difference of one year, the community voluntarily agreeing to purchase the energy under the old rates and contract for service for the next year on the same terms during the one year.

Mr. Thomas Miller, of the DAYTON (Ohio) Power & Light Company, read a paper on the possibilities of using lighting and power for irrigation, such as is done outside of Dayton. Farmers (hereafter) secured energy from these plants and pump it through canals and ditches to the fields in summer. At present this is being handled as an experiment on a farm 6 miles west of DAYTON in which 1000 ft. of 1000, high tension line, interrupted by several being used to improve plant growth. Last fall a similar experiment on a much smaller scale was tried with the result that potatoes

twice as large as those grown ordinarily were obtained from a box stimulated by electricity. Mr. E. P. Edwards, of the General Electric Company, said that farm business at present is unprofitable, but the problem is not one of to-day but a problem of the future.

Mr. M. O. Dell Plain, of the Syracuse (N. Y.) Lighting Company, outlined the experience of his company in rural business. The rates are the same as those in the city, and the business thus far has been chiefly lighting. Energy is distributed at 11,000 volts primary with long secondaries. Mr. L. H. Scherck, of the Central Hudson Gas & Electric Company, of Poughkeepsie, N. Y., said that in extending the service to reach brickyards, stone crushers, villages and highways the farming load can be made an adjunct of the other business. His company is now making experimental installations on a number of farms chiefly as an advertisement.

Messrs. S. H. Wallace, of St. Louis; S. M. Kennedy, of Los Angeles; M. Mast, of Peoria; F. V. Underwood, of Birmingham, and C. W. Pen Dell, of Chicago, joined in a discussion as to methods adopted in making extensions. In Peoria the farmer pays 25 per cent of the cost, furnishes poles and cross-arms and gives permission to cross his property to reach farms beyond. The average income from farm service, which is chiefly a lighting load, is \$27 a year. In Los Angeles extensions are made free of cost if the income is 40 per cent of the line cost the first year. In Birmingham extensions are made to coal and iron mines if from 20 to 30 per cent of the cost of the line is obtained in sales during the first year. Mr. Pen Dell outlined three systems of charging for extensions and also described some loads easily secured in rural communities, such as pumping water for railroads by automatic apparatus, which dispenses with the services of a man, operating railway signaling systems and introducing hoists, etc., in gravel pits.

#### SWITCHING APPARATUS FOR RURAL INSTALLATIONS

In view of the increasing importance of outdoor substations for certain classes of service the paper on switching apparatus for rural installations by Mr. E. B. Merriam, of the General Electric Company, is of interest. This type of equipment is applicable to many other industries besides farming which are now using isolated plants that are being operated with little thought of economy. A list of the industries to which these so-called rural installations may be made applicable was included in the paper. A table of minimum economical sizes of installation for various line voltages was also given. Portable substations for supplying energy to contractors, farmers and other consumers whose apparatus is being continually moved from one place to another were described and illustrated.

A modified lever switch provided with a mechanism for raising and lowering the blade in a vertical plane was said to offer many advantages over the other types of primary switches. Regarding primary fuses the author expressed the opinion that the horn-gap type of fuse is not so well adapted to this class of work as is the tube explosion fuse.

The secondary switching and measuring apparatus for a rural installation usually consists of disconnecting switches, automatic oil switches or fuses, watt-hour meters and instrument transformers. This portion of the equipment is generally housed in a steel or wooden switch house to prevent it being tampered with. Several switch houses of this type were described and illustrated.

Pole-top regulators were commended by the author for use on circuits where it is desirable to maintain constant potential. He described a regulator of the induction automatic type and stated that it was capable of controlling the potential of a 10-amp feeder from 10 per cent below to 10 per cent above normal voltage. Portable generating equipments for break-down auxiliary service, temporary peak loads, construction work for installation during rehabilitation of old stations and for assisting in new-business

solicitation were mentioned as a part of the operating equipment which should form an efficient and useful auxiliary for all transmission operators.

#### THE ELECTRIC VEHICLE

A paper enthusiastically presenting the case of the electric vehicle versus all other forms of central-station revenue getters was read by Mr. Edwin E. Witherby, of the General Vehicle Company. It is the opinion of Mr. Witherby that the electric vehicle offers an opportunity to the central station that is unsurpassed by that of any other source of revenue which the central station now has. Until every representative of the new-business department of the central station begins to realize that in every load of merchandise which passes him on the street there is an opportunity for the sale of electrical energy he will be overlooking one of the best sources of off-peak revenue which he would be able to secure for his company.

The policy of preaching the electric vehicle to prospective customers was recommended, but the further policy of practising what was preached was emphasized to a greater extent. The typical load curves which were shown in the paper well illustrated what is being done by the companies which have already begun to realize the importance of the electric vehicle load. Instances and data cited from the leading express companies and from the largest central stations in the country prove without a doubt that the electric truck is effecting a great saving for both the owner and the company which furnishes the energy.

The off-peak character of the electric-vehicle load was mentioned and the load curves of several garages serving both pleasure and commercial vehicles were given. It is a notable fact that practically all of the demand for changing energy is made at times when the demand from all other sources is at its lowest or is rapidly falling off. The practice of boosting at the noon hour was cited as the only way in which the depression in the load curve of the central station which occurs at that time can be filled.

Data on commercial vehicles in Chicago showed that the number of electric trucks had increased from 80 in the year of 1910 to 647 in May of 1913. In closing Mr. Witherby stated that, having convinced every live merchant, the large express companies and the entire brewery industry of the economy of the electric truck, it is his hope and the hope of all of the manufacturers that in the near future all of the central-station men will see the opportunity which is being offered to them and will co-operate in exploiting the electric truck.

#### Discussion

Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, of Baltimore, said that his company has taken upon itself the responsibility of pushing the sale of electric vehicles, but regrets that it has had to do so because considerable expense and trouble are involved. However, at present there is lacking an effective system of selling electric cars, so that active central-station co-operation with the manufacturers is necessary. He described the garage opened by his company and stated that through its activities over 100 electric vehicles have been introduced into Baltimore. That not more electric-vehicle manufacturers are locally represented is a cause for regret, because there are about fifty gasoline-car salesmen in the city willing to sell gasoline trucks at little or no profit.

Mr. W. H. Blood, Jr., of Stone & Webster, Boston, Mass., discussed the importance of central-station companies preaching what they practise. Too little is said, he declared, about the success attending the use of electric vehicles.

Mr. J. C. Parker, of the Rochester (N. Y.) Railway & Light Company, voiced the desirability of employing loaded synchronous motor sets in garages for power-factor correction purposes, and also the justification for central-station companies taking care of garages as a legitimate



part of the business. He called attention to the performance of electric vehicles in governmental service at Washington, as described in a paper prepared for the convention of the American Society of Mechanical Engineers by the superintendent having charge of that work, and suggested that an investigation be made into the conduct of garages with a view to bettering conditions.

Mr. F. W. Smith, of the United Electric Light & Power Company of New York, regretted that the author unintentionally "knocked" the central stations of the country in stating that over 60 per cent of them showed no interest whatsoever in the electric vehicle. He insisted that central station companies do support the electric-vehicle movement and stated in abstract the plans of the publicity committee of the Electric Vehicle Association of America.

Mr. F. D. Beardslee, of the Union Electric Light & Power Company, St. Louis, related the practice followed by that company in nursing the electric vehicle and then giving up its garages as soon as the use of the vehicles was well established and good garages owned by private companies were available.

Mr. R. S. Hale, of the Boston Edison company, doubted the wisdom of installing synchronous motor-generator sets if the business is off-peak, but Mr. Parker stated that in Rochester, N. Y., the sets in garages are used twenty-four hours a day.

Mr. G. B. Tripp, of the Harrisburg (Pa.) Light & Power Company, told of the advantages of the electric-vehicle load as affecting the load-factor of stations.

Mr. T. I. Jones, of the Brooklyn Edison company, questioned Mr. Parker as to the rates charged in Rochester for garage service. Mr. Parker said that where the owner furnishes his own apparatus the rate is 1.2 cents per kw-hr., and that where synchronous motor-generator sets are installed by the company it is for the advantages derived by the company.

Mr. S. M. Kennedy, of the Southern California Edison Company, Los Angeles, Cal., said there could be no doubt of the advantages of the electric-vehicle load, and that the way to obtain the load is for the central stations themselves to use the vehicles. He did not advocate electric vehicles for long-distance runs, but he did insist that the electric-light company should support the business by example.

A representative of the Denver (Col.) Gas & Electric Light Company told of what was being done in his city, and Mr. E. F. Lawton, of the Hartford (Conn.) Electric Light Company, gave the practice of his company, which owns the batteries and sells the service.

Mr. F. L. Morgan, of the Standard Electric Car Company, of Jackson, Mich., commented on the impression of the previous speakers that electric trucks are all-important, whereas the possibility of a low-priced electric pleasure car has not had any consideration. He said that statistics show that there are 4,500 families in the United States with annual incomes ranging above \$15,000 and 700,000 families with incomes of from \$5,000 to \$15,000. The latter class would be interested in a pleasure car selling for less than \$2,000 and also in the economies attending the use of electricity as the motive power. In summing up, Mr. Witherly said investigation had convinced him that 75 per cent of the central-station managers in the West are hostile to electric vehicles, and that little development will take place in any territory where the electric-light company is entirely neutral.

#### ELECTRIC RAILWAY LOADS FOR CENTRAL STATIONS

Because of its notably good load factor and power factor and its effect in improving the diversity factor, the electric railway load, both urban and interurban, was pointed out in a paper by Mr. E. P. Dillon, of the Westinghouse Electric & Manufacturing Company, to be a particularly good one for the central stations to obtain. The facts that it represents a large block of energy sold to one customer,

that it is generally a growing load, and that the customer is one of known credit, were stated to be additional advantages in favor of this load. A summary of reasons were cited, mainly in the larger cities, where the railway systems are operated by central-station energy. It was shown that, important as this demand is, its requirements are overshadowed by those of the lighting and motor loads, so that, although 25 cycles is a very desirable frequency for traction purposes, the 60-cycle frequency required for lighting and ordinary motor loads is usually preferred. A unique and interesting chart was shown showing that the railway peak occurs at all seasons from November to May, when the lighting and motor peaks occur between 4 p. m., at the end of December and 7 p. m., at the end of May, depending on the length of day at the various seasons. Taking into consideration, then, those days that are dark through stormy or cloudy conditions, there are only two periods of less than a month each per year—that is, at the end of March and at the end of September, when the railway and lighting peaks are likely to occur at the same time. Finally, it was stated that a very considerable advantage gained by the combination of the lighting motor-service power and the railway loads consists in the ability to use larger generating equipment, with its increased efficiency.

#### CENTRAL STATION SERVICE IS A MINOR

In a paper by Mr. W. A. Thomas, of the Westinghouse Electric & Manufacturing Company, were presented many interesting points as to the relation between central stations and coal mines, and some recent agreements in regard to energy supply were cited. Though many coal mines are in close proximity to central stations, but until rather recently did the central stations take up the subject of electric mine operations. Recently some stations have been lent close to coal mines for the primary purpose of supplying energy for mines.

The author related the business in connection with coal mines. He presented some figures relating to energy production derived from investment in an extensive part of the country. A study of fifty systems from a West Virginia showed an average of 200 kw installed, with an average load-factor of 20 per cent. The average equipment cost was found to be \$80 per kw-hr. installed. Ten mines in Ohio having an average output of about three thousand per month, with an isolated power plant at each showed an average cost of energy of 2.553 cents per kw-hr. The average load-factor for a twenty-four-hour working day was 30 per cent, but the average number of days was only fifteen and the load per month resulting in a thirty-day load factor of 20 per cent. The average consumption per ton of coal was 2.3 kw-hr., but in this case the two and the main pumps were driven by steam. In considering the question of supplying central station energy to these mines, it was necessary to figure on the loss of load carrying, and the rate for central-station energy without service charge, was in this case set at 1.733 cents per kw-hr.

A typical case is given in mining operations with central-station energy supplied by a single operating mine. Middle West where practically all of the industrial operations were closed and completely idle, requiring a steam plant and an electric plant. In one such steam operation the mine produced 500,000 tons of coal and used 180,000 tons of fuel oil, but had with it only a \$500,000 investment in a coal plant, and with the loss the production was 100,000 tons with an energy bill of \$4,165 or 2.24 per cent of the average value of the coal mined. It is evident from this that the energy bill is only 10 per cent of the normal value of the fuel used in steam operation, with a complete return to the mine in saving the millers and a very satisfactory return to the coal owner in the use of power plants as compared with the industrial investment.

The author emphasized the importance of the co-operation of the central station during a more or less through-



working knowledge of mine operations and understanding of the elements of cost entering into the matter of coal production. On the other hand, he must also be able to make the customer understand the conditions of operating central-station plants in order that he may have confidence in the ability of the central station to continue for a long period to furnish energy at the rates quoted.

In new developments the factor decidedly in favor of central-station service is the reduced investment on the part of the mine operator in substation apparatus as against an isolated generating station. In many instances the central-station company has even found it desirable to make the investment for the substation, allowing the mine operator to pay for it in instalments with a reasonable interest, or to retain the substation equipment and allow the mine operator to pay a reasonable interest and depreciation on the investment. A notable case of this kind is a contract made by the Centerville Light & Traction Company, of Centerville, Ia., for furnishing energy to coal mines some 8 miles from the central station, installing the necessary step-down transformers and 2200-volt motor-generator sets, the energy being metered at 2200 volts before it enters the motor-generator set. The coal companies furnish the building and the central-station company furnishes the apparatus and charges a rental of 15 per cent per year for the use of this with an option to purchase at any time less the amount attributable to depreciation, which is figured at 9 per cent per year. The power company constructs the transmission line to the coal mines upon an agreement with the coal companies of a minimum bill per year.

In conclusion, the author expressed the opinion that central stations located in the proximity of coal mines have a most attractive market for energy, especially where combined with a general lighting and motor-service load, and again emphasized particularly the necessity of understanding the mine operator's conditions.

#### Discussion

The paper was discussed by Messrs. W. H. Thomson, Jr., of the Des Moines (Ia.) Electric Company, and D. B. Rushmore, of the General Electric Company. Mr. Thomson inquired as to mining regulations calling for reserve supply for fans in case of failure of the main circuit, but none present could enlighten him. Mr. Rushmore stated that in the Pocahontas coal regions, where every pound of coal is marketable, no trouble was experienced in selling hydroelectric energy to mines. He described a method of induction motor control in which a converting set is connected in the secondary circuit of the motor and returns energy heretofore wasted in resistance to the line.

#### CENTRAL-STATION ICE MAKING

The report of the committee on refrigeration, of which Mr. George H. Jones, of the Commonwealth Edison Company, Chicago, was chairman, contained a short outline of the theory of refrigeration. The two systems, the compression system and the absorption system, were explained in detail and the various methods of applying each system were described. The method of estimating the size of the machine to be used for various purposes was explained, and recommendations were given as to the factors to be considered in such calculations. The committee particularly emphasized the qualities of the so-called Audiffren type of refrigerating machine recently placed on the market and described in the *Electrical World* of March 8.

In regard to central-station ice making the committee considered the practicability of central-station service for this class of business to be beyond doubt. Investigations made by the committee proved it to be a most attractive field, as these plants generally require the use of between 100,000 kw-hr. and 200,000 kw-hr. per month, particularly during the summer months. The 2000 steam-driven ice plants in the United States would, if operated by central-

station service, consume from 600,000,000 kw-hr. to 700,000,000 kw-hr. per year. The number of electric plants has been increasing steadily, and the probabilities are that the increase will continue. Though no general rule can be laid down in regard to rates and other factors entering into the energy supply, it seems that central-station companies should be able to secure practically all of the new ice plants which will be constructed in the future. The particular advantages of electrically operated ice plants are that they may be built at or near the center of distribution irrespective of railroad facilities. It is a well-established fact that a very large item of cost in the ice business is that of delivering to the consumer. The ideal arrangement would be to install plants of 80-ton to 100-ton capacity about two miles apart, so that each plant could supply ice for the territory within a radius of a mile, thus reducing delivery to a minimum. Another point of advantage which is also a well-established fact is that better ice can be produced in an electrically operated than in a steam-driven plant, as the trouble frequently encountered in steam-driven plants of having oil carried over from the engine cylinders is entirely eliminated.

A number of points were given as to methods for securing ice business. In this connection the committee presented a few facts concerning the quality of water which had important bearing upon the manufacture of ice and also advised as to the system to be used under different water-supply conditions.

The committee pointed out that the successful operation of an electrically driven ice plant is primarily dependent upon the equipment installed, an important part of which is the motor drive. In all plants thus far constructed three-phase alternating current is used. The opinion of the committee is that slow-speed, slip-ring, induction-type motors and drum controllers should be used. In case constant speed work is desired the resistance of the resistors to be furnished with the controller need be large enough simply for starting the motor. If variation of the speed should become desirable, the only change required would be to install additional resistors.

The use of multiple-speed motors has been suggested for this class of work, but it is the opinion of the committee that this practice should be discouraged as the efficiency of the motor at full load is not quite so high as that of the standard motor and, furthermore, the power-factor is considerably lower.

The question of superiority of the steam and electric plants the committee answered in the words of one of the largest ice operators in the country, who has a number of distilled ice plants of both types. He states that under his conditions of operation there is practically no difference in the cost of manufacture under the two systems. Under the electric plan of operation, however, he can locate plants in a way to suit best his needs, and, furthermore, the possibility of contamination from oil is removed, which is a point of value.

A particularly valuable feature of this report was an appendix containing a long list of refrigerating plants for various purposes, such as for office buildings, wholesale meat markets, provision dealers, residences, hospitals, packing houses, florists, drug stores, candy factories, groceries, dairies, restaurants, fur stores, hotels and others. In all, seventy-five plants were specified. For each plant were given the refrigerating equipment of electric motors, refrigerating machines and other particulars which may be of interest. There were also a number of specifications of ice-making plants which are of great interest, each one of these containing complete data as to time of operation, rated daily output, annual output, energy consumption by month of the year, connected horse-power, number of motors, average consumption per month per connected horse-power, consumption per unit of manufactured product, and the maximum demand in kilowatts of the plants. The mechan-

ical and electrical equipment of the plant was outlined in each instance.

### Discussion

An interesting discussion followed the reading of the report, Messrs. H. Cochran, of the Carbondale Machine Company's Chicago office; T. I. Jones, of Brooklyn; R. H. Tillman, of Baltimore; L. H. Egan, of Kansas City; J. P. Pope, of Lexington, Ky., and E. W. Lloyd, of Chicago, participating. Both Mr. Cochran and Mr. Pope spoke of the excellent results attending the use of exhaust steam in making ice as a central-station by-product. Mr. Jones told of two raw-water ice plants which the Brooklyn Edison company had recently connected to its circuits. In order to secure the load the rates were based on a yearly load factor with a minimum guarantee. In work of this kind Mr. Jones pointed out that the expense of ice making is chiefly in the distribution costs. The haulage of coal to the ice-making plant and the delivery of the manufactured product are items of importance. In Brooklyn the plan of the ice manufacturers is to establish numerous small plants so as to minimize the cost of delivery of ice.

Mr. Lloyd related his experiences with ice-making loads in Chicago. Ice-manufacturing plants, he said, have a yearly load factor ranging from 50 to 60 per cent. In the Chicago districts, the former figure being more nearly the average, although monthly load factors of 75 per cent will be guaranteed by the manufacturers from April to October. The maximum demand is governed very largely by the humidity in the summer time and is highest when it least affects the system. No manufacturer using steam-driven refrigerating apparatus knows exactly what his costs are, and if he did he would never admit that electricity effects any saving. However, more and more electrically driven raw-water plants are being installed. The electric meter measures exactly the consumption of electricity so that the cost of production can be determined with precision. It is possible to reduce the cost per ton by employing more cooling water. The ratio giving most economical results must be determined for each specific case. Where water is cheap the energy used per ton is least.

### CENTRAL-STATION STEAM HEATING

The work of the committee on steam heating, of which Mr. S. Morgan Bushnell, of the Commonwealth Edison Company, Chicago, was chairman, was largely devoted to the securing of data on cost of heating by steam and hot water, relative merits and demerits of the two systems, use of waste heat from gas and oil engines, and the relation between the steam and electric loads in large buildings as affecting the question of using exhaust steam for heating.

The committee did not express any definite opinion as to the profitability of the steam-heating business, though it holds an optimistic view on the matter and expresses the belief that a more satisfactory showing on a dollars-and-cents basis will be achieved with further experience and information concerning the various elements entering into the business. As a caution the committee points out one error often made by steam heating companies in extending their piping systems too far, with the consequent result of a large investment and excessive operating expenses on which they are unable to earn returns.

In order to compare the two systems of steam heating and hot-water heating the committee presented in tabulated form the arguments for each system from both the company's side and the customer's. In regard to methods of charging, it seemed to be the unanimous opinion that the meter rates should be used as far as possible. Single rate and two rate systems were discussed and experiences with both systems referred to. The single rate pressure system with a sliding scale of rates based on the amount of the meter readings was recommended for the small customers.

The subject of using waste heat from gas and oil engines for heating purposes is by no means a new one, though little

has been written about it. In fact, attempts were made more than twenty-five years ago along these lines. There are two distinct methods of utilizing this waste heat: (1) Heating water by means of exhaust gas either by raising the temperature of the water discharged by the jackets of the engine or raising the temperature of other water, such as that in a closed hot-water-heating system, without making any use of the heat in the jacket water, and (2) raising steam by means of the exhaust gas, using as boiler feed either the jacket water or other water, with no attempt to utilize the heat contained in the jacket water. The merit of each method and the application for common purposes were explained. Several systems were presented to show the amount of heat available from the exhaust of both oil and engine and the results of heat input on exhaust water subjected to a 250° F. gas engine. There are a number of reasons for the very limited extent to which the heat in the exhaust can be in the jacket water has been ordered for heating buildings, the most important one being the comparatively small amount of heat available from these sources compared with the amount present in the exhaust of a steam engine carrying a similar load. The approximate number of pounds per kilowatt-hour available from various types of prime movers is as follows: Simple automatic engine, 60; single-cylinder Corliss engine, 42; Corliss non-condensing compound engine, 31; gas oil engine exhaust used for raising low-pressure steam, 3.

An interesting study was made by the committee on the relation between steam and electric loads in buildings devoted to a great variety of purposes as affecting the question of using exhaust steam for heating. Typical curves for different types of buildings were reproduced. The curves showed that even in the winter time, when the heating and related service requirements more nearly approach each other, there is still a wide variation in the two types, at certain periods of the day the demand for steam for heating being far in excess of the demand for electricity, while at other periods of the day the demand for electricity is far in excess of the demand for heating. In view of the fact that the steam demand for heating disappears altogether in the summer and in the winter is not at all coincident with the demand for electricity, it is readily seen that the utilization of exhaust steam for heating in industrial plants is not nearly so great a thing in economy as has sometimes been claimed. There is also a considerable variation between different buildings, the lack of uniformity being much more marked in some than in others.

### Discussion

Messrs. W. R. Collier, of the Georgia Power Company, Atlanta, Ga.; J. H. Saunders, of Philadelphia, Pa.; S. B. Bolen, of Alton, Ill.; and E. E. McLean, of Youngstown, Pa., joined in the discussion of Mr. Bushnell's report. Mr. Collier called attention to a peculiar condition brought about by advances in steam. The company supplies steam heat in Atlanta from a steam-driven electric station, but recently it has gone completely into hydroelectric development, so that the steam industry is dead. It is cheaper to generate electricity by wind than by steam, but it will be necessary to use the steam for heating and the heating period in one town directly from the boiler. At high pressure steam is more valuable in the quantity as the weather warms and supply decreases. Mr. Saunders said that during the last winter electric on its hands for the same reason, but as a number of large isolated plants out of Philadelphia, Pa., where the plant is located, it is worth while to keep the system in operation, even granting that the gas would be used in raising the service a million. Mr. Bolen was particularly much interested in the subject, saying that in Alton, with 1000 inhabitants, steam heating is a profitable proposition. There the engine is connected to the system, but not to the building, so building through the basement. It is a very



matter to get at the mains at any time. Magnesia is used for insulation. A flat rate of \$4 per 1000 cu. ft. of radiation per year is in vogue, and a meter rate of 40 cents per 1000 lb. of condensation is charged. The income from the heating load is a trifle more than the cost of the coal.

## Relations with the Public

### PREVENTING PANICS

An important feature of the first commercial session was an address by President David R. Forgan, of the National City Bank, Chicago, on "How to Protect Business from Disturbances Caused by Panics." A large and representative audience cordially greeted the speaker, who was introduced by Past-president Samuel Insull, and at the close of the address much enthusiastic appreciation was displayed. Mr. Forgan explained, with great clearness, the functions of credit in modern business; discussed the disadvantages of the present American banking system, and reviewed the recommendations of the National Monetary Commission, whose exhaustive work in the past three years points the way toward the establishment of a flexible financial system in the United States. The commission finds that the country's currency lacks elasticity; that mobility of reserves is needed; that the American business world lacks liquidity of bank assets, and that the centralization of banking power closely allied to the national government is a vital essential in bringing our banking system up to date and establishing country-wide safeguards against rigid monetary conditions unresponsive to the legitimate demands of business in critical periods. In a comprehensive outline of the commission's recommendations, Mr. Forgan described the functions of the suggested National Reserve Association of the United States, which it is proposed to form through the united action of all the state and national banks of the country which care to come in and can qualify for membership. This great bank will also be the fiscal agent of the government, having possibly three hundred millions of capital, holding the reserves of the banks and having large power in issuing notes redeemable in the national money. As a great central reservoir of reserves it will act as a powerful agency against monetary stringency, and if established along the general lines recommended by the commission will go far toward making panics in the United States as rare as they are in England, France and Germany, where a centralized banking organization, closely allied to the government, insures stability and confidence throughout the nation.

Mr. Forgan explained that there is little to fear in such a centralization and that the contention that by this scheme Wall Street is seeking to control all the money in the country is beside the mark. The truth is that it is proposed to transfer the control from Wall Street to Washington, from the hands of the private banks to the hands of all the chartered banks of the country, with the closest governmental relations. Closing, the speaker urged the united support of business men on behalf of the proposed reform, which will put this country on a level with its largest competitors in this great matter of national and international credit.

### CONSERVATION OF NATURAL RESOURCES

In a paper entitled "The Failure of Conservation to Conserve," Mr. E. H. Thomas, of the *Post-Intelligencer*, Seattle, Wash., attacked the Bureau of Forestry of the Department of Agriculture, claiming that it is hostile to development, especially in Alaska and in the Far West, and thus instead of using without wasting has wasted without using, which of course is not conservation in its broadest sense. He showed the difficulty experienced by private companies in obtaining water grants in the National Forest Reserve

because the regulations are prejudicial to investors, and stated that it is time for the country to place the administration of the public domain on a business basis. This, he said, can be done by employing practical business men to carry on the work instead of theorists and politicians. The latter, he held, have brought conservation into disrepute and made it odious to the Northwest, which suffers most from the existence of an undeveloped and unprofitable wilderness.

### Discussion

Mr. D. B. Rushmore, Schenectady, N. Y., discussed the problem of conservation broadly, touching upon the new economic problems of hydroelectric development, whose difficult solution has tended to create more or less inactivity. Lack of understanding of the situation is largely responsible for the slow unfolding of public policies regarding hydroelectric developments. A campaign of education is needed to bring the facts to public appreciation. Closer connection between the public and its governmental representatives is essential in order to secure adequate development.

### LITERATURE ON ELECTRICAL SUBJECTS

In the report of the committee on publications, of which Mr. Douglass Burnett, of the Consolidated Gas, Electric Light & Power Company, Baltimore, was chairman, a record was given of the year's work in the distribution of literature on electrical subjects. Of the publications completed by the previous committee there were sent out during the season of 1912-13 up to the end of March, 1913, 165,930 copies on the following four subjects: "Electric Service in the Home," "Electrical Equipment of the Home," "Industrial Lighting" and "Ornamental Street Lighting." The committee reported also that it had been actively engaged in the preparation of new subjects and that before the expiration of its term of office there would be available for distribution literature on the following subjects: "Home Thoughts Electric," "Store Service," "Church Lighting" and "Electricity on the Farm."

The usefulness of this service especially to the smaller companies was dwelt upon, and an appeal was made for more interest in it from both the large and the small concerns among the members. It was stated that so far during the year the orders for this literature had come from eighty companies, while there are about 1300 Class A members in the association to whom the service is open. The work of the committee during the past year had fallen under three general heads—(1) supervisory, in looking after the stock of the various publications, their sale and delivery; (2) constructive, in the sense that it had undertaken the preparation of new matter, and (3) commercial, in that one member of the committee had acted as sales manager to arouse interest in the several publications. The N. E. L. A. monthly *Bulletin* was used during the year for advertising purposes. In closing, the committee recommended that the work be carried on next year under a new committee and that, owing to the large amount of time required for it, appointments be made on the basis of working membership.

### Discussion

In opening the discussion on the report of the publications committee, Mr. T. I. Jones, Brooklyn, N. Y., pointed out how large a number of the company members of the association are still unfamiliar with the good work being done by the committee. He emphasized especially the value of using the committee's literature in inaugurating commercial campaigns, declaring that the finished work of experts is thus made available to small companies at a cost for which even the mere printing could not be duplicated in small quantities.

Mr. F. H. Gale, Schenectady, N. Y., while complimenting the products of the publications committee, questioned what



could be lacking in its methods that only 80 out of 1300 company members had availed themselves of the literature offered. In reply, Mr. M. L. Turner, Cleveland, Ohio, suggested the use of more intense salesmanship in distributing the publications themselves.

Mr. M. S. Seelman, Brooklyn, N. Y., called to the section's attention the fact that several of the most popular and valuable publications of the committee had been issued only during the past few weeks. These booklets on store lighting, church illumination and farm service will doubtless shortly enjoy a large demand. Mr. J. C. McGuston, Pittsburgh, Pa., spoke of the delay always encountered in launching new publications and predicted better success later.

Mr. C. W. Lee, New York, urged that dependence be not placed on sales literature alone, but that this material be properly used to supplement the personal efforts of central-station salesmen. Mr. M. C. Osborn, Spokane, Wash., said that distribution of sample copies of the publications to central stations would prove fruitless unless care were taken to make sure that they reached the proper hands in the first place.

Mr. E. F. McCabe, Titusville, Pa., thought the quantity of some of the commercial literature "overdrawn" and said he found too many repetitions of the word "expert" in the pages he had examined to give the prospective customer a correct understanding of the simplicity of electric service.

Mr. John C. Parker, Rochester, N. Y., declared that no "canned" or syndicated literature could ever be as effective as material prepared locally with due regard for local conditions, even by a staff of ordinary skill. But the committee's publications, he insisted, contain much of real value, and he recommended that they be used where possible to inaugurate or supplement campaign literature produced locally.

Mr. S. M. Kennedy, Los Angeles, Cal., recommended that the committee subdivide some of its publications into a series of sections so that these might be sent successively to busy merchants and manufacturers. Mr. H. C. Sterling, Three Rivers, Mich., told of his own successful use of the printed material supplied by manufacturers.

#### EDUCATION OF SALESMEN

On the assumption that the central-station salesman is indirectly the means of disposing of manufacturers' products, and that the immense field of new business requires men having all-around training, capable of taking care of a district and meeting intelligently any local conditions without recourse to the home office, the committee on education of salesmen, of which Mr. George Williams, of H. L. Doherty & Company, New York, was chairman, carried on investigations to bring out the proper qualifications necessary in such a salesman. Eleven general characteristics are specified, and then, by way of elaboration, the committee quotes passages culled from various sources. One of the first essentials mentioned as a prerequisite is for the salesman to believe he has something which it is right for the customer to use and of which he has need. Other qualifications necessary to success are an effective personality, good humor being a predominant characteristic, and the absence of a continual "grinch"; imagination also to a degree, and absolute honesty in statement. Salesmen need not be purely technical, but they should be loyal to the organization.

Many central stations have established schools for training their employees, and the methods employed in some of these are described at length. Textbooks recommended for study classes by the committee are also enumerated. The books cover a wide range of subjects, but the greater portion have a direct bearing on modern organization, business and salesmanship. To questions asked of representative men of the larger companies the answers indicate that the college man has the advantage over self-trained and self-

educated men, that the best organization is secured by promotions from within, that from 75 to 100 per cent of the men employed by manufacturing companies are college graduates, and that from 5 to 15 per cent of the men in the central-station field are also college-bred. The subcommittee to which was referred the question of training by correspondence recommended that a course of instruction be offered to member companies only, and that the students should have no financial relation with the association. The plan of the course was outlined, however, only in a very general way.

#### Discussion

When starting in the new central-station salesman, Mr. C. A. S. Howland, Lenexa, Kan., proposed setting a trial period, at the end of which time, if the salesman candidate would receive \$100 a month if he "made good." At the end of the first year the amount might be increased to \$125. He suggested that Mr. D. W. Mendenhall, Salt Lake City, Utah, Chairman E. W. Lloyd, Chicago, Ill., explained that training at the Chicago Central Station Institute involves an obligation to continue employment later with the contributing company. "While the regular salary of a Chicago fireman with salary and commissions, it is hardly likely," added Mr. Lloyd, that the newly graduated central-station salesman will receive any considerable commissions during his probationary period.

Mr. A. C. Einstein, St. Louis, Mo., declared that the qualifications required of men to sell electrical machinery are entirely different from those required of central-station salesmen. Shortly after a general consideration of the subject will be found to handle more fully some of the subjects of residential, industrial or commercial work. The course of the Union Electric Light & Heat Company's training school are similarly divided into the above three classes. The head of department said Mr. Einstein's remarks need a considerable education, and that he is of the opinion service in leading and directing the training of these employees. The speaker expressed doubt whether a universal scheme of training electrical salesman would ever be successful.

Mr. J. W. Ferguson, Chicago, suggested that more provision should be made for advancing office boys and junior clerks, in return for faithful service during years when they were denied opportunities for schooling.

Mr. F. D. Burdick, St. Louis, said that his company requires every employee in the sales department to attain one of three classes of achievement. Advancement is awarded on a merit basis. A "pupil" cannot be promoted based upon the law of least seniority, meritorious promotion obtained, etc., credits being posted on a score board and bonuses awarded monthly in the five highest ranks. A desired all-around man can be held for several classes of business when certain ratings are made. In this way the best men are kept in the department. Years of service are also taken into account in increasing salaries. The classes above referred to by Mr. Burdick, and also by Mr. Einstein, are conducted by a "faculty" composed of the graduate sales engineers of the company. To pass from one class into the next the candidate must submit to an examination by a board of five selected from this faculty.

Mr. L. H. Scherck, Poughkeepsie, N. Y., suggested that the central-station salesman in the small town may not know a general deal more than the country fellow with the Argosy company. It is very difficult to develop an "all-around" man, he said. One of small town work, compared with that of a better community. The speaker approved most heartily the fact that the salesman should be responsible to his company for the growth of salesmen in the service.

Mr. R. B. Snyder, Milwaukee, Wis., also made a contribution during the discussion.

## CENTRAL-STATION ADVERTISING

Bearing in mind the fact that the best advertisement a central station or any other commercial organization can have is a satisfied customer, the report of the committee on advertising, of which Mr. J. Robert Crouse, of the National Quality Lamp Division of the General Electric Company, was chairman, asserted that 40 per cent of the arguments used by salesmen can be said, and said better, by advertising. This statement was intended to refer to the preliminary work only, since the actual closing of sales requires personal solicitation and can seldom be done, at least in this line, by the advertisement alone.

In order to secure efficiency, the responsibility for the direction of the advertising policy and activity should be definitely placed, and the closest co-operation should exist between the advertising and selling departments. The paper advocated either of two methods for determining the amount of the advertising appropriation—(1) taking a certain percentage of sales receipts of the previous year, (2) taking a certain amount for each unit of energy or merchandise it is planned to sell.

A section of the paper of distinct value was that in which was given an analysis of the several mediums and of what each is best adapted to carry. The ones mentioned were newspapers (morning, evening and Sunday), electric signs, letters, window displays, shows, fairs and demonstrations, theater programs, picture shows, billboards and street-car advertising. Particular emphasis was placed on the value of newspaper advertising for certain lines and also on that of direct mail solicitation. It was considered inadvisable to advertise for motor load, because of the comparatively few possible customers.

Essential qualities of good copy were then discussed, the principal items touched upon being ideas, arrangement, renewal frequency and seasonableness. Methods were suggested for the carrying on of special campaigns and co-operative advertising. House organs were acclaimed as an effective advertising medium, and it was advised that by supplying items of real news value to the newspapers a form of advertising not otherwise possible would be obtained. The report finished with the statement that the Commercial Section publications had been of much assistance in this field and were less expensive than the same material would be if secured anywhere else.

Supplementing his printed paper, Mr. Crouse also presented a bibliography of the twenty-seven papers on subjects of advertising which have been read before the National Electric Light Association since 1904.

Passing to some of the broader aspects of selling effort in the electrical field, the speaker pointed out that while increased efficiency had resulted in every other branch of the industry, the "selling cost" has shown no decrease during the past twenty years. With the electric-service companies of this country doing an annual business of \$400,000,000, 5 per cent of which is re-expended in sales work; with the manufacturers and jobbers turning over \$300,000,000 yearly, of which 15 per cent goes to selling expense, and with the contractors alone collecting some \$100,000,000 annually, Mr. Crouse estimated that at least \$15,000,000 is now being expended in competitive effort, and he urged the propriety of diverting some share of this toll of the "war of business" to a co-operative movement. Until the organization of the Society for Electrical Development, said Mr. Crouse, no forum existed where all branches of the industry might assemble and discuss their interrelated problems on an equal footing.

## Discussion

Postponed from the session of the preceding day, discussion of the report of the committee on advertising opened the third commercial session, held Thursday morning.

Mr. N. H. Boynton, a member of the committee, declared that the present report was only "the start" of the pace

which the advertising committee had set for itself. Heretofore much difficulty had been experienced in securing data of any kind relating to this subject. On two points in the report the speaker placed especial emphasis, urging (1) more serious consideration of advertising as an aid to sales work, (2) fuller realization of the fact that a salesman's time is too valuable to be spent in any work which advertising will accomplish at much less expense.

Mr. M. S. Seelman, Brooklyn, N. Y., observed that the matter to be found in the committee's report would prove of no less value to large central-station companies than to those in smaller communities. He complimented the report as being extremely practical and useful and declared that it represented the best compilation of its kind ever attempted, codifying as it did the experience of a number of companies.

Mr. C. W. Lee, New York, remarked that the report struck a new note in advertising. When considering individual pieces of literature, he said, attention should be especially given to their constructive use with other units in the same campaign. Mr. Lee recommended the use of newspaper space in presenting corporation policies to the public, and urged managers of properties to confide in and encourage newspaper men to visit their offices when in search of items of interest. A company might thus fortify itself in public opinion in a way that would prove extremely valuable in the event of labor, franchise or rate controversies.

Mr. T. R. Elcock, Jr., Philadelphia, Pa., reported his success in reaching wealthy residence "prospects" for electrical appliances, through return post cards attached to their gas bills. He had also made a practice of publishing in the local newspapers photographs of the stores of merchants who have good electrical installations. Public-service corporations, continued Mr. Elcock, need all the friendly public spirit they can earn.

Mr. W. D. McJunkin, Chicago, seconded Mr. Boynton in emphasizing the value of advertising for supplementing the efforts of salesmen. He quoted a recent address by Mr. Samuel Insull in which to the advertising campaign of the Commonwealth Edison Company was attributed much of the company's commercial development. During certain seasons, said Mr. Insull, this advertising, alone, keeps the full soliciting force busy answering inquiries. In closing Mr. McJunkin urged the need of expertly prepared advertising copy to obtain best results from space of any kind, and he described the benefits sure to result to the small central station from a co-operative advertising bureau.

Mr. T. F. Kelly, Dayton, explained that his company sometime ago adopted the motto, "If it isn't electric, it isn't modern." The force of this maxim had been so directed upon the local community that a Dayton landlord in recently advertising a dwelling for rent took care to state explicitly, "modern in all respects, *except electric light*." A copy of this rental advertisement was later republished in the electric company's own display space and attracted much interest.

## INDIRECT ADVERTISING OF THE ELECTRICAL INDUSTRIES

In a paper by Mr. J. G. Learned, of the Public Service Company of Northern Illinois, was discussed the tremendous influence of indirect advertising in the form of non-technical articles on scientific engineering and industrial topics. To any and all of these lines, he explained, there are two sides, one of commercial methods and practice and the other of visible results and bearing on the general welfare or community life. This last phase is one of human interest regardless of the training of the reader. The author expressed the opinion that effective publicity consists in the intelligent presentation to the public of this human-interest side. The electrical field, he thought, is especially rich in features of popular interest and of the sort that furnish excellent publicity material. He attributed



the wonderful growth of the electrical industry in no small measure to this indirect advertising. After citing examples of the class of literature which, through its wide appeal, has done much to spread a knowledge of the industry and arouse public interest in it, Mr. Learned closed with an urgent appeal to the central stations to push this class of publicity to its fullest extent.

### Accounting Methods

## PROGRESS TOWARD UNIFORM ACCOUNTING

The committee on uniform accounting, of which Mr. L. J. Bowers, of the Kansas City (Mo.) Electric Light Company, was chairman, reported that during the past year it had appointed sub-committee on public service, relative to uniform classification of accounts, and statistics and forms. Because the accounting requirements of the several companies represented vary so widely, the committee was unable to agree on any form that could be recommended by the association to all member companies. It therefore decided to make a collection of forms now in use in the industry, and this second set has been arranged according to population of towns. The report contained also a record of the joint sessions held during the past year with the accounting committee of the Electric Railway Association and with the United States Census Bureau to pass on a new form for reporting the five year census of the electric lighting industry to the government. It was hoped that such in the main the forms previously used by the Census Bureau were the same as those recommended by the association, there are still a number of points in which the latter can be improved by adopting the classifications used in the latter.

It was stated further that some attention had been given during the year to an attempt to co-operate with the various public service commissions in an effort to secure standardized forms that would be of most service both to the government and to the companies. Still another line in which progress has been made during the year was explained in the report, where details were given of a meeting held in Chicago in February, 1913, at which it was decided to include in the report for 1913 a complete index by topics of all of the papers that have been read on accounting matters before the association. The topic heads chosen were general accounting matters, depreciation, purchasing and stores, work order systems, meter and meter records, customers' accounts, collections, statistical and miscellaneous, and in pursuance of this policy the report closed with abstracts of these papers.

### Discussion

The report was discussed by Messrs. H. M. Edwards, of New York; H. W. Magruder, of Liberal, Kan.; W. W. Denner, of Niagara Falls; A. S. Scott, of Chicago; L. C. Scobell, of Rochester, N. Y., and L. M. Wallace, of Boston. Mr. Edwards expressed himself as believing that the report of the sub-committee on a tentative classification of accounts is superior to any forms so far promulgated by the public-service commissions in this country. Several gentlemen inquired how many members who were not operating under a public-service commission had regular accounting had not adopted the uniform system accepted by the N. E. L. A. and why. Mr. Scott said that the system could not be applied to hydroelectric and transmission business without several modifications. It was hoped that the tentative classification which was submitted by a sub-committee at a later session would fulfil the requirements of that branch of the industry, however. Copies of the uniform system of accounting were distributed at the end of the session in order that suggestions or changes might be recommended before the system was submitted on the following day. Mr. Bowers, in closing the discussion, urged

that the members adopt this uniform system before the public-service commissioners compelled them to adopt one less desirable.

[illegible]

In a paper by Mr. A. C. Humes a summary was given of the generally unsatisfactory conditions obtaining among the employees in the accounting departments of large central business concerns, and an attempt was presented at the topography by the New York University Company to overcome these conditions, in part at least, by the organization of an accounting school for accountants. The course was given on Wednesday evenings from 8 to 9 o'clock during the past winter season and attracted a good crowd. Nine lectures on accounting theory and practice were given by an instructor from the New York University School of Commerce, Accounts and Finance, and six by Mr. Humes, who made field and office talks were given by prominent officials on the following topics: "Accounting Methods of the Post-pays," "Relation of Accounting to the Company's Finance," "Warranted Capital and Investment Accounts," "Money," "Profit and Loss and Supply Accounting," and "Commercial Accounts." The paper gave the direct use of mathematics and, as well as an outline of the accounting system, in Mr. J. L. McKim, which was attractive under the following headings: "Accounting," "Assets and Liabilities," "Debits and Credits," "Current Accounts," "Patents, Copyrights and Trade-Marks," "Funds," "Capital Liabilities," and "Interests of Various Kinds."

While it is good to recognize the great need for an innovation of this character, particularly in the earth sciences, Mr. Holgate expressed the opinion that a final answer will not come until the first set of examination questions, he said, indicated that the course was really more than a book-learned thing, and the improvement in the succeeding examinations seemed to show an advance. He said also that much apparent interest was shown in the subject on accounting outside of the course, which he thought to be a favorable sign. As to the attendance, out of a possible 600, 390 enrolled for the course, the largest attendance was 307 at the first lecture, and the smallest was 172 at the last lecture.

### Discussion

Considerable interest was manifested in the discussion of this paper, in which the following participated: Messrs. J. L. Thompson, of Kansas City, Mo.; S. A. Bush, of Philadelphia; Thomas Sweeney, of St. Louis; R. W. Smith, of Detroit; J. C. Van Dine, of Brooklyn, N. Y.; H. B. Skinner, of New York; Earl Grady, of Chicago; S. W. Allen, of Harrison, N. J.; T. DeLoach, of Newark, N. J.; C. Ryan, of Wilmington, Del.; L. Rardin, of St. Louis; and H. M. Williams, of New York. The discussion consisted mainly of questions relating to the manner in which the New York Edison Company has had such a successful school. Messrs. Sweeney and Smith were particularly anxious to know how such an educational success could be maintained by another company. Mr. Grady said that it is worth while, financially, socially and commercially, to build the kind of a school that the Edison Company has built. It was suggested that further support for the company be afforded by every home, school, library and that certain groups be formed for the best advantage. Mr. Riordan believed that such a school should be considered as decided for a good success rather than for a doubtful one. Another suggestion was that it is worthy of attention that the corporation be organized as for the benefit of the public.

Thompson, J. D. & N. J. B. 1990. *Journal of Animal Ecology*, 59, 1-12.

One of the latest advances in scientific forecasting for natural resources is the modeling of ground and coastal ecosystems, defining the parameters for resource losses and environmentally sensitive or threatened areas or extended periods of low harvest or lower quality of a resource due to the



month in which they are made. A paper by Mr. Franklyn Heydecke, Public Service Electric Company, Newark, N. J., contained a brief explanation of the method employed in keeping various classes of prepaid and accrued accounts and an outline of the advantages gained by so doing. The particular accounts which the author indicated as requiring this treatment were taxes, rentals and income on investment, and he showed clearly that without such methods the actual condition of the business could not be correctly given in the usual monthly statements. He indicated furthermore that these special accounting methods act as a safeguard against unexpected financial embarrassment since they are essentially neither more or less than an equitable distribution of a lump expense or income over the period in which it is incurred or earned.

#### Discussion

Subjects relating to the details of accounting were discussed by Messrs. H. M. Edwards, of New York; F. A. Birch, of Philadelphia; R. W. Symes, of Detroit; F. G. Speidel, of Louisville, Ky., and F. L. Riordan, of St. Louis. The main subject brought up was the accruing of taxes over the fiscal year. Mr. F. Heydecke said that when the fiscal year commences at any other time than Jan. 1 the taxes should be considered as prepaid. He also recommended the use of separate schedules for each class of tax.

#### MECHANICAL AIDS TO OFFICE ROUTINE WORK

Mr. H. B. Lohmeyer, of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., presented a paper in which were described the more important machines at present available for saving time and labor in carrying on office routine work. In the past decade wonderful progress in the perfection of such devices has been made and there is hardly a part of office routine to which one or more of these devices has not been applied. Some of these machines have become so common as to rank with the telephone as necessities. Of this class are the typewriter, adding and listing machines and the slide rule. Among the less commonly used devices are the tabulating machine, the duplicating devices of various kinds, mail opener, addressing machine, counting machine and automatic cashier. Mr. Lohmeyer discussed each of these special devices and gave an outline of its development and of its field of usefulness in modern office procedure.

#### Discussion

Messrs. E. A. West, of Portland, Ore.; D. H. McDougall, of Toronto, Can.; C. N. Ryan, of Wilmington, Del.; F. L. Riordan, of St. Louis; F. L. Thornton, of Kansas City, Mo.; F. Heydecke, of Newark, N. J.; J. H. Gulick, of Chicago; H. M. Edwards, of New York; E. J. Bowers and several others took part in an animated discussion which arose over the system of accounting employed by one company. The applicability of automatic office machines to smaller offices was questioned by several, but it was generally conceded that large offices save considerable time and money by their use. It was recommended that the statistics showing the cost of accounting per customer be compiled in order that the advisability of installing mechanical office appliances might be studied.

#### TENTATIVE CLASSIFICATION OF ACCOUNTS

A scheme of balance-sheet and indicant accounts, together with a complete classification of operating revenue and operating expense accounts, was submitted by the subcommittee on tentative classification of construction and operating accounts, of which Mr. J. L. Bailey, of the Consolidated Gas, Electric Light & Power Company of Baltimore, was chairman. This report included a schedule embracing practically all of the general accounts of the larger companies either in items or group accounts. Realizing, however, that smaller companies do not require an elaborate array of indicant accounts, the committee recommended that of accounting divisions that would meet the need

of the smaller companies and could be enlarged upon as the occasion demanded. With respect to income accounts it was the suggestion of the committee that the least number of accounts used by the smaller companies should not fall below the eight main divisions of operation expense, and that, except in the case of the smallest companies, the revenue accounts as included in the report should not be neglected. No matter how small a company may be, it cannot afford to overlook the importance of segregating its income accounts so as to show operating expenses, so that a control of the outgo may be secured, and to indicate the revenue, in order to know that the thing sold is accounted for both as to charges and collections.

#### Discussion

As the classification of equipment and income accounts has been threshed out in discussions at previous conventions, Mr. H. M. Edwards, of the New York Edison Company, recommended that only items on general ledger and indicant accounts be discussed. Following his recommendation, each item was read and discussed before proceeding to the next.

Mr. Lohmeyer, of Baltimore, in reading the report suggested several additions to the classification. About eighty members were present at the session and a large majority of them took part in the discussion. Among those who spoke were Messrs. E. J. Allegaert, of Newark, N. J.; H. M. Edwards, of New York; E. J. Bowers, of Kansas City, Mo.; Herman Spoeher, of St. Louis; L. M. Wallace, of Boston; J. H. Gulick, of Chicago; J. L. Bailey, of Baltimore; Brenton, of St. Louis; F. L. Thornton, of Kansas City, Mo.; E. D. Marr, of Colorado Springs, Col.; A. L. Holme, of New York, and C. E. Calder, of Wichita Falls, Tex.

As the classification of hydroelectric accounts was compiled several years ago and is therefore not up to date, Mr. Edwards made a motion, which was passed, to the effect that a sub-committee be appointed to report to the general accounts committee before Aug. 1 on the classification of accounts connected with that industry. Arguments were raised as to the nomenclature of certain accounts. Mr. Lohmeyer suggested that items falling under plant investment should be lumped under "fixed capital," in order to conform with the public service commissions' ruling. The suggestion did not meet with much approval. Mr. Brenton believed that accounts resulting from central-station companies' selling appliances and fixtures should be listed under promotion of business and not under non-operating revenue. Considerable discussion arose over the disposal of cash discounts. Some contended that it should be credited to cost of material, others said that it should be credited to supply expense account. The problem of levying the overhead charge of supply expense met with the same variety of disposals. The discussion was passed over, with the question still hanging fire whether the overhead charge on supplies should be cleared or carried on the operating accounts. The New York Public Service Commission gives the option of clearing the account or carrying it on the operating expense, but desires to be informed what disposal is made of it. Another item in the classification of accounts which aroused discussion was the classifying of bond interest paid to trustees. Mr. Allegaert believed that the provision made in the report necessitated too much bookkeeping. Mr. Williams, of Chicago, drew attention to the fact that no provision was made in the report for the classification of contract obligations under liability accounts. Quite a general opinion existed that no obligation existed which could be classed as a liability.

Mr. Edwards was called upon by Mr. Bowers, the vice-chairman, to tell of the results of an interview which he had with the public policy committee on the subject of depreciation. In one instance which came before the public policy committee it did not feel like setting a form of de-

preciation. Both the public policy committee and the committee on accounting were of the opinion that depreciation is a charge which should be set by each individual company. The estimation of such a reserve fund as well as the accrual thereof should be at the disposal of the company. Several public service commissions in appraising properties estimate the cost of reproducing the property and deduct a certain value for depreciation. The earning power of the corporation is limited by this appraised value, and Mr. Edwards said: "How will they earn money to reproduce the property if they can earn only on the reduced value thereof?" In place of a depreciation fund Mr. Edwards recommended that the property be kept up to 100 per cent value by repairs and the amount of such repairs charged to operating expenses. He did not favor the term depreciation; in fact, he said that depreciation is not an item of serious consequence in the electrical industry when considered alongside of obsolescence.

#### HANDLING FREIGHT BILLS

A scheme was proposed in a paper by Mr. A. S. Scott, of the Public Service Company of Northern Illinois, for eliminating the usual inefficiency and delay incidental to the handling of railway freight bills. The plan is one that has been tried and found successful by the above company and by the Illinois Northern Utilities Company. In making the change from the old system a letter was addressed to the several department heads giving notice of the new method to be employed in caring for this end of the business and an outline of procedure under the new régime. These instructions were explained in the paper. Receipted original freight bills on delivery to local superintendents are paid immediately by drafts, made payable to the railway company, and these bills attached to the duplicates of the drafts are sent to the purchasing or fuel department for approval and from there to the auditor. The system is arranged so that the company is protected from loss through cashing of irregular drafts, and the railway companies readily agreed to entertain claims for incorrect charges after the items had been paid. The plan results essentially in placing railroad freight on a "c. o. d." basis. Among the advantages claimed for it are the elimination of a lot of unnecessary clerical work with a corresponding reduction of expense, the securing of more prompt payments, and the avoidance of considerable friction between local superintendents and the railroad agents.

#### Discussion

Opening the discussion of Mr. Scott's paper, Mr. F. A. Birch, Philadelphia, Pa., testified to his own difficulties in getting freight bills in. Mr. F. Heydecke, Newark, N. J., told of the work of the National Freight Tariff Bureau which handles freight bills throughout the country, auditing them for a nominal charge of about 1 cent each. Provisions are made for rebating overcharges. Mr. E. C. Scobell, Rochester, N. Y., said that in his case the carting company renders the bill for freight charges with its carting charge. The Chicago company, said Mr. Scott, has one man devote his entire time to checking freight tariffs. Several district offices are located throughout the country, to which the draymen take their freight bills, having drafts made and thus avoiding delays on the part of the railroad company in forwarding bills. The company pays its freight bills before the goods themselves are delivered, and if overcharges are made claims are filed against the railroad company. This plan, said Mr. Scott, has proved quite satisfactory.

#### ACCOUNTING FOR DEPRECIATION

In prefacing his paper on accounting for replacement of plant retired from service Mr. Frank A. Birch, of the Philadelphia Electric Company, stated that since local conditions, the earning capacity of the plant and, in some

cases, the supervision exercised by public service commissions must be taken into consideration, it is difficult to present a treatise on the subject which is possible of wide application. He therefore considers from an accounting viewpoint some of the things that should be done and from these observations makes suggestions as to practice. His accounts (based) show the cost to the company of all properties. This should include the separate cost of each generating station, substation, line and all units of construction. The accounts of material and construction construction should be kept at each source so well shown in all times the complete cost of any particular line or portion thereof, or that some department or department of the account to be charged to the depreciation reserve account and be readily determined. A summary of a general nature should not be maintained in the general ledger unless subsidiary books are also kept which will show in detail the properties and lines included in such general accounts with individual costs of each. By charging against depreciation reserve account the cost of entire plants, lines and cables, or the cost of any item of construction retired, and charging directly into the property accounts the cost of plants or lines reconstructed, the accounting end of the proposition is kept clear and plain. The author considered depreciation in connection with the construction of a new plant or the installation of new equipment, and reviewed briefly the operations that are involved under the work order system. In particular, he emphasized the fact that any scheme of accounting laid out should be consistently adhered to.

#### Discussion

Mr. F. L. Thornton, Kansas City, Mo., suggested that the difference between the salvage and actual value of the plant be credited to depreciation.

Mr. Herman Spodcher, St. Louis, Mo., told of the experiences of the Union Electric Light & Power Company in keeping a depreciation inventory.

Mr. A. L. Holme, New York, explained the use of separate accounts in charging up poles, lines and service runs. If salvage be credited to depreciation, in cases where a certain salvage is received, a % of the amount paid for freight will usually be lost. Instead of disposing of scrap metal to junk dealers, Mr. Holme proposed that companies classify this material and sell it as "clean metal." Similarly, lead can be melted up and made into pipe. In answer to a question by Mr. F. H. Palmer, Kokomo, Ind., Mr. Holme said that the New York practice is to charge replacement to depreciation, except where betterment has been involved.

Mr. L. L. Riedlin, of St. Louis, Mo., said that under the sub-order system disbursement sheets are numbered, to show to what expense account each should be charged. Mr. C. L. Thornton, St. Louis, said that the labor of removing and installing becomes a loss under a single account by the Union Electric Company, but not in a reconstruction charge. He means of the entire system, the cost of installing can be easily ascertained.

Mr. J. C. Van Dune, Brooklyn, N. Y., described his company's practice in charging installation and removal costs to property account, then transferring the account when the customer is rendered in for service.

Mr. L. M. Wallers, of Boston, described the practice of the Boston Edison company in charging all meters, apparatus, transformers, meters, etc., to work accounts, then transferring them to plant account when put into service.

Mr. W. H. Whitlow, Superior, Wis., described the use of large scale work orders with orders. The New Jersey Public Service Commission, according to Mr. F. Heydecke, Newark, N. J., requires that meter transformers, etc., shall be charged in "planting" bills.

Others who took part in the discussion of the paper were Messrs. A. S. Scott, Chicago, Ill.; F. L. Thornton, Kansas



City, Mo.; H. B. Lohmeyer, Baltimore, Md., and E. C. Scobell, Rochester, N. Y.

#### STATISTICAL EXCHANGE

A sample of the form report of the statistical exchange, together with a few words as to the reasons for this work, composed the report of the sub-committee under the chairmanship of Mr. Herman Spoehrer, of the Union Electric Light & Power Company, St. Louis. It was explained that, owing to the fact that the information obtained is such as is in constant demand and must be up to date and quickly available, it must be secured fresh each year. A statistical arrangement has not yet been perfected, but it is expected that one will be produced in the near future.

#### STANDARD ACCOUNTING FORMS

The activity of the sub-committee on forms, of which Mr. C. L. Campbell, of the United Electric Light & Water Company, Waterbury, Conn., was chairman, was outlined in its report. This activity consisted in bringing up to date the work of the accounting committee in 1910, of compiling information on the various forms used in public-utility accounting. The new compilation was arranged according to the size of the cities served rather than by the nature of the form. The principal divisions made were general accounting, current bookkeeping, storeroom bookkeeping, contracts, new-business solicitors' reports, shop and storeroom reports, workmen's affairs, superintendents' and foremen's reports and printed matter. The practices of the companies investigated were shown to vary widely as to style, size, color, typing and the completeness of the blanks and forms used, and it was suggested that much would be gained by standardizing practice in these matters.

#### RELATION BETWEEN ACCOUNTING AND OPERATION

Mr. F. H. Patterson, of the Rochester Railway & Light Company, presented a paper on "The Relations of the Accounting Department to the Other Departments of the Company." The accounting in the central-station industry has developed into nearly perfect conditions, with scientific accuracy available in regard to practically every detail of the business. This the author largely ascribed to the work of the Public Service Commission of New York and other public utility commissions in promulgating scientific classifications of accounts. The annual reports filed with the commissions, which deal so exhaustively with the company's affairs, are most exacting to compile but nevertheless invaluable.

The author strongly emphasized the necessity of having the auditor systematize the various departmental records, because he is by training properly fitted for such work and his comprehensive knowledge of the business enables him to outline the least wasteful system. The general knowledge of the business thus obtained is, if properly used, of the greatest benefit to the company. On the other hand, no officer in the service is in a position to work greater harm to the directors and stockholders than the auditor. Matters which affect the very life of the company are in his safe-keeping and, through ignorance, fraud or negligence, the reputation of the directors may be jeopardized or their financial ruin brought about. The directors, acting on the basis of the statements of the auditor, may declare a dividend when really no profit exists and where this action would be most inimical to the welfare of the business.

The policy adopted by some of the large public service companies whereby the auditor receives his appointment from the board of directors and is responsible to them only was considered a praiseworthy one. A number of points were brought out by the author showing the many pitfalls of an auditor in the ordinary course of his work, in order to show how essential it is that only men of the broadest experience and integrity be appointed to such positions.

The author further discussed the importance of sub-

mitting carefully prepared statements periodically to the general manager, directors, heads of departments and superintendents, so as to enable the executive officers to analyze cost and expenditures and make suitable changes where it may be found desirable in order to improve the economy of operation.

#### Discussion

In commenting on Mr. Patterson's paper, Mr. A. L. Holme, New York, declared that the author had "hit the nail on the head" so squarely that he thought no discussion was necessary.

Mr. J. C. Van Duyn, Brooklyn, N. Y., urged that the auditor be made directly responsible to the board of directors of the company instead of to the general manager. Messrs. F. L. Thornton, St. Louis, Mo., and E. E. Corkin, Peoria, Ill., also spoke briefly.

#### HANDLING OF BOND COUPONS

Some interesting data were given in a paper by Mr. W. J. Kehl, of the Virginia Railway & Power Company, Richmond, Va., on the subject of bond coupons, what they represent and how they are used. Explanation was given of the method of securing first-mortgage bonds by a deed of trust and also of the significance of the attached coupons, these being simply printed orders of the company to pay to the bearer at a specified time and place the semi-annual interest accruing on the bond. The coupons are numbered consecutively and bear, in addition to this number and that of the bond, the date for collecting interest and the name of the agency through which interest is to be paid. Upon payment of the interest the coupon is canceled by perforation. The author touched upon the accounting methods involved in keeping track of coupon payments and explained how record is kept of matured coupons unpaid. The preservation of canceled coupons, awaiting the maturity of the bond and final payment of both principal and interest, was stated to have become a very annoying problem through the increase in extent and size of bond issues. It was suggested that canceled coupons be periodically burned and a certificate of cremation issued to cover the transaction and represent that block of coupons in the final accounting.

#### Discussion

Among those who discussed the paper were Messrs. W. H. Winslow, of Superior, Wis.; E. C. Scobell, of Rochester, N. Y.; A. S. Scott, of Chicago; N. McDougall, of Toronto, and L. M. Wallace, of Boston. To avoid using a bulky book for bond coupons, Mr. Winslow said he uses a book with heavy manila leaves on which are numbers corresponding to the bonds and coupons. As the coupons are turned in they are pasted in this book, overlapping each other but showing the bond and coupon number. Mr. Scott advised keeping a record of the history of mortgages and disposal of bonds.

## Meters and Measurements

#### REPORT ON METERS

Mr. W. H. Fellows, of the Potomac Electric Power Company of Washington, D. C., chairman of the committee on meters, presented a forty-seven-page report covering the work of the committee for the past year. The code which the meter committees of the N. E. L. A. and of the Association of Edison Illuminating Companies have been formulating since early in the year 1910 has been revised and was presented in its latest form in this report.

The committee commended the "Electrical Meterman's Handbook," which was published last year, as a book which no public utility maintaining a meter department should be without. Further information has been gathered for addi-



tion to the handbook when at some future time it shall be deemed advisable to revise it. Last year the committee on meters had before it for consideration a standard form of dial face for watt-hour meters and the present committee has now adopted a form. The form of dial face adopted has been approved by the N. E. L. A. committee on meters and the meter committee of the Association of Edison Illuminating Companies. Different manufacturers also have been provided with a copy of the dial face and are assuring their co-operation.

#### Discussion

Mr. John C. Parker, Rochester (N. Y.) Railway & Light Company, spoke at some length upon the absence of adequate consideration of demand meters in the report. He urged that improvements of from 1 to 4 per cent in the accuracy of watt-hour meters are of less importance than corresponding betterments in demand instruments, which easily vary the consumer's rate by from 10 to 20 per cent. An instrument is needed which will give the hour-to-hour demand, permitting satisfactory interpolation when disputes arise and not requiring a large amount of clerical work in its use. An instrument of the contact-making type is objectionable on account of the tendency toward interrupted or inaccurate readings in the course of the year, some 16,000 makes and breaks being required in equipment giving half-hourly readings.

Mr. F. G. Vaughn, General Electric Company, Schenectady, N. Y., said that the committee's work is helpful to the manufacturers as facilitating standardization. He commended the specifications covering meter registering dials issued in the report and concurred in the desirability of standardizing connections. Closing, he touched upon the difficulties inherent in the design of an entirely satisfactory demand meter.

Mr. C. W. Wilder, Public Service Commission, First District, New York, cited the benefits of co-operation between the commission and the central station companies as observed in the frank discussion of meter problems at hearings.

#### UNITS AND TERMINOLOGY OF POWER MEASUREMENTS

Several of the power measurement units in use in this country and abroad were noted in the report of the committee on measurements, of which Dr. A. F. Kennedy, Harvard University, was chairman. There was also given a record of the recent action of the national engineering societies with regard to the watt. The committee favored the adoption of the myriawatt, about which there has been considerable debate during the past year. The advantage pre-eminently associated with such a step was held to be that of a unified system of measuring both the input and the output of steam engine-generator sets, making the important item of efficiency more readily apparent. The use of the term "kelvin," to displace the established kilowatt-hour, was opposed on the ground of ambiguity and because Lord Kelvin's name is being proposed for an important electrostatic unit.

#### Discussion

In the absence of Chairman Kennedy the report was presented by Dr. C. P. Steinmetz. The latter commented briefly on the report, pointing out that it is largely a compilation of information on recently proposed units, without any specific recommendations. Dr. Steinmetz deprecated the addition of units of a hybrid character to the nomenclature of the electrical industry, contending that the existing supply appears adequate for present needs. The proposed "myriawatt" for boiler rating is a make-do unit and one might as well use the kilowatt or the megawatt. Even the adoption of the term "kelvin" for the kilowatt-hour has not found large acceptance because it is a mixture of units of different characteristics and is not an absolute unit on account of the hour factor.

#### EXHIBITS BY METER COMMITTEE

The exhibition by the meter committee, at which Mr. W. H. Fellows, of Washington, D. C., was chairman, contained a complete line of service meters of six different makes and a fine display of testing apparatus and equipment for meter maintenance. A typical complete house-meter installation, protected against tampering and equipped with testing jacks as standardized by the Rochester (N. Y.) Railway & Light Company, was shown, with corresponding apparatus from the Philadelphia Electric Company and the New York Edison Company. Thirty different meters were displayed, including curve-drawing, printing and integrating instruments for a variety of purposes, special emphasis being laid upon equipment for the analysis of conditions in large industrial installations. The array of testing apparatus included a power-factor adjuster for laboratory service and a full line of the best American and European standard instruments for meter calibration and other precise measurements. Adjustable series transformer apparatus, portable loads, armature resistance boxes and other integrating and adjustable apparatus of the grade supplied by the United States Bureau of Standards were shown.

#### Miscellaneous Subjects

##### CENTRAL STATION INSURANCE

Mr. W. H. Blood, Jr., of the Stone & Webster Engineering Corporation, Boston, the insurance expert of the National Electric Light Association, reported that during the year the industry has been comparatively free from annoying litigation with insurance companies. This was partly due to better construction work by the lighting companies and also to the insurance companies' better realization of the importance and solidarity of the association. Reductions in rates have been brought about by constant negotiation and also because of the improved fire-loss ratio, which the insurance companies are getting from the lighting companies.

The changes in the National Electric Code voted at the March meeting were briefly reviewed. A recommendation was made that the member companies should employ inspection bureaus to look over the properties of the lighting companies. Mr. Blood also expressed his agreement to negotiate with member companies in the preparation and enforcement of laws or by-laws based on alleged negligence in wiring and in units brought because of serious or fatal accidents.

##### CHAIRMAN FELLOWS ON COMMERCIAL SECTION WORK

In his address at the first session of the Commercial Section, Chairman Edward W. Fellows gave a concise history of the work of the section during the year. As a result of the plan of meeting bi-monthly and in member companies the commercial section has to date a fairly good standard basis. The commercial papers at this and a previous conference reflected very strongly the trend of progress in connection with the commercial side of the electric service business. The chairman referred to the "Electrical Engineering Handbook" and said that it was his intention to arrange for some of the publications by cutting all matters of interest to electrical engineers. The work of the section on "Electricity in the Farm and the Rural" of meeting withings was mentioned next. The latter committee has before it a system of rural electricity, as well as some heating and there is no subject that should receive greater consideration at the hands of electric service men, manufacturers, dealers and contractors. In connection of your business the subject of rural electricity for refrigeration was also considered. The load factor of this class of business is 10 per cent or greater, averaging 25 per cent for the months from

April to October. During the year there have been added to the executive committee of the Commercial Section representatives of the national associations of electrical contractors and electrical supply jobbers.

#### COMMERCIAL SECTION, FINANCES AND MEMBERSHIP

Mr. T. I. Jones, Brooklyn, N. Y., chairman of the finance committee, reported total revenues of \$5,241 received during the past year, divided between dues and receipts from sale of publications. In all, \$4,755 was expended, leaving with the surplus already on hand a balance of \$502.87.

Mr. J. F. Becker, New York, chairman of the membership committee, reported a present enrolment of 1222 active members. Since last year 482 new members have been secured for the section, although 173 others were lost through resignation. Prospective lists of 2000 names are now being circularized, and a campaign is being waged to enrol members from among some 1000 applicants for the commercial session papers of the Seattle meeting. A scheme of organization with state captains is also to be attempted in making a more concentrated membership campaign during the coming year.

#### QUESTION BOX

The report made by Mr. S. A. Sewall, assistant to the secretary, on the Question Box dealt with the routine work involved in the handling, answering and printing of the questions received. By appealing to member companies to appoint a correspondent for their company who would see that questions were properly answered, 300 correspondents in as many different companies have been secured as regular contributors to the Question Box. Mr. Sewall believes that the Question Box should be devoted more and more to the problems confronting the smaller companies. During the year 300 new questions were asked, and to these over 1300 answers have been printed.

#### OIL-PRESSURE BEARINGS

A paper describing a new type of thrust bearing was presented by Mr. Albert Kingsbury, consulting engineer, Pittsburgh, Pa. The design of this bearing is based upon the principles established by Prof. Osborn Reynolds as a result of experiments by Beauchamp Tower. According to these theories, which are well borne out by experiments, there is practically no wear on a well-fitted cylindrical journal flooded with oil. The total friction is nearly independent of the load and the mean coefficient of friction is very low, in some cases not exceeding 0.001. It was further found that there was oil between the shaft and the brass under pressure, forming a wedge which completely separated the surfaces and reduced the friction to that within the oil itself. This wedge is thickest toward the side where the oil enters with the shaft in its rotation and thinnest toward the leaving side. The oil because of its adhesion to the shaft and because of its viscosity is dragged into the wedge-shaped space by the rotating shaft, and this action sets up the pressure in the oil, which in turn supports the load on the brass.

The mechanical details of this type of bearing are described elsewhere in this issue.

#### Discussion

Mr. J. C. Parker, Rochester, N. Y., commended the work of Professor Allen in hydraulic efficiency testing. He emphasized the rapid decrease in efficiency possible in hydraulic plants after long service. On a 10,000-hp unit this involves enough waste in idle investment to justify thorough testing even at considerable expense. Such tests at Rochester in the past year have led to plans for entirely rebuilding some of the company's hydraulic equipment to secure greater efficiency. He urged that every hydro-electric plant be equipped with a Pitot tube or a Venturi contraction in the pipe line, enabling the input of water

to be tested properly at regular intervals. The use of a weir for operating tests is undesirable on account of the variations introduced by the choice of formulas. The speaker favored electrical measurements of output in place of brake tests, as the operating man's chief interest is the over-all efficiency of the unit, and as a practical matter the efficiency of electric generators is so high that the error introduced by losses is within the limits of accurate hydraulic measurement. Mr. D. B. Rushmore spoke briefly on the depreciation of blades through oxidation.

#### THE LIFE HAZARD IN ELECTRICAL PRACTICE

The United States Bureau of Standards will shortly begin an investigation of the subject of "life hazard in electrical practice." The general plan, as explained in a paper by Dr. E. B. Rosa, will be that of first securing the advice and co-operation of those best prepared to give valuable assistance and counsel, and then, after gathering together a large amount of information and experience obtained from operating men, manufacturers and others, a comprehensive report will be prepared. Sets of rules will also be formulated for the guidance of managers of operating and constructing companies, detailing approved practice in electrical construction for safeguarding life. It is also hoped to formulate rules in co-operation with public-service commissions in such form that these rules can be adopted by the commissioners or by city authorities, thus insuring, as far as possible, that electrical companies shall conform to the best practice for safeguarding life. Not only is it the duty of electrical companies to do all they can to reduce the life hazard in electrical work, but it will be to their material advantage to do so. Legislation soon will compel unwilling observance of strict and possibly drastic rules, unless voluntary action forestalls such need and renders the observance of reasonable and wisely drawn requirements free from embarrassment. And if there are to be rules or requirements, it is far better that they be drawn up after a thorough and impartial investigation, with the co-operation of those most experienced and most interested, than that they should be formulated independently by a large number of legislative bodies, each acting on different advice and experience and all together causing a great confusion of requirements.

The study is being taken up in the spirit of investigation, appealing both to experiment and experience, and the Bureau of Standards, said Dr. Rosa, invites the co-operation of both the N. E. L. A. and its individual members in planning and carrying out the work.

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#### Exhibits by Class D Members

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The exhibition made by Class D members of the National Electric Light Association in connection with the convention was very creditable considering the great handicaps encountered in transforming a low basement into an exhibition hall. With a ceiling varying from 8 ft. to 9 ft. in height and with about sixty columns cumbering the floor space, the outlook was not inviting. However, a certain number of the columns were selected as a basis for a semi-circular court and special treatment in the way of lattice-work and pergolas was applied. The other columns were decorated with mirrors, as was also the entire background of the exhibition hall, latticework and indirect lighting of the signs in the latter case aiding materially in deceiving the eye as to the exact height of the room. White and French gray were the dominating colors, with rustic green signs for exhibitors in the center spaces. Owing to the lowness of the ceiling every effort was made to prevent glare, and to that end the 500 or more 25-watt tungsten lamps employed to supplement the regular building lamps were shaded with art glassware. Space was provided for



sixty-eight booths, but many exhibitors occupied more than one booth. A short description of the exhibits follows:

**ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio.**—Series alternating-current flame-arc lamps and transformers, incandescent lamps and reflectors, electric horns. Representatives: A. J. Selzer, V. N. Marker, C. W. Beach, R. H. Green.

**AMERICAN DISTRICT STEAM COMPANY, North Tonawanda, N. Y.**—Models of steam-heating fittings and meters, and district-heating literature. Representatives: W. H. Wells, C. R. Bishop, H. C. Kimbrough, B. T. Gifford, A. E. Duram, W. J. Kline, C. A. Gillham, J. A. Bendure.

**AMERICAN IRONING MACHINE COMPANY, Chicago, Ill.**—Electric ironing machines. Representatives: H. G. Grosse, G. A. Renner, J. L. Mayer.

**A. & W. ELECTRIC SIGN COMPANY, Cleveland, Ohio.**—Interchangeable electric signs and monogram letter units.

**BELL ELECTRIC MOTOR COMPANY, Garfield, N. J.**—Alternating-current, single-phase and compensated polyphase motors. Representatives: A. C. Bell, T. R. Bell, A. W. Eckhoff.

**BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill.**—Industrial fixtures and lighting specialties, including plug clusters and switch-controlling current taps. Representatives: R. B. Benjamin, W. D. Steele, H. E. Watson, A. N. Fox, B. G. Kodjanoff, F. H. Poss, G. B. Weber, A. E. Lubeck, M. F. Steel, O. L. Johnson.

**CENTURY ELECTRIC COMPANY, St. Louis, Mo.**—Single-phase and split-phase motors and alternating-current fans. Representatives: R. J. Russell, H. A. Porter, E. Kumbo.

**CHICAGO FUSE MANUFACTURING COMPANY, Chicago, Ill.**—Inclosed fuses, conduit fittings and switch and outlet boxes. Representatives: W. E. Finley, A. S. Merrill, W. W. Merrill.

**CONLON-SIMPLEX MACHINE COMPANY, Chicago, Ill.**—Electric washing machines. Representatives: W. J. Conlon, W. T. Haynie.

**CO-OPERATIVE ADVERTISING SERVICE FOR CENTRAL STATIONS, Chicago, Ill.**—Photographs, proofs and advertising specimens. Representatives: G. C. Tremaine, R. A. Pick.

**COOPER HEWITT ELECTRIC COMPANY, New York, N. Y.**—Mercury-vapor and quartz-tube lamps, and battery-charging rectifier. Representatives: I. E. Carey, G. C. Keech.

**DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind.**—Transformers, and house-type, portable and switch-board watt-hour meters. Representatives: Thomas Duncan, A. G. Lucas, H. O. Hall, W. H. Sinks.

**DUPLEX METALS COMPANY, Chester, Pa.**—Copper-clad bar and weather-proof wire, rods, choke coils, etc. Representatives: S. C. Munoz, T. K. Stevenson, W. D. Ball, W. T. Kyle, W. H. Lipscomb, J. M. Ridger, B. F. Cameron, C. B. Semple, L. M. Garden.

**ECONOMICAL ELECTRIC LAMP WORKS OF GENOVA ELECTRIC COMPANY, New York, N. Y.**—Incandescent lamps. Representatives: M. Lobenthal, L. Lobenthal.

**ECONOMY FUSE & MANUFACTURING COMPANY, Chicago, Ill.**—Inclosed fuses, renewal links and service fuses. Representatives: A. L. Eustice, J. B. Griffith, A. L. Trichter.

**EDISON STORAGE BATTERY COMPANY, Orange, N. J.**—Nickel-iron storage batteries, plates, parts, etc. Representatives: W. G. Bee, C. B. Frayer, W. C. Andrews.

**ELECTRIC APPLIANCE COMPANY, Chicago, Ill.**—Regulators and high-tension protective apparatus. Representatives: W. W. Low, P. R. Boone, E. F. Adkinson, H. Fable.

**ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa.**—Lightning arresters, insulators and line specialties. Representatives: J. W. Porter, M. A. Berg, O. Mueller, T. H. Henkle, H. H. Johnson.

**ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa.**

—Storage batteries, plates and parts; factory illustrations and publications. Representatives: G. H. Atkins, T. Milton, T. Cross, J. Rosholt, E. Kelly, P. Rebel, D. Parker, R. I. Baird, C. Blizard.

**ELECTRIC VEHICLE ASSOCIATION OF AMERICA, New York, N. Y.**—Samples of advertising copy, proofs, etc. Representatives: Horace Thompson, W. Smith, H. J. Moore, W. J. McDowell.

**ELECTRICIAN, JOURNAL & WIREMAN, LAKESIDE, CALIF., Ill.**—Electric magazines. Representatives: C. W. Price, A. A. Gray, H. E. Gifford, E. E. Wood, J. R. McCarthy, C. W. Forbrich, F. R. Schalck, M. G. Lloyd, F. H. Bernhard, H. Ehrlich, J. E. Latta.

**ELECTRICAL WORLD, New York, N. Y.**—Electrical and engineering magazines. Representatives: James H. McGraw, G. W. Kline, D. E. Brown, J. C. Brown, C. T. Walker, Sam A. Howard, J. A. Wynn, H. C. Matthews, W. H. Onken, Jr., W. E. Keily, O. H. Caldwell, H. S. Knowlton, A. M. Perry.

**KUBES VACUUM CLEANING COMPANY, Detroit, Mich.**—Electric vacuum cleaners. Representatives: F. Wardell, R. Felt, O. B. Schbert.

**FEDERAL SIGN SYSTEM, CHICAGO, Ill.**—Incandescent signs, miniature signs, fittings, supplies, shades, units, reflectors, fixtures, vacuum cleaners, and other accessories for billboards, outdoor lighting, water, fire, and other model productively signs and house signs. Representatives: A. B. Calhoun, A. E. Dean, E. J. Bass, R. J. Wherry, W. J. Devine, J. J. McCann, J. J. Brown.

**GENERAL ELECTRIC COMPANY, Schenectady, N. Y.**—Motor recorder; incandescent, luminous and flame-arc lamps, neonators, lightning arresters, electric ovens and ranges, instruments, small motor, refrigerator, motor, transformer, reflectors and shades. Representatives: A. W. Burchard, E. W. Rice, Jr., D. E. Robinson, E. F. Veighton, N. E. Buge, R. H. Carver, D. E. Baker, Frank H. Gale, Q. E. Morrison, C. E. Burleigh, H. B. Rogers, H. C. Ward, C. A. S. Howlett, W. H. McLaren, J. E. Gilbert, C. W. Scott, H. R. Sumner, J. E. Morrison, E. J. Veighton, C. P. Stearns, J. P. Roberts, R. E. Wadley, A. K. Bayler, R. E. Wadley, C. R. Conner, R. A. Scales, J. E. Kearns, D. S. Martin, W. M. Stewart, S. H. Biles, A. D. Page, H. Schneider, R. B. Porter, C. C. Gibson, F. W. Sanford, J. W. Howell, G. A. Chamberlain, J. E. Bay, M. Lattinfield, G. L. Thompson, J. H. Brown, J. W. Moore, P. Worth, T. J. Ross, J. E. Biles, H. M. Hall, J. A. Craton, William Hand, J. H. Livy.

**GENERAL VEHICLE COMPANY, Long Island City, N. Y.**—Electric truck chassis. Representatives: P. H. Wagner, F. F. Wadley, W. J. McDowell, E. W. Carter, E. H. W. Hillman, T. W. Barnes, J. S. Gorham.

**G. & W. ELECTRIC SUPPLIES COMPANY, Chicago, Ill.**—Cable terminals, junction boxes, regulators, line, etc. connecting wiring and high-tension devices. Representatives: G. C. Edwards, L. M. Thomas.

**HOPKINS ELECTRIC HEATING COMPANY, MIDDLETOWN, CALIF.**—Electric systems, room heaters, radiators, portable, galleys, chafing dishes, hot water heaters, and immersion water heaters. Representatives: J. E. Hopkiss, M. J. Wolf, H. A. Ross, W. A. Butts, E. W. Lamb.

**HUGHES & CHURCH, PITTSBURGH, Pa.**—Insulation, etc., standard steel pipe and cross-section, and high-tension line specialties. Representatives: C. T. Young, Jr., H. W. Youngquist, W. R. Pender.

**HUGHES ELECTRIC HEATING COMPANY, Chicago, Ill.**—Electric ranges, radiators and radiators. Representatives: G. A. Hughes, A. F. Hubbard, G. J. Stokes, A. Smith, C. F. Marsh.

**HURLEY MACHINE COMPANY, Chicago, Ill.**—Washing machines and vacuum cleaners. Representatives: N. C. Hur-



ley, T. J. Casey, R. C. Knopke, O. L. Romme, W. A. Murfey.

INNOVATION ELECTRIC COMPANY, New York, N. Y.—Motor-driven suction cleaners. Representatives: F. N. Davidson, L. Bourgette.

H. W. JOHNS-MANVILLE COMPANY, New York, N. Y.—Electric-driven refrigerating machines, thermal and electrical insulations, fuses, conduit, boxes and fittings, lamps and reflectors. Representatives: J. W. Perry, H. M. Frantz, H. W. Frantz, G. A. Saylor, W. E. Rapp, R. R. Braggins, R. C. Cole, R. F. Massa, R. J. Stewart.

LIFE-SAVING DEVICES COMPANY, Chicago, Ill.—Resuscitation apparatus. Representatives: F. T. Fowler, J. N. Giblin, F. T. Fowler, Jr.

W. N. MATTHEWS & BROTHER, St. Louis, Mo.—Fuse switches, line material, cable clamps, test devices and pole-height estimators. Representatives: W. N. Matthews, C. L. Matthews, W. Bischoff, J. L. Fay, V. L. Crawford.

METER EXHIBIT, N. E. L. A.—Meters and meter accessories.

METROPOLITAN ENGINEERING COMPANY, New York, N. Y.—Meter and central-station protective devices, and electric bath cabinet. Representatives: T. E. Murray, J. E. McClernon, F. E. Brown.

MINERALLAC ELECTRIC COMPANY, Chicago, Ill.—Maximum-demand devices, printometers, maxicators and graphometers. Representatives: H. S. Sines, C. I. Hall, J. Van Buskirk, A. J. Olson.

MOLONEY ELECTRIC COMPANY, St. Louis, Mo.—Transformers. Representatives: T. O. Moloney, J. J. Mullen, L. H. Keller, J. R. Dean.

NATIONAL QUALITY LAMP DIVISION OF GENERAL ELECTRIC COMPANY, Cleveland, Ohio.—Standard and miniature "Mazda" lamps, examples of illumination and moving and mechanically operated display devices. Representatives: J. R. Crouse, S. E. Doane, W. M. Skiff, G. S. Merrill, N. H. Boynton, E. J. Edwards, C. W. Bender, Ward Harrison, R. W. Shenton, M. D. Cooper, F. J. Blaschke, R. W. Tavey.

NATIONAL X-RAY REFLECTOR COMPANY, Chicago, Ill.—Indirect-lighting and direct-lighting reflectors and portable and ceiling units. Representatives: A. D. Curtis, H. B. Wheeler, T. H. Aldrich, E. L. Haines, E. E. McKinnie, W. R. Moulton, J. N. Labelle.

OSHKOSH MANUFACTURING COMPANY, Oshkosh, Wis.—Construction tools, pike poles, shovels, climbers, reels, insulator pins and pole anchors. Representatives: J. W. Whoolley, R. L. Thayer.

OTIS ELEVATOR COMPANY, New York, N. Y.—Elevators. Representatives: R. W. Charles, H. E. Turner, R. H. A. Carter, E. W. Eaton, E. A. Henderson, E. R. Wilson, H. S. Sneed.

PHILADELPHIA ELECTRIC & MANUFACTURING COMPANY, Philadelphia, Pa.—Lighting standards, hangers and fittings. Representatives: R. H. Manwaring, W. O. Dale.

PITTSBURGH TRANSFORMER COMPANY, Pittsburgh, Pa.—Exhibits and photographs of heavy-duty mill-type transformers, series street-lighting system, outdoor high-tension transformers, etc. Representatives: R. V. Bingay, H. G. Steele, P. H. Butler.

POPULAR ELECTRICITY MAGAZINE, Chicago, Ill.—Electrical magazine. Representatives: W. Harvey, Jr., J. A. Harney, H. W. Young, G. T. Hadley, B. E. Blanchard, W. J. Wheeler, B. W. Cook.

JOHN A. ROEBLING'S SONS COMPANY, New York, N. Y.—Wires, cables and fittings. Representatives: A. B. Conover, W. J. Slingluff, E. H. Christoph, A. V. Errickson.

SANGAMO ELECTRIC COMPANY, Springfield, Ill.—Instruments and meters, ampere-hour meters, circuit-breakers and distant-operating dial mechanism. Representatives: R. C. Lanphier, H. W. Young, J. H. Hodde, A. E. Pickard.

SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass.—Heating devices, irons, stoves, ranges, percolators, hot plates, heating pads, radiators, ovens, etc. Representatives: J. I. Ayer, E. R. Jacobs, D. Rollins, J. H. Johnson, F. L. McKenna.

SOUTHERN EXCHANGE COMPANY, New York, N. Y.—Poles and cross-arms. Representative: E. G. Chamberlain.

STANDARD UNDERGROUND CABLE COMPANY, Pittsburgh, Pa.—Wires, cables, junction boxes, terminals, insulating compound and cable-splicing sleeves. Representatives: G. L. Wiley, J. R. Wiley, E. J. Pietzcker, E. F. Norton, R. E. Green, J. H. Lytle, W. Hauck, R. B. Wilcox.

THOMPSON ELECTRIC COMPANY, Cleveland, Ohio.—Cut-out hangers for arc and incandescent lamps. Representative: A. J. Thompson.

TUNGSTOLIUM WORKS OF GENERAL ELECTRIC COMPANY, Conneaut, Ohio.—Household fixtures and industrial lighting units. Representatives: G. C. Webster, F. C. Maxheimer, A. B. Wilson, C. F. Reel, J. B. Higgins, W. G. MacMartin.

VALENTINE-CLARK COMPANY, Minneapolis, Minn.—Butt-treated poles. Representatives: L. A. Furlong, E. L. Clark.

WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo.—Electrical apparatus and instruments, unity-power-factor motors, converters and rectifiers. Representatives: W. A. Layman, J. Mustard, E. W. Goldschmidt, E. H. Cheney, F. Johnson, A. J. Meyers, J. A. Gelzer, P. L. Lewis, H. E. Griffin, E. M. Webber, W. R. Patton, R. D. Lillibridge.

WESTERN ELECTRIC COMPANY, New York, N. Y.—Heating appliances, vacuum cleaners, fans, incandescent lamps, fixtures, shades, fuses, insulators, line supplies, model high-tension pole line, interphones, loud-speaking telephones and special telephone equipment. Representatives: H. R. King, R. A. Griffin, A. G. Kingman, H. L. Grant, J. F. Sweeny, W. B. Pierce, W. Mueller, J. R. Kearney.

WESTERN WATER SUPPLIES COMPANY, Kansas City, Mo.—Electric sterilizers and electric sterilized coolers. Representatives: P. Thompson, J. H. Thompson.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa.—Heating apparatus for domestic and industrial use, meters, fans and small motors, ozonizers, insulating material and solder, mercury-arc and mechanical rectifiers, circuit-breakers, lightning arresters, transformers and spark-gap. Representatives: Guy E. Tripp, L. A. Osborn, S. L. Nicholson, G. B. Griffin, C. S. Cook, H. W. Cope, Robb Mackie, C. E. Allen, A. A. Brown, Wm. Clegg, Jr., J. McA. Duncan, J. J. Gibson, C. E. Heise, J. S. Tritle, K. E. Van Kuran, G. S. Vail, J. A. Brett, T. E. Collins, E. P. Dillon, G. C. Ewing, S. A. Fletcher, A. D. Fishel, E. O. Kirkpatrick, S. D. Levings, T. A. McDowell, A. H. McIntyre, J. C. McQuiston, H. W. Beaumont, J. N. Mahoney, Paul MacGahan, H. C. Owens, T. J. Pace, M. C. Rypinski, E. G. Reed, C. G. Schluederberg, W. A. Thomas, E. A. Thornwell, J. M. Tomb, H. H. Van Staagen, D. E. Drake, S. E. Chase, A. E. Allen.

WESTINGHOUSE LAMP COMPANY, Bloomfield, N. J.—Electric incandescent lamps. Representatives: Walter Carey, T. G. Whaling, B. F. Fisher.

WESTINGHOUSE MACHINE COMPANY, Pittsburgh, Pa.—Turbine-driven centrifugal boiler-feed pump. Representative: E. H. Sniffin.

WESTON ELECTRICAL INSTRUMENT COMPANY, Newark, N. J.—Alternating-current and direct-current indicating instruments, laboratory and miniature precision instruments, instrument transformers, etc. Representatives: G. P. Frey, P. Westburg, R. Johnson.

WILKINSON COMPANY, Chicago, Ill.—Portable lamps, art-glass shades, etc. Representatives: I. A. Jones, R. A. Soukup, O. C. Helm, O. Hochberg.

# Electric Service in Chicago Suburbs

**High system load-factors and operating economies achieved by the Public Service Company of Northern Illinois through diversified demands of its customers**



BETWEEN the extreme outposts of its system, 130 miles apart on the borders of the important industrial, suburban and agricultural region surrounding Chicago, the central station energy furnished by the Public Service Company of Northern Illinois finds numerous and remarkably varied applications in supplying the electrical needs of 400,000 customers in the communities whose

combined population is half a million.

As a natural consequence of the diversity of such interconnected operation the system load-factors achieved approach 70 per cent, the principal steam station operating, for example, at 65 per cent and higher, while full-load conditions are imposed twenty-four hours a day on the water-power plants which produce about a quarter of the system output. The large industrial and railway loads carried are chiefly responsible for the peak maximums, which now occur during daylight hours. Special attention has also been devoted to acquiring such characteristic long-hour loads as town water-works, sand and gravel pits, etc. Another interesting aspect of the company's activity has been the distribution of electric service to farms for lighting and power purposes, thus according to its rural customers the same conveniences and rates enjoyed by their cousins in town.

## GENERATING PLANTS AND TRANSMISSION SYSTEMS

The present system of the Public Service Company of Northern Illinois represents the combination of five utility corporations which formerly operated in their respective territories as follows: The North Shore Electric Company; the Chicago Suburban Light & Power Company, of Oak Park; the Economy Light & Power Company, of Joliet; the Illinois Valley Gas & Electric Company, of Streator; and the Kankakee Gas & Electric Company. The North Shore Electric Company, the nucleus of the system, has been operated for many years under the present management, supplying service to the suburban and industrial regions fringing upon the city limits. The outer borders of the North Shore company's activities at

that time were practically the limits of Cook County, including, in addition to Lake County, major towns in the Wisconsin line.

Up to the present, as shown by our map, the northern and southern transmission systems of the Public Service Company still remain to be united by the completion of the projected link between Park Ridge and Milwaukee, so that in matters of physical operation the two sets of lines are yet

TABLE I.—LOADS OF THE PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

Category	Power	Energy, Kw.
Chicago	22,000	
North Shore		
Chicago Suburban	1,500	
Economy	2,250	
Illinois Valley	2,200	
Kankakee	1,500	
Streator	700	
Streator	700	
Streator	500	
Streator		
Streator		

operated as distinct systems. Actual electrical connection is, however, indirectly established between the two systems by the tie lines connecting the Public Service Company's plants and substations with the Commonwealth Edison Company's system, thus making a unity of the entire interconnected central-station network in the Chicago district.

Electric generating stations situated upon the Public

Service Company's system include the central station which distributes by thirty or more substations. Twelve generating plants, with their ratings, are given in Table I.

In addition to the foregoing, certain smaller plants, the most important of them being located at Evanston, are connected with main lines extending from the North-west and Oak Street substations on the Commonwealth Edison Company. There are also a few small plants on the Evanston system, the most important of which are the Oak Street and Oak Park plants of the Public Service Corporation. These stations at Evanston, Woodstock and Oak Park furnish the power for the

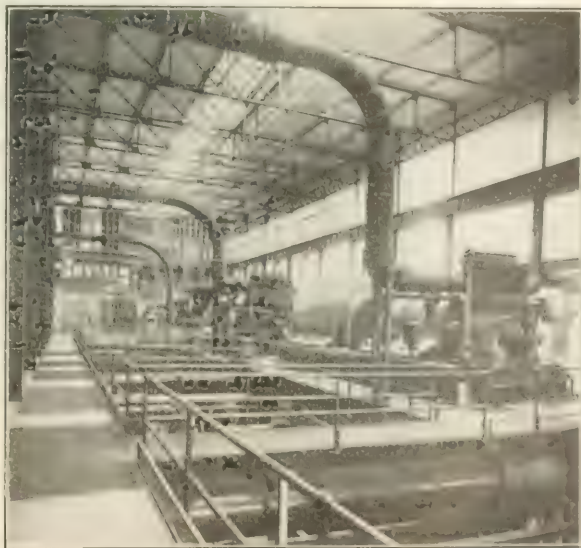


FIG. 1.—INTERIOR OF BLUE ISLAND STATION.



heating service; those at Streator and Pontiac heat with exhaust steam.

#### BLUE ISLAND TURBINE STATION

The principal generating plant of the system is located at Blue Island, Ill., on the bank of the Little Calumet River.

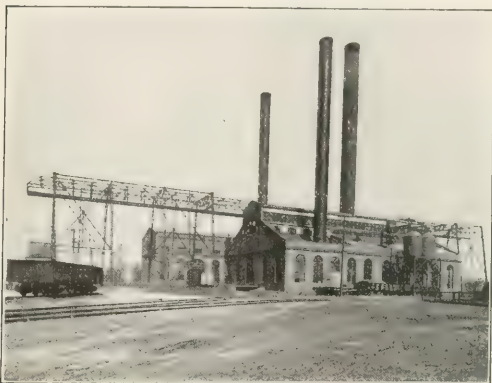


FIG. 2—BLUE ISLAND GENERATING STATION

Erected six years ago with an initial equipment of 3000 kw in steam turbines, the station has since undergone an extremely rapid growth to keep pace with the mounting power needs of the nearby industrial district. With its second 7500-kw turbine unit now being installed, the Blue Island station will shortly have a total rating of 22,000 kw. Its monthly output now reaches 3,500,000 kw-hr., and despite its use as a "swing" station operated along with water-power plants run fully loaded twenty-four hours per day, the Blue Island station daily load-factor is well above 60 and 65 per cent, as shown by the accompanying load curve.

Fuel for this plant is handled by means of a 3-ton telfer grab bucket whose car travels on a runway 76 ft. high. Carried on steelwork this runway passes above the overhead bunkers and extends out of doors for distances of

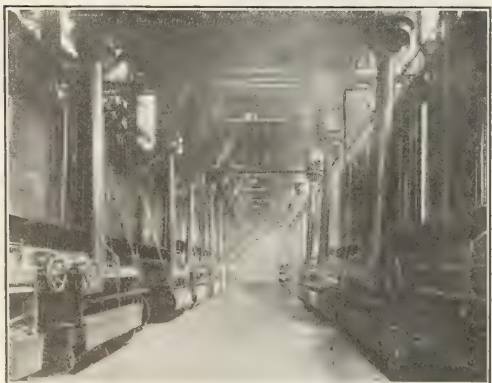


FIG. 3—BOILER ROOM OF BLUE ISLAND STATION

100 ft. over concrete-lined coal-storage pits in a line with the boiler-room building. On the grounds above the station there is storage capacity for 12,000 tons of fuel. From these piles or from the cars a locomotive crane delivers the coal to the crusher. The latter discharges into the concrete pit whose 750-ton capacity would provide fuel for

several days' operation in event of accident to the coal-handling equipment. The 3-ton bucket is handled by a 52-hp hoist motor and a 35-hp travel motor, both three-phase alternating-current machines. The overhead bunkers in the boiler room will hold 1100 tons of the Illinois coal used as fuel at this plant.

For generating steam at 200 lb. pressure per sq. in. and with 100 deg. Fahr. of superheat, the boiler equipment comprises six 500-hp and eight 400-hp Babcock & Wilcox units, all arranged with mechanical stokers. Each boiler is also provided with a steam-flow meter indicating its output at any instant. The flue gases of the plant are carried aloft through three steel stacks, one 260 ft. high and 11 ft. in diameter, the others 190 ft. high and 9 ft. in diameter. Ashes are removed by a Green suction conveyor which delivers to ash tanks commanding a railroad track alongside the building. De Laval and Curtis-Worthington turbine-driven centrifugal pumps are employed for boiler-feed purposes.

The prime-mover equipment at Blue Island comprises a 7500-kw, 4500-volt, 25-cycle horizontal turbine set; a 7500-kw, 12,000-volt, 60-cycle unit in process of being in-

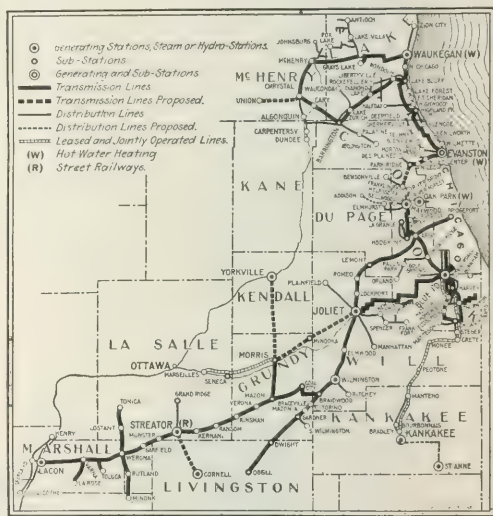


FIG. 4—SYSTEM OF PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

stalled; a 4000-kw, 12,000-volt, 60-cycle horizontal unit and one 2000-kw and one 1000-kw vertical turbine set generating 25-cycle current at 9000 volts. All machines are of the General Electric-Curtis type with the exception of a 100-kw Westinghouse turbine exciter set. Cooling water for the Worthington surface condensers is taken from the Little Calumet River which flows alongside the plant site.

For converting a portion of the 9000-volt, 25-cycle output to 60-cycle energy at 4000 volts for lighting and general power purposes two 2000-kw vertical frequency-changer sets are installed. Part of the transformers which step up to 33,000 volts are of the air-blast type. These are supplied with air through the bus compartments by motor-driven blowers on the main floor, which carry an air pressure of 1.2 in. of water column.

Connecting the Blue Island station with the system of the Commonwealth Edison Company through the latter's Roseland substation there is an 18,000-volt, 25-cycle No. 0 tie cable, as well as a 12,000-volt, 60-cycle tie line which, by throwing over disconnecting switches, can also be made available for 9000-volt, 25-cycle operation. In case of



emergency auxiliary service can be supplied over these lines, although with its present equipment the Blue Island plant no longer depends upon the Fisk and Quarry Street stations for assistance in carrying the load of the southern system. Attempts have also been made to synchronize Blue Island with both Fisk Street and the John plant, the latter being at the time paralleled with the Commonwealth Edison system, but owing to the presence of several frequency-changer sets in the loop thus formed, it has not been possible to bring about such double-paralleled operation without kicking out the circuit-breakers.

The Blue Island turbine station produces a kilowatt hour with a consumption of 4.3 lb. of mine-run Illinois coal, compared with which an average fuel-run economy of 5.7 lb. per kw-hr. is obtained for all the steam plants of the Public Service Company's system. Of these total steam station operating costs, 52 per cent is expended for fuel, 30 per cent for labor and 18 per cent for miscellaneous items.

## WATER-POWER PLANT AT KANEKATTE.

The best hydroelectric-plant practice of the company is exemplified in the recently completed Kankakee water-power plant built as an adjunct to the steam relay station

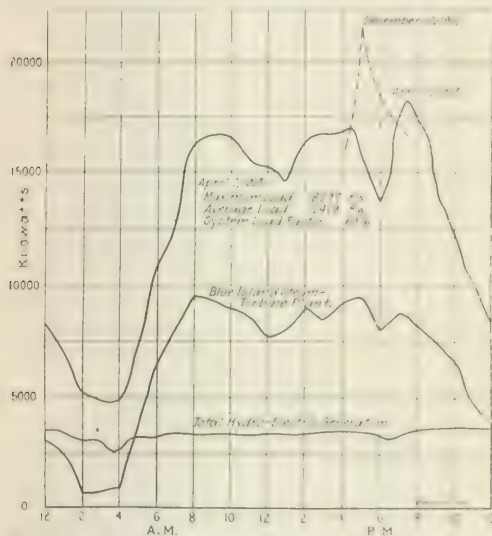


FIG. 5. DAILY LOAD CURVE OF THE BLUE ISLAND GENERATING PLANT AND SYSTEM

In that city, by developing a fall of only 8 ft. in the Kaskaskia River, 600 electrical kw. is here made available through the means of a pair of vertical-shaft waterwheel units which are unusual on account of the very low head and large volume of water to be handled.

Each of these waterwheels comprises a pair of side runners which discharge into separate draft tubes, one below the other. These concrete-lined passages molded in the station foundations measure 9 ft. by 10 ft. in section. The 8.5-in. steel shafts connecting the runners with the rotating field members in the generator room above measure 41 ft. in length. The entire rotating mass, including the shaft, runners and alternate field, weighs 17 tons, the full weight of which is carried by a thrust bearing located just below the generator-room floor. On account of the large quantities of water to be handled in these turbines because of the low operating head, special 12-in. diameter governors capable of exerting effective efforts of 10,000 ft.-lb. were required to control the wickets admitting the supply to the runners. The units operate at 75 r.p.m. The waterwheels were furnished by the S. Morgan Smith Co.

pany and the alternators by the Westinghouse Electric & Manufacturing Company.

In the steam plant following the water-power addition there are installed a single horizontal Westinghouse-Parsons turbine alternator unit and an auxiliary truck engine set. The city of Kankakee is lighted from the



FIG. 6. FURTHER FORM OF THE SECOND STATION.

station, which also transmits energy to Madison, Illinois, Bonnois and Bradley and supplies power for the Chicago & Interurban Traction Company, operating between Chicago and Kankakee.

As shown in the accompanying load curve, the water-power plants of the company are operated at as nearly full load as possible day and night, in this way taking the fullest advantage of the water-power available, while the variations in load are carried by the steam stations. Nearly 50 per cent of the total system output is produced in these water-power plants.

## LORD HENRY JAMES, BARON PLUNKET

The work of first depends on to follow the varying be



FIG. 5. Location of surface recording station.

mands has proved successful. The forest of the southern range of western mountains, however, for the southern system being treated as *total* and thus for the northern system as *Prunus*. These same mountains were entirely in the forest for the forest of western mountains, whereas in the northern range of the southern system, the forest was

operators are at times permitted to exercise their own judgment when necessary if on account of telephone-line interruptions the system dispatcher cannot be reached. With the great territorial extent of the present systems the orders of the dispatcher need not be rigidly depended upon in minor local situations, and in emergencies the local operators must be left free to use their best judgment.

When a switch is ordered opened by the load dispatcher a red warning card marked "Hold" is affixed to the handle. On the back of this blank there is also entered the description of the circuit, name of the employee for whom it was opened, name of the one issuing the order, probable time of completing work, name of operator placing and removing card, dates, etc. When the line is released the card must

specified for the earth connections. Below the top cross-arm the pole is gained for a second arm if needed, and also for a telephone line.

A form of double-arm construction, designated as "type B," is used on other important lines where it is not expected that a second circuit will soon be needed. Each arm carries two pins, one of the upper pins supporting the ground wire, which is earthed as before to buried cylinders. Approximately 3-ft. distances are preserved between conductors. In some instances this type of construction has been temporarily employed for 2300/4000 or 4600/8000-volt distribution, the ground wire being used as the neutral of the four-wire circuit. Such lines can later be converted to 33,000-volt operation when needed as a part of the main transmission system. This 4600/8000-volt plan of distribu-

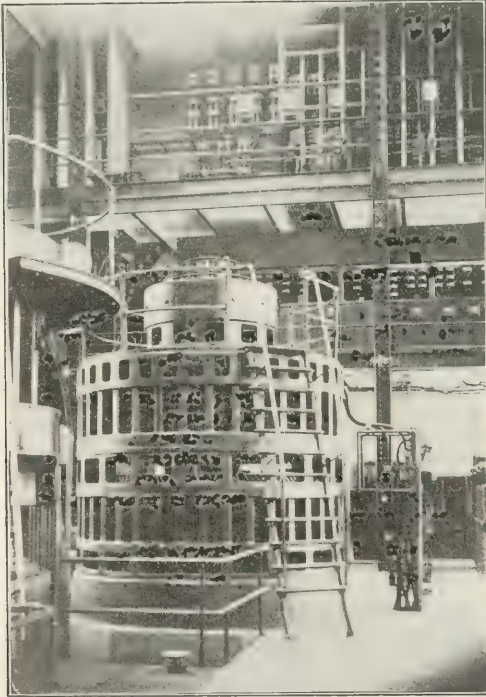


FIG. 8—VERTICAL FREQUENCY-CHANGER SET IN BLUE ISLAND STATION

be mailed to the load dispatcher, who indorses and files it as a complete record of the interruption.

#### TRANSMISSION-LINE CONSTRUCTION

For the southern system 33,000 volts has been adopted as the standard transmission pressure. The same specifications are being extended to all new construction on the northern system, although this group is now being operated at 20,000 volts, with a number of 4600-8000 volt four-wire subsidiary circuits. The main 33,000-volt lines employ No. 2 copper, while branch circuits have been built using No. 4. Poles are set forty-four to the mile, 30-ft. timbers or longer ones, with 7-in. tops, being the standard.

Between main generating stations the "type A" trunk-line construction employed as the standard provides for carrying one or two circuits, each in its own plane, on a 10-ft. cross-arm. Between conductors 3-ft. intervals are maintained. A bayonet angle supports the overhead ground wire, which is earthed at every fifth pole with a conductor of the same size as the line wire. Ground cylinders are

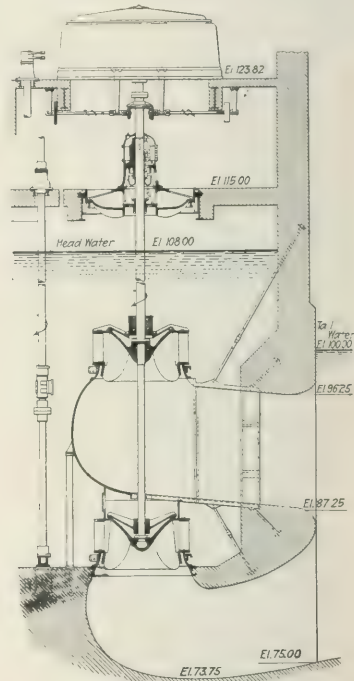


FIG. 9—SECTION THROUGH DOUBLE-RUNNER UNIT AT KANKAKEE, ILL.

tion is found to be of special convenience, however, in avoiding the necessity for substations at the smaller points, since regulators may instead be installed at nearby stations already in service. In such cases 4600-volt distribution transformers are sometimes employed, although it is usually necessary to install first-line transformers of two-to-one ratio to step down to the standard distribution pressure of 2300 volts.

The company's "type C" construction for branch-line use where limited investment is justified utilizes a single 4-ft. arm for carrying the two lower conductors, with the third wire mounted on the peak of the pole.

Wherever possible the transmission lines follow railroad rights-of-way, the poles being set several feet over the property line on the ground of adjoining farms by agreement with the owners. For patrolling the lines good use is made of gasoline "speeders," of which the company has several. These little "automobile hand cars" run on the standard-gage tracks and make good time while carrying a full crew and complete line-repair equipment.



It is the plan ultimately to complete cross-connecting lines between the present radial transmission circuits which have naturally branched out from the main centers of distribution. In this way all towns will be put on transmission loops so that in case of breakdown in one direction the second line will be available for service. Already, as the map shows, the work of closing in these tie lines has pro-



FIG. 10—WATER POWER PLANT AT JOLIET

ceeded to a point where probably half the communities which are reached by the transmission lines have at least two alternative sources of supply.

#### SUBSTATION STRUCTURES

A number of handsome and serviceable substation buildings have been erected by the Public Service Company to house its transforming apparatus at the larger distribution points. The substation at Lake Bluff, for example, cost \$19,000 for the building alone and is of undoubted architectural merit. But before this point was finally selected as a distribution center a temporary substation was first erected near by at a cost of \$125 to give the location a thorough trial. In planning this temporary wooden building the architect was instructed to embody a design of minimum expense for substation purposes with a house that could be later converted into a cottage for the operator in case a permanent station structure was decided upon.



FIG. 11—DOUBLE DISCHARGE TUBES FOR KANKAKEE PLANT

For two years the little building served its purpose as a substation, meanwhile demonstrating the fitness of the location as a distributing point. The present handsome brick, concrete and steel building (Fig. 15) was then put up, and the temporary structure was moved back and a room added, making it into an attractive little cottage for the operator.

The substation building at Chicago Heights (Fig. 19) is of a similar design and illustrates a case of the replacement of a former generating station house and converted into a warehouse. The substation now supplies the service which was formerly generated in the old steam plant.

In the larger substation installations aluminum-cell light-



FIG. 12—POLE-LINE POLES ON TRANSMISSION LINE

ning apparatus protect the high-tension lines, but in the case of the outdoor pole platform transformers, consisting of which there are a great number serving small communities, the electrolytic cells are disposed with the usual horn-gaps need being avoided through burning. Both airblast and self-cleaning oil-cooled transformers are employed as standard equipment for these stations. Where possible, as already intimated, such indoor substations are made automatic regulating units for several nearby towns fed over good power-line lines. Both induction type and auto-transformer type of regulator apparatus are employed for this voltage control.

#### OUTDOOR TRANSFORMING MAINTENANCE

To avoid the investment in substation buildings for serving small communities a type of out-of-door platform mounting has been developed for carrying transformers up to 75 kw in rating. An accompanying maintenance shed



FIG. 13—WATER INTAKE LINE AT KANKAKEE

clearly the arrangement by which the high-tension line is tapped through primary distribution lines and the secondary circuits fed off. Another picture shows a pole distribution of these lines S. & C. This will have been met with success on the line of the Northern Illinois company, experimental installations having now been in service for a number of months. The base link is held in tension by



spiral springs, the whole being inclosed in a glass tube filled with carbon tetrachloride.

One of the determining factors in the selection of 33,000 volts as the transmission-line potential was the economical use of transformers as small as 25 kw for furnishing service to small communities. In such towns having loads around 100 kw the drop over 10 miles of line will be so

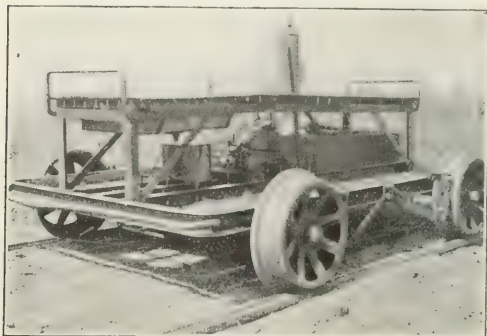


FIG. 14—RAILROAD SPEEDER USED FOR LINE MAINTENANCE

small as to render unnecessary the use of regulating apparatus.

#### OPERATING ORGANIZATION OF STAFF

For purposes of operation the territory reached by the lines of the Public Service Company of Northern Illinois is divided into four divisions and thirteen districts, each of the latter being designated by a letter which is in several cases the initial of the principal town. Each district is in charge of a district superintendent who maintains an office in the largest community, and to him are detailed his district salesmen, inspectors, etc., by the departmental heads. The four division superintendents act also as district superintendents for their own districts, receiving in addition reports from superintendents of the several other districts for which they are held responsible. The total number of the company's employees in all departments at present reaches 1500.

All matters of plant and substation operation and con-



FIG. 15—LAKE BLUFF SUBSTATION AND TEMPORARY STRUCTURE

struction are in charge of the general superintendent of the company, who has his electrical and engineering assistants to give specialized supervision to the work. By this arrangement the local superintendents are relieved of authority in connection with station operation, which is the province of the operating department, although the superintendents do have charge of maintaining the transmission

and distribution lines in their territories up to the substation entries.

At district headquarters and in towns where the business warrants it attractive offices are maintained, usually including a display of electrical appliances. In smaller communities arrangements are made with a local druggist or other merchant, who receipts for bills and exchanges lamps on a commission basis or for a fixed sum per month, usually credited on his lighting bill. Minor repairs and replacements of fuses are handled by the local electrician or by one of the company's own men dispatched by motorcycle from the district headquarters.

#### EMPLOYEES' WELFARE AND SAFETY WORK

Every candidate for employment by the Public Service Company, whether a prospective office, station or outdoor worker, is required to undergo a physical examination at the hands of the company's physician. This examination is in general similar to that demanded by life-insurance companies and has as its purpose not only to determine the applicant's fitness for the work but also the protection of fellow-employees against infection of disease.

At intervals employees receive instruction and demonstrations in resuscitating persons from electrical shock.

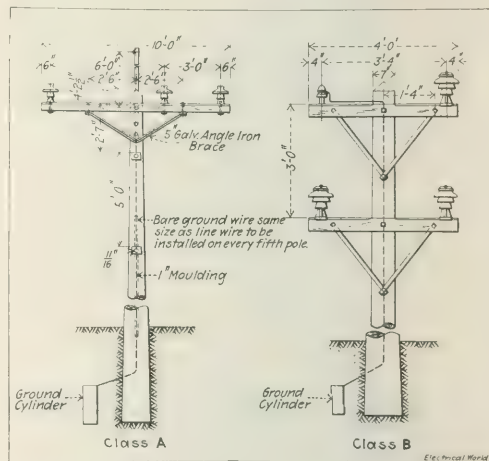


FIG. 16—MAIN AND BRANCH LINE CONSTRUCTION

Such dangers are also minimized as far as possible in the company plants, it being the duty of a special inspector to visit regularly the various stations and to recommend improvements conducive to personal safety.

All charged parts carrying 440 volts and higher are screened, while bus-pipe structures, transformer and apparatus cases, machine frames, etc., are all securely grounded. Guards are placed about flywheels and counter-sunk set screws are required on all shafts. Removable railings are set up to guard dangerous positions, their pipe standards dropping into sockets permanently embedded in the concrete floor.

Accidents that have occurred in the company's own stations and elsewhere are studied and the lessons to be drawn are applied to safety improvements. For example, all downspouts on substation structures have now been thoroughly grounded following a serious accident in which a gutter became crossed with a line wire. Oil switches are recommended for all purposes above 440 volts, and fuses are being inclosed in flash-proof covers. The use of rubber gloves, linemen's protectors, etc., is insisted on whenever lines have to be handled "hot." Lines opened for men to work in dangerous positions have red cards attached to the

switch handles, explaining the purpose of the interruption and by whom it was ordered. When the switches are finally ordered closed these cards are mailed in to the chief dispatcher, furnishing him with a complete record of the incident. Rubber mats are laid in front of all switchboards carrying 440 volts or higher, while such boards in the older plants having insufficient clearance at the rear are

& Interurban Traction Company's Chicago-Kankakee line, the Chicago & Joliet Electric Railway, the Joliet & Southern Traction Company's line from Joliet to Aurora and to Chicago Heights, the Kensington, Joliet & Joliet Electric Railway Company's line from Joliet to O'Fallon and the Streator city system which the Public Service Company itself owns.



FIG. 17.—SUBSTATION AT BARRINGTON, ILL.



FIG. 19.—CHICAGO HEIGHTS STEEL PLANT AND SUBSTATION

inclosed in order to prevent use as a passageway by careless persons.

The safety inspector gives talks on the subject of accident prevention before district meetings, illustrating his remarks with lantern slides. Addresses on the same topic have also been presented before the Public Service Company's section of the National Electric Light Association, which has an enrollment reaching 130.

The industrial applications of motor service from the interconnected system are both varied and extensive, ranging in character from steel making and fabrication to amusement park operations. Among the large mill and factory customers more than 100 are the following, with their connected loads, the latter reaching as high as some instances and making a striking total.

*Iron and Steel Industries—American Brake Shoe &*



FIG. 18.—ELECTRICALLY OPERATED STONE CARS IN QUARRY

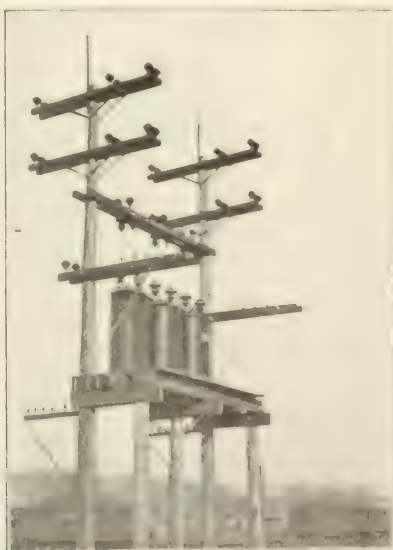


FIG. 20.—UTILITY POLE

Of the 81,125 kw of total connected load on the lines of the Public Service Company of Northern Illinois, 38,732 hp is in motor load and over 400 in rotary converters supplying interurban railways.

Besides furnishing energy to operate about one-half of the 70 mile Chicago-Milwaukee interurban line, the company supplies practically all the power needs for the Chicago

Copper Company, Alton, Pa., and Ep. Warehouse, McKenna, Wis.; American Lumber, Joliet, Ill.; Am. & Canadian Harbors, Inc., Chicago; Marquette, Quincy, Quincy, Niles, Chicago; Chicago, Edgar Allen, Southern, Milwaukee and Chicago; Chicago Heights, Inc., and Franklin Park; Quincy, Quincy, Quincy, Pa., and Ep. L. G. Rogers, Ill.; J. C. Co., Joliet, Joliet & Joliet Company, Joliet, Ill.



Joliet Rolling Mill Company, Joliet, 297 hp; King & An-drews Company, Chicago Heights, 140 hp, and Mark Manufacturing Company, Evanston, 1500 hp.

*General Manufacturing.*—American Straw Board Company, Wilmington, 450 hp; Barrow Lock Company, Lockport, 150 hp; Bray & Kates Company, Arlington Heights, 165 hp; The Buda Company, Harvey, 300 hp; Central Loco-

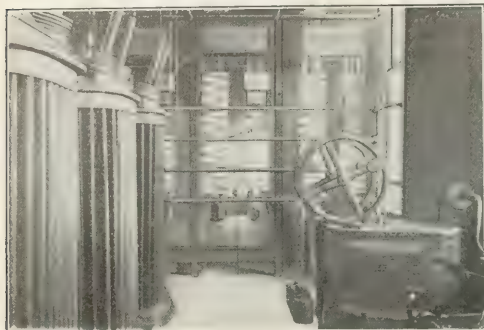


FIG. 21—SAFETY PRECAUTIONS IN GUARDING LIGHTNING ARRESTERS, REGULATOR AND TRANSFORMERS

motive & Car Works, Chicago Heights, 500 hp; Cyclone Fence Company, North Chicago, 125 hp; the Forsyth Brothers Company, Harvey, 300 hp; Gerlach-Barklow Company, Joliet, 171 hp; Illinois Iron & Bolt Works, Carpenterville, 150 hp; Ingalls-Sheppard Forging Company, Harvey, 155 hp; Mears-Slayton Lumber Company, Evanston, 120 hp; National Match Company, Joliet, 228 hp; Quaker Oats Company, Joliet, 136 hp; Streater Metal Stamp Company, Streater, 164 hp; Victor Chemical Company, Chicago Heights, 600 hp; Wilder-Manning Tanning Company, Waukegan, 382 hp.

*Miscellaneous.*—Chicago, Rock Island & Pacific Railway shops, Blue Island, 600 hp; Elgin, Joliet & Eastern Railway shops, Joliet, 450 hp; Forest Park Amusement Company, Forest Park, 134 hp; Green & Sons, Palos Park, 500 hp; A. Groth & Company, Joliet, 157 hp; Illinois & Michigan Canal, Bridgeport, 600 hp; Illinois Valley Coal Company, Sparland, 160 hp; Jos. Joseph & Brothers Company, Chicago Heights, 150 hp; Midlothian Country Club, Midlothian, 150 hp; Society of the Divine Word, Techny, 206 hp; United Car Company, Chicago Heights, 130 hp; United States Equipment Company, McCook, 100 hp; Vulcan Louisville Smelting Company, North Chicago, 155 hp.

#### STONE QUARRY AND GRAVEL-PIT OPERATION

Several of the characteristic long-hour applications of central-station service in the Chicago suburban district result from the peculiar geological formation of this region, where in ages past the retreat of the glaciers deposited upon the underlying blue-white stratified limestone thick surface beds of sand, gravel and clay. With active building operations always under way in Chicago, great quantities of brick, crushed rock, gravel, sand, etc., are required, and in the handling and preparation of this material electric drive has now largely replaced steam power.

Among the brick and clay-product manufacturers who use Public Service power are the Acme Brick Company, Chicago Heights, 250 hp; Illinois Shale Tie Company, Coal City, 175 hp; W. E. Pratt Manufacturing Company, Joliet, 280 hp, and Whiteacre Fireproofing Company, Chicago Heights, 300 hp.

Another important industry in this region is the production of crushed stone, an application of motor-drive which provides long-hour loads for the central station. One of the largest of these plants is that of Dolese & Shepard,

located near the Chicago Drainage Canal at Hodgkins, Ill. The company has a connected load of 2660 hp. Among the interesting applications of motor drive at the Dolese & Shepard plant is the operation of a number of electric stone cars which are controlled from the tower seen in the illustration, Fig. 18. Other large users of central-station energy in the stone industry are the Chicago Contractors' Supply Company, Joliet, 250 hp; Chicago Union Lime Works Company, McCook, 480 hp; Federal Stone Company, La Grange, 335 hp; Illinois Stone Company, Lemont, 345 hp; Michigan Central Railroad, Joliet, 380 hp; O'Laughlin Stone Company, Bellwood, 435 hp, and the Wabash Railroad Company, Richie, 175 hp.

Owing to its seasonable demand, the electric operation of the many sand and gravel pits which abound in the Chicago region affords desirable day business during the spring, summer and fall months. The following is a list of some of those now operated from the lines of the Public Service Company: American Sand & Gravel Company, Carpentersville, 140 hp; Joliet Sand & Gravel Company, Joliet, 325 hp; Joliet Sand & Gravel Company, Plainfield, 190 hp; Knickerbocker Ice Company, Fox Lake, 180 hp; Lake County Gravel Company, Libertyville, 105 hp; Lake Shore Sand & Gravel Company, Algonquin, 130 hp; Reinert Brothers, Algonquin, 140 hp.

The equipment of the Reinert pit at Algonquin (Fig. 24) is one of the most modern installations in the local field. The mixed gravel as quarried is passed through a crusher driven by a 50-hp motor and is then elevated by the 50-hp motor-driven inclined conveyor to the revolving screens, where after being washed it is separated into three sizes. The pump which circulates the supply of water between the settling tank and washer is driven by a 30-hp motor. All of the motors are three-phase, 440-volt machines and are manipulated from a control house near the foot of the conveyor. This washing and screening equipment is capable of handling forty carloads of gravel per day and has loaded fifteen carloads in four hours. The pit is started up about the first of April and is run until the end of October, operating daily from 7 a. m. to 6 p. m.

#### TOWN WATER SUPPLY PUMPING

From the standpoint of a long-hour load in suburban residential districts, an interesting aspect of the company's

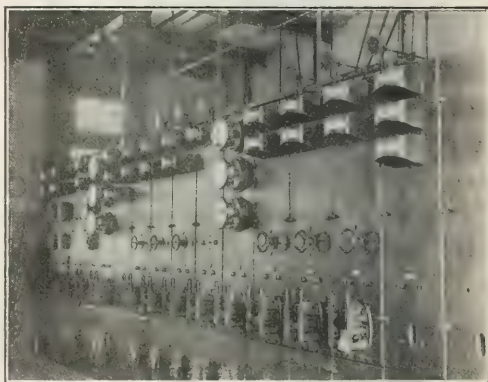


FIG. 22—SWITCHBOARD IN BARRINGTON SUBSTATION

service has been the development of town water-works pumping, which affords extremely desirable off-peak business. The water supply for more than thirty of the communities in the company's territory is now being pumped electrically with central-station energy.

Among the towns thus served are Antioch, Crystal Lake, Palatine, Cary, Lake Zurich, Fort Sheridan, Barrington,



Lake Bluff, Park Ridge, Franklin Park, River Forest, La Grange, McCook, Lamont, Harvey, Flossmoor, Chicago Heights, Steger, Joliet, Crete, Wilmington, Coal City, Braidwood, Bourbonnais, Kankakee, Dwight, Odell, Lacon and Chillicothe. At Joliet the city pumping load in three plants totals 500 hp. The Oak Park station has 220 hp in motors.

In some of these instances the Public Service Company owns and operates the water-works systems, as is the case at Harvey, La Grange, Chillicothe and elsewhere. In other places it furnishes both the electrical energy and the operating service, in this way keeping control of the hours of pumping so as not to conflict with its electrical peaks. Where standpipes are installed as the company recommends pump operation can be shut down during the hours of light load and water supplied from the reservoir. By itself supervising the pumping plant the company is able to maintain the equipment in better shape and thus to secure higher operating efficiencies.

A kilowatt-hour rate for energy supplied is regarded as the most desirable for this class of pumping business, since contracts taken on the basis of gallons pumped are likely to result in variable returns depending on the level of the water in the wells, condition of machinery, etc.

For its pumping service the company's rate to municipalities averages from 2.5 to 3 cents per kw-hr., although some contracts have been taken on a delivery basis of about 5 cents per 1000 gal. pumped, the company to have supervision of the pumping plant.

In most of the cases cited the company has converted former steam-driven water-works plants to electrical operation, but in some instances it actually promoted water systems in new communities that were formerly without modern conveniences. Following upon the heels of such an initial improvement, there is usually noticed a quickened civic spirit in the community, and shortly, it is said, pavements, street lighting, etc., take their place along with the electrically operated water-works. In several such cases the reduction in insurance rates following the introduction of a water-works system has more than paid for the cost of the latter's operation.

#### ELECTRICITY FOR LIGHTING IN SUBURBAN DISTRICTS

The standard schedule of rates for lighting service throughout the company's territory is 14.5 cents per kw-hr.



FIG. 23—SUBSTATION AT MAZON

for the first thirty hours' use of the maximum and 8 cents per kw hr. thereafter. For prompt payment within ten days, however, a discount of a cent per kw hr. is allowed, making the net rate 13.5 cents and 7 cents per kw hr. Free installations and free renewals of carbon lamps are made, while proportional credit is allowed on tungsten units at 25 watts and more.

Maximum demands to be employed in applying the rate schedule are usually estimated on the basis of the customer's total number of connected sockets, using multiplying factors given in a booklet furnished employees. If desired, the company will, however, install a maximum-demand meter, accepting this reading as the highest rate of consumption during the month.



FIG. 24—ELECTRICITY OPERATES SAND AND GRAVEL PIT

For the convenience of customers, an emergency service is maintained for making minor repairs, troubleshooters being dispatched to replace fuses, repair sockets, mend cords, etc. This service is all without cost to the customer, unless there is considerable outlay for material. Motors, of which the company has nearly 1000 in addition to an equal number of automobiles, are found at great service for conveying the troubleshooters about their districts.

On the basis of its twenty-four months to pay house-wiring offer, many new residence users are being added to the company's lines. The wiring job is preferably turned over to a local contractor, although the Public Service Company is itself equipped to install wiring if satisfactory work cannot be obtained from outside tradesmen. By means of a unit outlet schedule the cost of wiring can be estimated very closely in advance. If the customer elects to take advantage of the plan of twenty-four monthly payments, the company pays the contractor 90 per cent of the full estimated figure on completion of the work, itself carrying the account until the property owner has paid up the balance at the end of two years. Where available, the services of local contractors are, as already mentioned, utilized for making minor free repairs for customers, answering questions, exchanging lamps, etc.

Besides advertising in 110 local newspapers, the commercial department of the company conducts aggressive development campaigns by sending letters sent to prospective and present customers.

#### APPLICATION OF ELECTRICITY IN RURAL DISTRICTS

In the rich farming and grazing lands of McHenry, Lake and Cook Counties surrounding the Public Service Company's district headquarters at Crystal Lake, the distribution of electricity for farm use has been carried out on an unusual scale. This feature has certainly been a great benefit to the farmers, who have been supplied with electric power from the Southwestern Power Co. plant near the countryside in that county. The total installed load aggregates 100 hp in single phase motors and 2200 kw-hr. equivalent in lamps. Besides the practical agriculturalists of the region, there are a number of fine country estates in the neighborhood where their lighting and power demands to the hitherto rural lands along the transmission network.

Exclusive of the use of electricity for lighting purposes, the greatest power application in these farms is the motor

drive of pumps for farmhouse supply, watering stock, etc. All motors are of the single-phase type and none exceeds 10 hp in rating. Every farm customer in this region has an electric iron and many of them have motor-driven washing machines and vacuum cleaners. Motors are used to drive feed grinders, bone mills, milking machines, mangles, lathes, refrigerating outfits in dairies and other farm ma-

lines show a distinct pre-dawn peak due to the lighting of houses and barns incident to early morning chores. For these dark months the farm lighting bills may average several dollars, but in the summer they sometimes barely exceed the 50-cent minimum. Taking at random, a few farm lighting and power installations in this district, the ranges of energy consumption per month recorded during



FIG. 25—MOTOR-DRIVEN WATER-WORKS PUMPING PLANT AT MORRIS, ILL.

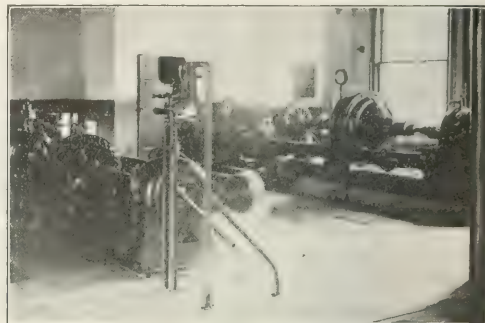


FIG. 26—MOTOR-DRIVEN PUMPING STATION OF LA GRANGE, ILL., WATER WORKS

chines. Five rural customers in this district have complete electric ranges.

The mistress of a fine country estate, 4 miles from the nearest town and 25 miles from a paved street, makes almost daily use of an electric brougham in which she journeys back and forth to town over roads and hills that would discourage many drivers of touring cars. Her garage is completely equipped with a rectifier charging outfit. She declares herself to be well pleased with her electric vehicle, which is less troublesome to make ready and use than to hitch up a horse or to drive a gasoline car the distance to town.

Rural customers obtain the benefit of the same schedule of rates for lighting and power purposes received by the company's consumers in town. The standard lighting rate is 13.5 cents net per kw-hr. for the first thirty hours' use of the maximum and 7 cents per kw-hr. thereafter, if paid within ten days of date of bill; otherwise the rate is 14.5 cents and 7 cents.

Although with the aid of motorcycles the farm meters are read monthly in summer, during the winter months when the roads are bad the inspector gets around only once in three months. On these infrequent occasions, however, he leaves with the customer a supply of meter-dial post cards on which the farmer at monthly intervals copies down the meter pointer positions, mailing the card to the district office. Unless in evident error, this reading is taken as the regular meter indication for the period covered and the customers are billed accordingly. If the farmer has clearly set down a wrong position, the reading is discarded and he receives a maximum bill for that month, with a note to the effect that at a later call the inspector will check his observation and a corrected bill will be rendered. The reports received from the farm users are, however, usually quite dependable. This class of customers has been found, furthermore, to be thoroughly responsible, and business with them involves no possibility of bad debts. The average farmer, it is also of interest to note, will agree cheerfully to a service proposition stated as "\$24 a year," whereas he would view with alarm a similar proposal to pay \$2 a month.

#### DATA ON FARM OPERATIONS

Owing to his early hours for rising and retiring it will have to be admitted that the farmer is not a very good lighting customer, although in the winter months the local

the year are shown in Table II, printed in this column.

As another example, one dairyman customer of the electric company by operating his 10-hp, 10-in. grinder half an hour a day chops enough feed for his fifty head of cattle. At an equivalent rate of 7 cents per kw-hr., he pays about \$14 a month for this service, which is less than the mill in town formerly charged him to grind the same quantity of food. His net saving in other directions includes the wear and tear in driving a team 3 miles to town and the time lost in waiting at the mill. In his own words, he can now grind a full supply in the time formerly required to load his wagon and hitch up the team. Moreover, this trip to the mill had to be taken during the daytime, whereas the grinding can now be completed during any half-hour at night. Without further handling the chopped food is thus delivered directly to the feeding bins.

Motor drive for silage cutting and filling also saves much work for the farmer. One farm customer near McHenry

TABLE II—MONTHLY RANGE OF ENERGY CONSUMPTION

	Kw-hr.
Lighting only, twenty-eight lamps.....	9 to 20
Lighting only, twenty-nine lamps.....	29 to 45
Lighting only, nine lamps.....	3 to 23
5-hp feed grinder.....	10 to 25
10-hp feed grinder.....	20 to 80
10-hp grinder and 2-hp milker.....	200 to 250
2-hp milker, 5-hp dairy and 10-hp grinder.....	250 to 500

filled his 175-ton silo with 180 loads of corn in sixty hours at an expenditure of 215 kw-hr. This energy, billed at \$15.85, made the net cost to him 11.5 cents per ton. A 7.5-hp, 220-volt, single-phase motor performed the work.

No difficulty seems to be experienced in getting farmers to use service; the trouble has rather been to convince those too far distant from the lines of the expense of reaching them. Where the farmer agrees to defray the cost of making the extension, the amount of his outlay will be credited to him in the form of receipted electric bills every alternate month until covered, although he pays, of course, the regular charge during the other months.

For 2300-volt farmer-line extensions No. 6 copper wire is used, carried on 20-ft. poles set at intervals of 100 ft. to 125 ft. The cost of such construction ranges about \$750 a mile. Meter and transformer are furnished free of charge by the company, exactly as in the case of a town



customer. For safety the neutrals of all farm secondaries are grounded at the poles next to the transformers. When taps are taken from the 8000-volt lines Matthews pole-type switches are mounted just ahead of the transformers so that the customer's branch can be completely "killed" in case it is necessary to insert fuses or work on the lines.

The operation of automatic electric signals on steam railroads appears to be a relatively new application for energy tapped from rural transmission lines and one that will undoubtedly grow in importance by the double reason of its long-hour consumption and its political aspects when routing transmission lines over or alongside of railroad rights-of-way. Many signal systems are now using 60-cycle alternating current which can be conveniently furnished directly from the central-station lines. The Northern Illinois Company is already supplying energy to operate signals on more than 100 miles of one of the railroads traversing its territory.

The difficulty heretofore has been to assure continuity of signal service in case of transmission-line failure. A plan is now being developed to feed the signal circuit at a number of points 20 to 30 miles apart from different power lines, equipping each such feeding point with a no-voltage release switch, which on failure of the local source of supply will close bridging over to the next energized section.

Such railroad signaling service of the closed track-circuit type consumes from 0.25 kw-hr. to 0.50 kw-hr. per hour per mile of track and is practically a twenty-four-hour load, continuing as it does more than 8000 hours a year.

#### THE RESULTS OF CONSOLIDATED OPERATION

In the territories reached by the Public Service Company actual experience in replacing local plants with centralized generation and distribution has shown that while the investment outlay for the transmission lines and stations needed will be perhaps double that of the former local plants, the resulting economies of operation are such as to leave a very large saving per kilowatt-hour produced, after paying the charges on the additional investment.

Not only do both customer and operator benefit from the reduction in unit costs, but group operation makes available twenty-four-hour service of urban quality in com-

munities where such a supply would be wholly out of the question under any other conditions. Again, for all branches of the industry there is assured a local development and diversity of electrical uses quite impossible under any plan of independent operation of small plants.

In general, the local generating stations that have been acquired and shut down by the Public Service Company were of types common among towns of this size. They were turning out their limited productions at costs of from 2.9 cents to 8.6 cents per kw-hr., the averages being in the region of 6.6, 6.2 and 5.5 cents per kw-hr.

One 100 kw steam plant furnishing 225,000 kw-hr. per year in a town of 1000 inhabitants expended \$1,723 per year for coal and \$1,501 for labor and other items, so that its fuel cost represented 85 per cent of its total \$3,224 annual expense. In this case, however, the low unit cost of 2.9 cents per kw-hr. was largely due to the excellent load-factor resulting from water pumping.

On the other hand, a certain 60 kw gas-engine plant supplied its community of 700 population with 45,000 kw-hr. at a unit cost of about 5 cents per kw-hr. Here the \$337 outlay for coal (at \$6.75 per ton) represented only 15 per cent of the total cost, \$2,227, after having added the \$1,771 required for labor and other items. Another producer plant in a town of 1100, but supplying practically the same output as the foregoing example, showed a unit cost of 8.6 cents per kw-hr. Its fuel cost was but 23 per cent of the total expense of operation, indicating again that the low fuel expense of this type of plant is not to be taken too optimistically in estimating what the total cost of operation is likely to be.

Many of these old plants were in poor condition and most were so badly overloaded that in case of accident to a machine it was necessary to drop part of the load. For a total rating of 475 kw in the group of stations referred to later the maximum load reached 415 kw. Few were being operated at a profit, and for most of them no further funds were in sight for extensions and repairs. One station, for example, was acquired for a consideration of \$1 and the assumption of the mortgage that hung over the property. The last remaining boiler of another plant blew up two days after the substation which replaced it had gone into commission. At the time of its failure the steam plant was being held in service only as an auxiliary while some final line changes were under way, but fortunately no damage or interruption resulted.

The effect of consolidation in improving load-factor conditions in even so small a group as three or four stations was also well exemplified when several plants near Elmhurst,



FIG. 27—ONE TYPE OF ELECTRIC MILKING MACHINE USED IN MODERN DAIRIES



FIG. 28—TOWN OF ELMHURST, ILL., ONE OF A GROUP OF TOWNS FROM N. ADAMS STREET

munities where such a supply would be wholly out of the question under any other conditions. Again, for all branches of the industry there is assured a local development and diversity of electrical uses quite impossible under any plan of independent operation of small plants.

In general, the local generating stations that have been acquired and shut down by the Public Service Company

were of types common among towns of this size. They were turning out their limited productions at costs of from 2.9 cents to 8.6 cents per kw-hr., the averages being in the region of 6.6, 6.2 and 5.5 cents per kw-hr.

Some of the results of better unified operation are per-



haps best shown by the figures given in Table III, which are taken from the Lake County region north of Chicago. This territory in 1910 had seven separate steam generating stations serving as many communities. Electric service is now, however, available in twenty-one communities, the energy being generated in the Waukegan plant of the Public Service Company and distributed by two substations.

In the two-year period during which consolidation of the

of \$368 per kw, or more than double the former outlay. This investment was divided as follows: Transmission lines, 50 per cent; generating apparatus, 32 per cent; substation equipment, 18 per cent.

The investment for this centralized distribution has involved a fixed charge of \$32,591 per year, or 1.83 cents per kw-hr. delivered. Adding to this capital charge the operating cost of 1.16 cents per kw-hr., the total present cost

TABLE III—DATA ON INTERCONNECTED OPERATION

Year	Population	Customers	Maximum Kw	Load-Factor, per Cent	Kw-hr. at Local Stations	Kw-hr. at Waukegan	Cost of Coal	Tons Coal	Lb. Coal per Kw-hr. at Plant	Substation and Station Cost	Station Cost per Kw-hr., Cents	Cost of Coal per Kw-hr., Cents
1910 .....	10,500	943	415	14.6	532,782		\$10,862	5,431	20.4	\$29,087	5.46	2.04
1912 .....	16,300	2,047	793	25.6	1,777,427	2,437,451	10,850	5,606	4.6	20,563	1.16	0.61

local properties was taking place it will be noted that while the population increased 50 per cent the number of new customers added was nearly 150 per cent. The maximum demand for all this additional connected load rose, however, barely 90 per cent, for, owing to diversity, the load-factor was nearly doubled. The consumption also more than tripled, indicating that the individual customers were using more service than before.

By a curious coincidence, the fuel cost of producing all this increased output was practically identical with the earlier fuel expense, although a dollar's worth of coal was now generating three or four times as much electricity as under the conditions of independent operation. Owing to purchasing advantage the coal was also bought at a lower price.

The fuel economies obtained by the small generating stations ranged from 16 lb. to 27 lb. of coal per kw-hr., the average for the seven plants being 20.4 lb. per unit, as noted. At the Waukegan station a generating efficiency of 4.6 lb. per kw-hr. is the rule, showing a saving in fuel cost of 1.43 cents per kw-hr. Nearly \$9,000 per year was also

becomes 2.99 cents. The production cost under the former conditions was made up of the operating expense, 5.46 cents, plus 0.83 cent for the fixed charges, making 6.29 cents per kw-hr. The net saving of group operation, including consideration of the extra investment involved, has therefore been 3.30 cents per kw-hr. for the territory referred to.

#### STATISTICS AND OFFICERS

The Public Service Company of Northern Illinois is capitalized at \$15,000,000. The recent report of the president showed a gross income of \$4,230,021 for the fourteen months ended Dec. 31, 1912. Of this amount, \$1,861,567 represented net earnings. As noted elsewhere in this article, the company serves nearly 150 communities with an aggregate population of 500,000. Its total connected load is 81,125 kw, of which 38,732 hp is in motors and 6100 kw in railway rotary converters. Its employees number 1500. For the year 1912 the company's income per connected kilowatt was \$38, total, or \$28 exclusive of street lighting. The yearly income per kilowatt per capita was similarly \$7.50, or \$5.50 not including street lighting.



FIG. 29—JOINT USE OF POLES



FIG. 30—VOLT BRANCH LINE FOR TWO FARM CUSTOMERS

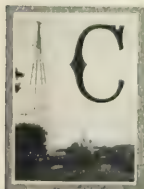
saved in station costs. In operating expense combined operation thus saved the difference between 5.46 cents and 1.16 cents per kw-hr., or 4.30 cents per kw-hr.

The investment in the seven old stations, which had an aggregate rating of 475 kw, averaged \$178 per kw. To shut these plants down and carry the same territory from the Waukegan generating station required an investment

The officers of the company are: President, Mr. Samuel Insull; vice-presidents, Messrs. Frank J. Baker and Charles A. Munroe; assistant to the president, Mr. John F. Gilchrist; secretary and treasurer, Mr. John H. Gulick. Mr. George H. Lukes is general superintendent, Mr. J. G. Learned is in charge of commercial development, and Mr. J. L. Hecht is mechanical engineer.

# Commercial Development Under Group Control

**Acquisition of new lighting and motor business by properties in northwestern Illinois following consolidation into system of the Illinois Northern Utilities Company**



COMMERCIAL development of an interesting kind has followed on the heels of group administration of the score of electric properties in Northwestern Illinois composing the Illinois Northern Utilities Company's system. Within less than a year of consolidated operation and sales effort, a thousand houses have been wired and connected up for central-station service in this territory,

while in the same period the additional industrial motor load contracted for has aggregated 2500 hp.

Apart from the other varied aspects of group operation which it illustrates, the case of the Illinois Northern Utilities Company has particularly shown the extent to which the lighting and power demands of an existing field can be increased by modern commercial methods. For here the specialized cultivation possible with a centrally organized and carefully directed, although not expensive, sales force has achieved results in intensifying local consumption far beyond anything ever accomplished under the former conditions of independent operation.

## PUBLIC CONFIDENCE AS AN ASSET

Nor will the local commercial department—modest as it has been successful—concede to itself all of the credit for the recent rapid development in a field supposed to have been already well worked. The department's own selling efforts, it asserts, have received incalculable support from the popular faith, met on all sides, that behind every proposition which the company offers there stands a great proved utility organization, offered by men who have already created substantial, successful businesses in the communities which for years they have faithfully served.

Such confidence on the part of the public, as the sales department is the first to admit, helps to close contracts and to sell service. And as an asset it is not to be overlooked when comparing the possibilities of a great interconnected electrical undertaking with the restricted operation of independent properties of limited resources and doubtful public favor.

The Illinois Northern Utilities Company now furnishes electricity and gas in a dozen counties in the northwest section of the State, reaching fifty communities scattered over an area of 4500 sq. miles. This territory was

formerly served by nineteen separate utility companies, principal among which were the Oregon Power Company, Oregon, Ill.; the Lee County Lighting Company, Dixon, Ill.; the Belvidere Gas & Electric Company, Belvidere, Ill.; the Morrison Gas & Electric Company, Morrison, Ill.; the Mendota Light & Heat Company, Mendota, Ill., and the Plano Heat, Light & Power Company, Plano, Ill.

Among the 60,000 inhabitants of these fifty communities the Illinois Northern Utilities Company now serves 8000 electrical customers and about an equal number of gas consumers. Its connected electrical load at present aggregates 11,000 kw., of which 2500 kw. is in industrial motors. Projected and in present operation the company's transmission system aggregates 250 miles of lines, of which 105 miles have already been built and are in use. Among the properties taken over are several district-heating plants, both steam and hot-water, as well as a condensation ice factory which will ultimately be converted to motor drive.

In addition to the several utilities already mentioned, the Illinois Northern Utilities Company owns and operates the Sterling, Dixon & Eastern Electric Railway Company, whose trackage includes 12 miles of interurban railway and 6 miles of city street-car lines in Dixon and Sterling.

## SYSTEM AND GENERATING STATIONS

The interconnected system of the Illinois Northern company centers about the group of water-power plants at Oregon, Dixon and Sterling which utilize low-head falls in the picturesque and scenic Rock River. These stations are at present tied together by a 13,200-volt transmission system, as shown by the map, these lines being a heritage of earlier operation. It is the intention later, however, to replace these lines with standard 33,000-volt construction which the company has planned for its entire system.

At all three of the water-power points there named steam relay equipment is also installed as an auxiliary to the hydroelectric plants. The water power is employed for carrying the bulk of the load, the steam plants being having to be called chiefly during peak periods. Ultimately it will be the plan to erect a central steam station at Dixon, supplying all the demands from that point. The steam equipment currently installed at each water plant will be rated at 2000 hp.

At Dixon a massive concrete dam 200 ft. long creates a net available head of 7 ft. on the stream of



FIG. 1.—DIXON DAM AND COMBINED WATER-POWER AND STEAM PLANT

the Rock River. The seven Leffel and American waterwheels installed have a total rating of about 500 hp and are controlled by Woodward mechanical governors. Belted to the same counter-shaft are 175-hp and 150-hp Armstrong-Simons engine units. The electrical generating equipment includes a 500-kw double-current railway generator, a 300-kw General Electric alternator and a 200-kw Westinghouse



FIG. 2—COMBINATION STEAM AND WATER-POWER PLANT AT STERLING

alternator. The water-power section of the Dixon plant is a modern concrete, brick and steel structure. Here also are located the 13,200-volt transformers, lightning arresters, etc., for the transmission line connecting the Dixon station with the other points of the system.

At Sterling two generating plants are at present operated, one being a purely steam station while the other is a combination hydroelectric and steam plant. The water-power units in the downtown station comprise in all five Leffel and Stillwell-Pierce-Smithvale waterwheels, aggregating

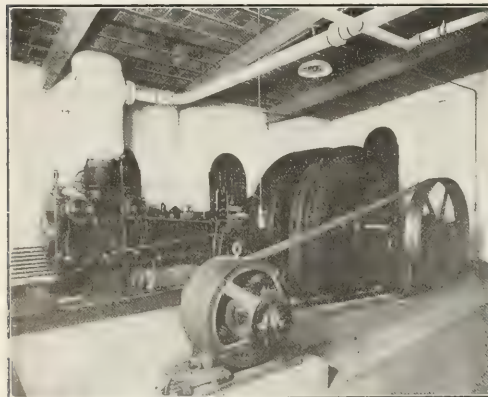


FIG. 3—DIRECT-CONNECTED ENGINE SET IN STERLING STEAM PLANT

about 300 hp in total rating. Supplementing these machines is a 250-hp Ames engine belted to the same shaft. The electrical equipment comprises a 300-kw Stanley alternator and a 200-kw Westinghouse double-current railway generator, which is motored during periods of varying railway demand to help drive the other machine. In addition to the interconnected units above mentioned, all of which are

belted to a common shaft, there is also installed a 300-kw Westinghouse 1100-volt, 60-cycle, two-phase alternator, directly connected to a Ball-Corliss engine. A pair of Kewanee boilers and one Star Scotch marine unit make up the 400 hp in boiler capacity installed at the Sterling combination plant, which is located near the center of the city.

On Fourteenth Avenue, Sterling, the company also operates a 300-kw belted engine-driven unit in the plant building originally erected to house the generating station for the interurban railway now owned by the utilities company. This station is called upon only during lighting hours, to aid in time of system peaks.

The combination hydro-steam station at Oregon contains 300 kw in steam-driven units and 200 kw in waterwheels.

At Dixon there is stationed the "system operator" who dispatches the load for the several generating plants feeding into the Dixon-Sterling-Oregon system. This dispatcher orders units started up to meet varying load conditions and in general dictates the operation of the system. All switch openings are also reported to him by "hold" cards giving a full account of the interruption, similar to those used on the other Illinois interconnected systems. Another system operator dispatches the loads for the company's interconnected lines centering about Belvidere.

Isolated steam plants are at the present time still being

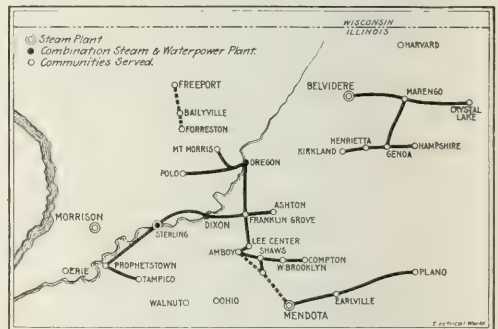


FIG. 4—SYSTEM OF ILLINOIS NORTHERN UTILITIES COMPANY

operated at Mendota, Walnut, Ohio, Morrison, Fulton and Erie pending the construction of transmission lines to reach these points.

#### DISTRICT ORGANIZATION

The plan of district organization which is followed in the other Illinois systems obtains also in the Illinois Northern company, whose territory is divided into lettered districts with headquarters as follows: B, De Kalb; C, Oregon; D, Dixon; E, Mendota; G, Geneseo; M, Morrison.

Each district is in charge of a district superintendent, to whose local staff are assigned salesmen, inspectors, etc., by the heads of departments located at the main office in Dixon. Operation of all plants and substations is in charge of the mechanical engineer of the company, whose own working organization is independent of the local superintendents' jurisdiction. The local inspectors, who have charge of lines, etc., compose the department of the electrical engineer of distribution.

Attractive sales offices are maintained at the district headquarters. Appliance exhibits attract attention to household electrical conveniences, and occasionally demonstrations of devices are given. It is the purpose to limit to the minimum, however, the stocks of equipment, supplies, etc., carried at the district offices. The company's large warehouse at Dixon is the principal distributing center for stocks of all kinds, supplies being shipped thence by freight to various points on the system. This problem of transport-



tation of both material and men becomes extremely important in the case of a company operating among communities as remotely scattered as are those of the Illinois Northern system. A number of small light automobiles are maintained by the company for the use of its officials and superintendents in visiting the various properties. A dozen motorcycles are also in use by inspectors, trouble men, etc.



FIG. 5. STEEL-TOWER SPAN ACROSS THE ROCK RIVER AT  
DIXON, ILL.

For hauling supplies, construction material, etc., between the Dixon warehouse and the railroad stations, and for distributing both gas and electrical apparatus locally, the company has in service a 5000-lb. Walker balance-drive electric truck, illustrated herewith. This equipment effects considerable saving over the cost of team delivery for the same service and is also of benefit to the commercial department in impressing upon local manufacturers the merits and economies of electric-vehicle operation.

## TRANSMISSION LINES AND SUBSTATIONS

For general transmission purposes 33,000 volts has been selected as the standard line pressure for the Illinois Northern system, although a number of miles of 13,200-volt construction is still being operated as originally acquired from the former owners. The transmission-line specifications for the Illinois Northern system in general resemble those of the Public Service Company of Northern Illinois, with which the Illinois Northern company has been closely identified in its administration.

For main trunk-line construction, especially along high ways where secondary distributing circuits of low voltage are likely to be added later, the type A four-pin-arm construction is employed, with all conductors in a single plane. For 33,000-volt lines paralleling railroads and those in other locations where additional circuits are not likely to be run at a later time the double-arm type B construction is used, employing a pair of 4-ft. two-pin arms and carrying the ground wire on one of the upper pins. Provisions for grounding at every fifth pole, etc., are identical with those already described.

Nearly 250 miles of transmission lines are projected or in operation by the Illinois Northern company, and of this mileage 40 per cent is already in service. By the extension of the Mendota-Plano line it is planned to connect with the Public Service company's southern system at Yorkville, and with the completion of a line now being built from Marengo and Belvedere to Crystal Lake connection will also be established with the Public Service company's northern system, thus making for interconnected operation in the largest sense.

For steps 1 and 2, power from the transmission substations at 33,000 volts and 13,200 volts to local distribution substations for which 2001 rates are available for the two largest substations of the Illinois Northern company's substations are of the highest type, were based on future gross loadings. Several other substations are, however, designed for supplying small communities.

Spectators are invited at Hamamye, Pasa, Franklin Grove, Astoria, Yacoubian, Astoria, Young Company, Sublette, Morrison, Fort, Eric Producers, Laramie, Fortville, Piano, Kirkland, Genoa and Laramie.

In the USSR, the average length of the lines with a loading does not exceed 40 kw to 75 kw, local distribution is chiefly effected by single-phase overhead lines. In the cities where there is considerable demand for power, operation there with three-phase distribution is organized. Such three-wire construction is exemplified in Fig. 1. In four-wire circuits where the load does not exceed several hundred kilowatts and the distances involved are almost not greater than 2 or 3 miles.

## RICHARD L. LUTTENBERG AND HELEN WINTER

Organized since its July 1964 inception, the success of the partnership at the Illinois State Agricultural Extension has lost no time in making itself the financially independent possible in communities previously served with difficulty, when attacked along aggressive business-getting lines with the aid of an active, coordinated sales organization. The results already shown in newly contracted and connected loads quite surpass the possibilities in the same towns under separate administration. Here, again, it appears that group operation makes for increased effectiveness and efficiency not only in the work of getting the electricity than in the production and distribution of the energy.

In ten months, the Illinois Department of Transportation, which is currently reviewing nearly 4,000 new proposals, found that selling more contracts to users seemed most likely under the theory that smaller, more frequent contracts would be more attractive. At the present time, only 100 to 150 contracts continue to come in at the rate of two-to-five contracts a week. Local contracting firms are the major bidders for the knob-and-tube construction permitted in these outlying areas.



FIG. 6.—TRANSFORMING TIME ENTERED AND DEPARTURE AS REPORTED BY ROAD STATION.

committees average \$4 per author. The contribution is paid in part out of the book advance on completion of the work, and companies receiving the manuscript must accept the terms if desired. Although many like the advantage of the two-stage security offer, the companies are prone to balk at the twice advance payment in two installments. In one case, a rejected manuscript was returned with the note: "A manuscript, the

countered in these communities are thoroughly responsible, and bad debts are unknown. The local contractors are themselves active "boosters" of house-wiring business and take an interest in working up lists of "prospects" for the salesmen to "close" on the latter's weekly visits to these smaller outlying communities.

The company's standard rates for residence lighting are



FIG. 7—ORNAMENTAL MAGNETITE-ARC LIGHTING AT DIXON

14.5 cents for the first thirty hours' use of the maximum demand and 8 cents per kw-hr. thereafter. For prompt payment within ten days this schedule is subject to a discount of 1 cent per kw-hr., making the net cost 13.5 cents and 7 cents per kw-hr.

In addition to securing 1400 new customers and wiring nearly a thousand old houses, the commercial department in ten months has sold over \$50,000 worth of merchandise, including about 900 electric irons and 250 toasters.

#### STREET AND ORNAMENTAL LIGHTING

Street illumination may be very properly termed the "backbone" of the lighting business in most of the smaller communities of the class reached by the Illinois Northern lines. Supplementing the regular street-lighting service, much valuable ornamental-lighting business has been obtained with the aid of the company's patrolled flat-rate schedule, reproduced herewith. The prices given in the table are on a weekly basis and are subject to a discount of 5 cents per lamp per week for payment within three days of date of bill rendered. The same schedule is also available for window-lighting and sign displays.

In furthering ornamental installations a most opportune time has been found to be that of renewing the regular street-lighting contracts. Some of the leading merchants are first tactfully approached and interested, if possible, in the matter of decorative post lighting. Then in their hands are left the details of promoting and carrying through a plan by which the local business houses defray the cost of installing the posts, the town agreeing to furnish energy to operate the lamps. The company offers every assistance, of course, tendering the use of its automobiles to take committees to inspect similar lighting installations in nearby towns, etc. But the actual carrying out of the plans is left in the hands of the self-appointed committee of progressive merchants. This plan has been extremely successful, valuable lighting business being acquired in this way without special direct sales effort.

In Forreston, for example, a ten-year contract was recently closed for \$1,688 worth of street lighting per year, of which amount \$860 covers the ornamental post lamps in the business district. The merchants defrayed the cost of

the latter equipment, and the town furnishes the lighting service. Forreston is a town of 890 inhabitants, so that its street-lighting outlay per capita is nearly \$2 per year.

At Amboy, a town of 1800, the company has contracted to furnish seventeen three-lamp post fixtures and sixty-eight street lamps, for which it receives \$2,700 per year.

At Dixon 4-amp ornamental magnetite lamps of the inverted type are being erected on trolley-pole brackets. Fifty-one are to be eventually installed, the lamps being furnished by the merchants while the cost of operation and trimming, \$47 per lamp per year, is defrayed by the city.

#### INDUSTRIAL MOTOR APPLICATIONS

In the ten-month period already referred to contracts have been closed for 2500 hp in motor load, although, owing to the rapid rate at which this business has been acquired, the company has been rather pressed to supply the increasing demand. For that reason not all of this new motor business contracted for is yet connected to the lines, although the present industrial motor load reaches a total of 3300 hp.

Among the large consumers with which contracts have been closed are the Independent Harvester Company, Plano, 600 hp; the National Silica Company, Oregon, 500 hp; the Chicago Stove & Range Company, Fulton, 125 hp; the Gossard Corset Company, 125 hp, and the Inderrueden Canning Company, Hampshire, 125 hp.

The 500-hp motor load of the National Silica Company, for example, is applied to grinding and reducing processes which continue uninterruptedly twenty-four hours a day and 365 days a year. This insures, of course, most desirable 100 per cent load-factor business for the central station.

A characteristic off-peak motor load found in many of the towns served by the Illinois Northern company is the operation of local gristmills. About fifteen of these mills are now operated by central-station energy, each such mill containing motors of 50-hp to 60-hp rating. This gristmill business is taken under a special off-peak contract by the terms of which the mill operator secures a net rate of 3.5 cents per kw-hr. provided he keeps off the lines from 4:30 p. m. to 10 p. m. during all twelve months of the year. During June, July, August and September the utilities company waives collection of the minimum monthly charge of 50 cents per hp connected.



FIG. 8—ELECTRIC DELIVERY TRUCK IN COMPANY'S SERVICE AT DIXON

In serving these gristmill customers the company is automatically protected in the observance of its off-peak clause, because all the farmers who come to town to have grinding done invariably start home by 4:30 p. m. to get their evening milking done. This insures, of course, that the mills will be shut down in ample time to avoid the evening lighting peak.



Supplementing the yearly load characteristics of the grist-mills comes the demand of the canning factory referred to. This plant is shut down during the winter and spring months when the milling business is at its height and, conversely, is operated at its own maximum output when the mills are running light. Here again is secured valuable seasonal diversity, of which advantage could hardly be taken without

TABLE OF RATES FOR PATROLLED FLAT-RATE SERVICE, ILLINOIS  
NORTHERN UTILITIES COMPANY

	C A T A L O G   O F   L A M P S						
	5	25	100	500	1000	100	2000
Dusk to 10 P.M. — 6 days							
Dusk to 12 P.M. — 1 day	\$0.080	\$0.15	\$0.17	\$0.22	\$0.32	\$0.45	\$0.70
Dusk to 11 P.M. — 6 days							
Dusk to 12 P.M. — 1 day....	0.0825	0.16	0.19	0.25	0.38	0.50	0.80
Dusk to 12 P.M. — 7 days....	0.1850	0.17	0.21	0.27	0.40	0.60	0.95
Dusk to 1 A.M. — 7 days	0.0900	0.18	0.23	0.30	0.45	0.60	1.00
Dusk to dawn — 7 days	0.1050	0.24	0.30	0.40	0.65	0.90	1.50

a transmission system covering a comparatively broad area and a group of communities.

Water pumping for towns is another long-hour application in the direction of which a start has already been made by the acquisition of half a dozen pumping loads in as many of the communities which are served by the Utilities company's lines.

The operation of sand and gravel pits in the company's territory affords a long-day load which has a desirable season load-factor. These pits cannot be conveniently worked during freezing weather, so that their principal demand comes during the warmer months when the output for lighting is at its minimum. Ordinarily they are started up in April and continue ten to twelve hours a day until October.

## OFFICERS

Mr. Samuel Insull is president of the Illinois Northern Utilities Company, Messrs. Frank J. Baker and C. A. Munroe are the vice-presidents, Mr. John H. Gulick is secretary.



FIG. 9—ELECTRICALLY OPERATED GRISMETTE

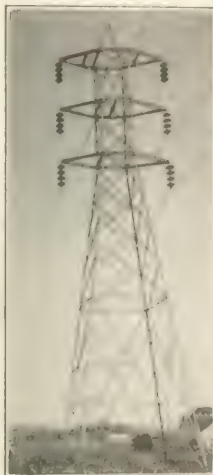
treasurer, and Mr. E. D. Alexander, as assistant to the president, has executive supervision of the company's operation.

Mr. L. E. Marshall is general superintendent, Mr. J. E. Harlow is mechanical engineer, Mr. L. E. Jacobson is auditor, and Mr. C. B. Yount fills the position of general contract agent.

### Cost of Erecting 110,000-Volt Transmission Lines

One of the features of high-tension electric transmission has been the rapidity with which 110,000-volt tower work has been standardized. This is really amazing considering the number of 110,000-volt systems in existence and their relative newness, but is explainable by the fact that one is largely patterned after the other.

from the staffs of companies having already installed systems in successful operation.



TRANSMISSION LOSS

team hire and transportation of material from the railroad to the right-of-way.

Line No. 1 passes through a high grade of country, necessitating more stub holes, angles and guying than Line No. 2, which passes through a wooded section most of the way. It will be noticed that the cost of distorting and stringing the wire in Line No. 1 is greater than in Lines 2, 3 and 4. This is due to the fact that while the three-phase line was operated at first, the other three-phase line having been

COST PER MILE OF ERECTING TWO-TRUSS HIGH-VOLT TOWER LINE

Operations	2009 144 Months	2008 144 Months	2007 144 Months	2006 144 Months
Direct operating costs	\$81.1	\$80.1	\$80.1	\$81.1
Asset impairment	1.1	1.1	1.1	1.1
Expense sharing	1.1	1.1	1.1	1.1
Depreciation and amortization	1.1	1.1	1.1	1.1
Goodwill impairment	1.1	1.1	1.1	1.1
Deferred tax expense	1.1	1.1	1.1	1.1
Restructuring costs	1.1	1.1	1.1	1.1
Disposing assets	1.1	1.1	1.1	1.1
Disposing assets (net of tax benefit)	1.1	1.1	1.1	1.1
<b>Total expenses</b>	<b>\$88.8</b>	<b>\$88.8</b>	<b>\$88.8</b>	<b>\$88.8</b>

strung afterward and while the first line was alive. In some of the more recent times observed in this country, notably that of the Central Georgia Traction Company, the mules were attached to the horses before the latter were harnessed and painted so that a saving in the first run. "Thumping muleskins" would be effected. All at one time traversed fairly rolling country, hilly here and there with heavily wooded sections, and water is used as a conductor for the most with a change of horses at lines Nos. 2 and 4 and at all distances. None at one time parallels any railroad system, for any distance, and the difference and has been approximately 800 feet. Where necessary footings are provided for the towers, a practice which obtains in many Transmissoan countries. The towers, rods, etc., increased in size at each end.



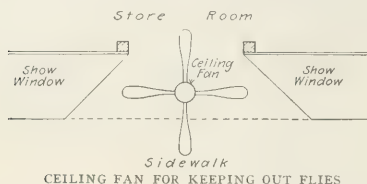
# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Electric Fans Versus Screen Doors

The progressive merchant who installs an electric ceiling fan in his doorway will keep the flies out of his store-room without the nuisance of a screen door. Experience in several Southern cities has shown that flies will not pass through the draft of air created by such a fan. On the other hand, its cooling breezes invite passers-by to stop and look in the show windows or enter the store.

A screen door largely cuts off the view of the interior



from the street. When arranged to be slammed shut by a spring it is a distressing noise maker. The fan, however, is quiet and inconspicuous, and it makes possible a clear doorway opening upon the street. Its effectiveness in keeping out flies was proved to one merchant whose store was across the street from a Greek restaurant which had been a rich breeding place for the insects. After being prevailed upon to substitute an electric fan for his screen door the visits of flies ceased altogether, although not a few hardy specimens had formerly ventured past the noisy screen door.

## A "Wire Now" Campaign at Dayton

Seizing the opportunity when property owners are rehabilitating and redecorating their flood-stricken homes, the Dayton Power & Light Company is conducting a "Wire Now" campaign which is securing many new residence customers who otherwise would probably never have had their houses wired for electricity. The flood waters which stood for several days in the lower stories at Dayton have made refinishing and redecorating everywhere necessary, and while this rehabilitation is going on a large number of hitherto unwired buildings are being equipped for electric service. Every contractor in the city is crowded with work, in spite of the doubled forces which some are running. Since the flood a large amount of new power business has also been taken on by the company in addition to the many new lighting services connected.

To impress further this "Wire Now" idea on the minds of the public, Mr. T. F. Kelly, contract agent for the company, has arranged to equip the store front of each electrical contractor in the city with a two-line 136-lamp electric sign flashing the words "Wire Now." There will be ten of these displays, located in all parts of the city, so that, approaching the downtown section from any direction, one cannot fail to notice and heed the wiring message. These signs are furnished and operated under the company's regular patrol service, at a cost to the contractors of \$5 per month, which amount barely covers, however, the energy used. The signs will be operated for six months, during which period it is expected most of the flood rehabilitation will have been completed.

## A One-Day Sale That Added 1031 Kw in Irons; Cost 85 Cents per Kw Connected

By a one-day special-offer sale at St. Louis, May 13, the Union Electric Light & Power Company added 1875 electric irons to its local circuits, securing this 1031 kw of connected load at a total outlay of only 84.6 cents per kw, including all expenses for advertising, post cards, delivery of irons, etc. The annual energy consumption of these 1875 irons is estimated at 215,625 kw-hr.; hence this one-day campaign will bring the central-station company an increased revenue of \$15,093.75 per year.

The irons were offered to customers at a special price of \$2.95 for only one day, May 13. Each iron purchaser also received a small shirt-waist ironing board, as shown in the accompanying illustration. These boards cost approximately 30 cents each, manufactured in quantities. The expense



WINDOW DISPLAY DURING WEEK BEFORE SALE

of delivering irons and boards to customers was 12 cents each.

For two days preceding the sale quarter-page advertisements were run in the St. Louis newspapers announcing the event. Some 40,000 red placard "hangers" were also distributed about town to advertise the special offer. Return stamped post cards were then mailed to each of the company's 23,000 residence customers. Name and address were already entered on the return card by addressograph, and hence it was necessary for the customer merely to place his signature under the blank form and mail the card to reach the company's office not later than May 13. The amount for the iron, \$2.95, was collectible with the customer's next monthly lighting bill. Of the total number of 23,000 cards mailed out, about 4.5 per cent were returned with signatures as orders for irons. On the day following the sale nearly 100 additional orders were received, but these had to be refused, as the announcement had distinctly limited the special offer to the single date.

## Electric May Breakfast at Newton, Mass.

At a May breakfast given by churches at Newton, Mass., on May 10 for the benefit of the Newton Hospital Social Service electricity was extensively used in cooking through the gratuitous co-operation of the Edison Electric Illuminating Company of Boston and the Simplex Electric

Heating Company of Cambridge, Mass. At the Eliot Congregational Church, Newton, about 1000 persons breakfasted between 7 and 9 a. m., and at the First Unitarian Church, West Newton, about 800 partook of the bill of fare. At the Eliot Church the Edison company installed three large electric ovens, twelve chafing dishes for scrambled eggs, an 8-in. disk stove for water heating, six egg boilers and a hotel-size plate warmer, the total load being 18 kw. At the West Newton church were six large pancake griddles, two plate warmers and eight water cups for egg boiling, the connected and actual load being 20 kw. The apparatus was run at the full heat throughout the entire breakfast period and was distributed at convenient points in each vestry and wired directly from the local Edison distribution circuits without recording meters. The Simplex company furnished the appliances without cost, and the only delay occurred through the inability of the kitchen staff to wash dishes at the requisite speed to meet the demand for service. At the next breakfast arrangements will be made for the use of electric dish-washing equipment. The work was supervised by a superintendent and three expert assistants from the Edison company's department of standardizing and tests, and by three expert demonstrators, two of whom were provided by the Edison company and one by the Simplex company. Printed matter describing the various devices used was available to those asking for it, and the Edison company advertised the event two or three days before by inserting the words "Electric Breakfast Saturday" in a 22-ft. by 35-ft. flashing sign at the Newton station of the Boston & Albany Railroad.

### Artificial Ice and Central-Station Service at Clifton Forge, Va.

The Virginia Western Electric Company of Clifton Forge, Va., operates a steam-driven station at Clifton Forge, a hydroelectric station at Buena Vista and a hydroelectric station at Lexington, Va. The company was organized in October, 1912, with a capital of \$300,000, at which time it took over the properties of the Clifton Forge Public Service Corporation, the Buena Vista Light & Power Company and the Rock Bridge Power Corporation of Lexington and Buena Vista. Besides conducting a central-station business in Clifton Forge the company manufactures ice and has a few buildings which are heated with live steam from its station. The latter are located close to the station and the heating business is not of great importance, the income from this source aggregating about \$400 a year. The company also owns water-power sites on the Cowpasture River and also on the Jackson River, the former site being capable of yielding 1000 hp and the latter site 4000 hp. No work on either development has been started, and of the two sites that on the Jackson River will be the first to receive attention.

The equipment at Clifton Forge comprises two 450-hp water-tube boilers burning soft coal costing about \$1.90 a ton in the bin; a 750-kw, three-phase, 60-cycle, 2300-volt General Electric turbo-generator, and a Worthington surface condenser outfit. Water for boiler-feed purposes is taken from a deep well and also from the city supply, while water for condensing purposes is pumped from Smith Creek, which flows past the station. A low dam is thrown across the creek so as to form a pond of water during low water periods for condensing purposes. The main line of the Chesapeake & Ohio Railroad Company passes in front of the station and a siding affords excellent facilities for bringing the coal to the outside of the boiler room. An 11,000-volt transmission line has been recently installed over which energy is transmitted to Covington and a 2300-volt line transmits energy to Iron Gate. There is a 200-kva substation at Clifton Forge, where the voltage is stepped up for transmission, and another 200-kva station at Covington,

12 miles away, where the voltage is again stepped. Energy is sold at bulk to the Chesapeake Light & Power Company on a meter with the meter being on the high-tension side of the transformers at Covington. Covington has a population of 6000. The equipment at Buena Vista consists of a 90-kw substation in the city and the hydroelectric development at Cowpasture, 4 miles away from the city, where two 200-kw, three-phase, 60-cycle, 6600-volt units are installed operating with a head of 10 ft. The development is on the South Street and runs into a cut in Lexington on the same river, a smaller hydroelectric unit at the latter unit being wound for 2200 volts, through which energy is transmitted to Lexington. The substation at Buena Vista is located in the old stone station formerly operated by the Buena Vista Light & Power Company, which has since been dismantled. The latter company owned the franchise for furnishing electrical energy for lighting purposes, while the franchise of the Rock Bridge Power Corporation permitted the company only to sell electrical energy in Buena Vista for motor service. The 6600-volt transmission line from the Cowpasture plant passes through the Buena Vista substation to Lexington, 12 miles away, where it is stepped down in potential and fed in the circuits with that coming from Lexington station. Aside from the constant to the Lexington station is not run during the day, the load being carried at the Cowpasture station, and during low water periods one unit in each station is operating.

#### Ice-Making Business

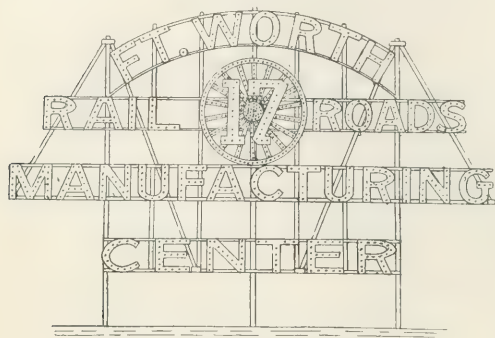
The station at Clifton Forge is fitted up with two electrical apparatus two 25-ton Triumph ice machines, the units being steam-driven. During the winter months the output averages in time a ton, while during the summer the two machines are operated under full load together with a 12-ton York machine located in a separate ice-making station on Smith Creek, a short distance above the larger station. In the larger station the condensed steam from the turbine is used in making the ice, rendering it unnecessary to reheat the water so long as there is sufficient condensate for ice-making purposes. During the summer months, however, the condensate is not sufficient, so that reboiling of the extra water becomes necessary. The smaller ice-making station is not operated during the winter months.

The company has no competitors from artificial ice in Clifton Forge and supplies through the Clifton Forge Ice & Bottling Company all of the ice used by the Chesapeake & Ohio Railroad Company for its passenger cars and refrigerator cars. The rest of its ice output is also handled by the Clifton Forge Ice & Bottling Works, a subsidiary company which retails it throughout the city. It will be understood of course that Clifton Forge, being in the mountains of Virginia, is not a winter resort, so that not much ice is required in the winter months. However, the company finds it expedient to keep its ice plant in operation in order that it may be in good condition when the heavy load of summer comes on. During the winter, therefore, the ice is sold at approximately \$2 a ton in the retailing company, while in summer the market brings approximately \$3.50 a ton. Storage is afforded in an ice-making building for ice when it is desired to keep for exceptional demands and to permit repairs on the machines when necessary. An electric crane with its hoist is used in handling the tons of ice and usually carries on a twelve-inch shift run back after the ice has been stored. In the construction of the plant itself no expense was spared for exceptional durability and to permit repairs on the machines when necessary. An electric crane with its hoist is used in handling the tons of ice and usually carries on a twelve-inch shift run back after the ice has been stored. In the construction of the plant itself no expense was spared for exceptional durability and to permit repairs on the machines when necessary. An electric crane with its hoist is used in handling the tons of ice and usually carries on a twelve-inch shift run back after the ice has been stored. While no actual figures of the revenue of the business are available for publication the revenue from the ice business is said to be two-thirds the revenue received for the electrical energy generated in the station at Clifton Forge.



### Electric Slogan Sign for Fort Worth

A new electric slogan sign was recently purchased by the Chamber of Commerce of Fort Worth, Tex. This sign is now being erected upon the roof of the Gamer Building, on East Front Street, overlooking the railroad yards at the Union Station, where it will be visible from all incoming and outgoing trains. The accompanying illustration shows this



ELECTRIC SLOGAN SIGN, FORT WORTH, TEX.

huge municipal advertisement as it will soon appear to travelers arriving at Fort Worth. The rim of the wheel will revolve while the spokes will be seen running toward the center of the wheel. This design was selected as being symbolic of the seventeen railroads running to one point.

This sign is to be one of the largest in the city, measuring over all 31 ft. in height and 45 ft. in length. Seven hundred red, green and white tungsten lamps rated at 5 watts and operating at a potential of 12 volts will be used in the sign. It has been stated by the contractors that the sign will be in operation within forty-five days from the date of signing the contract.

### Maintenance of Dangerous Apparatus in the Streets

The Eastern Wisconsin Railway & Light Company maintained in the city of Fond du Lac an electric-light tower about 150 ft. high (built by and the property of the city), at the top of which was placed a cluster of lamps used for municipal lighting. On this tower of iron rods and piping and about 18 ft. from the ground was a platform readily accessible from the ground, and inside the tower there was an iron basket attached to a cable running over a pulley at the top of the tower. At the other end of the cable there was a heavy iron counterweight. In the basket there were three large paving stones used for ballast, so that the total weight of basket, ballast and occupant exceeded slightly that of the counterweight. The basket was used by the employees of the company to get to the lamp cluster for trimming purposes, and when not in use this basket had to be fastened to the platform to prevent it from rising by the action of the counterweight. This was accomplished by wrapping a chain around the basket rail and the platform rail and passing a hook at one end of it through one of the links. On June 2, 1911, while H. B. Harris was standing about 15 ft. from the tower and two small boys were playing on the platform the chain became unfastened and the basket shot upward, finally throwing out the stones when it had reached the top of the tower. One of these struck the man and inflicted fatal injuries. His widow sued for damages, charging negligence on the part of the lighting company. A verdict for the plaintiff in the lower court was sustained by the Supreme Court of Wisconsin (140 N. W. 288). Chief Justice Winslow in rendering his opinion said that if an electric light company to enable

employees to attend to the lighting of a tower maintained in the street an unguarded hoisting apparatus, and if, while children were playing about, the basket in which employees rode, which had not been securely fastened, came loose and ascended rapidly, throwing out a stone which struck and killed a pedestrian, the company was liable, though it did not own the tower and though at long intervals a city official used the apparatus to inspect the tower.

### Power Matters in Textile Mills

At the ninety-fourth annual meeting of the National Association of Cotton Manufacturers, held at Boston, Mass., lately, Mr. F. W. Dean, consulting engineer, presented a paper on power matters in textile mills. The author compared the advantages of steam engines and turbines for mill-plant service and emphasized the importance of using larger boilers, favoring the vertical or horizontal-return tubular type, on the ground that such boilers are cheaper to build, more easily cleaned and safer than water-tube boilers and of better permanent economy. The costs shown in Table I were given for various sizes of reciprocating engines and turbines, with condensing apparatus and exciters, all erected and including foundations, the capacities being at 80 per cent power-factor.

TABLE I—COST OF RECIPROCATING ENGINES AND TURBINES

Rating, Kw	Horizontal Four-Valve Engine	Horizontal Turbine	AREA OCCUPIED	
			Engine	Turbine
500	\$22,700	\$12,250	18 ft. x 26 ft.	14 ft. x 6 ft.
1000	40,200	17,900	24 ft. x 30 ft.	14 ft. x 8 ft.
1500	62,200	23,800	26 ft. x 35 ft.	19 ft. x 9 ft.
2000	76,400	30,500	28 ft. x 37 ft.	21 ft. x 9 ft.

The author also submitted Table II, showing the steam consumed per kilowatt-hour at 150 lb. pressure.

The point was emphasized that turbine-blade design and construction is now improving, so that the initial economies on such apparatus are maintained longer than formerly. The field of the low-pressure and the mixed-pressure turbine types was also outlined. Among the advantages of large boilers, say of 400-hp or 500-hp rating, are sustained safety conditions, slight gain in economy of operation, reduction of area, and decrease in steam piping, valves, blow-

TABLE II—STEAM CONSUMPTION

Rating, Kw	ENGINE		TURBINE
	Saturated Steam Guaranteed per Kw-hr., Lb.	Superheat 100 deg. Fahr. Guar- anteed per Kw-hr.	Superheat 100 Deg. Fahr. Guar- anteed per Kw-hr.
500	18.67	16.8	17.7
1000	18.8	16.9	18.
1500	18.8	16.9	16.8
2000	18.93	17.	16.6
	Vacuum 26 in.	Vacuum 26 in.	Vacuum 28 in.

off pipes, water columns, steam gages, brickwork and pipe covering. The author advocated the use of stronger draft and more rapid combustion, with the object of reducing the number of boilers and firemen required per mill. The paper closed with a discussion of the difficulties of central stations in meeting the costs of service for mills having steady loads and requiring a large amount of steam for exhaust heating.



# Illumination and Wiring

## Contrast in Illumination

By J. R. CRAVATH

Few realize how important a part contrast plays in all matters of illumination. By contrast as used in this article is meant the contrast between the surface brightness, or the illumination received by the eye, of various adjacent surfaces within the range of vision. For example, a bright lamp against a black background makes a very strong contrast. The same is true of a black letter on a white page. It is evident that the contrast produced by difference in surface brightness is an all-important element in seeing objects. In fact, objects are seen by virtue of two things, their difference in light-reflecting power and shadows. Of these two, shadows are probably the less important, and their importance is greatest when the light-reflecting powers of the different parts of an object are quite uniform. For example, a white statue uniformly illuminated from all directions and of uniform light-reflecting quality will have its features practically obliterated by the absence of shadows. On the other hand, shadows play no part in the illumination of a page of reading matter, as the letters are seen entirely by virtue of the difference that exists in the reflecting power of the black ink and that of the white paper.

Contrast in the amount of light received by the eye from various surfaces is therefore an essential to vision; but there is another aspect of this subject of contrast to which the writer wishes to call attention in this article. This is the discomfort which may be caused by combining methods of illumination with wall colorings and furnishings in such a way as to cause strong and annoying contrasts. In considering the bad effects of exposed sources of light it is too frequently assumed, by those who have not given much thought to the matter, that a lamp of a certain type and candle-power exposed to the eye at a given distance is always equally objectionable independently of the surroundings. This is far from being the case, as must be evident when it is considered that a lamp which may cause one considerable conscious annoyance at night may be almost unnoticeable in broad daylight. Another simple experiment which will convince anyone that the contrast between a lamp and its surroundings has much to do with any discomfort caused by the glare from it can easily be made. When a lighted tungsten lamp is held against a white wall and a black cloth is drawn in back of the lamp the added discomfort caused by the black background will be very noticeable to anyone looking at the lamp.

More emphasis should be laid upon contrast and less upon absolute candle-power values than has been customary when attempting to predict what lighting arrangements will or will not give annoying glare. While it is undoubtedly true that the total candle-power of the lamp the light of which is shining in the eyes and the light flux entering the eye are important factors in producing annoying or detrimental glare, it must not be forgotten that no small part of the discomfort and eye strain caused by the glare from lamps under ordinary every day conditions is due to contrast between the brightness of the lamp and its surroundings. I have even known cases where positive annoyance and discomfort were caused by strong contrasts in the colorings of walls and woodwork, where no lamps were exposed at all.

There are some very common instances of annoying contrast effect in connection with daylight in offices and homes. Nearly everyone has had experience with the extreme discomfort of sitting in a long, narrow office with a window at one end and attempting to converse with a man who is seated nearer the window. It is not the amount of light entering the eye in such a case that causes the annoyance, but the contrast between the bright sky, which is the source

of light, and the much darker walls and surroundings inside of the office combined with the attempt to see the shaded side of a man's face against the dark background. Such unpleasant effects are too often aggravated further by dark-colored walls and dark-colored window shades so pulled down that the daylight is received from a still narrower angle than if it were coming from the entire window. Both of these add to the darkness of the interior as the observer and to the contrast which the eye experiences in passing from the shadows in the office surroundings. Now, this same sky viewed from a darkened office room with discomfort would cause no discomfort if seen by the open window with bright sky all around. On the same principle, a small kerosene lamp and black surroundings outdoors on a dark night may be temporarily more uncomfortable to face than even a 250-watt tungsten lamp in a brilliantly lighter interior.

Another very convincing illustration of the effect of contrast in producing annoyance in connection with artificial illumination was accidentally given to the writer on a railroad day-coach. This coach was one which began its run on a branch line with oil lamps and was later switched onto a through route with electric lamps. On entering the car only two oil lamps were visible in front of the writer, and the contrast between these lamp flames and the surrounding dimly illuminated car was such as to make them very disagreeable to face. The car was equipped with a modern electric-lighting system consisting of a row of lamps in deep translucent reflectors over each row of seats. The reflectors were deep enough to cover the lamp reflectors except in the case of the two lamps nearest to the eye of any passenger. The electric lamps were suddenly turned on in addition to the oil lamps. The result, of course, was a large increase in the general illumination of the car and also a considerable increase in the flux of light entering the eye from lamps and reflectors. The general effect, however, was much more comfortable because the car as a whole was fairly well illuminated and there was not the annoying contrast between the lamps and surroundings that there was with only the oil lamps in use.

The reason for the discomfort caused by these contrasts is easy to find when one considers the mechanism of the eye. The muscles which govern the size of the pupil of the eye are always attempting to adjust the amount of light entering the eye to the amount the retina can comfortably use. Now, when such extreme contrasts are within the range of vision, it is impossible to reach any adjustment which is comfortable, and these muscles soon become worn and tired from their rapidly repeated spasmodic attempts to make an adjustment.

Experience shows that the retina of the eye can adapt itself to enormous changes in illumination and does so several times every twenty-four hours, but some time is required for this adaptation, and in the meantime the amount of light is quickly adjusted by the pupil of the eye. From this it must be evident that, even though the surface brightness of lamps or surroundings may not be more than the retina would comfortably take care of under daylight conditions, yet there may be much considerable eye strain through the introduction of too great contrasts in surface brightness to the range of vision.

The practical application of these principles to comfortable lighting, both natural and artificial, should be considered by every architect and electrician. There are many more or less so illuminating contrasting. In natural lighting window shades should be made as large as possible and walls and ceilings should be treated in light colors to avoid the annoying contrasts described. For the same reason, dark window shades and ceiling and wall colors are extremely objectionable in light buildings and should be strictly avoided in contrast effect.

Consideration of the foregoing principles teaches that it is very difficult and often impossible to produce comfortable

artificial lighting in rooms where the ceilings and walls are dark in color. In such rooms lighting entirely by indirect means is evidently impossible, and when one puts up any kind of direct lighting, even though lamps are concealed in globes of excellent diffusing qualities, there will still be such a decided contrast between the lamp globes and the surroundings as to make the arrangement more or less uncomfortable. Of course, one may use indirect lighting for displaying the ceiling and wall decorations and rely on direct localized lighting at certain points where more light is needed, but such a plan is obviously of limited application. In general, one cannot get away from the uncomfortable fact that the sources of light in a dark-colored room are also sources of discomfort if one is to sit facing them for any length of time. Fortunately such extremely dark interiors are rare. They have sometimes been treated with fair success by the use of lamps and reflectors recessed in the ceiling. Sometimes with a beamed ceiling construction it is possible to obtain the desired result in such a way that light shining in the eyes is not uncomfortable to the occupants of the room. A dark-colored room with low wall brackets usually affords as uncomfortable a method of lighting as one can find. The room is likely to be uncomfortable by daylight for the same reasons, unless one can sit with his back to the window.

The most comfortable conditions of artificial lighting in practice are likely to be found where violent contrasts of surface brightness within the ordinary range of vision have been eliminated. This does not, as some might infer, by any means necessitate or make advisable a uniform light color of walls, ceilings and floors and a system of indirect lighting which will uniformly illuminate these surfaces. It does mean, however, that one should seek to eliminate as far as possible sharp contrasts in the surface brightness in the adjacent parts of a room. To be specific, this means with artificial lighting that:

1. The light should come from as large an area as practical considerations will permit. With direct lighting this means that one should employ globes as large and as perfectly diffusing as possible and should not attempt to get too much light from any one lamp, but should subdivide the light sources as far as practicable.

2. Indirect lighting (or luminous-bowl indirect lighting with not over 15 per cent well-diffused direct light coming from the bowl) will reduce the annoying contrast effect below anything which can be obtained by means of direct lighting.

3. If indirect lighting is used, care should be taken to avoid decided contrast in the surface brightness of the ceiling immediately over the fixture and the more distant portions of the ceiling.

4. Sharp contrasts between a light-colored ceiling and dark-colored walls are undesirable in a large room where ceiling and walls come within the ordinary range of vision at the same time, though in small rooms they are less objectionable.

5. The practice of painting the lower part of the wall very dark with a sharp change to a light color from 4 ft. to 6 ft. from the floor is objectionable and should be modified to the extent of having less contrast. Under such circumstances if darker color is wanted along the lower part of the wall, a light green or reddish tint would be found better.

One should avoid purely local illumination by individual lamps amid dark surroundings.

Reduction of contrasts by the means indicated in the preceding paragraph will help to reduce the annoyance and eye strain caused by the glare or glitter from various papers which the occupants of the room may be reading or working over, and in homes and offices this is even more important than the increase in comfort due to a reduction in contrast between the various other light-giving surfaces in

## Portable Indirect-Lighting Fixture

The Union Electric Light & Power Company, St. Louis, has had made up and is offering for sale to its customers portable indirect-lighting fixtures of the type illustrated herewith, the design of which was suggested by Mr. A. C. Einstein, president of the company. With one of these standards any room can be quickly converted to the indirect scheme of illumination. While itself inconspicuous, the fixture avoids the use of reflector bowls suspended from and marring the ceiling.

This reflector standard measures 7 ft. to the rim of the bowl and has a 30-lb. weight in its 12-in. base, assuring a stable setting. The mirrored bowl contains four 100-watt



PORTABLE INDIRECT-LIGHTING FIXTURE

lamps. Base, standard and bowl are attractively finished in brass. The fixture is sold for \$22.50 without the lamps, which cost about \$3 additional. Our photograph was taken by the light from the indirect unit alone, illustrating the diffusion obtained.

## Control of Electric Street Lamps in Kansas City, Mo.

A uniform system of street-lighting fixtures is being installed along several of the outlying business streets in Kansas City, Mo., by the Kansas City Electric Light Company. At present 102 fixtures of the four-arm-bracket type are being installed, and eventually all of the old vertical twin-bracket type will be replaced. On the streets where there are car tracks the fixtures will be placed on the posts supporting the span wires. The fixtures will be staggered along the streets, forty being used per mile.

Three wires strung along the top of the posts will be used to supply energy for the lamps. Where there is interference from overhead construction underground conduit will be used between poles. The energy will be transmitted to the different districts at 2200 volts single-phase and the emf will be stepped down to 220 and 110 volts for the distribution of energy over a three-wire, single-phase system. A 3 per cent drop in voltage was assumed in arriving at the







## Field of the Operating Engineer

**A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers**

## Convenient System of Motor Maintenance and Repair Record Cards

In its plant in Lorain, Ohio, the American Ship Building Company makes use of a convenient and effective system of record cards in keeping track of the maintenance and repairs of the large number of motors it has in service. All these machines are of the 230-volt direct-current type. For each motor three data cards are employed for record purposes—a motor card, an armature card and a controlling-apparatus card.

As shown by the form itself reproduced herewith (Fig. 1), the "motor card" contains data concerning the frame, fields, journals and brushes. At a glance all the essential facts relating to this 7.5-hp motor driving a punch are thus available, including even such minute details as the size and number of turns in the series and shunt field windings. Blanks for the entry of catalog numbers, for example, prove especially useful when parts are needed in a hurry. Special attention is called, however, to the last item next to "remarks," where by cross-references there are given the numbers of all other duplicate motors about the shops, so that in emergency similar machines can be located quickly to be substituted if necessary.

The "armature card" (yellow) covers all winding, shaft and commutator data, and, in addition to a description of the motor to which this particular armature belongs, includes a list of the various other motors around the plant with which it can be used. On the back of the armature card, which is reproduced in Fig. 4, the blank space can be utilized for indorsements detailing the previous history of the armature. This particular card carried the following notations: Motor No. 32—3-19-10. Repair slip No. 678—7-30-12. Motor No. 76—10-12-12.

1912, was put in motor No. 76. The "apparatus card" (reproduced in Fig. 5), which is printed on red cardboard, records miscellaneous information concerning the controller or starting box used with the motor, details of the resistor grids, circuit-breakers, brake, pulley, pinion, etc.

When any motor or part is sent to the shop for repairs a serially numbered repair card like that shown in Fig. 2 is made out, and on this is kept a record of the repairs made. Following the description of the motor or part, there is

<b>The American Ship Building Co.</b> MOTOR NO. 76 ..... Operating Horz. Punch ..... Location: Boiler Shop ..... Model: Westinghouse ..... Type: "B" ..... Rated H.P. 7-1/2, Rated Speed: 975 ..... (Complete Service Contract) Frame No. 3 ..... Field Serial 866524 ..... BRUSHES ..... No. 4 ..... Width 1-1/2" Thickness: 3/8" Length 2-1/4" ..... SERIES FIELD ..... SHUNT FIELDS ..... Cat. No. 32710 ..... Cat. No. 32700 ..... #7/144 mm ..... Weight of wire ..... #21/.0289 ..... 17-1/2 ..... No. of turns ..... 2400 Intols ..... No. of layers ..... Winding remarks ..... Journal 2, Cat. No. ..... Com End 30602, Pulley End 30602 ..... No. of duplicate motors: 18- 19- 25- 32- 33- 34- 38- ..... 39- 40- 44- 46- 72- 73- 76 ..... Remarks .....		<b>THE AMERICAN SHIP BUILDING CO.</b> <b>ELECTRIC DEPT.</b> REPAIR SLIP NO. 678 ..... Date: 7/10 ..... Description of Apparatus: Armature #56634 ..... West. S-3, 7-1/2 H.P. ..... Taken from: Motor #32 Mch. 46 ..... #2 Punch Shop ..... By: Weigand ..... Probable cause of breakdown: Commutator shorted ..... 4 coils burned ..... Details of repairs made: Put in 4 new coils and ..... 80 Con. Sags, Bent, Stretched shaft ..... Re-banded and Con. turned .....	
--	--	--	--

LABOR				MATERIAL			
DATE	C.E. #	HRS.		DATE	C.E. #	HRS.	
8-5	262	4	4 Coils				
8-7	124	4	Taps				
8-8	124	4	Solder				
8-12	84	10	336 Mica Plate				
8-12	87	3	255 Miller board				
8-13	87	3	20 Bars				
8-13	120	10					

Cost labor \$ 9.78	Cost material \$ 2.76	Total cost \$ 12.54
Repairs completed: 8/14 ..... Inspected by: HIGMAN ..... Put in service: 10/12/12 in motor #78 .....		

FIGS. 1 AND 2—MOTOR CARD AND REPAIR SLIP

given a statement of the trouble and its probable cause, and the repairs necessary. In the columns below space is provided for entering up the labor required, noting the dates, number of workman's check and hours engaged. Parallel-

[illegible]

FIG. 3—MONTHLY RECORD SHEET FOR MOTOR REPAIRS

From this record the superintendent understands that the armature was put in motor No. 32 on March 10, 1910, and ran until July 30. It was then taken to the shop for repairs, as detailed on repair slip No. 678, and on Oct. 12,

ing this is an itemized enumeration of the material used, with an estimate of its cost. Adding to material expense the cost of the labor, the total outlay for the job is obtained. The repair card record closes with a memo by the inspector

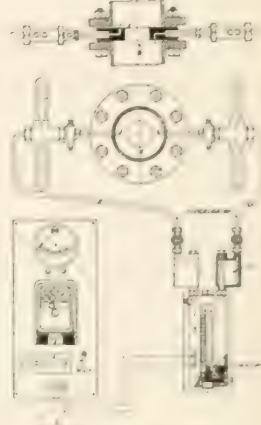
and a final statement concerning the disposition made of the finished job.

Each month the repair-slip records are condensed on a sheet having headings as shown in Fig. 3, from which com-

of known dimensions. As the mercury rises, these circuits are completed and a current furnished from a 12-volt storage battery (capacity 30 amp) flows through and actuates a small integrating ammeter of special construction. This

The American Ship Building Co. ELECTRIC DEPT.	
ARMATURE No. 56544	
Make <u>Westinghouse</u>	Type <u>B-3</u>
Rated H. P. <u>7-1/2</u>	Rated Speed <u>975</u> R. P. M. 1075
Winding Diagram No. <u>10</u>	Insulation sheet No. <u>D3</u>
WINDING	
No. of slots <u>49</u>	No. of poles in slot <u>2</u>
No. of wires in coil <u>2</u>	Neat turns in coil <u>2</u>
Size wire <u>#15/.0571</u>	Length in coil
Total weight of wire	
Turns of coils <u>1-12</u>	Turns of leads <u>1-60</u>
Out. No. of coils <u>33028</u>	Out. form No. <u>J2</u> A. S. B.
Remarks	
COIL END	
Size <u>1-3/4"</u>	Ins. bearings <u>1-3/4"</u>
Ins. Pinion or brake	<u>1-5/8"</u>
Remarks	<u>3/8" x 1/8"</u>
COMMUTATOR	
No. of bars <u>97</u>	Length <u>2</u> Width <u>5/16</u> Length in core
Ins. commutator can be used in motor	
No. <u>38</u>	<u>40</u> <u>41</u> <u>45</u> <u>48</u> <u>49</u> <u>72</u> <u>73</u> <u>74</u> <u>76</u> <u>78</u>
Remarks	

The American Ship Building Co. ELECTRIC DEPT.	
CONTROLLING APPARATUS, ETC.	
Motor No. <u>76</u>	
Make <u>Cutler-Hammer</u>	Type <u>Four</u>
Rated H. P. <u>76</u>	Rated Speed <u>7-1/2</u> R. P. M.
Winding Diagram No. <u>220-250</u>	Insulation sheet No. <u>220-250</u>
WINDING	
No. of slots <u>49</u>	No. of poles in slot <u>2</u>
No. of wires in coil <u>2</u>	Neat turns in coil <u>2</u>
Size wire <u>#15/.0571</u>	Length in coil
Total weight of wire	
Turns of coils <u>1-12</u>	Turns of leads <u>1-60</u>
Out. No. of coils <u>33028</u>	Out. form No. <u>J2</u> A. S. B.
Remarks	
COIL END	
Size <u>1-3/4"</u>	Ins. bearings <u>1-3/4"</u>
Ins. Pinion or brake	<u>1-5/8"</u>
Remarks	<u>3/8" x 1/8"</u>
COMMUTATOR	
No. of bars <u>97</u>	Length <u>2</u> Width <u>5/16</u> Length in core
Ins. commutator can be used in motor	
No. <u>38</u>	<u>40</u> <u>41</u> <u>45</u> <u>48</u> <u>49</u> <u>72</u> <u>73</u> <u>74</u> <u>76</u> <u>78</u>
Remarks	



FIGS. 4 AND 5—ARMATURE CARD AND CONTROLLING APPARATUS CARD

STEAM FLOW METER

parisons can be made of the relative repair costs of different types and makes of motors. Mr. A. B. Walton is electrical superintendent for the American Ship Building Company.

### A New Integrating Steam-Flow Meter

A type of steam-flow meter which has been used very extensively in Germany—although only three or four have been brought to this country—is the Hallwachs steam meter, illustrated herewith, employing the principle of the Pitot or differential-pressure tube. In the Hallwachs meter a mercury column is used as the measuring device, short-circuiting successive sections of known resistance, so that a quantity indication of the steam flowing can be read from the integrating ampere-hour meter which forms a part of the apparatus. One of these meters has been under observation and test during the past year by the Illinois Maintenance Company, Chicago, and has been found to compare in accuracy with other instruments of similar type.

As the drawing shows, a disk or ring, with a bore somewhat smaller than the diameter of the pipe through which the steam to be metered is passing, is inserted between two pipe flanges in a clear run of vertical or horizontal piping. The diameter of the opening in this disk is carefully computed from data based on the maximum flow of steam, pressure of steam, and whether steam is to be used for engines, giving a fluctuation in the flow, or for steam heating, where the flow is more constant. The openings in this disk are piped to the differential manometer, which is filled with mercury up to a certain point. The height of the mercury levels in this manometer at any instant will be in proportion to the square of the velocity of the steam when passing through the openings in the disk.

In one leg of the differential manometer platinum wires are fused into the glass at certain intervals, and when the velocity of the steam increases, the mercury is forced upward, making successive contacts with these platinum points. The platinum points are connected by small resistor coils

integrating ammeter is so designed that its reading, when multiplied by a constant depending on the pressure of the steam, will give the number of pounds of steam that have passed through the meter. These constants are determined by calculations based on the formula for the flow of steam through an orifice.

When proper care is taken in this meter there seems to be no reason why it should not meet the requirements, said Mr. S. M. Bushnell, of the Chicago company, in reporting on the subject before the National District Heating Association. The meter is fairly easy to install and requires very little attention except for recharging the storage battery. The principal objection to the meter is, however, that particular pains must be taken when turning steam through it. If steam is turned on suddenly, the mercury column will be lifted out of the manometer, necessitating refilling. This can be overcome by providing a by-pass across the two terminals of the manometer so that if it is necessary to turn steam suddenly on the pipe line, the pressure will equalize through this by-pass until the steam has attained its normal velocity, after which the by-pass valve may be closed. It should be noted, however, that this means careful attention on the part of the engineer and makes it desirable for the engineer for the company selling the steam to turn it on and off for the customer.

### Proper Location for Synchronous Motors

When a synchronous motor is installed for power factor correction, the motor should be in some large industrial plant.

To obtain the maximum benefit, the synchronous motor should be installed at the station, preferably at the end of the line. If installed in the power house, it benefits only the generating apparatus, which at times is sufficient justification for its installation. When installed at the end of the line, it will render possible the use of less copper, smaller switches and smaller transformers to carry the same load carried heretofore at lower power factor.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Noiseless Operation of Electric Machines.**—G. PONTECORVO.—The author points out the importance of noiseless operation of electric motors in private houses, office buildings, etc., and the difficulties which are encountered in this respect, especially in the United States. The Westinghouse Electric Manufacturing Company, Pittsburgh, has a special noiseless testing room in order to study machines with respect to production of noise. The author distinguishes three different noises. The first is the "magnetic noise" due to the oscillations of the magnetic circuit. These oscillations are produced by a field of very high frequency and act in a radial direction, that is, perpendicular to the axle of the machine. These noises are very troublesome and generally very shrill. It is difficult to prevent them and to know in advance of building a machine where such noises will occur. In one case an induction motor produced a noise of such a high pitch that it could be heard above the noises of a very noisy factory. This motor was a 75-hp, three-phase, 60-cycle machine, with eight poles, running at 900 r.p.m. It had 108 open slots on the primary and 96 on the secondary and an armature diameter of 420 mm. The magnetic noise is practically the same at full load and at no load. This distinguishes it from the second type of noise, which is called "load noise" and is due to a lack of electrical or mechanical symmetry. It is generally of a lower pitch than the magnetic noise. It increases with the load and is often zero at no load. The third kind of noise is the "ventilation noise." There are two types of this. In one the noise is produced by the large quantities of air which are set into motion by the rotating parts of the machine and which are pressed out of the frame with great speed. This noise is of low pitch and in general endurable. It is more often found now since there is a tendency to improve the ventilation of electric machines. Another type of the ventilation noise is that found with induction motors, especially those with squirrel-cage armature, when they are operated with a high peripheral speed. The noise is here produced by the air blown from the rods at both sides of the armature through the field coils or from the armature into the ventilation channels of the field structure. It is a whistling noise of high pitch and very disagreeable. While it is similar to the magnetic noise, it can be distinguished from it by suddenly disconnecting the circuit while the motor is running. These "ventilation noises" can be obviated with comparative ease by simple mechanical means. To avoid the "load noise" perfect mechanical and electrical symmetry must be obtained. Several illustrative examples are given of what perfect symmetry means. The magnetic noise is most difficult to obviate. It depends on the frequency, and with the same induction, the same number of poles, etc., a 60-cycle machine will make more magnetic noise than a 25-cycle machine. The field intensity should be held rather low in machines which are to be noiseless. An induction of 12,500 in the teeth is to be considered as high. Alternating-current motors, as well as direct-current motors, should have a very large number of slots; less than three slots per pole and phase should not be either in the armature or in the field structure. A table is given for the design of a certain motor with different numbers of primary and secondary slots, indicating what kinds of noises are to be expected with the different de-

signs. Magnetic wedges closing open slots are often a good remedy. For direct-current machines a special form of the pole shoes is recommended.—*Elek. Zeit.*, May 15, 1913.

**Formation of Deposits in Oil-Cooled Transformers.**—A. C. MICHIE.—A paper, in abstract, read before the New Castle Section of the (British) Institution of Electrical Engineers. The "sludging" of transformer oil is dealt with and various tests and theories are described. The conclusion arrived at is that it is an oxidation process. Apart from the question of the quality of the oil, the design of the transformer has to be considered, and in this connection, if the formation of deposits is to be avoided or minimized, the following conditions should be avoided: overheating, undue access of air to the oil, conditions likely to give rise to the formation of ozone, contact of the oil with clean surfaces of copper, iron and lead.—*London Electrician*, May 16, 1913.

### Lamps and Lighting

**Tungsten Lamp with Downward Uniform Light Distribution.**—An illustrated description of the new "Wotan focus lamp" in which the consumption per mean lower hemi-

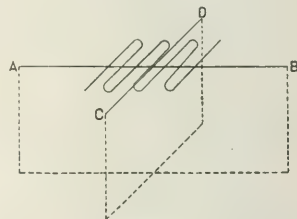


FIG. 1—ARRANGEMENT OF FILAMENT

spherical candle-power is 1 watt per hefner candle. Reference is first made to the arrangement of the filament in a plane in zigzag form shown in Fig. 1. This method has been used in tantalum lamps, but with this arrangement the

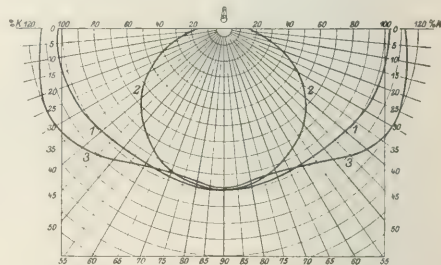


FIG. 2—LIGHT DISTRIBUTION CURVE

distribution of light is far from uniform. The distribution of light in the plane *AB* of Fig. 1 is shown in curve 1 of Fig. 2, and the distribution of light in the plane *CD* of Fig. 1 is shown in curve 2 of Fig. 2. This shows that with the filament arrangement in a plane the distribution of light varies greatly in different directions. In the new lamp, in which it is made more uniform, as shown in curve 3 of



Fig. 2, the filament is arranged in conical form and the part of the globe near the socket is used as a white reflector.—*Elek. Zeit.*, May 15, 1913.

**Squirted Tungsten Filament.**—A note on a recent British patent (No. 11,455, 1912) of J. A. Scouler and Dick, Kerr & Company. Viscous sodium silicate solution is used as a binding agent. The intimate mixture is calendered, squirted and dried. The raw filaments so formed are baked in an inert atmosphere and sintered in one operation in an electric resistance furnace.—*London Elec. Eng'g.*, May 15, 1913.

**Drawing Tungsten Filaments.**—A note on a recent British patent (No. 11,439, 1912) of the Deutsche Gasglühlicht company. During the process of hot-drawing tungsten filaments the heated wire is passed through dehydrated acids or their salts, which are viscous at the temperature of the wire as it enters the die. The use of boric and phosphoric acids is claimed.—*London Elec. Eng'g.*, May 15, 1913.

**Street Lighting.**—A. P. TROTTER.—His long reply to the extended discussion of his recent paper on standard clauses for inclusion in a specification of street lighting. He sums up the principal points again as follows: Illumination should be the criterion where it is not lower than 0.01 ft.-candle, while where it is lower the candle-power basis should be adopted. The illumination method will cover only about 20 per cent of the street lighting of England, and the balance of 80 per cent should be measured by candle-power.—*London Electrician*, May 16, 1913.

**Train Lighting.**—G. MATTAUSCH.—An illustrated description of a new system of electric train lighting. It is a combined dynamo and battery system, but the dynamo is not driven by an axle of the train but by a special wind turbine. There are, in fact, two generators, both coupled to the same turbine. The first generator provides current to the lamps while the train is running above a certain speed, while the other generator, which is in series with the first, charges during the same time the electric batteries which are discharged and supply current to the lamps when the train stops.—*Zeit. f. Beleucht.*, May 10, 1913.

**Quartz Lamp.**—An illustrated description of a new lamp which is a combination of the sun quartz lamp and the Cromeyer medical lamp. The former is used for sun baths in larger rooms, the latter for treating restricted portions of the body. The new quartz lamp is from 700 cp to 800 cp and is inclosed in a box. In one of its sides a smaller or larger slit may be produced so as to permit more or fewer rays to get out of the box.—*Elek. Zeit.*, May 8, 1913.

### Generation, Transmission, and Distribution

**Starting and Speed Control of Induction Motors.**—F. C. ALDOUS.—An abstract of a paper read at Manchester. Two types of motor are concerned:—(1) the squirrel-cage induction motor with permanently short-circuited rotor; (2) the slip-ring induction motor with phase-wound rotor and external resistors. For constant-speed work the squirrel-cage motor is generally to be preferred to the slip-ring motor and can be used where its starting current is not objectionable. For motors of very large size the slip-ring type is generally preferred. For variable speed work the slip-ring motor is generally used. The squirrel-cage motor can be used for intermittent service, but only in small sizes or when the use of slip rings is not desirable. When the speed is reduced continuously on heavy torque, the slip-ring motor is not suitable, owing to the constant rheostatic losses, and a multi-speed motor giving several efficient speeds is preferred. The multi-speed motor is also used where good speed regulation is required at several speeds. Where the torque at reduced speeds is diminished the slip-ring motor with rheostatic control is often the best system. For fan-driving, where the speed is occasionally reduced, the average power consumption with the slip-ring motor may be as low as or even lower than with other systems,

as well as the first cost being lower. When starting a motor with an auto-starter, if the maximum current and the maximum torque at starting are measured at different voltages, the current drawn from the line is directly proportional to the torque developed. If the motor starts against a load consisting entirely of inertia, the total energy absorbed and the heating of the motor are independent of the starting voltage. If the load consists partly of a friction load, the energy absorbed and the heating are reduced if the voltage be increased. From this it is seen that a high starting voltage is generally advantageous. When the starting conditions are fixed and the friction of the load is fixed but the inertia is varied, then the time of starting, the total energy absorbed and the heating of the motor are proportional to the inertia of the load. The determination of the short-circuit current and the correct proportioning of the "slip" are of very great importance in the design of a squirrel-cage motor. The starting torque is dependent on the short-circuit current and upon the slip at normal load. The slip at normal load is not, therefore, a definite percentage, but depends on the required starting conditions. In the same way a motor with an inherently large short-circuit current can be built with a small slip. An account of the extended discussion which followed is also given.—*London Electrician*, May 16, 1913.

**Reserve of Water-Power Plant.**—F. DREXLER.—In order to provide a reserve for the 1450-hp water-power plant at Amstetten at times of low water or high water, a Diesel engine of 400 hp has been installed and another one of 600 hp is to be erected later. The Diesel engine was chosen as it can be put into operation quickly.—*Elek. und Masch. (Vienna)*, May 11, 1913.

**Small Water-Power Stations.**—C. REINER.—A long illustrated paper on small hydroelectric stations with special reference to automatic regulation systems. Automatic regulation is absolutely necessary with small stations to keep the cost of attendance down.—*Zeitschr. f. d. ges. Turbinenwesen*, Vol. 8, 1912, page 145; briefly abstracted in *Elek. Zeit.*, May 15, 1913.

**Electric Cranes.**—R. LODER.—A profusely illustrated article on the different controller arrangements for direct-current and alternating-current cranes of the Siemens-Schuckert company.—*Elek. Zeit.*, May 15, 1913.

### Traction

**Electrification of Paris Suburban Railways.**—J. REYVAL.—A review of the recent long paper by N. Mazen on the electrification of the suburban lines west of Paris operated by the French state railways. The author discusses, especially, the reasons why direct current at 650 volts has been adopted. There will be 400 to 500 motor cars fed with 650-volt direct-current energy from a third-rail. This energy is delivered from substations which are fed with three-phase energy at 15,000 volts and 25 cycles.—*La Lumière Elec.*, May 3, 1913.

### Installations, Systems and Appliances

**Voltage Regulator.**—ROBERT FORBES.—The author gives an illustrated description of a new voltage regulator for generators. When the load changes an auxiliary hydraulic motor starts quickly the regulation by short-circuiting the regulating resistor. But simultaneously the lever of the regulating resistor is moved in the opposite direction, bringing exactly to the new load so that when the correct voltage has been obtained and the auxiliary motor is thereby brought back to its normal position the correct regulating resistance is available. This means that the whole regulating operation is completed.—*Elek. Zeit.*, May 8, 1913.

**Electric Illumination in China.**—A new company, set up in the district of the Chinese Municipality of Harbin, have the following plants:—The Russian Consulate has a six-wire direct three-phase plant for supplying energy to the arc lamps and some incandescent lamps at 110 volts, having

a total of 1200 hp. A gas-driven 200-volt direct-current plant at Kulajet supplies energy to 2000 incandescent lamps and motors of 20 hp. The three-wire,  $2 \times 220$ -volt direct-current plant at Mitschlof supplies energy to fifty arc lamps, 8000 incandescent lamps and motors of 60 hp. The 220-volt direct-current plant of Tschurin & Company supplies energy to 3000 incandescent lamps and motors of 25 hp. A 650-hp, 5000-volt, three-phase plant in Tsinanfu started operation in 1912. In the same city there are two more generating stations and two substations.—*Elek. Zeit.*, May 15, 1913.

**Electric Installation of Aluminum Plant.**—A description of the electric generating plant of the Vigeland aluminum works, which contains four direct-current generators, each of 250 volts, 8000 amp, running at 220 r.p.m. Three of these generators produce 2000 tons of aluminum per year.—*Schweiz. Bauz.*, No. 4, 1913; briefly abstracted in *Elek. und Masch.* (Vienna), May 18, 1913.

**Safety of Electric Installations.**—G. DETTMAR.—A continuation of his long article giving in tables and diagrams a great many statistical data on electrical accidents, fires, etc., in German practice during the last twelve years.—*Elek. Zeit.*, May 15, 1913.

**Fires in Central Stations.**—ANDRÉ GÉRARD.—An article on the causes of fires in electric central stations, with some recommendations concerning means of preventing them in the erection of a new station.—*La Lumière Elec.*, May 3, 1913.

### Wires, Wiring and Conduits

**Determination of Voltage Drop.**—KARL MELLER.—With large transmission systems the voltage of the generating plant is usually kept constant so that the voltage at the consumers' terminals will vary according to the load. The author describes a simple graphical method for determining the voltage drop in overhead lines with high voltages due to load fluctuations so that it is possible to find quickly whether the voltage variations at the consumers' ends will remain within the permissible limits.—*Elek. und Masch.* (Vienna), May 11, 1913.

**Crossings.**—PAUL KVETENSKY.—An illustrated article on methods by which a high-tension wire may be carried safely over a telephone or telegraph wire without danger of breaking the wire.—*Elek. und Masch.* (Vienna), May 11, 1913.

**Duralumin.**—L. M. COHN.—A review of the change of physical conditions of aluminum and its alloys by heat treatment or mechanical treatment, with special reference to duralumin.—*Elek. und Masch.* (Vienna), May 18, 1913.

### Electrophysics and Magnetism

**Traveling of Electric Waves.**—R. RUEDENBERG.—A mathematical article on the traveling of electric waves over lines with variable characteristic, the characteristic being defined as the square root of the ratio of inductance to capacity. Whenever there is a sudden change in the characteristic, the energy of the traveling wave is diminished since part of it is reflected. If the loss by reflection is to be made as small as possible the two lines with different characteristics are not put together directly, but a piece of medium characteristic is coupled between them. In this way the loss by reflection is reduced. In lines in which the characteristic varies continuously (not suddenly) the waves travel without great losses if the change is gradual compared with the length of the waves. The author develops the differential equation for lines which will be wholly devoid of reflection and makes an application to Pupin lines.—*Elek. und Masch.* (Vienna), May 18, 1913.

**Spectroscopic Resolution of an Arbitrary Function.**—C. V. BURTON.—An abstract of a (British) Physical Society paper. An ordinary grating has periodic rulings, and a spectrum obtained by means of it is characteristic of the radiation entering the spectroscope slit. But if the radiation is homogeneous while the distribution of the rulings is

arbitrary, we obtain a spectrum characteristic of the grating. It is thus found to be theoretically possible to resolve spectroscopically a given arbitrary function  $f(x)$  into its harmonic constituents. The "permeability" of a photographic negative at any point being defined as the square root of the reciprocal of the "density," the first step is to make an "equivalent grating." This is a plate whose permeability (variable in one dimension only) has at any point  $x$  the value  $A+B f(x)$ , where  $A$  and  $B$  are constants. When this (transmission) grating takes its place in a spectroscope whose slit is fed with homogeneous light, the spectrum of the function  $f(x)$  can be seen or photographed. Suitably interpreted, it gives the periodogram of  $f(x)$ . A description is given of a device which it is hoped may prove useful for determining the phases of the various harmonic constituents. The theory of the proposed method of resolving functions is discussed and is as complete as that of ordinary spectroscopy, while in one respect it is more simple; for, since the light entering the spectroscope slit is entirely of one wave-length, the comparison of intensities of spectral lines (whether visually or photographically) is facilitated. Some preliminary practical tests are now being made.—*London Electrician*, May 16, 1913.

**Hysteresis Loop and Index.**—W. M. THORNTON.—An illustrated article giving a brief analysis of the forms of electric and magnetic hysteresis loops. It is found that a magnetic loop formed of curves, taken to be the same on both the rising and falling sides, agrees as closely with experimental results in alternating fields as the loops obtained by the point-to-point method, and that the means of the indices corresponding to these agrees with the Steinmetz coefficient 1.6, defined by  $W=\eta B^{1.6}$  very closely.  $W$  being the energy dissipated per cycle and  $B$  the maximum flux density. The physical meaning of an index 1.5 is that the residual flux is proportional to the maximum number of molecular magnets per centimeter length ranged in line with the field per cycle, and the slightly higher index observed is explained by a linear polarization in weak fields, giving rise to a coercive force proportional to the maximum flux-density—that is, to the closeness of the packing of molecules which are ranged into line with the field in a plane at right angles to it.—*London Electrician*, May 16, 1913.

### Units, Measurements and Instruments

**Electromagnetic Instruments.**—A. SCHORTAU.—An illustrated article giving an outline of the principles of design of electromagnetic instruments. The author deplores the fact that there are too many types and sizes on the market in Germany, greatly increasing the cost of manufacture. With respect to size he recommends the practice of the Weston company, which has put on the market only two sizes, 242 mm and 170 mm in diameter. All the other manufacturers have built instruments varying between 90 mm and 300 mm in diameter, in about five different sizes. This is economically disadvantageous. The author outlines concisely the fundamental technical requirements which electromagnetic instruments must fulfil in order to be considered as "good" and which at the same time permit manufacture on a large scale and in an economical way.—*Elec. Zeit.*, April 24, 1913.

**Insulating Batteries.**—A. WERTHEIMER.—In measurements of the insulation resistances of cables it is very important that the high-voltage battery which serves as the source of current be very carefully insulated from earth. The author gives tables of the insulation of a battery consisting of twelve groups each of 40 volts in which special arrangements were made to improve the insulation. The different connections of the battery during charging, discharging and while making insulation measurements are explained and illustrated in diagrams.—*Elek. Zeit.*, May 15, 1913.



*Testing.*—In a continuation of the long serial on shop-testing of electrical apparatus the description of tests of direct-current machines, shunt and compound generators, is continued. The present instalment deals with the determination of resistance and copper loss, core loss and saturation tests, the retardation method of determining core losses, voltage regulation and efficiency.—*Elec. Journal*, May, 1913.

### Telegraphy, Telephony and Signals

**Wireless Telegraphy.**—An illustrated description of the Goldschmidt high-power wireless station at Hanover, Germany. The generating plant consists of a 500-hp locomobile which drives two 150-kw generators by belt, the armatures of these machines being directly connected with the motor of the high-frequency alternator. The latter machine consists of a stator and rotor, each of which carries a winding forming 384 poles. If, for instance, the machine runs at a speed of 3130 r.p.m., and the stator winding is excited by continuous current, alternating current will be produced in the rotor with a frequency of 10,000 cycles per second. The stator is excited from the continuous-current generator *A* or a battery (Fig. 33). This battery is protected by a block choking coil *B* from the effects of the alternating voltage produced in the stator of the Goldschmidt machine, the choking coil at the same time preventing the alternat-

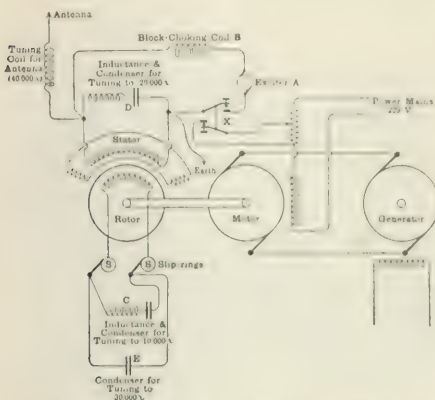


FIG. 3—CIRCUIT DIAGRAM OF HIGH-POWER WIRELESS STATION

ing energy in the antenna from passing to earth through the exciter. The alternating current of 10,000 cycles produced in the rotor by mechanical rotation in the constant magnetic field of the stator passes, as shown, through a circuit consisting of an inductance coil and a condenser  $C$  which is connected across the slip rings  $SS$  of the rotor winding. This inductance and condenser are tuned so that the whole rotor circuit is in resonance for 10,000 cycles, thereby minimizing the continuous exciting current in the stator necessary for producing a certain current in the rotor. Owing to the reaction of the rotor winding carrying 10,000 cycles on the stator a frequency of 20,000 cycles is produced in the stator. The stator winding is tuned for this frequency of 20,000 cycles by the combination of an inductance coil and condenser  $D$ , so that the 20,000 cycles have a well-tuned path to flow in. These 20,000 cycles in the stator react again on the rotor and produce here a frequency of 30,000 cycles, the rotor winding being tuned to this frequency by the condenser  $E$ . Naturally, in selecting the combination of the inductance coil and condenser  $C$  for the tuning to 10,000 cycles, as well as for the selection of the condenser  $E$ , account must be taken of the two tuning circuits in parallel affecting one another, but by careful correction the tuning of the rotor circuit for both 10,000 and 30,000 cycles can be carried out very exactly.

Through the reaction of the current (at 30,000 cycles) in the rotor, 40,000 cycles are produced on the stator terminals, which are connected to earth and to the antenna as shown in the diagram. The machine is operated by the key *F* in the exciting circuit, which, besides exciting the alternator and thus supplying energy to the antenna circuit, controls the speed of the machine through a relaying device as follows. The total of the generator is accurately calibrated and runs at a constant predetermined speed. Thus, for the field circuit of the driving motor is also supplied from the mains. The motor consists of a motor which can be run in or out of the circuit by means of a relay. Thus, when current is supplied to the antenna, *A*, is pushed the motor back to its position so that it is not in contact with the terminals of the generator, and thus ceases to act on the increased output. The point is that the speed of the Goldschmidt generator remains constant at 3100 r.p.m.—London *News*, May 15, 1913.

**Loaded Telephone Cables**—The use of a new aluminum-patent cable, known as the Western Electric Loadable Plug-in cable for locally-terminating telephone cables, are made up in long measuring reel coils. These are joined onto the cable during laying, and the end plugs inside each reel casing are locked to it after the cable and connections are in place. To this end the plugs are provided with recessed faces for the application of water-lubricated twisting.

*London Elec. Engng. May 15, 1913.*

### Miscellaneous

*Exposition in Belgium.* I. R. PROSS: A brief account of the official opening of the Gand exposition in the presence of the King and Queen of Belgium. The French, English and German sections cover 4,500, 17,000 and 4,500 sq. m. respectively. The author mentions some exhibits in the French electrical and metallurgical sections and in the Belgian sections.—*La Lumière Elec.*, May 3, 1913.

## Book Reviews

LA THÉORIE DU RAYONNEMENT ET LES QUANTA. Rapports et Discussions de la Réunion tenue à Bruxelles les 30 Octobre et 3 Novembre 1911. Sous les auspices de M. E. Solvay. Paris, 461 pages. Price, 15 francs.

A valuable compendium of the paper and discussion offered at a "physical conference" held at Brussels (Belgium, in November 1971). This conference was international in a broad sense, being attended by delegates from Belgium, Germany, England, France, Austria, Holland and Denmark, but Argentine delegates seem to have been over-represented. The papers presented were mainly devoted to the mathematical treatment of physics. All of them are beautiful papers, although most of them relate to theoretical mathematical and physical topics. The volume will be useful as a reference book by advanced students in physics, chemistry and molecular physics.

Illustrations: DRAWINGS BY CHARLES F. SMITH, and FRANK P. FARR. PHOTOGRAPHS: Copyright by authors. Printed on Daigremont paper. 34 drawings.

This book contains a collection of wiring diagrams of call systems, simple lighting circuits and connections for various types of motors. There are also 51 circuit diagrams with short explanatory text to each one. The text as well as the diagrams is purely elementary, the diagrams being well labeled in order to give a clear illustration of the fundamental principles of electric wiring. Each diagram brings out clearly the connection of the various components. The book was originally prepared as a text for trade-school courses but it will also be found useful by wiring men of limited experience.

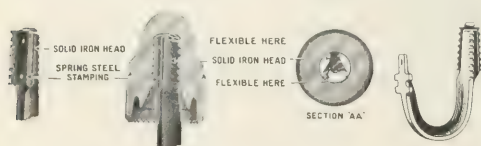


# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Flexible Clip for Insulator Brackets

The Line Material Company, South Milwaukee, Wis., has brought out an insulator bracket with a flexible clip which provides protection against expansion, contraction and irregularities in the insulator grooves. A full section



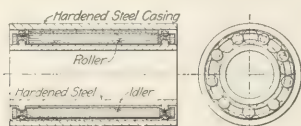
DETAILS OF FLEXIBLE CLIP

of the malleable-iron bracket enters the insulator and a part section of this is used as a thread for the insulator. The clip adjusts itself both as to diameter and length. The high-grade malleable iron used in making these brackets, it is claimed, will outlast steel, and this, together with the ability to absorb sudden strains or jerks, tends to insure long service. The illustrations show the construction of the clip and a new type of malleable-iron one-piece bracket fitted with the clip.

### Non-Lubricant Roller Bearing

A new type of bearing called the "California" roller bearing has recently been placed on the market by the American Roller Bearing Company, Pittsburgh, Pa. It is of the non-lubricant anti-friction type and consists of four parts: sleeve, rollers, spacers and outer casing. The sleeve fits on the shaft and is made of hardened steel and the outer casing fits inside of the hub of the wheel, pulley or bearing. Cylindrical rollers are circumferentially spaced by means of idlers between these sleeves. These idlers are smaller in diameter than the rollers and run on a separate track. They are held in place by two retaining rings. When end thrust has to be taken care of in a bearing it is provided for by a ball race or a nest of cylindrical rollers of the non-lubricant type.

It is stated that the Pennsylvania Railroad Company, in its Olean (N. Y.) shops, has used these bearings in a large Sturtevant blast fan which has made 2400 r.p.m. twenty-



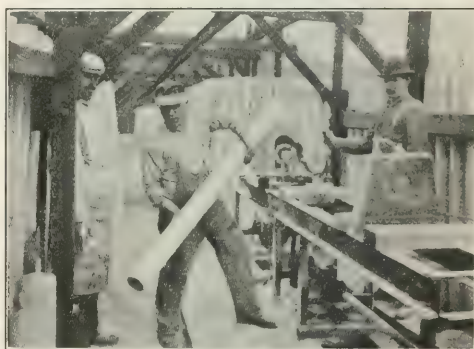
SECTIONS OF ROLLER BEARING

two hours a day for three years without lubrication, the bearing still being in first-class condition. It is also stated that in tests made on the Pennsylvania Railroad a locomotive bearing was in service more than 20,000 miles, sometimes with a train speed of seventy miles an hour, with the California bearings constantly cool while the ordinary bearings were considerably overheated.

### Molded-Concrete Conduit

A type of conduit called "stone-duct," made by the Chicago Stone Conduit Company, 137 South La Salle Street, Chicago, is of considerable interest. It is a pipe conduit made of concrete molded by the Graham process. Both the inside and the outside of the pipes are machine-finished so as to give perfectly smooth surface. This is of importance particularly in regard to the inside as it minimizes the labor of rodding and cable drawing. The pipes are made in 6-ft. lengths and the ends are provided with metal rings. These rings, which are used for connecting two sections of duct, form a tight joint, making it impossible for any foreign articles to get into the duct. This is a particularly desirable feature in connection with installations in wet sand or mud.

It is claimed that this type of conduit is not injured by arcs occurring within the conduit. Consequently, trouble on



REAMING CONCRETE CONDUIT

account of arcs in one conduit is not communicated to the cables in adjacent ducts.

When this conduit is laid with an envelope of courser concrete, it forms a monolithic mass, as the concrete envelope makes an excellent bond with the concrete duct. The ducts can be readily cut with an ordinary cross-cut saw. It is stated that the weight per linear foot is less than that of tile, with a consequent advantage in transportation. No skilled labor is required for its installation.

### Oil-Pressure Thrust Bearing

A new type of oil bearing was recently invented by Mr. Albert Kingsbury, consulting engineer, Pittsburgh, Pa. Of particular interest in this bearing is that oil pumps are entirely omitted and that, instead of pumps, the viscosity of the oil is depended upon to maintain the film. Bearings of this type have been installed at several of the hydroelectric plants, and three bearings are being installed at the new Keokuk station.

In general the design consists of a collar rotating with the shaft and sliding on stationary parts arranged to receive the thrust, the whole being submerged in a bath of oil. It resembles to some extent the ordinary collar thrust bearing

such as is used on line shafting, etc., but it differs from the common type in one essential feature. In the ordinary collar bearing the stationary bearing surface is provided by a continuous ring, while in the new bearing this ring is divided into several independent sectors or shoes, generally six in number. Each of these shoes is so supported against the thrust that it may independently align itself to the best bearing conditions at the sliding surface, thereby enabling the lubrication to be effective in the highest degree.

The self adjusting feature of the shoes is generally provided by rounding one of the supporting surfaces at the back of the shoe so that the shoe may rock or pivot over a point near its center of area. These shoes are loosely held in a supporting ring, which is generally provided with a spherical seat permitting alignment of the group of shoes as a whole to the rotating collar. In some cases, as in very large bearings, each shoe has an adjusting wedge for equalizing the load on the shoes.

Generally the collar is made of cast iron or mild steel and the shoes of cast iron or cast steel faced with babbit metal. For very heavy loads at slow speeds harder materials are used, such as chilled cast iron or bronze shoes. The bearing is made in halves when required for assembling without removing the shaft collar.

The explanation of the effect of the rocking support for the shoes is that this feature insures conditions of lubrication similar to those in cylindrical bearings, such as railway axle bearings, which are capable of sustaining relatively high unit pressures at high speeds, while flat surfaces, such as ordinary plain collar or footstep bearings, are in general suitable only for moderate pressures and speeds. Careful experimental and theoretical investigations have shown that in well-fitted cylindrical bearings the sliding curves are separated by a very thin film of oil which is under a static pressure equivalent to the load on the bearing. All the friction in this case occurs in the oil, not between the metals and the coefficient of friction is relatively low. The film invariably has a wedge form, being thicker at the edge where the oil enters with the rotation of the shaft and then

drical bearings the wedge-shaped space for the film is provided by a slight difference in the radii of the surfaces, or by a slight eccentricity of line. In ordinary collar and footstep bearings it is evident that the conditions do not permit the formation of the oil wedge, and consequently the lubrication is imperfect; there is relatively little oil between the surfaces and there is great and unnecessary friction.

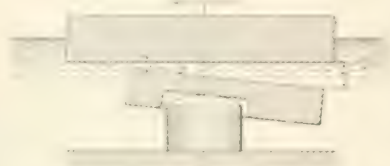


FIG. 2. COLLAR BEARING IN CROSS SECTION.

a correspondingly high coefficient of friction and often troublesome heating and wear. In the bearing here described each shoe is free to adjust itself to the collar, hence the desired wedge-shaped film is formed between the shoe and the collar.

This bearing is being built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

### Direct-Current 2400-Volt Locomotives

The electrification of the Great Atlantic & Pacific Railway is of exceptional interest, this being the first installation in this country of the expensive direct-current system. The reconstruction work necessary to effect the change from steam to electric equipment is now practically completed.

The selection of the 2400-volt direct-current system for this railway was determined after a comprehensive study of local conditions and requirements. The traffic demands are unusually severe and the principal difficulty of handling long trains collecting current from three lower-voltage systems. In comparison with other existing systems the 2400-volt direct-current system was considered best-suited for service of this character.

The Baltimore section, which has now been equipped, comprises a series of six-mile single-track and numerous double-track and double-track segments, a total of about 60 miles in a single-track line. The change of current on each of these miles is in the district of Annapolis, consisting of 11 miles, supporting double-track service in both directions, powered by two 1000-horse-power 400-volt generators. The power supply is made up of three battery units, each of which is handled against a rating grade of 400 per cent for a limited emergency use of the same capacity. Single units will be used for backing or thrust in the event of an "empty" car.

The three segments consist of six-mile locomotive units, fifteen-mile freight and low-boom passenger double-track segments, and a single-track segment. The last two are known as "dog" segments, as they will be coupled together and operate as single-track segments. Double-track segments will have the usual form of a piece of a continuous track, or will be made up of the rolling stock, but will not have any fixed points of track.

The maximum operating rate of the road change is 100 miles per hour, but may be lower for a balance load of 40 cars per hour or less, instead of 20. A grade of 1000 feet per mile is provided, and the maximum speed of the passenger train is 100 miles per hour. The maximum speed of the freight train is 40 miles per hour.

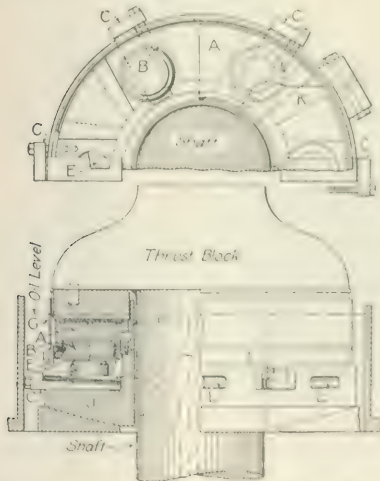


FIG. 1. DETAILS AND GENERAL VIEW OF THE BEARING.

ner toward the leaving edge, the difference in radii being only a fraction of a thousandth of an inch. The film is maintained by reason of the attraction of the shaft in its rotation and by the viscosity of the oil. It has also been proved that the wedge form of the film, although the degree of taper is extremely small, is the only essential for low friction and high load-carrying capacity. In cylin-

All the locomotive equipment, as well as the substation apparatus and overhead line material, was designed and built by the General Electric Company.

The locomotives are of the articulated double-truck type with all weight on the drivers. On each axle is mounted a motor of the twin-geared type.

The engineer's compartment, at each end of the cab, contains controller, air-brake valves, bell and whistle ropes, ammeter, air gages, sanders and other control apparatus that should be within immediate reach of the engineer. These compartments are heated electrically.

In the central section of the cab is grouped the control apparatus. The contactors, reverser and rheostats are mounted in two banks running lengthwise of the compartment and are arranged with ample space between them to afford convenient access for cleaning, inspection and repair. All parts and circuits carrying 2400 volts are thoroughly protected from accidental contact. A dynamotor is employed to furnish 600 volts for the operation of the contactors, lamps and air compressor. The motors are of the commutating-pole type, wound for 1200 volts and insulated for 2400 volts. A forged pinion is mounted on each end of the armature shaft and meshes into a corresponding gear mounted on the wheel hub. The gear reduction is 4.84 on the freight locomotives and 3.2 on the passenger locomotives.

The continuous rating of each motor is 190 amp at 1200 volts under forced ventilation and 225 amp at 1200 volts for one-hour rating. For the double-unit 160-ton locomotive this is equivalent to a continuously sustained output of 2100 hp.

The control equipment on the locomotives is the Sprague-General Electric multiple-unit control and is designed to operate the four motors in series and series-parallel. The pairs of motors with their respective resistors are connected in series on the first point of the controller. The resistance is varied through nine points on the controller and finally short-circuited on the tenth or running point. The pairs of motors are then operated similarly in series-parallel and all resistance is cut out on the nineteenth point, which is the

switch is provided having manually operated handles for cutting out either pair of motors, so that the locomotive can then be operated with one pair of motors in the usual way.

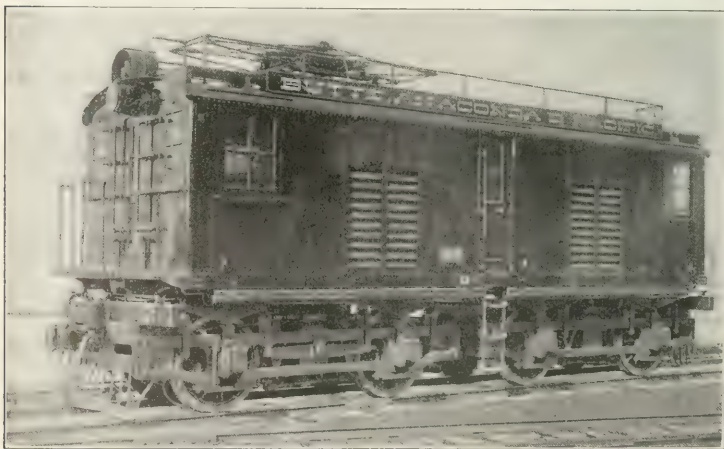
The main switch is provided with a powerful blow-out so that heavy currents can be opened. The three smaller switches, one for each of the two heaters and one for the dynamotor circuits, are designed specially for 2400 volts. The blade is controlled by a lever attached to the grounded part of the locomotive frame and insulated from the live parts of the switch by a rod of treated wood.

There is one main fuse for the trolley circuit and two fuses for the motor circuits. They are all of the copper-ribbon type and are fitted with hinged covers to facilitate fuse renewals. The boxes are placed as near as possible to the overhead trolley in order to protect the wiring circuits near the source of supply. There is also an auxiliary circuit fuse for protecting locally the dynamotor and heater circuits. The main, motor and auxiliary fuse boxes are provided with powerful magnetic blow-outs, energized by current passing through the fuse, to insure proper rupture of the arc.

The overhead trolleys are pneumatically operated from the engineer's compartments by a hand-operated valve. The passenger locomotives are equipped with two collectors and the freight unit with one collector. A 2400-volt insulated bus line connected direct to the pantograph is run along the center on the roof of the cab. The bus lines are connected by couplers between the two units of the freight locomotive, so that current is obtained from both collectors or from a single collector. The collectors and bus lines are adequately guarded by railings.

### Water Sterilizer and Receptacle

The Forbes Company, 1208 Callowhill Street, Philadelphia, Pa., has added to its sterilizing apparatus a receptacle for pure water to prevent any possibility of contamination. The raw water supplied from the upper bottle is sterilized on the heat-treatment principle by passing it



80 TON DIRECT-CURRENT LOCOMOTIVE FOR 2400-VOLT OPERATION



WATER STERILIZER

full-speed running point. This plan provides a control with ten steps in series and nine steps in series-parallel.

The transition between series and series-parallel is effected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The smooth transition between control points permits acceleration close to the slipping point of the wheels. A

over electric heating units, is again cooled and delivered to the receptacle or lower bottle. A part of this receptacle extends down onto the ice cooler, from which it can be drawn through an ordinary faucet. By this method there is no possibility of contamination from ice or handling. The complete outfit of sterilizer and receptacle is shown in the accompanying illustration.



### High-Tension Weatherproof Transformers

A simple inexpensive installation of outdoor high-tension transformers used for supplying energy to pumps is shown in the accompanying illustration. The transformers are rated at 25 kva and are mounted on a platform large enough to accommodate 50-kva units in case the load should increase. Carbon-tetrachloride fuses mounted above



OUTDOOR TRANSFORMER STATION

the transformers can safely be replaced by opening the disconnecting switches mounted on the next pole. This particular type of installation is especially suited for supplying energy for small motors where the cost per kilowatt for equipment and installation must be kept at a low figure. Opportunities for this class of service occur along practically every high-tension line. The installation shown in the illustration was made by the Delta-Star Electric Company, Chicago.

### Cold-Drawn-Steel Union

A pipe-union made of cold drawn steel has recently been placed on the market by the Mark Manufacturing Company, Chicago, Ill. It consists of the usual three main parts, namely, male and female ends joined by a coupling nut. These parts, as well as the brass seal ring, are drawn cold from flat stock, thereby obtaining a fitting that is said to be seamless and free from sand holes, pin holes or similar



PIPE UNION OF COLD-DRAWN STEEL

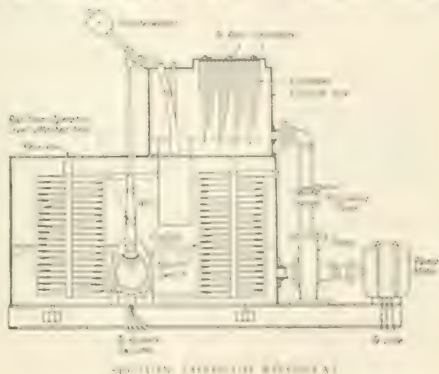
structural defects. As the union is threaded to the Briggs standard for pipe threads, it carries the same taper as the pipe instead of being tapered straight through as most unions are. The union is made of the same material as wrought-steel pipe, and therefore leaks are eliminated because of the equal expansion and contraction of the union and pipe. Another novelty is the densified hardened steel

seat which is formed by applying the die with such great pressure that the metal is hardened and a smooth, accurately shaped surface is given to the seat. When the coupling nut is screwed into place the hardened seat and the opposing soft brass ring in the female end make a joint which is leak proof under liquid pressure pressure. Both seat and ring are formed in dies without machining or grinding so that the fit of one fitting against the other is exact. After the threads are cut, the steel is heat-treated to protect against corrosion. In this processing, there are given the sharpness and fit of the threads.

### Liquid Rheostats for Large Alternating-Current Motors

For use with large alternating-current cuprating motors driving mine hoists, winding gears, rolling mills, etc., the Westinghouse Electric & Manufacturing Company has developed a new type of liquid rheostat provided with a large number of steps between the minimum and maximum limits, thus permitting fine speed adjustments and smooth acceleration. The rate of acceleration can be definitely fixed and is independent of the load at which the motor is manipulated the starting load.

The principle of operation of these rheostats is shown by the accompanying diagram. Two rheostat containers of



two compartments, an upper tank for the electrolyte and a lower reservoir. The three portions of the pump are connected to electrodes suspended in the upper tank. A small motor-driven pump sends a steady stream of liquid, usually a solution of soda, from the reservoir into the electrolyte tank and back into the reservoir over the pump. By raising or lowering the pump, the height of the liquid in the electrolyte tank is automatically varied. The resistance in the rotor circuit decreases as the liquid level rises and vice versa, and the motor speed of rotation varies with the rotor position.

The primary circuit of the motor is closed and opened by means of electrically controlled switches which are controlled by a motor driving mechanism on the platform. The operating level of the primary circuit is kept the same with the level of the electrolyte. When the level of the electrolyte is low, the primary circuit is closed and the motor is started. As the level of the electrolyte rises, the primary circuit is opened and the motor is stopped. When the level of the electrolyte is high, the primary circuit is closed and the motor is started. The motor is started and stopped by means of a switch on the platform. The motor is started and stopped by means of a switch on the platform. The motor is started and stopped by means of a switch on the platform.

A 440-v. alternating-current supply of the platform line feeds

lates the rate at which the liquid is pumped in, so that no matter how quickly the operating lever is moved the liquid can only rise at the rate for which the valve is adjusted, thus fixing the rate of acceleration. When the lever is returned to the "off" position the weir drops and the liquid level promptly falls.

Cooling coils in the reservoir prevent rapid evaporation of the liquid. These rheostats are made in ratings from 400 hp to 1500 hp.

### Splicing Sleeve

In the past considerable trouble has been experienced with transmission-line splicing sleeves owing to the fact that after they had been twisted over the wire they did not



FIGS. 1 AND 2—DOUBLE-TUBE SLEEVE BEFORE AND AFTER TWISTING

fit snugly to the conductor at all points. This led to difficulty as it allowed a vacant space in which moisture collected and caused corrosion of the sleeve and the conductor. It is claimed by the manufacturers of the sleeve here shown that when properly installed on a splice it will not allow moisture to creep into the joint, all clearance spaces having



FIG. 3 AND 4—OVAL-TUBE SLEEVE BEFORE AND AFTER TWISTING

been reduced to a minimum and the twisting of the sleeve taking out all of the slack in the splice. As will be noted, the splice does not have a separate compartment for each wire, as did the older designs, but consists of a seamless oval tube. It has been placed on the market by Hickey & Schneider, 227 Fulton Street, New York.

### The Motograph Sign

One of the novel outside electrical features which aroused widespread interest among hundreds of N. E. L. A. convention delegates at Chicago was the "motograph." This is a panoramic "talking sign" operated by perforated paper rolls. It is located on the roof of the Commonwealth Edison Company's North Market Street building and is seen most prominently from the Chicago & Northwestern station. It is the first installation of this device in Chicago.

The peculiar and rather mystifying effect of the motograph on the spectators is due to the rapid-fire manner in which the reading matter is introduced onto the bulletin panel. Each letter appears at the extreme right, travels the entire length of the sign and disappears at the extreme left. There is a continuous flow of letters, three or four words being visible constantly.

The installation was made by the Motograph Company of America, Detroit, Mich. The work of construction was completed in eleven days, night shifts being employed to insure completion in time for the convention.

One of the many messages flashed on the bulletin panel was: "Welcome, N. E. L. A. convention delegates. We hope your visit to Chicago will prove enjoyable, profitable and memorable."

The motograph displays the advertising bulletins under a moving washing machine and figure of a woman operator. It is said to have attracted so much attention from the public that the traffic division of the Chicago Police Department requested the Commonwealth Edison Company to limit the perforated rolls to lengths of not longer than three minutes' duration.

The installation consists of a bulletin panel containing 1360



MOTOGRAPH SIGN IN CHICAGO

10-watt, 115-volt tungsten lamps arranged in ten horizontal rows of 136 lamps each. The lamps are 4.5 in. apart. The total length of the bulletin panel is 51 ft. The height of the letters produced is 4 ft. The entire electrical display is 65 ft. long and 70 ft. high.

The perforating machine will produce old English, script or block letters and even complicated characters such as Chinese symbols if desired.

The operating device is an automatic motor-driven controller of special design which operates the perforated tape and effects a quick succession of "makes" and "breaks." The paper tape is said to run through the controller at the rate of 33 ft. per minute. The roll used in this particular installation contains 100 words, operates continuously for three minutes and then repeats.

### Fractional Horse-Power Motors

Small motors are finding a great many new applications and some of these are made in astonishingly large numbers. For example, 20,000 motors of this type have been put out in drink mixers alone by the Hamilton-Beach Manufacturing Company, Racine, Wis. Motors made by this company have also been applied to portable grinders for machine shops, hair and shoe driers and fans, and are built for almost any other purpose where the requirement is for fractional horse-power. In these motors use is made of double-silk-covered wire dipped and baked three times. The commutator is made practically a solid piece under 10 tons pressure. Nickel babbitt with a rifle-bore finish forms the bearings. Particular care has been taken to make the provision for lubrication as simple as it is effective in keeping oil distributed over the entire bearing surface. The diversified applications of fractional horse-power motors have produced a large number of entirely new electrical devices which create markets not heretofore open to energy-consuming devices of any kind. One example is a drier made especially for shoe-cleaning stands, which have not heretofore contributed to central-station revenues.







and controller panels and eighteen motors ranging from 15 hp to 400 hp for the Boston Woven Hose & Rubber Company, Cambridge, Mass.; one 75-kw alternator, one 3-kw exciter, six 25-hp motors and a switchboard for the Avery Company, Peoria, Ill.; switchboard apparatus and accessories and ten motors ranging from 10 hp to 100 hp for the Grantville Oil Mill, Grantville, Ga.

**Increasing Demand for Brushes.**—Mr. W. J. Jeandron, United States agent for the "Le Carbone" brushes, recently returned from a visit of six weeks in Europe, where he spent ten days in the factory of the Le Carbone Company arranging for a larger production to meet the increased demand for these brushes in the United States.

**Large Power Contract Closed in Minneapolis.**—The Minneapolis General Electric Company recently closed a contract with the Minneapolis Steel & Machinery Company, covering 1066 hp at present and ultimately 1500 hp, for a period of ten years. The machinery company makes, among other things, steam engines. It has been operating its own power plant for over twenty years and is the largest concern of its kind in the city.

**Financial Statement of a Pittsburgh Utility Company.**—The American Water Works & Guarantee Company, of Pittsburgh, Pa., reports net earnings for the fiscal year ended April 30 of \$1,704,500, as compared to \$1,090,061 in 1912 and \$823,133 in 1911. The properties of the company are scattered through seventeen states, and there will be issued and mailed to its stockholders on June 11 a complete report of them, including a number of views.

**Pumping Water for Irrigation in California.**—At Stockton, Cal., the water level is so near the surface of the ground that it has been found very cheap to raise water for irrigation purposes by means of electrically operated pumps. More than 300 pumping plants have been equipped for this purpose with electric motors, and this business has been secured by the Western States Gas & Electric Company, which since the first of the year has gained 2249 hp of power business.

**Planning a Copper Merger.**—The Consolidated Copper Mines Company, recently incorporated in Delaware, is making an effort to form a combination with the Giroux Consolidated Copper Company, the Butte & Ely Copper Company, the Copper Mines Company and the Chairman Consolidated Copper Company. At the present time the Giroux and Copper Mines companies are the only producers, but it is believed that further development of the other properties under a single management will prove profitable.

**Electric Power for Zinc Mining.**—A contract has recently been closed between the Interstate Light & Power Company and the Mineral Point Zinc Company, both of Galena, Ill., for the delivery of energy to 310 hp of electric motors, to operate in the Black Jack Mine near Galena. The greater part of the energy used in the lead and zinc mines in this territory is supplied by the Interstate company. Mining activities, which were temporarily affected by the tariff measures, are resuming their normal condition and several new mines are being opened up.

**New Power Plant to Start Up at Gadsden, Ala.**—A new steam generating station will be put in operation at Gadsden, Ala., during the coming month by the Alabama Traction, Light & Power Company. Energy will be delivered from this station to Anniston, Sylacauga, Talladega, Alexander City, Pell City, Leeds, Birmingham and Gadsden. The equipment at the Gadsden station consists of two generating units, with six boilers, and mechanical fuel and ash handling apparatus. The generating voltage will be 2300 and this will be stepped up to 110,000 volts for transmission.

**Automatic Stoker Installations.**—Through Mr. R. W. E. Leach, of the American Engineering Company, it is learned that during the past week that concern has closed contracts with the Rhode Island Company, Providence, R. I., for Taylor stokers of 5000-hp capacity and with the Narragansett Electric Light Company, also of Providence, for stokers of the same and 7200-hp capacity. It is claimed that these two plants are to be among the most up-to-date in this country. Orders for Taylor stokers have also been placed by the New York, New Haven & Hartford Railroad Company for its Van Nest (New York City) repair shops and by the Fitchburg (Mass.) Gas & Electric Company.

**Annual Report of J. G. White & Company, Inc.**—The tenth annual report of J. G. White & Company, Inc., was placed in the hands of the stockholders this week. Accompanying it was a brief summary of the main points of interest by J. G. White, president of the company. The balance sheet for the fiscal year ended Feb. 28 showed that at the close of the fiscal year the total debts of the company were less than half of the cash in bank and on hand. Actual profits for the year were nearly \$847,000, and after deducting various items for reserves and undistributed expenses a net profit of over \$296,600 was shown. During the past year in connection with the reorganization of the company's properties it was found advisable to take up a bond issue which was made in the previous year, and the reserve fund of \$300,000 set aside for this purpose made the net profit somewhat smaller than it might otherwise have been. The addition to the surplus was \$176,647.95, making the total surplus of the company, as of Feb. 28, \$782,169.98.

**Decision in the Proposed Louisville Merger.**—H. M. Byllesby & Company, of Chicago, have been endeavoring for some time to form a combination of the two gas companies and the four electric companies operating in the neighborhood of Louisville, Ky. Some time ago the necessary ordinances were passed and franchises granted to allow of the carrying out of this plan, but negotiations were then held up by a taxpayers' suit alleging violation of the anti-trust statutes of Kentucky. On May 28 the Court of Appeals of Kentucky handed down a decision to the effect that the proposed consolidation is legal and does not violate any anti-trust provisions of the Kentucky laws. This decision removes the last obstacle to the unification of these gas and electric interests. The conditions of the grant provide for the bringing of natural gas from West Virginia and for a reduction in electric and gas rates. It is expected that the unification of management, together with the decrease in rates, will greatly increase the volume of service.

**Proposed Telegraph Extensions in the Middle West.**—During the coming summer the Postal Telegraph & Cable Company plans to construct along the right-of-way of the Frisco lines an extension of its telegraph system reaching from Kansas City to Joplin, Mo., and there dividing into two branches, one going eastward to Springfield, Mo., and the other stretching in a southwesterly direction to Muskogee, Okla., from which center short branches will reach to Tulsa, McAlester and Fort Gibson, Okla., and Fort Smith, Ark. These extensions will aggregate 571 miles of new line and will open up to the company sixteen important towns which it has not been able to reach so far on its own lines. It is hoped that the work on these lines will be completed before the first snowfall. Other extension work in which the same company is interested is that being carried on by the North American Telegraph Company in North Dakota by which it is planned to enter the cities of Grand Forks and Fargo by July 1, resulting in important patronage for the Postal-North American system.

#### NEW YORK METAL MARKET PRICES

	May 26		June 3	
	Bid.	Asked.	Bid.	Asked.
Copper:				
Standard, spot.....	15.37 1/2	15.00		
London, standard, spot.....	6 12 1/2	6 12 1/2		
Prime Lake.....	15.65	15.75		15.50
Electrolytic.....	15.55	15.65	15.20	15.30
Casting.....	15.40	15.50	15.10	15.20
Copper wire, base.....	17.00	16.50		
Lead.....	4.35	4.35		
Nickel.....	40.00	40.00	40.00	40.00
Sheet zinc, f. o. b. smelter.....	7.50	7.50		
Spelter, spot.....	5.40	5.45	5.30	5.35
Tin, spot.....	48.20	46.25		
Aluminum:				
Prompt delivery.....	25.00	25.50	25.00	25.50
Future.....	25.25	26.25	25.00	25.50

#### OLD METALS

Heavy copper and wire.....	14.87 1/2	14.62 1/2
Brass, heavy.....	9.37 1/2	9.37 1/2
Brass, light.....	8.50	8.50
Lead, heavy.....	4.25	4.25
Zinc scrap.....	4.50	4.50

#### COPPER EXPORTS IN JUNE

Total tons to June 3.....	495
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## Electric Securities

Security	Q. Quarterly. M. Monthly. S. Semi-annual. A. Annual.	Dividend	Per Cent. Dividend	Last 2 Years	
				Div.	Yield
Air Inland Electric Power, c.		\$2, 500, 000	16	15	
Air Inland Elec. Power, pt.		2, 500, 000	16	61	
Amer. Gas & Electric Co.		2, 500, 000	2	Q	18
Amer. Gas & Electric Co. pt.		1, 500, 000	12	Q	42
Amer. Light & Traction, c.		10, 000, 000	25	Q	380
Amer. Light & Traction, pt.		14, 200, 000	12	Q	108
Amer. Power & Light, c.		2, 000, 000	1	Q	67
Amer. Pwr. & Lt., c. & E. pt.		2, 000, 000	1	Q	80
Amer. Pwr. & Lt., c. & E. pt.		1, 000, 000	12	12	11
Amer. Pwr. & Lt., c. & E. pt.		2, 100, 100	1	Q	98
Appalachian Power, c.		2, 000, 000	9	12	
Appalachian Power, pt.		2, 000, 000	9	12	
Arizona Power, c.		3, 000, 000	9	12	
Arizona Power, pt.		81, 000, 000	45	50	
Asheville L. & P., Ist S. S. 42		1, 100, 000	24	1	92
Augusta Aiken R. & E., c. & E. pt.		2, 185, 000	24	S	89
Augusta Aiken Ry. & Elec. Co.		2, 200, 000	18	Q	
Augusta Aiken Ry. & Elec. pt.		1, 000, 000	18	Q	
Augusta Ry. & El., Ist S. S. 40		960, 000	25	S	98
Central Maine Power, Ist. S. S.		2, 502, 000	24	1	91
Cities Service, c.		1, 000, 000	5-12	M	110
Cities Service, pt.		10, 000, 000	2	M	81
Columbia Gas & El., c. & E. pt.		2, 000, 000	23	1	92
Columbia Ry. & El. Co.		2, 000, 000	23	1	92
Columbia Ry. & El. Co. pt.		840, 000	18	Q	85
Commonwealth Edison, cap. stock		52, 000, 000	7	A	141
Con. Gas, El. & P. (Ed.), c. & E. pt.		11, 000, 000	24	S	87
Consum. Pwr. (Mich.), S. S. 36		10, 088, 000	24	S	82
Consum. Pwr. (Mich.), Ist S. S. 29		9, 280, 000	24	S	89
Dallas Elec. Corp., S. S. 22		5, 000, 000	25	S	94
Denver Gas & El. Lt., c.		7, 000, 000	4	M	
Denver Gas & El. Lt., c. & E. pt.		6, 000, 000	24	S	94
Edi. El. Ill., Boston cap. stock		15, 000, 000	3	Q	100
Federal Light & Traction, c.		4, 000, 000	12	Q	70
Federal Light & Traction, pt.		2, 500, 000	12	Q	71
Fort Worth Pwr. & Lt., Ist S. S.		1, 500, 000	25	S	92
Harwood Electric, S. S. 39		1, 000, 000	25	S	100
Kansas City Ry. & El., c.		9, 000, 000	12	Q	20
Kansas City Ry. & El., c. & E. pt.		9, 000, 000	18	Q	15
Kan. City R. & El., Ist S. S. 3		10, 000, 000	25	S	92
Kan. City R. & El., c. & E. pt.		10, 000, 000	25	S	92
Lincoln Gas & Electric, c.		2, 000, 000	12	S	30
Lincoln Gas & Electric, c. & E. pt.		2, 000, 000	12	S	30
Mobile Electric Co., pt.		800, 000	12	Q	71
Mobile Elect. Co., Ist S. S. 46		1, 000, 000	25	S	71
Northern States Power, c.		5, 000, 000	18	Q	70
Northern States Power, pt.		8, 000, 000	14	Q	75
Pacific Gas & Electric, c.		31, 000, 000	14	Q	74
Pacific Gas & Electric, pt.		15, 000, 000	14	Q	88
Philadelphia Electric, c. & E. pt.		21, 000, 000	12	Q	71
Portland General Electric, c.		8, 000, 000	25	S	100
Republic Railway & Light, c.		1, 500, 000	12	Q	71
Republic Railway & Light, pt.		1, 500, 000	12	Q	71
Santa & San Francisco Pwr. Co.		1, 000, 000	12	S	71
St. Joseph's R. L. Co. & P. Co.		1, 000, 000	12	S	71
Seattle Electric Co., cap. stock		1, 000, 000	25	S	71
Southern Calif. Edison, c. & E. pt.		10, 000, 000	14	Q	71
Southern Power, c.		2, 000, 000	25	S	100
Standard Gas & Electric, S. S. 30		1, 000, 000	12	Q	71
Standard G. & E. Co., S. S. 30		1, 000, 000	12	Q	71
Tennessee R. L. & Pwr. Co.		2, 000, 000	12	Q	71
Tennessee R. L. & Pwr. pt.		10, 000, 000	12	Q	71
Western Power		1, 000, 000	12	Q	71
Western Power, c. & E. pt.		1, 000, 000	12	Q	71
Western State G. & E. Co.		1, 000, 000	12	Q	71
W. Sta. G. & E. Co., S. S. 11		1, 000, 000	24	S	71

## Personal

Mr. Fred H. Vore has been appointed city electrician for Pasadena, Cal., to succeed Mr. W. D. Brown.

Mr. Charles White has been appointed general manager of the Detroit (D. C.) Electric Light Company.

Mr. W. H. Brown, formerly of the Pacific Gas & Electric Company, San Francisco, has been back the Electric Power Company, D. C. Central.

Mr. L. A. Baldwin, formerly of Boston City, Mass., has become superintendent of the Municipal Water & Light Department of Coldwater, Kan.

Mr. A. E. Ingles, formerly of the Public Service Company at Little Rock, Ark., has been appointed with the Gas, Electric & Heating Company at Quincy, Ill.

Mr. J. F. Nisbet has retired his connection with the Triumph Electric Light Company, Cincinnati, Ohio, having accepted a position in London, England.

Mr. Clarence M. Lewis, formerly with the Southern Michigan Gas Company, has been appointed with the Pontiac Power Company, at Pontiac, Mich.

Mr. F. D. Mahoney, consulting engineer of the Luzerne County Gas & Electric Company, formerly at the Plymouth office, is now at the same company's office at Kingston, Pa.

Mr. Ralph E. Tuttle, formerly with the United Electric Light Company of Springfield, Mass., is now associated with the Central Massachusetts Electric Company, of Palmer, Mass.

Mr. H. E. Dunbar, who has been associated with the South Dakota Falls, Mass. Electric Light Company for the past twenty years, has accepted his position as superintendent and chief engineer.

Mr. B. E. Tabler, formerly chief engineer of the Cleveland Railway & Electric Company, Cleveland, Ohio, has been appointed general superintendent of the company to succeed Mr. C. E. Stephens.

Prof. Philip S. Biegler, of the school of engineering of the University of Montana, Missoula, Mont., will spend the summer in the engineering school of the Washington Water Power Company, Spokane, Wash.

Mr. H. K. Smith, formerly electrical superintendent of the Pacific Electric, Indian Land, Conn., who has become associated with the Washington Electric & Manufacturing Company at Fort Detrick, Va.

Mr. Edward F. Peck, a consultant of the Stewart Street & Old Town Railway & Electric Company, has been elected president of the Hingham & Frederick Railway. An outline of Mr. Peck's career in the electrical field was given in our issue dated Jan. 20, 1913.

Mr. W. D. Weaver, of Charlottesville, Va., formerly editor of the Electrical World, has been elected an honorary member of the Phi Kappa Phi Fraternity of the University of Virginia, an organization comprising members of the faculty and elected officers of the university.

Mr. Fred J. Maxwell, former of the Western Wisconsin Railway & Light Company, Fond du Lac, Wis., and in the Western Electric Railway, St. Paul, Minn., who has been stationed in London, Eng., has been transferred to the executive offices of the company in Milwaukee, Wis.

Prof. John Price Jackson, formerly head of the electrical engineering department and vice president of the School of Engineering at Georgia Institute of Technology, has been appointed a member of the Phi Kappa Phi Fraternity of the University of Virginia, an organization comprising members of the faculty and elected officers of the university.

Mr. E. H. Tishman, a member of the Pacific Electric Railway & Light Company, Fond du Lac, Wis., and in the Western Electric Railway, St. Paul, Minn., who has been stationed in London, Eng., has been transferred to the executive offices of the company in Milwaukee, Wis.

Mr. W. E. Herring, who has been in charge of general electrical engineering at the University of the South & West, has been appointed with the company at the same university. He will be in charge of the electrical engineering at the University of the South & West, which is now in the Pioneer Building, South West.



**Mr. E. B. Korst** has succeeded Mr. W. Crawford as district superintendent for the Central Illinois Public Service Company at Pittsfield, Ill. The Pittsfield division includes eleven towns.

**Mr. Edgar G. Scott** has resigned his position as electrical engineer at the Boott Mills, Lowell, Mass., to become superintendent of power and machine shops of the Ludlow Manufacturing Associates, Ludlow, Mass. Since his graduation from Worcester Polytechnic Institute in 1905 Mr. Scott has been successively connected with the Westinghouse Electric & Manufacturing Company, the Boston Elevated Railway Company and N. J. Neall, consulting electrical engineer.

**Mr. James E. Hewes** has been appointed general manager of the Albany (N. Y.) Southern Railroad, which operates an interurban railway between Albany and Hudson, N. Y., and also supplies electrical energy to Hudson and the towns between it and the capital. Mr. Hewes succeeds Mr. R. C. Smith, who resigned some time ago to accept a position in Jackson, Miss. He is a graduate of Johns Hopkins and for many years was engaged in the construction of both railways and electric light and power stations.

**Mr. W. W. Coleman**, for the past twelve years with the Union Switch & Signal Company, has been appointed sales engineer in the railway sales department of the Edison Storage Battery Company. After graduation from the Park Institute of Pittsburgh, Mr. Coleman was employed by the Westinghouse Electric & Manufacturing Company and later he was designer for the chief engineer of the Cambria Steel Company. With the Union Switch & Signal Company Mr. Coleman was successively chief draftsman, assistant engineer and designer to chief engineer. His headquarters will be at Orange, N. J.

**Mr. W. J. Harvie**, whose appointment to the position of railway manager of the operating department of J. G. White & Company, was noted in our issue dated March 2, 1912, has been appointed assistant to the president and engineer of construction of the Hagerstown & Frederick Railway. Mr. Harvie graduated from Syracuse University with the degree of electrical engineer, and has served as electrical engineer for the Syracuse & Suburban Railroad and the Utica & Mohawk Valley Railway and as chief engineer of the Syracuse Rapid Transit Company and the Oneida Railway. He was president of the American Electrical Railway Engineering Association in 1911.

**Mr. W. S. Townsend**, who has been acting manager of the Albany (N. Y.) Southern Railroad Company for some time, has been appointed assistant general manager of the company with headquarters at Hudson. Mr. Townsend is a graduate of the Worcester Polytechnic Institute and for many years was in charge of the Tri-State Railway & Light Company of East Liverpool, Ohio. When Mr. R. C. Smith resigned as manager of the Albany company over a year ago Mr. Townsend was placed in charge temporarily, there being no assistant general manager under Mr. Smith. The plan of the company now is to have a resident officer at both terminals so as to handle the railway and electric business in the section between Hudson and Albany to better advantage.

**Mr. P. T. Glidden**, whose appointment as general manager of the Consumers' Power Company of St. Paul, Minn., was announced in these columns on May 24, was born in Massachusetts in the year 1870, reared and educated in South Carolina, and returned to Boston, his native city, in 1887. From 1889 to 1893 Mr. Glidden was with the Holtzercabot Electric Company, leaving its employ to go with the Schaeffer Electrical Company. In 1895 the New York Edison Company added Mr. Glidden to its staff, and for eight years he was with this company in the operating, business and commercial departments. The year 1903 he spent with the Ohio Brass Company. In 1904 he accepted the position of manager of the new-business department of the Binghamton (N. Y.) Light, Heat & Power Company. A year and a half of effort there resulted in his being elected vice-president and general manager. A few months later he assumed charge of the Sayre (Pa.) Electric Company, and a year after he became vice-president and general manager of the Eastern Pennsylvania Power Company, of Easton, Pa., retaining the management of the Binghamton

and Sayre companies (all Meikleham & Dinsmore properties) until he became associated with the Louisville Lighting Company, which utility he left to go to St. Paul.

**Mr. Theodore Insee Jones**, who is the new chairman of the Commercial Section of the National Electric Light Association, is general sales agent of the Edison Electric



T. I. Jones

Illuminating Company of Brooklyn, and has been for the past year vice-chairman of the Commercial Section. He is also chairman of the Commercial Section electrical merchandising and finance committees. Mr. Jones was graduated from the Massachusetts Institute of Technology with the degree of B. S. in the class of 1896. In that year he began work in the New York office of the American Telephone & Telegraph Company, being identified with the inspection and executive departments. While there he originated and

equipped the first school of instruction for telephone traffic, writing the first book of instruction for handling long-distance business. This has since become an important adjunct of all telephone companies' work. After four years with the American Telephone & Telegraph Company he directed the traffic department work of the New York & New Jersey Telephone Company in New Jersey. During this period he began delivering a course of lectures on telephone topics for the New York Board of Education in the public and high schools of the city. Mr. Jones has continued his lecture work, including electric light, power and railway subjects, up to the present time. Leaving the telephone field in the early part of 1907, he accepted a position as illuminating engineer with the Nernst Lamp Company in New York, a Westinghouse corporation, and while in this position was called upon to organize the sales department of the United Electric Light & Power Company of New York, becoming its first sales manager. After two years' work with the United company, he was invited to take charge of the sales activities of the Brooklyn Edison company, which position he accepted in September, 1909. He reorganized the department, including from that time the advertising and old-building work, which had until then been conducted separately from the selling organization. In less than four years, under Mr. Jones' direction, the sales department has written business amounting to approximately 3,033,472 50-watt equivalents, increasing the company's gross income from \$3,700,000 during 1909 to \$5,200,000 during 1912. Since the present organization of the sales department, more than 200 private plants have been replaced in Brooklyn by Edison service. Mr. Jones has presented a number of papers before the conventions of the National Electric Light Association and the Association of Edison Illuminating Companies. Among these may be mentioned "Functions of a Sales Department," "Development of Revenue from Existing Customers," "Canvassing by Telephone," "Selling Electricity" and "Instrumental Methods of Measuring Maximum Demand." He is past-statesman of the Sons of Jove, New York district, and is a member of the American Institute of Electrical Engineers, the Illuminating Engineering Society, the New York Electrical Society and the Manufacturers' Association of New York. He is also a member of the Technology Club of New York, the Crescent Athletic Club of Brooklyn and the Long Island Automobile Club.

## Obituary

**Robert J. Daley**, superintendent of the Pittsburgh Bureau of Electricity, died on June 2 at his home in that city. He was born in Elyria, Ohio, fifty-seven years ago. Moving to Pittsburgh when a young man, he became associated successively with the Allegheny County Light Company, the Postal Telegraph Company, the Home Telephone Company and the Pittsburgh Board of Underwriters.



## Construction

## New England

BOSTON, MASS. - Plans have been completed by the Brookline Avenue Improvement Association for the construction of an experimental street lighting system on Brookline Avenue from County Square to Massachusetts Avenue.

BROCKTON, MASS.—The Brockton Police Department has been permitted to erect a traffic circle at the intersection of the Brockton and Durant Circle.

FALL RIVER, MASS.—The Massachusetts Photographic Association is sponsoring the construction of a 1935 fund to honor the late Mr. John W. ...

MARLBORO, MASS. The Marlboro Electric power plant, scheduled to be completed within the next month, is set to produce 40 megawatts of electricity for the town of Northboro, which will necessitate a new transmission line from the plant to the town. O. W. Halladay is general manager.

MILFORD, MASS.—Bids for the erection of two 250-hp. General Electric motors, Mayno, until June 5, for the electrical installation of the new power plant, to be completed by the Milford, in accordance with drawings of the project, to be made by the Richard D. Kimball Co., engineers, in Boston, for the purpose of generating and supplying power to the city of Milford, Mass.

NEW BEDFORD, MASS.—The New Bedford Electric Light & Edison Co. have decided to build a new garage building with a public electric garage attached, for vehicles and automobiles. The building is to be located on the corner of State and Commercial streets. The cost of the building is estimated at \$100,000.

**PUTSFIELD, MASS.**—The Putsfield Electric Co. has recommended the installation of 100-watt fluorescent lamps and six arc lamps. The Putsfield Co. Co. manufactures the Putsfield

**TURNERS FALLS, MASS.**—The Turners Falls Electric Co. has been authorized to enter into a ten-year lease with the Turners Falls Electric Co. for the Turners Falls, New Street Light Co. The lease is for the use of the street lights and the Turners Falls, New Street Light Co. will be required to replace the street lights.

WRENTHAM, MASS. The City of Wrentham is installing in this place a new water supply system from the Pittsburgh Treatment Plant. The new 400-p. Mazda lamps, erected on a 100-ft. high overhead lamp consists of 400 lamps. The system is estimated at \$7,000. M. L. K. is the architect. H. R. Wilson is the engineer.

**BRIDGEPORT, CONN.**—The United Engineering Co. is building the new Louise and Congress Street car line at Bridgeport, Conn. The company expects to start construction in the fall of 1922, and to complete the Bridgeport system.

### Middle Atlantic

FORT ANN, N. Y.—Dr. Edgar F. Smith, Jr., of the United States Army Medical Service Commission, is preparing a report on the health of the town, based on a survey by the towns of Fort Ann and Conesville.

**NORTHPORT, N. Y.**—An electric pump is being used to pump water from the high pressure system, which supplies water to the village from the village.

PRATTSBURG, N. Y.—A general election will be held July 2, 1906, to vote on the proposition of having the county of the county seat on Cayuga, at annual cost of \$1,000.

ROCHESTER, N. Y., July 14.—The N. Y. Co. of power & power house, 30 D. Ex. Bldg., is erecting a new power house at the Street Bridge, which will be connected with the main power and the main line, and will be a great improvement to the city.

**SANCTA FAITHS**, N. Y., S. C.—The city's new ornamental street-lighting system will save \$700 per year while adding beauty to the streets. The street-lighting service is provided by Gas & El Co. The company has been awarded a South Carolina contract.

FROM, N. A. MAYER: Bureau has received the Department's decision on the tract of land and the engineer has not finished his work on the same, and it is not yet ready.

AL100NA, PA—The Perry County & Potomac County Electric Co. is in the construction of a power plant at Williamsburg, Va. The plant will cost about \$1,000,000 and will have a generating capacity of 10,000 kw. A wireless system will be installed to connect the plant with the Williamsburg and the Washington, D.C. Area.

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### North Central

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## North Central

a number of extensions to outlying districts. Otto Snyder, superintendent, has charge of the work.

**MARQUETTE, MICH.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 26 for a conduit and wiring system, gas piping, lighting fixtures, etc., in the United States post office and court house, Marquette, in accordance with drawings and specifications copies of which may be obtained at the above office or at the office of the custodian at Marquette. O. Wenderoth is supervising architect.

**NORTHVILLE, MICH.**—Bids will be received by the village of Northville at the office of the superintendent of the electric-light plant until June 10 for the construction of a concrete spillway, according to plans and specifications which are on file at the above office and at the office of L. L. Van Tuyl, consulting engineer, Detroit. Samuel Wilkinson is superintendent of the municipal plant.

**WHITEHALL, MICH.**—The Frugale Pwr. Co. will erect an electric-power plant to be located at Goderich Dock, Whitehall, to cost between \$15,000 and \$20,000. The equipment will consist of one 125-hp Monarch oil engine, one Westinghouse 180-kva, three-phase, 60-cycle generator and General Electric switchboard (100 kw to 200 kw) and General Electric transformers, 356 25-ft. and 35-ft. cedar poles for 6½ miles of overhead distribution lines. Lamps not yet decided upon. Frank H. Speese, of Whitehall, is engineer in charge.

**CINCINNATI, OHIO.**—The Cincinnati Pwr. Co., recently incorporated, has authorized Stegner, Hughes & Alves, architects, to prepare plans for a series of independent power plants. It is understood that the company proposes to build small power plants in all sections of the city.

**CINCINNATI, OHIO.**—Bids will be received at the office of the clerk of Board of Education, City Hall, Columbus, until June 23 for furnishing material and doing all work necessary to complete the installation of electric-lighting systems in the Whittier and Hyde Park Public Schools, in accordance with plans and specifications on file in the office of G. W. Handman, business manager, 511 West Court Street, Cincinnati, where blank forms may be obtained.

**CLEVELAND, OHIO.**—The Continental Gas & El. Co., of Cleveland, expects to erect within the next three months 50 miles of 33,000-volt transmission lines in Iowa and Nebraska and to purchase one 300-kw and one 400-kw generator with engines, etc., and stokers for several small power stations. C. S. Eaton is president.

**COSHOCTON, OHIO.**—The Coshocton Lt. & Htg. Co. expects to install within the next three months a 4000-kw General Electric steam turbine and to erect 17 miles of transmission lines from Coshocton to Newcomerstown. The company has secured a contract to furnish electricity to operate the plant of James B. Clow & Sons at Newcomerstown (about 450 hp), as noted in the issue of May 17. C. H. Howell is superintendent.

**DELPHOS, OHIO.**—The Delphos El. Lt. & Pwr. Co. is changing its transmission lines from Main Street to alleys in rear and expects to purchase within the next month material for same, including poles, wires, etc., and within the next two months expects to purchase about 28 three-lamp and 32 five-lamp boulevard posts and underground cable for same, using 60-watt Mazda lamps. The company has within the last four months changed its station from reciprocating engine-drive to turbo-alternator, running condensing, consisting of General Electric Curtis turbine and 500-kw alternator and switchboards. Clarence K. Beilharz is superintendent.

**McCONNELLSVILLE, OHIO.**—The Marietta, Parkersburg & Interurban Co., has purchased the plant and water-power lease of the McConnellsville-Malta El. Co., of McConnellsville. The sale includes 20-year franchises and 10-year street lighting contracts in McConnellsville and in Malta. The plant will be used by the purchasing company to furnish power in connection with an extension of its system from Beverly to McConnellsville. The main portion of the plant was wrecked by the flood in March.

**STUEBENVILLE, OHIO.**—The installation of an ornamental street-lighting system throughout the city is under consideration by the Chamber of Commerce.

**ELKHART, IND.**—The Board of Education has decided to change the lighting system in the new high school building.

**FORT BENJAMIN HARRISON, IND.**—Bids will be received at the office of the Department Quartermaster, Federal Building, Chicago, Ill., until June 17 for furnishing material and constructing an Isolation Hospital at Fort Benjamin Harrison, Ind., including plumbing, heating, electric wiring and fixtures, etc. Plans, specifications and blank forms of proposals will be furnished on application to the office of the depot quartermaster, Chicago, Ill. Plans and specifications may be seen at the office of the quartermaster at Fort Benjamin Harrison. A. L. Smith is depot quartermaster.

**INDIANAPOLIS, IND.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric-vault protection system in the United States post office at Indianapolis, in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian. O. Wenderoth is supervising architect.

**JEFFERSONVILLE, IND.**—Bids will be received at the office of the depot quartermaster, Jeffersonville, until June 11 for furnishing and in-

stalling two 75-hp tubular high-pressure boilers with Dutch ovens. Further information may be obtained upon application to H. R. Perry, depot quartermaster.

**PORTLAND, IND.**—The city of Portland is contemplating the installation of a new boiler and fittings in the municipal electric-light plant, to cost \$4,000. O. O. Clayton is city engineer.

**BEDEVIERE, ILL.**—We are informed that the Illinois Northern Utilities Co., of Chicago, does not contemplate the construction of a power plant at Belvidere this year. It is possible that a plant may be built here sometime next year.

**CHICAGO, ILL.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States post office at Chicago, Ill., in accordance with plans and specifications copies of which may be had at the above office or at the office of the custodian at Chicago. O. Wenderoth is supervising architect.

**LEWISTOWN, ILL.**—Improvements are contemplated by the Lewistown El. Co., including the installation of two or three new boilers, the rating and make not yet determined, and from 75 kw to 100 kw in new transformers, make not determined. A coal and ash conveyor equipment may be installed. Later on the company may install a direct-connected unit with Westinghouse five-panel switchboard and instruments. Overhead-line material will consist of 20,000 ft. of weatherproof wire, etc., from the American Insulated Wire & Cable Co.; underground distribution system for 36 posts for tungsten-lamp clusters will be required. The purchase of 40 series 6.6 amp, 200-cp tungsten lamps and from 100 to 200 meters (type not yet determined) is under consideration. The company will carry electrical supplies and equipment. C. W. King is treasurer and general manager.

**MOLINE, ILL.**—The City Council has decided to change the present arc-lamp system in the residential district for incandescent lamps.

**PEORIA, ILL.**—Bids will be received by the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States post office at Peoria, Ill., in accordance with plans and specifications copies of which may be obtained at the above office or the office of the custodian at Peoria. O. Wenderoth is supervising architect.

**STERLING, ILL.**—The Twin City Booster Club has been formed by business men of Sterling and Rock Falls. The project to install an ornamental lighting system in both cities and over the connecting bridge will probably be taken up.

**GREEN BAY, WIS.**—The special committee appointed by the Council has recommended that the present arc lamps be abandoned and incandescent lamps erected at every street corner.

**HOLLANDALE, WIS.**—Plans have been prepared by Herman Azza-line, Sr., for the installation of an electric-light plant in Hollandale. The proposed plant will be operated by water-power.

**KILBOURN, WIS.**—The Southern Wisconsin Pwr. Co., of Madison, contemplates the erection of a high-tension transmission line from Kilbourn to Portage, via Sauk City, Prairie du Sac and Baraboo. The company proposes to furnish each of these cities with electricity for lamps and motors.

**SHEBOYGAN, WIS.**—Steps have been taken by the City Council to secure a hearing before the Wisconsin Railroad Commission on the project to establish an electric-light plant.

**WAUTOMA, WIS.**—The Village Board has granted Charles T. Dahlke, of Neshkoro, a franchise to install an electric-light system here for a period of 20 years. Electricity for operating the system will be supplied from the plant at Neshkoro, 9 miles distant.

**BEMIDJI, MINN.**—The electric-light plant and dam of the Warfield El. Co., at Warfield, on the Mississippi River, a few miles east of here, was completely destroyed on May 24 by a wind and electrical storm. The plant supplied electricity in Bemidji.

**FARIBAULT, MINN.**—Bids will be received by the Board of Education, Faribault, addressed to Dr. W. H. Robillard, chairman, until June 14, for construction of new high school building, including general contract work, heating, plumbing and electrical work, in accordance with plans and specifications prepared by C. H. Johnston, architect, 715 Capital Bank Building, St. Paul. Bids will be received collectively and separately, to be submitted only on form of bids supplied by the architect. Copies of plans and specifications may be seen at the old High School building, Faribault, and at the Builders' Exchanges at St. Paul and Minneapolis, Minn., and La Crosse, Wis.

**LAKE CITY, MINN.**—Bids will be received by the Board of Education, Lake City, until June 13 for the construction of an addition to the present High School building according to plans and specifications which are on file at the Builders' Exchange, Minneapolis, Minn., and St. Paul, Minn.; Betcher Lumber Co., Red Wing, Minn., and Alban & Hausler, architects, 407 Chamber of Commerce Building, St. Paul, Minn. Separate bids are desired on general construction, heating, plumbing and electric wiring. F. H. Kemp is secretary.

**MAYVILLE, MINN.**—Bids will be received by the city of Mayville at the office of the Auditor, C. O. Vangon, until June 10 for furnishing and installing material and equipment for a complete electric-light plant and an addition to the water-works system as follows: Division (1) brick power station; (2) radial brick stack or concrete stack or self-supporting steel stack; (3) boiler-room extension; (4) steam-engine in-

station; (5) electrical equipment, for power and water means; (6) pump and pump installation, remote control, etc., and all old equipment. Plans and specifications are on file at the office of the city engineer and at the offices of the O'Brien Contract Engineering Co., commercial engineer, 312-316 Commercial Building, St. Paul, and at the D. H. Co. Electric Exchange, Duluth. Copies may be obtained on application to the consulting engineers, for whose charge the work will be made the project of reproduction.

**WARROAD, MINN.**—At a special electric board meeting the proposition to issue \$30,000 in bonds for the construction of an electric power plant and water works system was adopted. Work will begin in the past as soon as the bonds are sold.

**BELMONT, IA.**—W. T. McVasly & Co. is contemplating the installation of an electric light plant here.

**CLARINDA, IA.**—The Lee H. Co., of Clarinda, has started work on the erection of a three-phase transmission line 12 miles long. The line will run south from Clarinda, through the town of Clarinda to Bradville, thence west from Bradville to the Golden Stream and Bradville. Twenty-five mile tranches have been erected on all four sides, mostly with ten-year street-lighting conductors. In most cases the Madison line will be used, for which the company will receive \$10 cents per year with midnight service. All material for these purposes. Ralph E. Lee is manager.

**DAVENPORT, IA.**—Plans are being prepared by the Davenport Telephone Tel. Co. for the construction of telephone system in Davenport, Rock Island and Moline, Ill.

**DES MOINES, IA.**—The City Council has authorized Safety Superintendent Van Law to ask for bids for the installation of a proposed alarm system in the downtown district.

**DES MOINES, IA.**—The City Council has voted to install 18 arc lamps at the Seventh Street Viaduct and the most street lamps in various parts of the city. The Des Moines Electric Co. is making the street lighting system.

**HOLSTEIN, IA.**—The Holstein Service Co. is planning the installation of an electric light plant and a power to purchase a 100-kw direct current generator, switchboard, equipment for the plant, storage battery, etc.; also about 300 poles and wires for distributing system. W. F. Hutton is secretary.

**MANLEY, IA.**—The People's Gas & E. Co., of Manley City, has applied for a franchise to furnish electricity and heat and natural gas. Manley. It granted a franchise, the company will extend its transmission line here. The company contracts for installing electrical service to a number of surrounding towns.

**MAXWELL, IA.**—A special election has been called for June 10 to submit the proposition to grant a 20-year franchise to W. A. Carter to construct and operate an electric light plant in Maxwell.

**RUSSELL, IA.**—At the special election held recently the proposition to establish a municipal electric light plant was approved. A transmission line will be erected to Chariton where construction will be made for the electric plant there.

**STATE CENTER, IA.**—The State Center Business Men's Association has decided to install a system of electric light and heat. Twenty-one lamp standards will be erected outside along the main street.

**WASHINGTON, IA.**—It is proposed to install a new electric power system, plans for which will be prepared immediately by the city committee.

**GRANT CITY, MO.**—The El, Lt. & Pwr. Co., of Grant City, expects to purchase within the next 10 months two 100-kw. three-phase induction, 2200-volt generator (not over 1000 rpm.), one three-phase single-phase switchboard with instruments and a series transformer distribution system (about 10 kw.). G. D. Beckwith is engineer.

**JOPLIN, MO.**—The City Council is contemplating the extension of the municipal electric light plant and extending the water and gas system in East Joplin, at a cost of approximately \$100,000.

**PORTAGIAILLE, MO.**—Plans are being prepared by the Portagaville Mfg. Co. for the erection of an electric light and gas system and steam mill. The equipment will include a 100-hp. horizontal engine. The remainder of the apparatus has not yet been decided upon.

**KENMARE, N. D.**—Contracts will soon be made for the construction of an ornamental street-lighting system in Kenmare. The contract provides for the erection of 50 lamp standards equipped with incandescent 100-watt lamp and four 30-watt lamps, 100 ft. of 100-volt, 100-watt lamp wires. P. M. Cole and L. K. B. are the contractors.

**MOTT, N. D.**—S. Stewart, of Mott, Minn., has been awarded a 10-year electric light franchise in Mott. The contract provides for a plant with electricity for a period of 10 years.

**HUDSON, S. D.**—Plans are being prepared by the Hudson Electric & Pwr. Co. for the construction of an electric power plant. The contract plans provide for the construction of a 100-hp. horizontal engine, electric system will consist of 100-hp. horizontal engine, 100-hp. horizontal street lamps, about 25 water and gas mains. No other equipment has yet been purchased. The contract will also include the lighting system and small household electrical equipment. J. D. Bradley is president of the company and S. T. Hudson is secretary, both of Hudson.

**HUMBOLDT, S. D.**—An agreement has been made to extend the transmission line from Hartford to Humboldt.

**PIERRE, S. D.**—We are informed that the city of Pierre has con-

sented the two propositions for an electric light plant and installed in the summer of May 1. The new plant will be a 100-hp. horizontal engine and will be installed in the summer of May 1.

**NORTH PLATTE, NEB.**—The North Platte Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**WATFORD, NEB.**—A special election will be held in the summer of May 1 to submit the proposition to grant a 20-year franchise to W. A. Carter to construct and operate an electric light plant in Watford.

**MEMPHIS, TENN.**—The Memphis Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**BEATLE, TENN.**—The Beatle Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**BURTON, TENN.**—The Burton Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**CHAMPLAIN, TENN.**—The Champlain Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**HOLTON, TENN.**—The Holton Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**HETMORE, TENN.**—The Hetmore Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**KANSAS CITY, TENN.**—The Kansas City Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**LAWTON, TENN.**—The Lawton Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**LOUISVILLE, TENN.**—The Louisville Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**MEMPHIS, TENN.**—The Memphis Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

## Southern States

**GASTONIA, N. C.**—The Gastonia Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**GREENSBORO, N. C.**—The Greensboro Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**WILMINGTON, N. C.**—The Wilmington Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**CHARLOTTE, N. C.**—The Charlotte Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**RALEIGH, N. C.**—The Raleigh Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**DUKE, N. C.**—The Duke Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**WILSON, N. C.**—The Wilson Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

**WYOMING, N. C.**—The Wyoming Electric Co. is planning the construction of an electric power plant and water works system. The company will be installed in the summer of May 1.

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**JACKSONVILLE, FLA.**—The Southern Utilities Co., of Jacksonville, is planning the installation of additional equipment in several of its plants as follows: In the plant of the Ariston Ice & El. Co., at Fort Myers, one 300-kw turbo-generator set and four-panel switchboard; the Arcadia Ice & El. Co., of Arcadia, one 150-kw direct-connected tandem-compound unit and four-panel switchboard; the Tarpon Springs Ice & El. Co., of Tarpon Springs, one 150-kw compound direct-connected unit. The machinery has already been purchased. The J. G. White Engineering Corp., 42 Exchange Place, New York, N. Y., is operating manager. H. C. Adams, of Jacksonville, is general manager.

**ALICEVILLE, ALA.**—The Aliceville El. Co. is installing an electric-light plant in Aliceville. The equipment will consist of one 35-kw General Electric single-phase, 60-cycle generator, transformers, 36,000 ft. Nos. 8, 6 and 4 wire, and cyress poles, and about 400 tungsten lamps. William F. Wolff, of Aliceville, is engineer in charge.

**BIRMINGHAM, ALA.**—The Birmingham Ry. Lt. & Pwr. Co. contemplates erecting a 2200-volt transmission line to Lewisburg, Kimberly and Sibleyville to furnish electricity for coal mines and manufacturing plants in that territory and will also install a large turbine engine in its power plant at Eighteenth Street and Powell Avenue. The cost of the transmission lines is estimated at \$56,000.

**CARROLLTON, MISS.**—Within the next three months the town of Carrollton expects to purchase weatherproof wire, lamps, etc. W. E. Stilson is manager.

**PONTOTOC, MISS.**—The Pontotoc El. Lt. & Pwr. Co. is contemplating the installation of a water-works system and would like information on mains, pumps, an additional boiler and probably an overhead steel tank having a capacity of from 75,000 gal. to 100,000 gal. L. E. Price is manager.

**GREEN FOREST, ARK.**—We are informed that the Green Forest Milling & Elevator Co. has purchased all the machinery for its plant. J. Villines is president.

**HOPE, ARK.**—Within the next two months the city of Hope expects to erect an addition to the power house of the municipal electric-light and water plant for the water pumps. A 300-kw Bullock generator and Filer & Stowell engine (direct-connected) are now being installed. Charles M. Richards is superintendent.

**MORRILLTON, ARK.**—The Morrillton Lt. & Pwr. Co. contemplates rebuilding the electric-light plant, which was destroyed by fire. William L. Moose is president of the company.

**NEW ORLEANS, LA.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States mint at New Orleans, La., in accordance with plans and specifications copies of which may be obtained at the above office or at the office of the custodian at New Orleans. O. Wenderoth is supervising architect.

**CADDO, OKLA.**—The Caddo El. Lt. & Pwr. Co. expects to purchase within the next 30 days one 15-kw, single-phase, 60-cycle, 1100-volt generator. John W. Thomas is manager.

**ELK CITY, OKLA.**—The Elk City Ice, Fuel & Lt. Co. expects to erect a new transmission line from its new power house to the center of the town and has recently purchased a 150-hp boiler, a 300-hp Bates-Corliss engine and a new 275-kw Allis-Chalmers generator, exciter, condenser and new switchboard.

**HOLDENVILLE, OKLA.**—The Holdenville El. & El. Co. has placed an order with the General Electric Co. for a 150-kw, three-phase, 2300-volt, 60-cycle generator. W. M. Dunn is president and manager.

**MCCURTAIN, OKLA.**—The Twin City Ice, Lt. & Pwr. Co. would like quotations of prices on line material, poles, etc., and will purchase 50 or 60 meters within the next 60 days and some transformers immediately. The company will install next fall one 100-hp high-pressure boiler and one 80-hp high-speed steam engine. Next year the company expects to purchase a new 75-kw, three-phase, 60-cycle generator and switchboard for same. The company will do all the inside wiring in the town. B. A. Little, of McCurtain, is engineer in charge.

**NEWKIRK, OKLA.**—The city of Newkirk expects to purchase material for an ornamental street-lighting system (three blocks) within the next three months. J. H. Fox is superintendent.

**OKMULGEE, OKLA.**—The Okmulgee Ice & Lt. Co. expects to increase the generating capacity of its power plant and enlarge the boiler room this fall. Details of the proposed improvements have not yet been worked out.

**VALLIANT, OKLA.**—An election has been called to vote on the proposition to issue \$51,000 in bonds for the installation of an electric-light plant and water-works system in Valliant. E. W. Gantt, Sam Houston Life Building, Dallas, Tex., is consulting engineer.

**DALLAS, TEX.**—Plans have been prepared by Harry A. Overbeck, 503 Juniata Building, Dallas, for the installation of a power plant in connection with the jail. Bids will probably be received from Aug. 1 to 15.

**DENISON, TEX.**—We are informed that the Texas Pwr. & Lt. Co., of Dallas, does not contemplate the construction of a power plant in Denison at present as reported in the issue of May 10. F. R. Slater is general superintendent.

**FORT WORTH, TEX.**—The wagon factory on Fostepco Heights, of the Fort Worth Wagon Factory, Inc., is to be equipped with electrically driven machinery. J. F. Shelton is manager.

**FORT WORTH, TEX.**—The Mutual Cotton Oil Co., of North Fort Worth, has closed a contract with the Fort Worth Pwr. & Lt. Co. for the installation of electric motors to replace the present steam plant. The contract calls for 11 motors, aggregating 561 hp, to be installed by Aug. 1.

**FRANKLIN, TEX.**—The city commission is considering the purchase of the water and light plants of the Franklin Wtr. & Lt. Co. If the deal is consummated, bonds will be issued for enlarging the plants and for other improvements to the property.

**GALVESTON, TEX.**—Bids will be received by John D. Kelley, city secretary, until June 12 for furnishing 60 ornamental posts, combination trolley and arc-lamp design, and 26 ornamental arc-lamp posts, all to be complete with lamps, etc., installed ready for operation. Bids are also to cover the installation of 13,000 ft. of cable. Specifications may be seen at the office of W. D. Masterson, city superintendent of electricity.

**PLAINVIEW, TEX.**—The Malone Ice & Lt. Co. is doubling the output of its power plant and will erect a system of transmission lines for the purpose of furnishing electricity to operate a number of irrigating pumping plants in this section.

## Pacific States

**EATONVILLE, WASH.**—Arrangements are being made for the construction of a municipal electric-light plant to be located near Eatonville. The present plans provide for the installation of one 50-kw, three-phase, 2200-volt generating unit, impulse type of turbine and oil-type governor. Other data will not be decided upon until the power site is located. Contracts for construction of plant will be let in about two months. Evans-Dickson Co., 725 Commerce Street, Tacoma, is engineer.

**PUYALLUP, WASH.**—The City Council is considering a proposition of utilizing Salmon Springs as a site for a municipal hydroelectric power plant to furnish electricity for lighting the streets and public buildings and for power and commercial purposes, and also to pump the water from Maplewood Springs (part of the local water system).

**TACOMA, WASH.**—The Department of Light and Water will soon begin work on the erection of an additional pole transmission line (20 miles long) from the city to connect with the present double line and transfer one line from the single-pole double line. B. W. Collins is superintendent of electric works.

**COTTAGE GROVE, ORE.**—Investigations are being made at the head of the McKenzie River, above Belknap Springs, and estimates prepared by the Oregon El. Ry. Co. for the construction of a power plant there. G. S. Edmundson, hydraulic engineer, is in charge of the work.

**BAIRDSTOWN, CAL.**—G. W. Baird, president of the Bairdstown Improvement Association, is promoting the installation of an ornamental street-lighting system from the mountains to the sea. The Board of County Supervisors has been authorized to advertise for bids for the installation of the lighting system along Huntington Drive from Los Angeles to Alhambra.

**DAVIS, CAL.**—Plans are being perfected by R. T. Stone for the construction of a large irrigating project in this vicinity. Electrically driven pumps will be used throughout the system.

**FRESNO, CAL.**—Surveys have been made by the San Joaquin Lt. & Pwr. Corp., of Fresno, for location of a 60,000-volt transmission line along the east side of San Joaquin Valley which will ultimately connect Bakersfield, Porterville and Fresno. Plans for construction of this line (at least part of it) are now being prepared. A. G. Wishon is general manager.

**JACKSON, CAL.**—Plans are being prepared for the installation of a street-lighting system in Jackson.

**LOS ANGELES, CAL.**—The Pacific El. Ry. Co. has taken out a permit to erect a substation on Vermont Avenue, to cost about \$5,000.

**LOS ANGELES, CAL.**—The Southern California Edison Co., of Los Angeles, Cal., has applied to the State Railroad Commission for authority to sell 30,000 shares of capital stock at \$100, the proceeds to be used for extensions to the Long Beach plant and to pay existing indebtedness.

**SAN FRANCISCO, CAL.**—The Pacific Gas & El. Co., of San Francisco, has applied to the State Railroad Commission for permission for a certificate of public necessity for the construction of three additional power plants on the Bear River, in Placer County, and the erection of a transmission line from the Bear River development to Nicolaus in the Sacramento Valley.

**SAN FRANCISCO, CAL.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 20 for an electric vault-protection system in the United States Sub-treasury (old) building, San Francisco, in accordance with plans and specifications, which may be had at the above office or at the office of the supervising superintendent, Post Office Building, San Francisco. O. Wenderoth is supervising architect.

**TULARE, CAL.**—The State Railroad Commission has granted the Tulare County Pwr. Co. authority to issue promissory notes to the amount of \$15,971 to cover certain extensions.

**ASHTON, IDAHO.**—The Ashton & St. Anthony Pwr. Co., Ltd., recently incorporated, contemplates the construction of an electric-light plant near Ashton, to cost about \$200,000, work on which will begin in the near future. The proposed plant will furnish electricity for lamps

and motors for towns in this vicinity. N. N. Howe is engineer in charge of construction and A. Whitten is president of the company.

**HAILEY, IDAHO.**—The Beaver River Pwr. Co., of Boise, has applied to the City Council for a franchise to furnish electricity for lamps and motors.

**IDAHO FALLS, IDAHO.**—The City Council has decided to install an ornamental street lighting system on Shoup and Park Avenues and C Street. Cluster lamps will be used.

**MIDDLETON, IDAHO.**—The Council has granted the Beaver River Pwr. Co., of Boise, Idaho, a franchise to supply electricity for lamps and motors here for a period of five years.

**MOUNTAIN HOME, IDAHO.**—Preliminary arrangements are being made by the Eagle Cove Irrigation Co. for installing a plant of 2000 kw. of land near Loveridge Ferry on Snake River. Electricity for operating the pumps will be supplied by the Great Shoshone & Twin Falls Wtr. Pwr. Co., of Twin Falls. F. C. Horne, of Boise, is engineer of the project.

**MOUNTAIN HOME, IDAHO.**—The Great Shoshone Irrigation District, located south of Mountain Home on Snake River, is negotiating for the sale of bonds to secure funds to meet cost of installing an irrigation pumping plant of approximately 300 hp. Electricity for operating the plant will be supplied by the Great Shoshone & Twin Falls Wtr. Pwr. Co., of Twin Falls. Transmission lines have already been erected. E. A. Tolman is engineer in charge.

**TWIN FALLS, IDAHO.**—The Great Shoshone & Twin Falls Wtr. Pwr. Co. has practically completed excavations for the construction of a canal and flume for a 15,000-hp plant on the Malad River.

**FLAGSTAFF, ARIZ.**—Preparations are being made by the Flagstaff El. Lt. Co. for the erection of a new electric light and power plant at Flagstaff. The company was recently granted a new franchise.

**FREDERICK, COL.**—The Town Board has awarded the contract for furnishing electricity for operating the pumping plant of the new water works system and the municipal electric light system to the Northern Colorado Pwr. Co., of Denver, Col.

**GREELEY, COL.**—The Greeley Hydro-Electric Co. is planning to erect a power station about 75 miles west at Fort Collins to furnish electricity to two northwestern counties of Colorado. The plant provides for the installation of four 200-hp waterwheels, probably Peltons, Lombard watershed governors, General Electric alternating-current generators, type and number not yet decided upon; the switchboard equipment has not yet been determined, the transmission line will be about 10 miles long. Active construction work has been delayed. J. L. Stricker, of Greeley, is engineer in charge, and C. A. Foley is secretary.

**WELLS, NEB.**—Work will soon be started on the erection of a power plant to be established on Trout Creek, for which permission has been granted by John H. Garzer and H. H. Garzer. The present plant will furnish electricity for lamps and motors at Wells and surrounding territory.

**CLAYTON, N. M.**—The city of Clayton is contemplating the installation of a new street lighting system within the next six months. H. E. Kirtley is superintendent.

**DEMING, N. M.**—The Deming El. & P. Co. expects to erect at once a large extension to its generating plant and to install six waterwheels, turbines, pumps, etc. The company is erecting a 2000-hp high-tension transmission line and distributing line in this state to handle contract for 2500 hp. All purchases are made from the N. Y. N. Y. office of the Federal El. & Pw. Co., of Brooklyn, New York. N. Y. Improvements are being made to this power for distribution purposes in the Mimbre Valley, turbines and waterwheels pumps are used with direct motor drive, all of which are vertical. Frank Moore is general manager.

**GALLUP, N. M.**—The Gallup El. & P. Co. has completed in two months built an addition to its power plant and installed two 2000-hp, 2500-volt, three-phase, 60-cycle generators. Also two high-tension engine and switchboard. The company expects to produce 2000 kw. within three months at a 200-hp boiler and condenser. The new power plant has two 2000-hp, 2500-kva and 2000-circuit. A turbine condenser is being installed within 60 days.

## Canada

**KAMLOOPS, B. C.**—The city of Kamloops has contracted to install a new power plant and street lighting system. The city has also contracted to install a new power plant and street lighting system.

**MILITIA, MAN.**—The Militia El. & P. Co. is planning to erect a new power plant and street lighting system. The company has also contracted to install a new power plant and street lighting system.

**MURORA, ONT.**—A new power plant and street lighting system is being installed in Murora. The company has also contracted to install a new power plant and street lighting system.

**BURLING, ONT.**—The Burling El. & P. Co. is planning to erect a new power plant and street lighting system. The company has also contracted to install a new power plant and street lighting system.

**SAULT STE. MARIE, ONT.**—The Sault Ste. Marie El. & P. Co. is planning to erect a new power plant and street lighting system. The company has also contracted to install a new power plant and street lighting system.

**SAULT STE. MARIE, ONT.**—The Sault Ste. Marie El. & P. Co. is planning to erect a new power plant and street lighting system. The company has also contracted to install a new power plant and street lighting system.

**TORONTO, ONT.**—The Hydro-Electric Power Commission has announced that it will be installing a new power plant and street lighting system in Toronto. The company has also contracted to install a new power plant and street lighting system.

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## Mexico

**GUERRERO, ZAMORA, MEXICO.**—The Guerrero Hydro-Electric Co. is planning to erect a new power plant and street lighting system. The company has also contracted to install a new power plant and street lighting system.

## New Industrial Companies

**THE LOCAL ENGINE COMPANY, INC.**—This new company is organized and is located in Chicago to manufacture engines and motors. The company is organized and is located in Chicago to manufacture engines and motors.

**THE ELECTRIC MOTOR COMPANY, INC.**—This new company is organized and is located in Chicago to manufacture electric motors. The company is organized and is located in Chicago to manufacture electric motors.

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## New Incorporations

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**BROOKS, MAINE.**—The Waldo County El. Lt. & Pwr. Co. has been organized with a capital stock of \$150,000 for the purpose of operating electric light and power plants. A. E. Kilgore is president and J. W. Hobbs, treasurer, both of Brooks.

**WATERTOWN, N. Y.**—The Continental Pwr. Corp. has been incorporated with a capital stock of \$100,000 by Victor W. Cutting, George W. Phillips, Jr., Leon Well and S. Gibson, of 320 West Eighty-third Street, Brooklyn.

**KALIDA, OHIO.**—The Kalida El. Lt. Co. has been incorporated with a capital stock of \$10,000 by J. E. Devoe, S. E. Shipp, A. D. Devoe, Pearl E. Devoe and H. D. Grindie.

**GEORGETOWN, S. C.**—The Georgetown Gas & El. Co. has been incorporated with a capital stock of \$100,000 to build and operate an electric system and gas plant and electric railway in Georgetown. The incorporators are: Joseph T. Hayden and Clawson Backman.

**PARSONS, W. VA.**—The Parsons El. Co. has been granted a charter with a capital stock of \$25,000. The incorporators are: J. B. Van Wagoner, Byron Trimble and Alexander Murdock, of Pittsburgh, Pa.; C. W. Sheek, of Lebanon, Pa., and J. A. Lynch, of Swissvale, Pa.

## Trade Publications

**WIRE.**—The New York Insulated Wire Company, 114 Liberty Street, New York, has issued Price Booklet No. 23 on its Raven black core, rubber-covered wire.

**VIBRATORS.**—The Shelton Electric Company, 4 East Forty-second Street, New York, has issued a leaflet descriptive of its vibrators, massage apparatus and hair dryers for home use.

**BELT DRESSING.**—The Cling-Surface Company, Buffalo, New York, has issued a twelve-page illustrated booklet which advances arguments as to why "Cling-Surface" should be used and contains data regarding results from this form of belt treatment.

**ALTERNATING-CURRENT RECTIFIERS.**—In an eight-page bulletin, No. 100, a May publication of the Wagne. Electric Manufacturing Company, St. Louis, Mo., alternating-current rectifiers for charging small storage batteries are illustrated and described.

**CONVEYING MACHINERY.**—Bulletin No. 51 of the Robins Conveying Belt Company, 13 Park Row, New York, has for its subject coal and coke crushers, feeders and elevators. Brief references are made to this class of apparatus, accompanied by illustrations and diagrams. A horse-power chart for Robins belt conveyors is given.

**RECORDING THERMOMETERS.**—Catalog No. 1300, one of the Bristol Company's publications, issued from Waterbury, Conn., is devoted to Bristol Class III recording thermometers for working ranges of temperatures between 60 deg. below zero and 800 deg. Fahr. A number of models for varying applications are shown, as are also specimen sections of different size charts.

**WATER METERS.**—In a sixteen-page booklet published by the Thomson Meter Company, Brooklyn, N. Y., are given illustrated descriptions of the Lambert water meters, registers, dials, strainers and

fish-traps, together with cuts illustrating the component parts of the water meter, a price list and a table showing maximum deliveries, weights and dimensions of Lambert meters. A leaflet containing a number of testimonial letters accompanies the booklet.

**FANS.**—Colonial single-phase alternating-current motors are described and illustrated in Bulletin No. 41, recently issued by the Colonial Fan & Motor Company, Warren, Ohio. These motors are said to embody radical improvements in mechanical construction over those placed on the market a year ago. The motors are of the induction type with rotating secondary member. They start on the split-phase principle and neither carbon brushes nor commutators are required. Various tables of ratings are given.

**AUTOMOBILE TIRES.**—The B. F. Goodrich Company, Akron, Ohio, has recently published a sixty-eight-page pamphlet, entitled "Motor Trucks of America," which contains illustrations and the more important specifications of the 1913 American-made models of motor trucks whose manufacturers either furnish Goodrich wireless motor-truck tires as standard equipment or supply them without extra cost when specified. Many models for trucking purposes in a wide variety of industries are shown, all of them using the Goodrich tires.

**CONVEYING MACHINERY.**—The Peck carrier, manufactured by the Link-Belt Company, Philadelphia, Pa., is the subject of a comprehensive 112-page catalog, known as Book 120 and recently copyrighted by the manufacturers. The Peck carrier, which is used for conveying coal, coke, ashes, cement, sand and other materials, consists of a continuous series of buckets pivotally suspended between two endless chains. The book is excellently illustrated with many cuts and diagrams which tell their story in an interesting manner. The Peck carrier for handling coal and ashes in power plants is illustrated and described, and a list is included of many public utility companies in whose plants this system has been installed.

## Business Notes

**THE COVIC ELECTRIC COMPANY** has moved its New York office from 1133 Broadway to 118 East Twenty-eighth Street.

**JAMES R. CRAVATH**, consulting engineer, has moved his Chicago office from the Old Colony Building to 140 South Dearborn Street.

**C. G. YOUNG.**—The banking firm of C. G. Young, Trust Building, New York, has been engaged to make examinations and reports on certain important public utilities in Central America. Mr. H. A. Belden, one of the firm's engineers, will make the local studies.

**HAMILTON-BEACH MANUFACTURING COMPANY.**—A New York office has been established at 50 Church Street, in the Hudson Terminal Building, by the Hamilton-Beach Manufacturing Company, Inc., Racine, Wis. This office will be in charge of Mr. J. Jorgensen.

**COLUMBIA INCANDESCENT LAMP WORKS.**—At the Columbia Incandescent Lamp Works of the General Electric Company, St. Louis, there has recently been organized an illumination department with a view to assisting salesmen and all agents handling Columbia lamps in planning improved and efficient lighting installations for isolated plants and central-station customers.

## Directory of Electrical Associations, Societies, Etc.

**ALABAMA LIGHT AND TRACTION ASSOCIATION.** Secretary-treasurer, H. O. Hanson, Mobile, Ala.

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.** Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

**AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION.** Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J. Annual convention, Atlantic City, N. J., Oct. 13-17.

**AMERICAN ELECTRIC RAILWAY ASSOCIATION.** Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

**AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION.** Secretary, H. C. Donecker, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 13-17.

**AMERICAN ELECTROCHEMICAL SOCIETY.** Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

**AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.** Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

**AMERICAN INSTITUTE OF CONSULTING ENGINEERS.** Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The council meets the first Friday of every month.

**AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.** Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Cooperstown, N. Y., June 23-27.

**AMERICAN PHYSICAL SOCIETY.** Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

**AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.** Secretary, W. W. Macon, 29 West 39th St., New York.

**AMERICAN WATER WORKS ASSOCIATION.** Secretary, J. M. Diven, 271 River St., Troy, N. Y.

**ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS.** Secretary, W. J. Tharp, Little Rock, Ark.

**ASSOCIATION OF EDISON ILLUMINATING COMPANIES.** Secretary, Geo. C. Holberton, Pacific Gas & Elec. Co., San Francisco, Cal. Annual meeting, Cooperstown, N. Y., Sept. 8.

**ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.** Secretary, James Farrington, Steubenville, Ohio.

**ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.** Secretary-treasurer, Jos. A. Andreuccetti, Chicago & Northwestern Railway, Chicago. Annual meeting, Chicago, Oct. 20-24.

**ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.** Secretary, P. W. Drew, 112 West Adams St., Chicago.

**CANADIAN ELECTRICAL ASSOCIATION.** Secretary, C. E. Bowden, Birkbeck Building, Toronto, Ont., Can. Annual convention, Toronto, Can., June 25, 26, 27.

**COLORADO ELECTRIC CLUB.** Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

**COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.** Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Denver, Oct. 6.

**ELECTRIC CLUB OF CHICAGO.** Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

**ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE.** Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.





# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 27, 1913.

[Prepared by Robert Starr Allyn 16 Exchange Place, New York.]

- 1,062,586. **SPRING MOUNTING FOR MAGNET ARMATURES**; C. J. Erickson, Chicago, Ill. App. filed Dec. 14, 1905. Armature carried by torsional spring and a striker adjustable toward and away from the armature; used in harmonic ringers for selective party lines.
- 1,062,589. **MOTOR CONTROLLER**; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 17, 1908. For rolling mills; table which carries the bloom is lowered and raised through the lower rolls of a "three-high" rolling mill and raised to pass it through the upper rolls.
- 1,062,590. **MOTOR CONTROLLER**; C. T. Henderson, Milwaukee, Wis. App. filed April 23, 1909. Relays respond upon closure of motor circuit to reinitiate accelerating switches inoperative, and thereafter operate successively as flow of current through motor decreases to cause successive operation of the accelerating switches.
- 1,062,629. **TERMINAL CONNECTOR FOR SPARK PLUGS FOR EXPLOSIVE ENGINES FOR AUTOMOBILES AND OTHER USES**; C. W. Beck, Rocky Hill, Conn. App. filed Jan. 11, 1910. Terminal has a switch device which when opened causes spark to jump between supplemental visible sparking points.
- 1,062,707. **SYSTEM OF CONTROL FOR ELECTRIC CONTROLLERS**; J. H. Hall, Cleveland, Ohio. App. filed Nov. 27, 1911. Manually operated controller which directly controls cutting in of resistance but which directly controls the cutting out of a portion of the resistance, and magnetic switches controlling cutting out of resistance in accordance with current strength in motor circuit.
- 1,062,708. **CONTROL SYSTEM FOR ELECTRIC MOTORS**; J. H. Hall, Cleveland, Ohio. App. filed Dec. 16, 1912. Series-parallel system; means for connecting motors in series with each other and the windings controlling the resistance contacts, and means for de-energizing the windings and connecting the motors in series.
- 1,062,722. **PERIODIC CIRCUIT-CLOSER**; J. G. MacPherson, Philadelphia, Pa. App. filed Nov. 2, 1911. Attachment controllable from the tracing position of a taximeter wheel, the electromotor of the taximeter is actuated to record the tariff for mileage as well as for time.
- 1,062,728. **CONTROL MEANS FOR ELECTRIC SWITCHES**; R. C. Pierce, Cincinnati, Ohio. App. filed Nov. 26, 1912. A control lever for the movable die of a welding machine which closes the operating switch and applies a predetermined pressure and opens the switch upon increased pressure.
- 1,062,745. **ELECTRIC-HEATED STEERING RIM**; R. S. Smith, Marshall, Tex. App. filed Aug. 14, 1912. A heat-conducting core surrounded by a resistance element is inclosed between a pair of annular trough-like members which are bolted together to form the rim of a steering wheel.
- 1,062,754. **TELEPHONIC APPARATUS**; C. Adams-Randall, Boston, Mass. App. filed Nov. 1, 1912. For automatically relaying or repeating telephone messages; system of electromagnets including a vibrating circuit-closing member and magnet cores forming an adjustable gap between them.
- 1,062,791. **STREET-CAR CONTROLLER**; C. and J. G. Munson, Cedar Rapids, Ia. App. filed Aug. 26, 1912. Connections to controller by which the motor can operate the same from either side of the platform instead of being obliged to stand in the center of the platform.
- 1,062,799. **ELECTROMECHANICAL DEVICE**; G. H. Rowe, Chicago, Ill. App. filed Oct. 8, 1909. For percussive drills and like tools; a cushioning magnetic connection is established between the driving device and the reciprocating driven device and auxiliary means increase the force of the working stroke in relation to that of the return stroke.
- 1,062,801. **SERIES-MULTIPLE SWITCH**; H. R. Sargent, Schenectady, N. Y. App. filed Aug. 16, 1911. Rotary switch with four posts carrying contact segments located in different planes and different distances from the spindle, and three insulated blades on the spindle in different planes and of different length.
- 1,062,805. **PRODUCTS OF AMMONIUM COMPOUNDS**; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 11, 1910. Gaseous mixture containing oxygen, nitrogen and water vapor is passed through an electric arc and the products of the resulting reaction are withdrawn into a space maintained below the dissociating temperature of the reaction products.
- 1,062,809. **ELECTRIC-ARC LAMP**; A. G. Way, London, England. App. filed April 1, 1911. For lanterns and projectors; carbons at right angles; inclosed arc; horizontal carbon is fed by a ring clutch operated by a hand lever.
- 1,062,812. **PROTECTIVE DEVICE**; D. Basch, Schenectady, N. Y. App. filed Oct. 9, 1912. For transmission systems; switches for disconnecting the feeders from a switch station; a switch controlling a tie line between the feeders and trip coils controlling the switches.
- 1,062,824. **TELEGRAPH SYSTEM**; C. M. Edwards, Galveston, Tex. App. filed April 9, 1912. Selective telegraph system for operating the keyboards of linotype machines from a distance.
- 1,062,836. **INCANDESCENT LAMP**; M. M. Merritt, Middleton, Mass. App. filed Nov. 27, 1905. Has an anchor wire sealed into the stem of the lamp, a glass sleeve upon the wire, and separate branch wires sealed into the sleeve and connected at different points in the length of the filament.
- 1,062,857. **ARC LAMP**; R. Scott, Newark, N. J. App. filed June 15, 1907. Flaming arc type; plurality of downwardly converging electric arcs; electric circuit for controlling the arcs; a plunger and form a single magnetic field which by acting equally on all the arcs constitutes their exclusive regulating means.
- 1,062,859. **REFILLABLE FUSE PLUG**; J. G. Clemens, Buffalo, N. Y. App. filed Sept. 26, 1911. The end caps force fuse-clamping members in yielding engagement with the ends of the fuse.
- 1,062,860. **ELECTRIC STORAGE DEVICE**; L. T. H. Dempster, Schenectady, N. Y. App. filed Oct. 7, 1912. Has storage mass and a thermal switch rotatably mounted thereon, with the contiguous surfaces of the mass and switch grooved to form contact and separation areas.

- 1,062,900. **WATER-COOLED RESISTANCE**; W. L. R. Emmet, Schenectady, N. Y. App. filed Nov. 7, 1910. Rheostat embodying a resistance inclosed in a duct and a condenser system circulating water through the duct to cool the resistance.
- 1,062,907. **MAGAZINE ARC LAMP**; E. J. Guay, Lynn, Mass. App. filed July 21, 1909. Single lower electrode of material size and an automatically rotated magazine carrying upper electrodes of smaller size.
- 1,062,918. **ELECTRICAL SYSTEM AND APPARATUS THEREFOR**; J. W. Jepson and A. McGary, New York, N. Y. App. filed Aug. 20, 1909. For charging storage batteries; carbon-pile resistance in series with battery, coil for controlling said resistance responsive to variations in battery current, and means controlled by the coil for opening the battery circuit.
- 1,062,920. **SAFETY LAMP PLUG AND SOCKET**; H. C. Jones and C. M. Weeks, Somerville, Mass. App. filed Jan. 17, 1913. To prevent unauthorized removal of lamp or socket; device having a plug to seat in a socket and provided itself with a lamp-receiving socket, a pointed screw being forced into engagement with the lamp and another pointed screw being forced into engagement with the socket in which the device is seated.
- 1,062,966. **PROCESS OF ELECTROLYSIS AND APPARATUS THEREFOR**; K. S. Guiterman, New York, N. Y. App. filed Nov. 11, 1912. Creates current of electrolyte to wash slime from the electrodes and collect the suspended slime, removes slime and a portion of the electrolyte, separates slime from the electrolyte and returns electrolyte to the bath.
- 1,062,974. **OZONIZER**; N. M. Hopkins, Washington, D. C. App. filed Feb. 26, 1913. An electrode consisting of a thick sheet of metal electrodeposited on a dielectric layer; heat-radiating coils in contact with the electrode and air to be ozonized is passed between the electrodes and a separate current of cooling air is passed over the radiators.
- 1,062,978. **ELECTRIC WORK-CIRCUIT-REGULATING METHOD**; F. Kraemer, Chicago, Ill. App. filed Dec. 14, 1906. For preventing fraudulent and illicit use of current under a "flat-rate" contract; when additional translating devices not bargained for are put in the circuit a monitor cuts in resistance and then after a time cuts it out, thus giving warning and notice that the illicit use has been detected.
- 1,062,982. **PROCESS OF PRODUCING ELEMENTARY SILICON AND BY-PRODUCTS**; F. J. Machalske, Philadelphia, Pa. App. filed May 13, 1912. Splits up the silicious compound by electrolytic fusion and subjects the fused mass directly to centrifugal action.
- 1,063,026. **ATTACHMENT PLUG**; G. W. Goodridge, Bridgeport, Conn. App. filed Jan. 25, 1913. One-piece porcelain body with longitudinal wire passages therein opening adjacent the binding screws.
- 1,063,035. **INCANDESCENT ELECTRIC LAMP**; R. Jahoda, Vienna, Austria. App. filed Dec. 23, 1911. Crossed members spaced one



1,063,035.—Incandescent Electric Lamp.

above the other on an axial support and filament extending between the ends and intermediate points of the bars.

- 1,063,058. **SPRINKLER SUPERVISORY SYSTEM**; C. F. Patterson, Orange, N. J. App. filed June 17, 1912. Heating means raise locally the temperature of the water in a certain part of the conduit and a thermal device is operated by the fall of temperature due to a flow of water in such localized area to give an alarm.
- 1,063,096. **SIGNAL SYSTEM**; G. S. Williamson, McKeesport, Pa. App. filed Aug. 23, 1912. Combined telephone, telegraph and alarm apparatus ordinarily used in connection with the police and fire departments of a municipal system.
- 1,063,097. **ELECTRIC SPOT-WELDING MACHINE**; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed Sept. 18, 1911. Holders are constructed to support the welding points in angular relation to produce welds in places which would be inaccessible to ordinary spot-welding machine; has a set of auxiliary point holders with detachable water-supply connections.
- 1,063,101. **THERMAL CIRCUIT-CONTROLLING DEVICE**; G. Adam, Paris, France. App. filed July 17, 1911. Permanently located socket and a detachable plug which carries the circuit-controlling mechanism; plug carries a distinguishable portion which becomes detached upon heating.
- 1,063,167. **OZONE-PRODUCING MACHINE**; D. C. Smith and F. M. Hummel, Des Moines, Ia. App. filed Aug. 14, 1912. Hollow dielectric tube centered between electrode teeth and carrying a centrally disposed conductor.
- 1,063,170. **ELECTROMAGNETIC APPARATUS**; J. C. Lincoln, East Cleveland, Ohio. App. filed Sept. 27, 1909. For curing meats; tank with electrodes therein, whereby current is passed through the tank contents, and magnets having pole faces arranged to maintain the tank contents in a magnetic field.

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## The Institute as Defendant

Our readers will not be surprised to learn from a note in this issue that no temporary injunction was granted as a

result of the suit brought to restrain the board of directors of the American Institute of Electrical Engineers from transferring members of the former highest grade to the newly created highest grade and from transferring to the new intermediate grade those associates whose qualifications for transfer were certified to in accordance with a special section in the constitution. The opinion expressed by Justice Page would seem to leave no doubt as to the legal interpretation of the special section. That, at least so far as numbers are concerned, the insertion of this temporary clause in the constitution has resulted in no measurable damage to the Institute is shown by the fact that a total of only about 375 members and 600 associates will be transferred under this special section, which has already expired, whereas it was predicted that 705 members and 2257 associates would be transferred during the life of this section. While the door is yet open for appealing from the decision of Justice Page or continuing the suit for permanent injunction, there are indeed few well-wishers of the Institute who do not hope that the denial of the temporary injunction means the end of the unfortunate public airing of differences of opinion as to methods or procedure in Institute affairs.

## The Safety-First Idea

The growth of the "safety idea" among central-station companies, particularly in the case of the larger properties and

systems, is one of the most significant movements of recent years in this industry. It is a march for the conservation of life and limb with which even the smallest company should fall into line. In the average electrical station dangerous conditions and life hazards exist by the score—unnoticed because of the familiarity which breeds carelessness. These dangers pass without discovery until the inevitable accident occurs. Then the specific remedy is applied; the victim goes to the hospital, and a hundred other hazards get their chance at his successor. If one particular individual in a company can be charged with the responsibility of locating and eliminating dangerous conditions and will make it his duty to analyze and anticipate possible perils, local results of great good can be accomplished. The man with the outside viewpoint will discover dangers of which the operator in daily contact is altogether unconscious. As a mere dollars-and-cents precaution against the heavy expenses of injury cases, to say nothing of the humanitarian principles involved, it will pay to look over the station from time to time with a critical eye—discovering where screens could be used to advantage about high-tension terminals

transformers, buses in substations, etc., where ground connections are needed on overhead lines, and, in other cases, bus structures and primary and line circuit breakers. Rubber mats should be placed before switchboards and alongside meters, where footings are needed for working belts and flywheels and around those flywheels, together with all the other multifold precautions which must be taken to guard employees against forms of secondary accidents.

## Growing Electrical Exports

It is gratifying that the electrical export figures should continue to be as such a liberal success and should maintain the growth and expansion based on previous months. The figures for April, just in hand, show a gross total for electrical machinery, lamps, trunks, telegraphs, telephones, etc., at not less than \$2,551,941, as compared with \$1,744,116 in April, 1912. That is an advance which might well be called remarkable, and such a pace will carry the total above \$45,000,000 for the twelve months very easily. The figures for the ten months are as follows: 1911, \$15,402,431; 1912, \$16,077,012; 1913, \$21,809,197. As compared with the small total of 1912 of 1911, a very sharp upward sweep of the curve is thus to be noted, and we cannot help wondering what it would have been if the war in Europe with its alarms and panics had not arrested the splendid industrial development being place all over the world. As it is, England is reporting better trade returns, and in spite of recent financial worries—salutary perhaps in themselves as inviting to caution—the general commercial and industrial conditions in this country could hardly be better, while the outlook for the crops is excellent. Apparently our electrical exports are destined to increase in amount rather than ever. Let us hope it is so, for it is a somewhat belated remedy we are now witnessing.

## British Standardization Rules

The learned contemporary *The Engineer* of London has recently quoted and commented upon certain proposed rules for the standardization of electrical machinery prepared by the British Electrical and Allied Manufacturers' Association. The promulgation of one such set of rules always involves a great deal of technical, industrial and commercial work. To many purposes the standard referred to corresponds fairly well to the A. S. E. E. standardization rules and to the rules which have been prepared by the International Electrotechnical Commission. So far as details of construction are concerned, it is important that each and every country should be prepared to follow its own standards, although, of course, it is



to the interest of each and all countries alike that the rating specifications for machinery should be the same and should be recognized internationally. No advantage can accrue to any country from rating its machines in such a fashion that people in other countries cannot clearly understand what is meant. It is, therefore, greatly to be hoped that, in regard to the specifications and ratings of machines, all countries will bring their standardization rules into line with the I. E. C. international rules.

There are two salient points of rating in which we think both the B. E. A. M. proposed rules and also the existing rules of the A. I. E. E. could be much improved. The first is in the recognition of a maximum internal temperature of the insulation winding, under rated load conditions, which maximum temperature, for each kind of insulation, should on no account be exceeded. This "hottest spot" rarely admits of being reached for measuring the maximum internal temperature. The best one can do is to measure the maximum external temperature of the insulation winding and draw inferences therefrom as to the maximum internal temperature. A certain temperature drop should be allowed for each class of machines as existing in the insulating cover, so that a corresponding maximum external measured temperature can be assigned for each kind of insulation and class of machines. All machines should then be operated, ideally, in such a manner as to keep their measurable temperatures just below the assigned maximum limits. How much load it will take to do this depends on whether the load is steady or intermittent and what the cooling conditions are in regard to the temperature and rate of supply of ambient air or other cooling medium; but the machines should be worked for economy well up to their assigned temperature limits. The actual load that any machine can carry will depend upon its local conditions of operation, but its rated continuous load should be that which will bring its measured external insulation temperature to the assigned limit from a conventionally assumed ambient temperature, the same for all machines. The papers and discussions at the New York midwinter convention of the A. I. E. E. tended to favor the adoption of the above outlined maximum temperature basis for determining the rating of machines, in place of the mere temperature-elevation principle laid down in the A. I. E. E. rules.

The second salient point is that no overload specification should be made. On the above maximum temperature plan no such overload is permissible. If a machine is carried by its output to the assigned maximum externally measurable temperature, any appreciable duration of overload will cause that limit to be exceeded. The whole theory of overload range is pernicious from the standpoint of a maximum safe internal insulation temperature. If a safe overload is possible consistently with such a limit of temperature, then the rating and output of the machine should be increased accordingly and the overload ruled out. It is to be hoped that the I. E. C. will adopt the maximum-temperature basis of rating and exclude the overload clause. According to the A. I. E. E. midwinter convention papers, 40 deg. C. should be the assumed ambient temperature for determining rated loads.

## Resale of Patented Articles

It is hardly too much to say that the Supreme Court has not in a generation handed down a decision of more far-reaching consequences than that delivered on May 26 when it held unlawful the fixing of the resale price on patented articles. The opinion is given almost in full in another column. To the popular mind, at least, the court has reversed its position in the Dick case, although the decision in the two cases can be reconciled on the ground of law as it now stands, as Justice Day was at some pains to point out. A distinction is drawn between the right to use, as in the Dick case, and the right to vend, as in the present case. The statute grants to the patentee for seventeen years the exclusive right to make, use and vend the invention or discovery, and the main question here presented was the proper interpretation of the term "vend." The court held in substance that this right is comparatively simple and terminates when the vending has once taken place. Or, in other words, when a purchaser procures a patented article from the seller thereof and pays down the full price in one lump sum for complete title, the rights and title of the seller cease and he may impose no further restrictions. The same question previously arose under the copyright law and was similarly decided.

Looking backward for a moment at the testimony given a year ago before the House committee on patents, it will be recalled that a great mass of argument was directed against the provision in the Oldfield bill taking away this supposed right to fix resale prices. The complaints came, not from inventors, but from manufacturers and jobbers who were employing patents to enable them to fix resale prices on articles in which the patent monopoly was extremely limited and narrow. That is to say, patents in these instances did not reward invention or discovery but fostered a commercial monopoly. The supposed right to fix the resale price was used not only to fix the price, and fix it at a scale much higher than otherwise would have prevailed, but furthermore to harass and injure competitors through oppressive restrictions attached to the handling and sale of the patented article. So far as the inventor himself is concerned, there is plenty of testimony to show that his rights are frequently sold or assigned for a comparatively insignificant sum long before the invention reaches the market in salable form. It is difficult to see that this decision has in any way prejudiced or compromised the reward which Congress intended to bestow upon inventors in order to stimulate our material progress as a nation.

The time is now ripe for action by Congress to solve many patent procedure problems including those related to the suppression of patents, or the locking up of an industry, and the numerous other forms of abuse. Something has already been accomplished in the work of the former Commission on Economy and Efficiency, but that investigation was incomplete and related primarily to the organization of the Patent Office. There is urgent need for reform which will strengthen the position of the patentee and punish adequately those wilful and wealthy infringers who deliberately appropriate his rights and defy him to stop them. Nothing less than a thoroughgoing investigation

by a competent commission, such as we have long advocated, will remedy the situation without jeopardizing the great stimulus to progress which our patent system has afforded to the nation in more than a century past.

### The Electrical Development Society and the Central Station

Here and there is expressed the opinion, a mistaken one, we believe—that the Society for Electrical Development does not offer to central stations a sufficiently direct return for their money. It is conceded that the efforts of the society will be productive of general good, but the question before each manager is, "What can it do for me in my own town?" As it is admitted that the society's work will be effective in impressing upon the general public the advantages of electricity and potent in breaking down such resistance as remains to its introduction, it is not necessary to enlarge upon this phase of the matter further than to insist that from this general educational effort central stations will necessarily derive direct benefits—only, they cannot be traced.

There are entirely tangible benefits to be obtained from central station membership in the society and cooperation in its work. For example, the moving picture film tells the story in compelling fashion of the advantages of electricity in factory, office and home. Arrangements will be made whereby any central station can obtain the use of the film locally merely by paying the cinematograph theater the price of a few tickets, to be distributed by the electric company itself where they will do the most good. Then there will be the traveling electric show, with trained exhibitors to talk and a press agent to create interest through the local papers. Another thing that the central station will gain is skilled assistance in making local advertising most productive. This will secure to members the services of the best advertising counsel obtainable and place them on a footing with those companies that can afford high-priced advertising experts. Of the same order will be the assistance offered by experts in local business getting campaigns and the services of publicity men for localized work outside of commercial lines. The general advertising in journals of vast national circulations is also of direct value to central stations, in so far as their present or possible customers are readers of these publications.

The above are only a few of the ways in which the central station can get back in direct, individual benefit what ever sum it may subscribe to the Society for Electrical Development. It may truly be said to the person now spending, say, \$3,000 annually for advertising that \$200 of the amount would not be an excessive price to pay for being shown how to get the maximum return out of \$2,800 to be used for advertising purposes. Comparing commonplace central-station advertising with the very best that is done or might be done leads to the conclusion that it would be well worth while to spend from 15 to 20 per cent of the appropriations for "average" advertising in order to make it certain that the remaining 80 to 85 per cent of the outlay would be spent for really effective business getting advertising.

### The Electricity Supply of Berlin

In this week's *Digest* will be found some striking data regarding the supply of electricity in Greater Berlin. The service in the suburban territory is far from being unified. In fact, the municipal-plant idea so frequently carried out in Germany has run riot in the immediate vicinity of Berlin with results which are far from beneficial to the distribution as a whole. The technical features of the matter we may pass over, the important thing being the general service in Berlin, as compared with that obtained with the unified supply system in single-utility American cities. There are a dozen or so municipal plants operating in the territory of Greater Berlin, besides the privately owned central stations of which the most important is, of course, that in Berlin itself, which serves as well some of the suburbs. Of these smaller stations, the largest two are in the neighborhood of 15,000 kw, the others all being much less, and five of them below 1000 kw. With this wonderfully mixed supply system there is no satisfactory price for electricity. The base price in Berlin proper from its large central station and in the suburbs immediately reached by its own system is 10 cents per kw-hr. for lighting and 4 cents for power service. In addition, there are special night rates for all the-peak lighting as low as 4 cents. In some of the suburban districts served by the same system the base lighting rate gets down to as low as 2.5 cents per kw-hr. The lighting tariff in Charlottenburg, with the chief municipal plant of the territory, starts at that point with a different series of discounts from those in Berlin. Its base summer rate starts at the same point, 4 cents per kw-hr. with a different series of discounts, and its seasonal rates, including a reduced summer rate, are notably different from those in Berlin itself. Another group of suburban stations, over the lighting rate of 12.5 cents, with rather haphazard and somewhat complicated sliding scales from a cent down to less than 2 cents with still a different schedule of special provisions.

And so it goes on, each utility having a different scale of prices, some higher and some lower than those charged in the city proper, with all kinds of discounts based on almost every provision conceivable used in making rate schedules. Except for the suburban territory directly served by the Berlin Electricity Works, there is nothing like unity in the scheme of charges, and so the whole suburban consumer depending on his local plant gets rather the short end of the bargain. The situation is a striking contrast to that which exists for large cities in our own country, where as a rule the supply, at first both in terms of metering and in terms of the basis of a single central station with uniform rates over the whole territory, almost always materially reduced below time in later times consolidation. In principle one big station is always a much more economical source of supply than many small ones, as has been amply demonstrated in the growth of central station systems here. The complex situation, as reflected in the article before us, is a beautiful illustration of the same thesis. One united network over the whole territory led with energy and speed to the fact that there was no other way of doing it, and that the only contribution to the matter of efficient and economical service.

# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Denial of Injunction Against the A. I. E. E.

Justice Page, of the Supreme Court of the State of New York, has rendered a decision in the suit brought against the American Institute of Electrical Engineers to enjoin the Board of Directors from transferring members of the Institute from the old grade of Member to the new grade of Fellow, and from that of Associate to the new grade of Member, the demands of the plaintiffs for a temporary injunction during the pendency of the suit being denied. In handing down his decision Justice Page stated that the Board of Directors in acting upon applications for transfer to the higher grades under the special section of the constitution have regarded the section as a complete and independent provision temporarily made for that purpose, and where the applicant has complied with the section in regard to certification by his fellow-members have made the transfer without further inquiry or examination. The plaintiffs claimed that the special section should be read in conjunction with the other provisions of the constitution concerning transfers, and that application for transfer under its provisions should be referred to the board of examiners for investigation as to the professional qualifications of the applicants. Justice Page held that the section is independent of all other provisions of the constitution and by-laws and provides "a convenient, practical and temporary method whereby old members of the society who are eligible for transfer to the grades of fellow and member may quickly assume their new title and standing without being compelled to go through the routine provided for in the other sections of the constitution." The plaintiffs are not debarred from continuing the suit for permanent injunction, but it is understood that the legal interpretation of the special section made by Justice Page would have enormous weight in any further legal action and would probably prove controlling.

### Convention Program of the Canadian Electrical Association

The twenty-third convention of the Canadian Electrical Association will be held in the Chemistry and Mining Building, Toronto, June 25, 26 and 27. It is expected that matters of vital importance having to do with the future of the association will come up for discussion and settlement at the meeting, because at a recent meeting of the managing committee the advantages of a broader organization were discussed. Although it was clearly shown that there is a strong desire on the part of the central stations of Canada to continue to receive the benefits to be derived from the present affiliation of the Canadian Electrical Association with the National Electric Light Association, it is thought that an organization which will bring together men engaged in all branches of the electrical business for social intercourse and for friendly discussion of technical and commercial progress of interest to all will result in much good. The following papers are scheduled for presentation at the convention: "The Hydroelectric Rules and Regulations and the National Electrical Code," by Mr. H. L. Strickland, of the Hydro-Electric Power Commission of Ontario; "Service," by Mr. Stephen L. Coles, of the So-

ciety for Electrical Development, New York; "Central-Station Advertising," by Mr. D. H. McDougall, of the Toronto Electric Light Company, Ltd.; "Underground Distribution for Small Cities," by Mr. S. Bingham Wood, of the Toronto Electric Light Company, Ltd.; "Electric Vehicles from the Central-Station Point of View," by Mr. C. Rummel, manager of the light and power department of the British Columbia Electric Railway Company, Vancouver, B. C.; "Electricity on the Farm," by Mr. J. C. Parker, of the Rochester (N. Y.) Railway & Light Company; "Watt-hour Meters with Maximum-Demand Attachments," by Mr. H. S. Baker, of the Ontario Power Company, Niagara Falls, Ont.; "Flame Carbon Arc Lamps," by Mr. T. J. Pace, of the Westinghouse Electric & Manufacturing Company; "The Electric Vehicle," by Mr. Stephen G. Thompson, of the Electric Vehicle Association of America; "Pole-Type Transformers," by Mr. C. E. Sisson, of the Canadian General Electric Company, and "Magnetite Street Lighting," by Mr. W. E. Young, of the same company.

An enjoyable and well-varied program for both members and ladies attending the convention has been arranged by the local committee in Toronto. Mr. C. E. Bowden, Birkbeck Building, Toronto, Can., is the secretary of the association.

### Federal Control of Rivers

The recent decision of the Supreme Court of the United States in the Chandler-Dunbar case is regarded by Senator Burton, of Ohio, as of the utmost importance because of the sweeping extent to which it upholds government ownership and control of water-power and navigable rivers, and at his request the decision is being printed as a public document. The court held that owners of the river banks or riverbed have no ownership of the water-power as against the government seeking to improve a river for navigation. Senator Burton laid particular stress upon that part of the decision which says that the government need not let the water-power go to waste but may use it or lease it to private individuals or concerns. This opinion of the court is evidently a direct answer to arguments recently advanced to the effect that after improving a river or stream for navigable purposes the government could not control the water-power incidentally created but must let it revert to the owners of the abutting property.

### National Government to Control Water-Power at Troy, N. Y.

Secretary of War Garrison has informed the New York State authorities that the federal government will have jurisdiction over the water-power created by the proposed new dam on the Hudson River at Troy, N. Y. The Secretary upholds the contention of ex-Secretary of War Stimson that the federal courts have established the proposition that when water-power is created as an incident to a dam erected by the national government for navigation purposes such power is subject to the exclusive regulation, control and disposition of the United States.



## Meeting of the Austro-Hungarian Association of Central Stations

The Austro-Hungarian Association of Central Stations—an organization somewhat similar in scope to the National Electric Light Association—held its annual convention in Budapest from June 1 to June 4. For the first time in the history of the association an electrical show was given in connection with the convention. The event was held in the old Hungarian Parliament building, with Mr. H. Sauer, director of the Vienna municipal central station, acting as chairman. The committee of arrangements included the mayor of Budapest, Dr. S. Barczay, who was honorary president; Mr. Etienne de Fodor, of the Budapest General Electric Company; Prof. Karl Ziperowsky and Dr. John Buzath, presidents, and Messrs. R. F. H. Scheuer, J. Ziperowsky and Dr. A. Tonelli, secretaries. The members of the executive and reception committee were Dr. Frank Ripka, Director L. Stark, Councilor Gelleri, Chief Councilor Hollis and Mr. Charles Perci. The example of Mr. de Fodor, of the Budapest General Electric Company, in making a liberal contribution toward the expenses of the convention was followed by many other large companies, and the association was able to carry through its plans with complete success.

## Norfolk & Western Railroad Not to Purchase Electricity

In the electrification of the 30-mile section of the main line of the Norfolk & Western Railway Company from Bluefield, W. Va., to Vivian, W. Va., which was outlined in these columns on May 3, the company will not follow the example of several other railroad companies which have recently decided to purchase energy. Instead, according to Messrs. Gibbs & Hill, consulting engineers for the complete electrification, the Norfolk & Western will build its own central generating station at Bluestone, which is on the line of the railway about one-third of the way from Bluefield to Vivian. The generating station will have steam equipment installed with a rating of 24,000 kw., and it is stated that electricity can be generated at an unusually low cost because of the fact that excellent coal is obtainable at the point of origin. The characteristics of the current to be employed in the locomotives have not yet been decided on, neither have the plans for the erection of the generating station been completed. For a time the officials of the company were negotiating with the Appalachian Power Company, which last year completed a system of hydro-electric plans on the New River, for energy; but it was finally decided that the railroad company would generate its own electricity and thus be independent of any other corporation.

## Membership Classification of Society for Electrical Development

As reported in last week's issue, changes in the classification of members were made at the meeting of the Society for Electrical Development, Inc., held in Chicago on June 2. Owing to the fact that many electrical manufacturing companies were not willing to join the society because the old classification of members necessarily divulged their annual business the following plan of classifying members by letter was decided on:

Class A, to be composed of members with a yearly business of less than \$15,000; Class B, of those with a yearly business of from \$15,000 to \$25,000; Class C, \$25,000 to \$50,000; Class D, \$50,000 to \$75,000; Class E, \$75,000 to \$100,000; Class F, \$100,000 to \$250,000; Class G, \$250,000 to \$500,000; Class H, \$500,000 to \$1,000,000; Class I, \$1,000,000 to \$2,000,000; Class J, \$2,000,000 to \$4,000,000; Class K, \$4,000,000 to \$6,000,000; Class L, \$6,000,000 to \$8,000,000;

Class M, \$8,000,000 to \$10,000,000; Class N, \$10,000,000 to \$12,000,000; Class O, \$12,000,000 to \$14,000,000; Class P, \$15,000,000 to \$20,000,000; Class Q, \$20,000,000 to \$25,000,000.

This enables the manufacturer to get into the society without divulging too closely his annual business and at the same time permits a fluctuation in his business without disclosing it to the general subscription. As is well known, the subscription for central stations and manufacturers is one-fiftieth of 1 per cent of the normal business, and in the case of contracting and jobbing approximately 1 per cent.

## Changes in New York City Wiring Rules

The Department of Water Supply, Gas and Electricity of the city of New York has announced the following changes in the Electrical Code of the city to take effect as of June 1:

Rule 30 (a) is changed so that some insulated wires to permit the employment of metal molding in offices and showrooms. Rule 30a, (b) (2) (3), third paragraph, has been amended to read as follows: "Where insulated joints are required, fixture enclosures or metal race to thoroughly and permanently insulated from metal walls or ceilings or from plaster walls or ceilings or metal tubing and from metal boxes." Rule 23d has been changed so that water sockets or receptacles instead of thirteen as provided in the first paragraph, and thirty-two sockets or receptacles instead of twenty-six is provided in the second paragraph, are now permitted. Rule 38A and Rule 38C, second paragraph, have also been similarly changed so as to permit thirty-two receptacles instead of twenty-six receptacles in one circuit. In Rule 72 the clause at the head of the rule reading "at not less than 50 watts each" has been changed to read "at not less than 40 watts each."

## Supreme Court Decision Affecting Franchise Rights

The United States Supreme Court on May 26 handed down an opinion, delivered by Justice Van Devanter, in the case of the city and county of Denver (Col.) against the New York Trust Company and the Denver Union Water Company respecting the rights of the latter under its twenty-year franchise granted in 1890. This franchise provided that the grant by the city should be limited to twenty years and stipulated that upon the expiration of the period the city might, if it so elected, purchase the company's plant at its appraised value, or, if it elected, renew the franchise on certain stated terms for another twenty-year period, but neither course was made binding upon the city. It was also stipulated that the company's plant should forever remain its property, except in the event of purchase by the city or agreement between it and the company.

In 1907 the city adopted an ordinance providing for an immediate appraisal of the plant and the fixing of a schedule of water rates for the next twenty-year period. It further requested the holding of a special election to vote upon whether the city should purchase the water works at the appraised value or renew the franchise for twenty years at the rates fixed by the appraisers, and in case neither proposition received sanction by the voters the rights of each party were to remain without prejudice as provided under the existing franchise for the unexpired term thereof.

The appraisers in 1907 returned a valuation of \$14,000,000 but failed to fix the rates and assessments on the water supply. Then in 1910 the city elected a special amendment creating a public utility commission and voted a bond issue of \$8,000,000 for a municipal waterworks under the provision that the city should be offered for the plant of the Denver Union Water Company.

This offer the company refused and therefore no election to authorize the purchase was held.

Litigation ensued, and the company averred in substance that the city was compelled under the old franchise to pursue one of two courses, either to purchase the plant or to renew the franchise, while the city set up that the franchise had expired and the rights of the company had ceased entirely, without obligation on the part of the city to renew. The Circuit Court issued interlocutory orders temporarily enjoining the city from constructing a municipal water plant or issuing bonds for the same, and upon appeal to the Circuit Court of Appeals the orders were affirmed (187 Fed., 890).

Application was next made to the Supreme Court for a writ of certiorari, and the present decision comes as the result. The numerous legal arguments advanced in the effort to show that the old ordinance, which expired in 1910, bound the city to accept one of the two alternatives previously stated were reviewed at length, and all were set aside upon the general ground that the wording and evident intent of the franchise could not be so construed. The court stated the matter thus: "In other words, the bill discloses that the city's position is that the trust company's claim is refuted by the very ordinance and charter amendment relied upon to sustain it," and the city's position in the matter was finally upheld. The interlocutory decrees were accordingly reversed, and the case was remanded with a direction to dismiss both bills.

### Resale Price on Patented Articles

As announced on page 1125 of our issue dated May 31, the Supreme Court of the United States handed down on May 26 an opinion in the case of Bauer & Cie and the Bauer Chemical Company against James O'Donnell, holding that in the ordinary sale of a patented article the chief value of which resides in its use, and where the purchase price covers the entire value and includes the complete profit or royalty to the patentee, the passage of title is complete and it is illegal for the patentee to attempt to fix the price at which it may subsequently be sold. In view of the fact that this decision is epochal in the history of patent law, we quote at length from the opinion itself, which was delivered by Justice Day, with Justices McKenna, Holmes, Lurton and Van Devanter dissenting but filing no minority opinion.

Bauer & Cie, of Berlin, Germany, are the holders of a United States patent covering a medicinal preparation known as "Sanatogen" and entered into an agreement with F. W. Helmeyer, doing business in New York City under the trade name of the Bauer Chemical Company, to become the sole American selling agent. Packages of this preparation bore a notice that they should not be retailed for less than one dollar, under liability for prosecution for infringement of the patent, followed by injunction and damages.

The appellee O'Donnell is a druggist in Washington, D. C., and purchased packages of this preparation from the Bauer company, retailing them afterward at 85 cents each. In March, 1911, the Bauer company severed relations with him, and he then purchased from jobbers in the District of Columbia. About one year ago the appellants sought to obtain an injunction, which was denied. They noted an appeal, and the District of Columbia Court of Appeals certified the case to the Supreme Court of the United States.

After reciting the preliminary facts the opinion continues as follows:

"The question propounded is: 'Did the acts of the appellee in retailing at less than the price fixed in said notice original packages of "Sanatogen" purchased of jobbers as aforesaid constitute infringement of appellants' patent?'

"The right to make, use and sell an invented article is not derived from the patent law. This right existed before and without the passage of the law and was always the right of an inventor. The act secured to the inventor the exclusive right to make, use and vend the thing patented, and consequently to prevent others from exercising like privileges without the consent of the patentee. (*Bloomer v. McQuewan*, 14 How. 539, 549; *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U. S. 405, 425.) It was passed for the purpose of encouraging useful invention and promoting new and useful improvements by the protection and stimulation thereby given to inventive genius, and was intended to secure to the public, after the lapse of the exclusive privileges granted, the benefit of such inventions and improvements. With these beneficent purposes in view the act of Congress should be fairly or even liberally construed; yet, while this principle is generally recognized, care should be taken not to extend by judicial construction the rights and privileges which it was the purpose of Congress to bestow.

"In framing the act and defining the extent of the rights and privileges secured to a patentee Congress did not use technical or occult phrases, but in simple terms gave an inventor the exclusive right to make, use and vend his invention for a definite term of years. The right to make can scarcely be made plainer by definition and embraces the construction of the thing invented. The right to use is a comprehensive term and embraces within its meaning the right to put into service any given invention. And Congress did not stop with the express grant of the rights to make and to use. Recognizing that many inventions would be valuable to the inventor because of sales of the patented machine or device to others, it granted also the exclusive right to vend the invention covered by the letters patent. To vend is also a term readily understood and of no doubtful import. Its use in the statute secured to the inventor the exclusive right to transfer the title for a consideration to others. In the exclusive rights to make, use and vend, fairly construed, with a view to making the purpose of Congress effectual, resides the extent of the patent monopoly under the statutes of the United States. (*Bloomer v. McQuewan*, *supra*, 549.)

"The question therefore now before this court for judicial determination is: May a patentee by notice limit the price at which future retail sales of the patented article may be made, such article being in the hands of a retailer by purchase from a jobber who has paid to the agent of the patentee the full price asked for the article sold?

"The object of the notice is said to be effectually to maintain prices and to prevent ruinous competition by the cutting of prices in sales of the patented article. That such purpose could not be accomplished by agreements concerning articles not protected by the patent monopoly was settled by this court in the case of *Dr. Miles Medical Company v. Park & Sons Company* (220 U. S. 373), in which it was held that an attempt to thus fix the price of an article of general use would be against public policy and void. It was doubtless within the power of Congress to confer such right of restriction upon a patentee. Has it done so? The question has not been determined in any previous case in this court, so far as we are aware. It was dealt with under the copyright statute, however, in the case of *Bobbs-Merrill Company v. Straus* (210 U. S. 339). In that case it was undertaken to limit the price of copyrighted books for sale at retail by a notice on each book fixing the price at one dollar and stating that no dealer was licensed to sell it for less and that a sale at a less price would be treated as an infringement of the copyright. It was there held that the statute, in securing to the holder of the copyright the sole right to vend copies of the book, conferred a privilege which, when the book was sold, was exercised by the holder, and that the right secured by the statute was thereby exhausted. The court also held that it was not the purpose



of the law to grant the further right to qualify the title of future purchasers by means of the printed notice affixed to the book, and that to give such right would extend the statute beyond its fair meaning and secure privileges not intended to be covered by the act of Congress. In that case it was recognized that there are differences between the copyright statute and the patent statute, and the purpose to decide the question now before us was expressly disclaimed.

"Section 4952, Revised Statutes, a part of the copyright act, secures to an author, inventor, designer or proprietor of books, maps, charts or dramatic or musical compositions the sole liberty of printing, reprinting, publishing, completing, copying, executing, finishing and vending them. While that statute differs from the patent statute in terms and in the subject matter intended to be protected, it is apparent that in the respect involved in the present inquiry there is a strong similarity between and identity of purpose in the two statutes. In the case of patents the exclusive right to vend the invention or discovery is added to the like right to make and use the subject matter of the grant, and in the case of copyrights the sole right of multiplying and reproducing books and other compositions is coupled with the similar right of 'vending the same.' So far as the use of the terms 'vend' and 'vending' is concerned, the protection intended to be secured is substantially identical. The sale of a patented article is not essentially different from the sale of a book. In each case to vend is to part with the thing for a consideration. It is insisted that the purpose to be subserved by notices such as are now under consideration—keeping up prices and preventing competition—is more essential to the protection of patented inventions than of copyrighted articles; and it is said that the copyrighted article may be and usually is sold for a lump consideration by the author or composer and that he has no interest in the subsequent sales of the work, while patented inventions require large outlays to create and maintain a market. To some extent this contention may be based upon fact, nevertheless it is well known that in many instances the compensation an author receives is the royalties upon sales of his book or a percentage of profits, which makes it desirable that he shall have the protection of devices intended to keep up the market and prevent the cutting of prices. But these considerations could have had little weight in framing the acts. In providing for grants of exclusive rights and privileges to inventors and authors we think Congress had no intention to use the term 'vend' in one sense in the patent act and 'vending' in another in the copyright law. Protection in the exclusive right to sell is named in both instances, and the terms used in the statutes are to all intents the same.

"It is apparent that the principal difference in the enactments lies in the presence of the word 'use' in the patent statute and its absence in the copyright law. An inventor has not only the exclusive right to make and vend his invention or discovery, but he has the like right to use it, and when a case comes fairly within the grant of the right to use, that use should be protected by all means properly within the scope of the statute. In *Beaumont v. National Harrow Company* (186 U. S. 763), the owner of a patent granted a license to the defendant to manufacture and sell harrows embodied in the invention covered by the patent. The license provided for the payment to the licensee by the licensee of a royalty of one dollar for each harrow or frame sold and stipulated that the licensee was not to sell to any person for a less price than that named, and that the license was subject to change from time to time. The case was one arising upon license agreements, originating in a state court, and did not involve the construction of the patent act in the circumstances now disclosed.

"Chief reliance, however, of the plaintiff in this case is upon the recent decision of this court in *Henry v. Dick Company* (224 U. S. 1). An examination of the opinion in that case shows that the restriction was sustained because

of the right to use the machine created in the patent statute, distinguishing it from the power given the copyright act. In that case a printed mimeograph had been sold which bore an inscription in the form of a notice that the machine was sold with the license restriction that it might only be used with stencil, ink and other supplies made by the A. E. Dick Company, the owner of the patent. The alleged infringer sold to the purchaser of the mimeograph a set of ink bottles for use with the machine with full knowledge of the restriction and with the expectation that the ink sold would be used in connection with the machine. It is expressly stated in the opinion that the machine was sold at cost or less and that the patentee depended upon the profit realized from the sale of the non-patented articles to be used with the machine for the profit which he expected to realize from his invention (224 U. S. 207).

"That case was distinguished from *Bobbs-Merrill v. Straus*, *supra*, construing the copyright act, because of the difference in the terms of the copyright and patent statutes, the patent act conferring not only the right to make and sell but the exclusive right to use the subject matter of the patent. It was under the right to use that the license notice in question was introduced, and it is shown that the notice in that case dealt with the use of the machine and limited it to use only with the paper, ink and supplies of the manufacture of the patentee. While the title was transferred, it was a qualified title, giving a right to use the machine only with certain specified supplies. It was not in the Dick case that 'there is no relation whatever between the decision in the *Bobbs-Merrill* case and the present opinion. Each rests upon a construction of the appropriate statute and the special facts of the case.'

"It is contended in argument that the notice in this case deals with the use of the transaction, because the notice states that the package is licensed 'for sale and use at a price not less than one dollar,' and it is claimed to be in accordance of the conditions, and that all rights revert to the patentee in event of violation of the restriction. But in none of the facts certified in this case is it shown that plaintiff introduced the article in question as a non-patented article to sell the transaction to purchase a license to use the instrument. The notice from which the article was introduced had previously been for sale at a price which must be assumed to have been satisfactory, the package of supplies afterward sold to the appellee. The plaintiff had an interest in the proceeds of the sale of the article, and it is not necessary for it to participate in the profits thereof. The packages were sold with a full and complete title in law which would have when sold to the same holder, excepting only the notice to limit the use of the article and prevent further sale of the article. In order words, the title transferred was full and complete, with an attempt to prevent the title so to be the price at which subsequent sales could be made. There is no showing of a qualified sale here, that notice for limited use with other articles sold as one done in the Dick case. There was no transfer of a limited right to use the invention, and so all the sale is shown to be a sale of a complete right.

"The plaintiff further is directed to the exclusive right secured by statute to vend a patented article, there is included the right, by statute, to destroy the goods in which such right is embodied in the article, and to make. The plaintiff relies solely upon the notice placed on the printed form of the article as a limitation of his right to sell to be of any avail, and he fails to consider the statute. The statute and the license from which the article was introduced were made the subject of the license of the parties. They had the title to and the right to sell the article purchased without accounting for the proceeds to the patentee and without making any license agreement there and without being made by the plaintiff from the agent of the plaintiff. Upon such facts as are now presented we think the right to vend secured by the patent statute is not distinguishable from the



right of vending given in the copyright act. In both instances it was the intention of Congress to secure an exclusive right to sell, and there is no grant of a privilege to keep up prices and prevent competition by notices restricting the price at which the article may be resold. The right to vend conferred by the patent law has been exercised, and the added restriction is beyond the protection and purpose of the act. This being so, the case is brought within that line of cases in which this court from the beginning has held that a patentee who has parted with a patented machine by passing title to a purchaser has placed the article beyond the limits of the monopoly secured by the patent act."

The position taken by the Court of Appeals of the District of Columbia in denying the application for injunction was sustained.

### Comments on the Supreme Court Decision on Resale Prices

Representative Oldfield, who introduced at the last session of Congress a bill modifying the patent law in several vital respects, as we have fully reported, is quoted as regarding the decision of the Supreme Court in the O'Donnell case as one of the most important in a generation. Giving out a statement on the subject in Washington, he said, in part:

"The decision affects from \$10,000,000,000 to \$15,000,000,000 worth of capital invested in manufactured patented articles, and it also affects every man, woman and child in America. Now that the Supreme Court has decided along a line which I have been arguing for several years, I do not intend to be slow in pushing my bill.

"The people will never see the justice of a manufacturer forcing a retailer to sell a patented article at a fixed price. My bill specifies that it is not an infringement of the patent rights for a retailer to sell at whatever price he may choose, but that if anything it is merely a breach of a civil contract, if a contract of this kind to maintain prices exists."

Officials of the Department of Justice declare that the decision sharply draws the line of demarcation between the Sherman anti-trust laws and the patent laws. The department has contended that once a patentee sells his patented article he loses all control of it and is powerless, in view of the Sherman anti-trust law, to establish resale prices. It is stated at the department in Washington that several anti-trust suits now in the courts or in prospect of being filed are based on this principle, and that it is now expected that companies which have been claiming the right to establish resale prices will at once cease to do so and avoid attack by the government.

The first decision sustaining what was then thought to be the right of the patentee to fix resale prices was handed down in the United States Circuit Court of Appeals by Justice Lurton when he was on that bench, which decision was concurred in by Justice Taft, then on that bench and afterward President. Justice Wright and Justice Barnard, of the District of Columbia Supreme Court, were the first members of the bench of the country to render decisions in such cases which accord with the decision of the Supreme Court of the United States of May 26. With the exception of Judge Ray of the federal court of New York, they were the only judges of the country who had taken such a view, the courts holding with the patentee in the many other decisions rendered touching on this point.

The court permitted the Gillette Safety Razor Company, the Victor Talking Machine Company, the Waltham Watch Company and the Ingersoll Dollar Watch Company to file briefs in the Bauer-O'Donnell case, as they had suits pending in various courts throughout the country in which the same issues were involved.

### Decision on Electric Sign Patent

The Alcock patent covering an electric sign in which is produced the illusion of human or animal figures in motion (No. 648,677 issued May 1, 1900) was recently upheld in a suit brought against an alleged infringer. The decision in the case was handed down by Judge Day, in the United States District Court, Northern District of Ohio, Eastern Division, at Cleveland, Ohio, on May 28. The essential feature of the patent is the illuminated display of a figure in consecutive positions representing some natural action or motion, as exemplified by many familiar motion signs in nearly every city of the country. Perhaps the most notable of these are the chariot-race signs, one of which has been on nightly exhibition on Broadway, New York, for some years past.

The parties in the action were the O. J. Gude Company, of New York, complainant, and the A. & W. Electric Sign Company, defendant. The object of the invention as stated in the patent is to cause "illuminated designs or portions of them to appear to move or travel by means of a suitable arrangement of the lamps and by providing for their successive lighting and extinguishing." The alleged infringing sign constructed by the defendants was in fact one of the chariot-race signs above mentioned. In regard to the novelty of the device the court stated as follows:

"When Alcock conceived the idea of outlining a figure in electrical lamps and connecting these various lamps forming a certain outline of the figure with a flasher or switch in such a manner as to have a portion of this figure permanently lighted, by successively lighting and turning off the lamps on other portions of the figure by an arrangement of the contact switch or flasher, he produced the illusion of a figure assuming different attitudes and positions. This was new, as none of the former devices ever conceived the idea of a permanently located figure appearing to move in various different ways as would the man tipping his hat, or the chariot horses running and the wheels of the chariot turning."

The court held that Alcock's effects were new, and that no such novelty had been disclosed in prior patents or publications, and that he was entitled to have his invention protected.

### Patent License Restrictions

Another notable case involving the supposed right to circumvent the Sherman act under the cloak of the patent laws has just been settled adversely to the defendants, who pleaded guilty and accepted a decree which was mutually satisfactory to the government and themselves. This decree was signed on May 27 by Judge Hazel in the United States District Court for the Western District of New York, at Rochester, N. Y. The defendants, comprising the so-called "Coaster-Brake Trust," included six corporations and eighteen individuals. Fines aggregating \$35,000 were imposed on the six corporate defendants and some \$37,500 on eleven of the individual defendants, and all were permanently enjoined from carrying out the same or similar agreements in the future. Among the fines was one of \$1,000 imposed on Mr. Gales P. Moore, who was patent attorney for the combination.

This trust was organized in Buffalo in 1908 for the purpose of fixing uniform prices for coaster brakes and other bicycle parts. Prior thereto there were seven large independent concerns manufacturing bicycle and motor-cycle sundries, each manufacturing coaster brakes under its own patents. Owing to competition and small profits four of these concerns agreed to operate under a so-called patent license, to be given to three of their number by the fourth, the New Departure Manufacturing Company, which was also to file suits against infringing competitors and defend the pool. One of the three outside concerns was then put out

of business by a patent suit and the other two joined the combination. Each corporation put up a sum of \$1,000 as a forfeit to guarantee obedience to the rules. A selected list of bicycle jobbers was prepared, and only those jobbers whose names appeared on the list were allowed jobbers' discounts from the list prices. It was charged that in this way the combination managed to control the entire market in bicycle and motor-cycle sundries. It was furthermore charged that the patent attorney for the New Departure Company sent out from time to time large quantities of letters to dealers threatening them with damage suits if they sold any other make of coaster brake. Prior to the formation of the trust, brakes sold at from \$2 to \$3, but afterward the prices were raised until they ranged from \$3.25 to \$6.50.

The decree of the court not only enjoined the combination but also enjoined the constituent concerns from harassing the trade and from fixing resale prices under patent licenses. The stipulation was entered, however, that the fixing of resale prices should be forbidden "unless and until the Supreme Court of the United States shall decide that a licensor may lawfully fix and impose such resale price." The Association of Coaster Brake Licensees was formally declared in the decree to violate the anti-trust law of 1890. Sixty days were allowed the defendants to reorganize their business.

In view of the decision of the Supreme Court in the "Sanatogen" case, filed May 26, the terms of the coaster-brake decree become perpetual, and the fixing of resale prices, where title to the commodity or article sold passes completely to the purchaser at sale, has become illegal.

## 20,000-kw Turbines and Big Boilers for Detroit Edison's New Station

The Edison Electric Illuminating Company of Detroit has ordered, for delivery next year, the first of the 20,000-kw horizontal turbo-alternator units for its new Conners Creek generating station to be built on the east side of the city where the growth of load has been very rapid in recent months. As far as now outlined the plans provide for an ultimate installation of eight of these 20,000-kw sets. Steam will be generated in 2300-hp double-fired boiler units of the type installed at the company's Delray plant in the west end of town, where turbine loads as high as 11,000 kw have been carried on a single boiler.

Some thirty acres of river-front property at a point opposite the north end of Belle Isle have been acquired for the new station. Much of this land is now submerged, but will be drained during the present year and work on the plant foundations started. It is expected that two of these 20,000-kw, 60-cycle General Electric horizontal Curtis turbine sets will comprise the initial installation. All circuits leaving the plant will be operated at 23,000 volts, step-up transformers being installed in the station. The new Conners Creek plant will transmit to the system of the Eastern Michigan Edison Company, in addition to sharing the Detroit Edison load with the Delray station. The latter is located on the western edge of the city, its position having been dictated some years ago by the plan to install non-condensing engines whose exhaust was to have been used for evaporating salt pumped from brine wells in the vicinity of the site. Meanwhile, however, the steam turbine was perfected and units of this type were installed at Delray, so that the salt-drying project was given up, though the plant remained. Two stations have been erected on this West End site, and in the second of these there is now being installed its fourth 14,000-kw turbine unit. The Detroit company's steam-heating subsidiary recently completed the initial installation of two 750-hp boilers in its new Park Place heating plant, placed in commission Jan. 1. Six other large boilers of similar rating will be installed.

## Dayton Company Gives \$50,000 to Flood Prevention Fund

On behalf of the Dayton Power & Light Company, President E. M. Tolt has sent a check for \$50,000 to the Dayton Flood Prevention Fund, for which \$2,000,000 is being raised among local citizens and business firms. The amount subscribed by the electric company is one of the largest of the donations made by local corporations.

Just before the recent flood days of March 25, 26 and 27 the Dayton company had announced a general reduction in its rates to take effect April 1. In the meantime following the flood disaster this reduction had generally been urged by the public, but after order had been restored the change in schedule was brought in the company's intention the reduction in bills being dated as from April 1. On the Monday following Flood Prevention Day the company distributed to school children thousands of cardboard wheels in the form of electric lamps, bearing reminders of the rate reduction. The new schedule involves no minimum charge or term-contract provision. In the clean-up days after the flood a large number of the smaller customers presented



MULTI SIGN ON MAIN STREET, DAYTON

several weeks' electric service without registration, and the flooded meters could be changed and repaired.

Giving expression to its motto "For a bigger, better and brighter Dayton," the Dayton Power & Light Company has erected in a prominent position on Main Street a large roof sign bearing the above legend, with the company name. This display was inaugurated on Flood Prevention Day, and may serve as an excellent reminder of the better things to come for the beleaguered city in the future.

## Ontario Towns to Get Energy from Detroit

With the granting of permission from the Ontario government, a proposed Niagara energy loan from the Detroit Delray station will be applied to the Canadian towns of Essex, Kingsville, Wingham, Watford and Amherstburg. Authority has already been received from the Ontario government at Toronto for the construction of this power. For a time permission had been given by the Ontario government, but it was withdrawn by the latter, hoping to make this western station in connection with municipal Niagara power, have since received the official permit. To justify extension of the Hydroelectric Com-



mission's high-tension system to Windsor all available loads would be required, and the loss of this Essex County prospective load is, of course, not relished.

The interconnected system for the towns above mentioned is being developed by the Essex County Light & Power Company, Ltd., whose officers are: President, Mr. R. Stuart Stewart; vice-president, Mr. A. C. Marshall; secretary, Mr. J. V. Oxtoby, and treasurer, Mr. George Wiley. In addition to the foregoing, Messrs. Alexander Dow and J. B. Osler are included in the board of directors. All are Detroit men.

Some 40 miles of 40,000-volt transmission line has already been built to connect the Ontario towns. No. 0 aluminum conductor has been employed carried on 35-ft. poles set at 160-ft. intervals. For the crossing beneath the Detroit River opposite the Delray station a 23,000-volt submarine cable has been provided. On account of the width of the river at this point, this cable had to be made and shipped in two sections and afterward joined together. The Canadian terminal of the cable is a transformer substation at Sandwich where the incoming energy will be put on the transmission line at 40,000 volts. Completion of the cable connection now awaits the governmental authority before mentioned.

### The Heterodyne Receiving System

At a meeting of the Institute of Radio Engineers held in New York on June 4 Mr. John L. Hogan, Jr., of the National Electric Signaling Company, presented a paper describing the principle and apparatus involved in the heterodyne receiver, invented by Prof. R. A. Fessenden and used for all long-distance communications in the recent test between Arlington, Va., and the U. S. S. *Salem*.

Since the "beats" principle, upon which the heterodyne operates, is not generally understood, Mr. Hogan opened his paper by a discussion of the classification of radio receivers and of the addition of simultaneous wave motions. He stated that radio receivers are of two broad classes—first, the relay or "trigger" type, in which the received energy releases an amount of local potential energy which in turn operates an indicator to produce a signal, and, second, the "converter" type, which acts merely as a transformer linking the antenna and the indicator and in which the signal is produced by energy actually received by radio from the transmitting station. Receivers of the first class (such as filings coherers) are limited by their delicacy and inefficiency, while those of the second, such as the gas, liquid or solid rectifiers, cannot utilize in producing a signal any more energy than that actually received. This has led to attempts to use microphonic or other telephone relays to amplify received signals, but in general these have been unsuccessful. A selective receiver which will amplify persistent waves but will not increase effects due to highly damped discharges (such as those of atmospheric interference) is needed in the art of radio transmission. The only receiver of this type is the heterodyne, which gives an indication by the conjoint operation of two high-frequency alternating currents, one received from the transmitter and the other usually generated at the receiving station.

Mr. Hogan illustrated by lantern slides the graphical addition of waves of various types, treating mathematically the several cases. The production of acoustic beats by organ pipes and singing flames was shown, and the distinction between polarized and non-polarized indicators was demonstrated by generation of inaudible air-wave beats with Galton's whistles.

Five types of heterodyne receiver were described. In the first two streams of waves having slightly different frequencies were received on two separate antennas. Currents set up by them passed through the coils of a non-polarized magnetic telephone and reacted on its diaphragm

to produce audible signals. In the second form a single antenna was used, one of the two interacting currents being generated by an alternator, arc or other oscillator at the receiver. The third form shown had its sensitiveness increased by use of a dynamometer telephone, and the fourth type was made still more effective by the use of a static telephone receiver.

With this last arrangement of heterodyne apparatus signals had been received more than 3000 miles, in spite of the notoriously low sensitiveness of the static telephone. The great increase in effective sensitiveness could be explained by a theory of operation which had been proposed and which indicated that the static telephone used upon the heterodyne principle would respond to a given strength of sustained wave several hundred times as loud as if used simply.

The fifth type shown adds to the sensitive rectifier and telephone combination of modern receivers the amplifying power of heterodyne excitation. Receiving either from sustained-wave or spark transmitters, it is possible to read signals so weak that they cannot be heard with the ordinary receiving apparatus. On spark signals the intensity of heterodyne response is from five to fifteen times as great, in audibility, as that of the best rectifier receivers operating normally, while on sustained waves the effective amplification is still greater. This increase of sensitiveness to continuous waves accounts for the long distances of transmittal by the arc temporarily installed at Arlington and used for special tests during the cruise of the *Salem* to Gibraltar. During those trials all long-distance signals, whether from arc or spark sender, were received on the heterodyne, the ticker receiver having been abandoned by the United States Navy engineers after the first few days of the test.

Data secured on the trials between Arlington and the *Salem* permitted modification of the constants in the Austin-Cohen transmission expression\* so as to compensate for the increased sensitiveness of the heterodyne. Extending such data, it is found that two stations of the Arlington type could exchange messages regularly by day and night over a distance of 4500 km (2800 miles) or could transmit between them daylight signals of twenty-five times audibility (readable through light static), even if 5500 km (3400 miles) apart. These distances would be impossible with anything like similar transmitting power if any known receiver other than the heterodyne were used.

### The Electric Vehicle at Boston

Rapid growth in the electric-vehicle service of eastern New England was shown at a regular meeting of the Electric Motor Car Club of Boston on June 5, when figures were presented by Mr. O. G. Draper setting forth registrations of electric vehicles for the several states to June 1, 1913, as shown in Table I.

President Day Baker, in the chair, outlined the work done by the civic committee of the club in assisting to defeat the proposed law raising the fee charged on trucks to \$5 per ton per annum throughout Massachusetts. The bill passed the Senate, but was killed in the House a few days ago by a vote of 126 to 66.

It was announced that the present membership of the club is 106, and data gathered under its auspices show that there are a total of 201 charging stations in New England at present. A plan was discussed to secure additional data on charging stations from representatives of electrical manufacturers visiting electric-service companies in this territory.

A thirty-two-page booklet describing nearly a dozen of the best routes for electric-pleasure-car travel, with Boston

\*Bureau, Bureau of Standards, Feb. 1, 1911, pages 315-363.



as a center, was distributed at the meeting. A clearly written article on the electric automobile, by Mr. H. P. Thomson, of the Massachusetts Institute of Technology, Boston, is included.

The recent electric-vehicle convention at Boston was discussed at the meeting, and the point was brought out that the total attendance was 144, representing ten states and

TABLE 1.—REGISTRATION OF ELECTRIC VEHICLES IN GREAT  
ENGLAND AND WALES

	1900-1909	1910-1919	1920
Maine . . .		3	5
New Hampshire . . .	17	1	13
Vermont . . .	2	1	1
Massachusetts . . .	45	100	100
Rhode Island . . .	1	1	20
Connecticut . . .	21	22	33
Totals . . .	86	106	1,110

The growth in Massachusetts for the year ended May 31, 1913, is given in Table II.

TABLE II—REGISTRATION OF CLIPPER VESSELS IN MASSACHUSETTS

	Percentage	Percentage	Year
Registrations, 1911-12	3.1	100	1914
Registrations, 1912-13	4.3	139	1915
Gain during year	1.0	32	1915
Gain in per cent	32	100	96

including fifty-six central-state non-party secret representatives of electric-vehicle manufacturers, thirty-eight representatives of battery and accessories makers, and twenty press representatives. It was announced that some \$7,000 has been expended in the Boston offices in an advertising campaign about fifteen columns of publicity matter having been printed. The next meeting is scheduled for June 1 at Boston, when the subject of fines as specifically related to electric vehicles will be treated. Later in the summer a conference will be held in response to the interest of Massachusetts, North Shore central offices in the campaign.

## National District Heating Association at Indianapolis

The fifth annual convention of the National District Heating Association was held at the "Clayton Hotel," Indianapolis, Ind., May 27, 28 and 29. Following the welcome extended by ex-Mayor C. W. Bookwalter, President R. De Wolf delivered his official address in which, while congratulating the association on its past achievements, he pointed the way to even greater aims and purposes for the future. The collection of complete and satisfactory engineering data was included among his suggestions, while he also advised a careful study of the subject of rates for heating service. In many situations, as he pointed out, the central station must be prepared to furnish heat for the service and district heating in order to hold its share of the normal growth of the community. The district heating company, he went on, needs the cooperation of the local heating contractor, for satisfactory construction on the customer's premises is in all cases essential for good service. Greater uniformity of both rules and specifications is also badly needed among the charts of the country. "District heating," concluded Mr. De Wolf, "is right economically

and the numerous ways in which it is using the best real possibilities of the future which central heating holds.

Secretary D. L. Gaskill, Greenville, Ohio, followed with the secretary-treasurer's report. The report showed a surplus balance and an enrolment of 168 active members and

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The report of the select committee, composed of Messrs. S. Morgan Burnip, Chairman, C. H. Smith, Dayton, Ohio, and C. D. Morgan, former Ashli, was also authorized by the House. Mr. Ashnell. This paper included descriptions of the Hallwachs, Gebhardt and St. John steam meters and of the standard forms of steam meters used at the present installation. Diagrams were given for the form of steam or hot water pressure and condensation types, together with a list of all valves, the setting and use. The report closed with a concise comparison of the advantages and disadvantages of the rate and pressure method of charging. Data were collected showing the increased pressure and condensation steam requirements with transfer to a closed system.

J. Barrow, Indianapolis, Ind.; C. R. Barry, New Mass.  
 H. R. Wetherill, Phoenix, Ariz.; H. G. Gehringer, Birmingham, Ala.;  
 C. L. Gentry, Seattle, Wash.; C. R. Bishop, North Tonawanda, N. Y.; M. M. Marshall, N. Y.; H. A. Hall,  
 London, Ont., and A. C. Sauer, Toledo, Ohio.

[illegible]

## DISCUSS THE WAY HEADING AND DISTANCE...

Mr. J. C. Rogers, District Chief, opened Tuesday afternoon's session with a report on "Distributing the Water Budget for Residential" districts. He then made the following findings of variations in the amount of radiation, water temperature and atmospheric conditions. Taking a given five-mile diameter the two parameters, Mr. Rogers, selected, yielded the results. First, the sun's radiation is changing latitudes, ranging from 25 to 35 miles to the north. The author recommended high radiation with a low rate for heating as being the ideal condition, even both, the economy and comfort's viewpoint. He also urged attention of the public with respect to the effects of radiator outlets, inside clothing, etc. Mr. Rogers closed his report with a synopsis of data from various sources concerning humidity, wind and daily temperature.

[illegible]

### Temperature in the Waxing Season

"Preservation of the Wood Hoop" was the title of a paper presented by Mr. N. M. Argersinger, Elwood, Ind.

Exhaust steam from engines may be used to heat the circulating water in the following four ways: (1) Contact in open heater or drum; (2) use of group of small upright heaters with copper tubes; (3) passing exhaust to jet-type condenser, giving fair vacuum on prime mover; (4) exhausting steam into over-sized heating condenser, circulating the heating water through latter's cooling chamber and using a dry-vacuum pump and hot-well pump to obtain all possible vacuum and to return condensate to boilers. The last is, of course, the most efficient.

Care must be taken in laying out the size of the heating plant to correspond with the electrical load, developing the latter if necessary, he suggested, by the wholesaling of energy at low rates. Mr. Argabrite's paper directed special attention to the expensive practice of using steam circulating pumps in hot-water systems. The 25 hp to 40 hp required to provide circulation in a 100,000-sq. ft. system can, of course, be furnished much more economically by motor drive. To convert losing heating-plant propositions into "money-makers," special stress was laid on the following items: Cleaning out wasteful auxiliaries; getting rid of open heaters and installing heater condensers, thus making plant condensing; installing thermostatic control on consumers; improving pipe insulation; reducing excessive circulating pressures; closing every leaky pipe on the system; getting optional power contracts with local power users who make their own power to use live steam from time to time; getting connection with some other company, such as a street railway, to avoid using live steam.

Mr. Argabrite's paper was discussed briefly by Messrs. Thomas Donohue, Lafayette, Ind.; D. S. Boyden, Boston, Mass.; T. Weinsbank, Indianapolis; R. D. De Wolf, Rochester, N. Y.; B. T. Gifford, Chicago, Ill.; H. A. Woodworth, Indianapolis, Ind.; E. Darrow, Indianapolis, Ind.; T. Wilson, New York; F. C. Chapman, Oak Park, Ill., and O. C. Irwin, Berlin, Wis.

#### STATION RECORDS

Mr. A. P. Biggs, Detroit, Mich., opened Wednesday morning's session with the report of the committee on station records. The advantages and economies incident to modern practices in record keeping were described, and the following were enumerated as being the most useful items to be noted: (1) Monthly and yearly cost report on all branches of operation; thousands of pounds of steam sold; tons coal consumed, price per ton and total fuel cost; labor cost; total operating cost; operating cost per 1000 lb. of steam sold; total maintenance cost; maintenance per 1000 lb. of steam sold; production expense per 1000 lb. of steam sold. (2) Monthly report, showing: Amount of steam used; amount of radiation added and cut out; number of feet of mains and service laid; number of meters set and removed. (3) Meters: Complete record of all tests and repairs. (4) Cubical contents: Exposed wall and glass, amount of radiation installed and amount required for all buildings connected to mains. (5) Mains and services installed: Size, length, square feet of heating service and exact location of pipes and fittings.

Messrs. D. S. Boyden, Boston, Mass.; R. D. De Wolf, Rochester, N. Y., and N. M. Argabrite, Elwood, Ind., spoke briefly in discussion of the report.

#### BOILER PRACTICE AT DETROIT

Mr. Norman Reinicker, Detroit, Mich., followed with a paper describing the boiler practice of the Detroit Edison Company. At its Delray plant the company has used 2365-hp Stirling boilers with great success. Important operating improvements have also been made in the rebaffling of the 500-hp boilers and the removal of the furnace arches to secure higher combustion chambers. Efficiencies as high as 80 per cent are now obtained with this improved construction. Other refinements in boiler-plant practice and operating methods were discussed by Mr. Reinicker.

In a written discussion Dr. D. S. Jacobus pointed out that the success of the huge Detroit boilers is a tribute to the foresight of the local company. The experiments with the smaller boilers reported by Mr. Reinicker show in an interesting manner, he said, the results of the baffling arrangements. But advances in power-plant operation such as those obtained by the Detroit Edison Company depend very largely upon the high class of the operating personnel, as well as upon equipment or instruments. Messrs. L. H. West, Cleveland, Ohio; D. S. Boyden, Boston, Mass., and H. S. Spiehler, Dayton, Ohio, took part in the discussion.

#### BLEEDER OPERATION AND UNDERGROUND CONSTRUCTION

During a symposium on bleeder-type turbine operation Mr. N. M. Argabrite referred to the successful performance of a plant at Atlantic City, N. J., using 275 lb. steam pressures. Mr. R. D. De Wolf reported that the Rochester Railway & Light Company is installing two 7500-kw turbo-sets, from the first stage of which steam will be bled for heating. This initial stage is designed to pass 25 per cent more steam than the following stages. Mr. N. G. Reinicker told of the method of bleeding the second stages of the Detroit turbines to obtain steam for the closed feed-water heaters.

At the afternoon session Mr. H. W. Prentiss, Jr., Pittsburgh, Pa., gave an illustrated talk on underground pipeline construction and insulation, referring particularly to the use of infusorial or diatomous earth and its preparation as thermally insulating pipe covering. Messrs. C. R. Bishop, North Tonawanda, N. Y.; T. Donohue, Lafayette, Ind.; N. M. Argabrite, Elwood, Ind., and T. Weinsbank, Indianapolis, Ind., also spoke.

In the absence of Mr. C. F. Murphy, of San Francisco, who was to have read a paper on "District Heating on the Pacific Coast," Mr. G. E. Quinan, of Seattle, Wash., gave an extemporaneous account of heating practice at Seattle. Owing to the prevalence of water-power in that region the heating plants distribute live steam, generated by burning coal and oil. The Seattle company has two heating stations on the water front of the city and serves some 40,000 ft. of mains and pipes.

#### APPRAISALS AND UTILITY COMMISSIONS

"Appraisal of Heating Properties" was the title of a paper by Mr. Harold Almert, Chicago, who discussed the practice of state public-service commissions in evaluating plants and systems and the theories on which are based equitable appraisals of both tangible and intangible plant values. Mr. Almert recommended that operating companies determine carefully their own investment valuations, preferably having such appraisals made by outside engineers and experts. The speaker also reminded his audience that utility companies by their very existence in a community often enhance the value of surrounding property twelve-fold without themselves sharing in this increase or profit. He recommended careful analysis of business methods and investments involved and urged that operating companies obtain without delay careful and comprehensive appraisals of their own properties by engineers of recognized standing. Such appraisals will be of the greatest value in fortifying corporation interests against commission investigations and for correcting books, adjusting rates and organizing finances.

Mr. D. L. Gaskill, Greenville, Ohio, secretary of the association, read at the opening of Thursday's session a paper on "Commission Control of Public Utilities." Where such commissions have had ample funds and power given to them, said Mr. Gaskill, most of the ill-feeling and distrust existing between the utilities and the public has disappeared and a feeling of co-operation and confidence has taken its place. Both the standing and the rewards of the commission should be such, he insisted, as to attract the highest class of officials. Local utility commissions for each



municipality, as advocated by some adherents of the "home rule" idea, would lead back again to the old unsatisfactory conditions of poor service and high cost to the people and injustice to the utilities. Under intelligent state control, said Mr. Gaskill, all the intricate problems of utility management may ultimately be worked out to a standard. With nearly all the states in possession of public-utility commissions, unity of action will result among such bodies, bringing about safe, reasonably profitable and well-managed public utilities. For those who have invested their money and are seeking to give the best possible service such a day cannot come too soon.

#### DISTRICT HEATING AND THE CENTRAL STATION

The paper by Mr. C. J. Davidson, Chicago, "Is District Heating Profitable to the Central Station?" pointed out some of the undesirable conditions which have contributed to the unprofitable character of certain heating plants. The author strongly recommended the policy of metered service, urging this point as one of the advantages of steam heating over the circulation of hot water. Location of the plant with respect to the load can also work important economies by eliminating long transmission mains. The selection of prime-mover units, whether engines or bleeder-type turbines, the choice of pipe-line construction, use of tunnels, etc., are all problems requiring careful study. While figures or statistics obtained from one property or locality may be entirely misleading when applied to another company or section, there nevertheless remain certain fundamental principles of policy and management non-observance of which may make for failure in the operation of such district-heating systems. Usually the district-heating service is of material value in securing additional electrical business, although the advantage gained in this way will often depend upon local conditions.

#### HEATING LARGE FACTORY BUILDINGS

Some of the operating economies to be attained in the heating of large factory buildings were pointed out by Mr. E. L. Wilder, of Rochester, N. Y., in his paper which closed the convention program. The Rochester company has, for example, taken care to see that all windows in factories which it heats are closed during the night. Steam is also shut off during these hours, being turned on again to have the buildings warm when the operatives arrive at 7 a. m. Recording thermometers enable the temperatures prevailing all hours of the twenty-four to be carefully checked and measures taken to avoid any waste of heat discovered. Before this inspection was put in force it was found that some buildings reached 80 deg. during the night. Accordingly, schedules have been prepared for various ranges of temperature, as 45 deg. Fahr. and above, 35 to 45 deg., 25 to 35 deg., and 25 deg. and below. Corresponding to each range, hours are fixed for turning on steam in the fan coils and starting the fans, the time being advanced as the temperature falls, until in the case of 25 deg. Fahr. and below the coils are operated all night long and the fans started at 1 a. m. Mr. Wilder presented curves showing the substantial savings accomplished in the steam required during the night hours by the observance of this schedule. The total steam used for heating in the case of one of the factory plants referred to showed a decrease averaging 32 per cent.

#### ELECTION OF OFFICERS

By unanimous vote the convention ratified the suggestions of the nominating committee, which comprised Messrs. W. A. Wolls, Columbus, Ohio; D. S. Boyden, Boston, Mass., and A. D. Spencer, Detroit, Mich., and elected the following officers: President, S. M. Bushnell, Chicago, Ill.; vice-presidents, E. Darrow, Indianapolis, Ind.; H. R. Wetherell, Peoria, Ill., and D. S. Boyden, Boston, Mass.; secretary treasurer, D. L. Gaskill, Greenville, Ohio. Executive com-

mittee—C. F. Oetmann, Denver, Col.; W. A. Wolls, Columbus, Ohio, and R. D. De Wolf, Rochester, N. Y.

Constitutional amendments were adopted by the convention changing the association's membership into three classes—honorary, active and associate. Active members are in turn members of three classes, A, B and C, engineering and consulting engineers, B, electrical engineers of some 15 members, C, local heating contractors, etc. Class A members will pay \$10 annual dues, and classes B and C \$5 a year. Associate members, which class includes all manufacturers and dealers, transmits the papers, etc., and are \$10 a year.

A pleasing feature of the convention was the generous response accorded to the proposal to begin an endowment fund, the first amount to be received through the destruction of the time lamp glass works in the Dayton fire and flood disaster. The subscription list, opened with a \$100 contribution by Mr. C. R. Bishop, of the American District Steam Company, reached a total of nearly \$200 before the books were closed.

Among the entertainment features tendered the visiting delegates by the local committee, of which Mr. E. Darrow acted as chairman, were a dance, concert show and luncheon at the Union Trust Hotel, a garden tour, a boat-seeing and a theater night to see "The Fortune Hunter" on Wednesday evening.

#### Electrolysis Situation in Chicago

Alleged violation of the law prohibiting interference with regulates the potential drop over sections of electric-railway track in Chicago, across the street for the electric trolley has been brought against all of the electric-railway companies operating in that city. According to the city authorities, tests show voltage drops between the negative trolley and certain sections of the tracks as high as 25 and 32 volts. The ordinance, which was passed July 15, 1912, allows a maximum limit of only 10 volts. The suits were set for trial originally on June 25 in the Municipal Court at Chicago before Judge Roster. The railway companies, it is said, do not believe that serious damage arises from the stray currents, and in addition assert that the method prescribed by the ordinance would be ineffectual in reducing the stray currents. The companies intimate that they will carry the case to the Supreme Court of the United States if necessary, as they believe that the requirements of the ordinance are unreasonable and unfair.

Since the companies contend that reducing the potential drop over the tracks and the other requirements would necessitate an exorbitant investment, Mr. Palmer, the city electrician, contemplates equipping and manning with test wires and instruments and improving the track system so as to comply with the ordinance. At a conference held on June 9, where the city and railway companies were represented, Mr. Palmer suggested that the railway appoint an engineer to work in conjunction with the city in equipping the selected stations. This proposal was favorably received. It is hoped by the city authorities that the sample installation will demonstrate that the treatment required to comply with the ordinance will not be prohibitive. The suits will now be brought to trial until after the next January.

#### Catacarr Power & Conduit Company to Appeal

The Buffalo General Electric Company has decided to accept the proposed order of the New York Public Service Commission of the Second District regarding the rates to be charged by the company. The findings of the commission on the case of the rate of Buffalo against the Buffalo General Electric Company were published in the *Electrical World* for April 12. In a signed statement President



Charles R. Huntley stated that while the serious reduction of income which will result from the change in rates has been a matter of concern to the directors, the opinion of the commission, that the reduced rates will result in a much more extensive use of electricity, so that the reduction in income will be somewhat lessened by the larger use of the company's product, has been accepted. The Cataract Power & Conduit Company has, however, appealed from the decision of the commission, which reduced its annual income by \$89,000. Its appeal is based on the ground that the commission has no power to interfere with the contracts made between it and the Buffalo General Electric Company.

### Chicago Telephone Rate and Wage Adjustment

An ordinance was passed by the City Council of Chicago on May 26 effecting a reduction in the rates of the Chicago Telephone Company which, it is estimated, will amount to about \$500,000 a year. In addition, the ordinance provides for an increase in wages, pensions and disability funds for employees amounting to about \$420,000 a year. The suggestions made by Mr. Edward W. Bemis, the city's rate expert, in his final report of May 12 were carried out in the ordinance, with two amendments.

Three reductions are effected by the installation of a single-line measured service for business uses and for residence lines and by a reduction of rates on excess messages on one-party and two-party business nickel-prepayment stations and two-party and four-party residence nickel instruments. To single-line measured business service there will be allowed 960 messages for \$48 a year, with a 5-cent charge for each of the next 240 messages and a 3-cent charge for each of the succeeding 1200 messages. Single-line measured residence service will have the privilege of 800 messages for \$40 a year, with a 4-cent charge on the next 400 messages. A reduction from 5 cents to 4 cents will be given on one-party and two-party business nickel phones and on two-party and four-party phones for messages in excess of the guarantee. The toll rate between adjacent communities at city limits is reduced from 10 cents to 5 cents. Minor reductions affect the transfer and reinstatement of telephones, as well as the installation of a free service for the board of education, board of election commissioners and police bureau.

One of the amendments provides for the balancing of deficits and excesses in the number of messages made under guarantee every three months. The other amendment, which is less important, applies to the charge on meters for measured service. The ordinance does not reduce the rates of existing subscribers, even though they move to a new location, but it prevents the further growth of a flat-rate service such as used by the largest business houses at present.

### Ontario Commission Wins Newmarket Contest by Close Vote

Accompanied by a public demonstration, the final result of the vote of the taxpayers of Newmarket, Ontario, giving a victory to the Ontario Hydro-Electric Commission, was announced May 30. The vote was on the acceptance of the Toronto & York Radial Railway Company's proposition to supply electrical energy to the town for \$25.50 per hp-year, with the provision that the town should spend \$12,000 on the necessary distributing plant. The vote stood 226 for and 248 against the project. This undoubtedly means that in the immediate future the citizens of the town who went on record as favoring the provincial system in preference to that privately owned will petition for the admission of the commission's lines into the town for supplying the local service. The Hydro-Electric Commission's proposal to the town at the rate of \$27.90 per hp-year.

## Public Service Commission News

### INDIANA COMMISSION

An interesting case was presented to the Indiana Public Utilities Commission in the first week of June. The Hawks Electric Company, of Goshen, Ind., operates a privately owned electric service in that city. For fifteen years the city of Goshen has operated a municipal electric lighting plant, doing the street lighting of the city and also some commercial lighting. The municipal plant has not heretofore gone into the business of supplying electricity for industrial uses, however. The municipal plant is antiquated and badly run down. The engineers who have examined it have recommended that the city build an entirely new plant. Inasmuch, however, as the municipality is near its debt limit, the city authorities have proposed to build a new electric-service plant to supply electricity for all purposes out of the city's current funds. The Hawks Electric Company secured a temporary injunction restraining the city from doing this until the equities of the case could be determined.

While this controversy was pending the Indiana Public Utilities Commission came into existence and the Hawks Electric Company surrendered its franchise and took out an indeterminate permit under the public utilities law. By the terms of this indeterminate permit the utility is protected against competition so long as it complies with the regulations of the state commission. The company contends that the city must now apply to the commission for a certificate of necessity before building its new plant. The case came on to be heard before the commission on June 2 and succeeding days. The lawyers for the city moved that the commission dismiss the case for lack of jurisdiction, but the commissioners determined to hear the evidence first, and the case was considered for four days. Testimony on the part of the company was given by Mr. F. A. Vaughn, consulting engineer, of Milwaukee; Messrs. Larson and Cadby, of the engineering staff of the Railroad Commission of Wisconsin, and Mr. W. J. Norton, of the Commonwealth Edison Company of Chicago.

The contention of the company is that inasmuch as the city proposes to build an entirely new plant and to compete in furnishing electrical energy for industrial purposes, it should be prevented from doing so under the equities of the indeterminate permit by virtue of which the company is now operating. It may be added that the existing rates in Goshen are low, the maximum rate being 6 cents per kw-hr. The city has the right to purchase from the private company energy for its own system at the wholesale rate of 3 cents per kw-hr. After hearing the evidence the commission asked the lawyers in the case to file briefs and reserved its decision.

### OHIO COMMISSION

The American Gas & Electric Company has made application to the Ohio Public Service Commission for authority to combine the capitalization of the companies it has purchased during the past eight months into the Ohio Light & Power Company, with an issue of \$1,500,000 capital stock. The companies to be taken into the new corporation and the prices to be paid for them are as follows: The Logan Light & Power Company, Logan, \$71,912.34; Perry Electric Company, Crooksville, \$25,814.29; People's Electric Light & Power Company, Shawnee and New Straitsville, \$40,880.34; Lancaster Electric Light Company, Lancaster, \$363,178.05; Licking Light & Power Company, Newark, \$426,860.66; Field W. Swezey, Fostoria, \$146,856.45; George N. Tidd, New Lexington, \$46,206.78, and Frank B. Ball, Mount Vernon, \$216,611.19.

### WISCONSIN COMMISSION

The commission has ordered the Ettrick Telephone Company, of Galesville, and the La Crosse Telephone Company to take such steps as may be necessary to effect a physical

connection between their lines in the city of Galesville. The expense is to be apportioned equally between the utilities, and in case the utilities fail to agree on rates for joint service the commission will prescribe a schedule of charges. The case came to the commission upon complaint of the Ettrick Telephone Company, which alleged that it had been impossible to reach any agreement with the La Crosse company concerning the use of its toll lines to the city of La Crosse and vicinity, although the Western Wisconsin Telephone Company, a competitor of the petitioner, enjoyed such privileges.

The Supreme Court has decided that the decision of the Railroad Commission ordering The Milwaukee Electric Railway & Light Company to reduce street-car rates in Milwaukee was legal and that thirteen fares for 20 cents constitutes a reasonable city rate. The point at issue before the court was whether the company's franchise constituted a contract in which the fares to be charged were fixed, and whether the attempt of the commission to reduce the fares did not interfere with a binding contract, thus being unconstitutional. The court held that there is nothing in the statutes to empower municipal authorities to make any contract with a street railway company fixing rates of fare so that they may not be changed by the legislature or through a legislative agency, such as the Railroad Commission, in the manner provided by law.

#### MASSACHUSETTS COMMISSION

The Massachusetts Gas and Electric Light Commission has issued a decision granting the municipal light board of the town of Westfield permission to reduce the price of gas from \$1.04 net to \$1 per 1000 cu. ft. and to reduce the prices charged for electricity from 10 cents net per kw-hr. to 7 cents for lighting service and from a minimum of 2.9 cents to 2 cents for certain industrial service. The principal question involved was the expediency of permitting the town to charge prices for energy for motor service admittedly below the cost of electricity as defined by the statute governing municipal lighting plants, and the chief opposition to this policy arose from a local private power company which leases factory space and sells electricity to its tenants under a contract entitling them to the same rates which are charged by the municipal plant. These protestants claimed that, as nearly as they could determine from their own experience, electricity for industrial service cannot profitably be sold as low as 2 cents per kw-hr. in Westfield.

Under the schedules formerly prevailing it was possible to obtain a rate of 2.0 cents per kw-hr. by using a 20 hp motor at 90 per cent of its rating for more than 200 hours per month. Under the new schedule this rate is obtained by a similar use of a 15 hp motor. Since the town acquired the plants its business has increased rapidly, and the electrical output in the fiscal year 1912 was 1,000,000 kw-hr. including 377,600 kw-hr. delivered at the switchboard for street lamps and 15,799 kw-hr. supplied to municipal buildings. The commission states that at the prices which have prevailed the income from private customers has in some years been sufficient not only to take care of operating expenses, interest and the 5 per cent statutory depreciation but to provide in part for the municipal lighting. In deciding the petition the commission was not called upon to prescribe what rates shall be established but to determine if the minimum rates proposed are likely to be prejudicial to the interests of the taxpayers or customers generally and constitute a reasonable business risk. The board points out that the difference between the proposed price for gas and the prospective price is so small that it would not be justified in interfering with the establishment of the new price. The principal effect of the present and proposed rates now proposed for motor service is to simplify the existing schedule by reducing the number of differentials and to lower slightly the existing prices to the smaller consumers.

Regarding the 2-cent rate, which obviously applies to larger users, the board states that the maintenance of the existing company rates actually would be prohibitive and to the community at this price is by no means conclusive as to the town light costs. In the offering of new gas will increase the motor load and improve the load-factor, it will probably result in decreasing to some extent the operating cost per kilowatt-hour for street lighting and it is a much larger decrease in the cost per kilowatt-hour for interest and depreciation. The town's return to the board indicates that the cost of the town gas and of production of the town plant at a 2-cent rate is only 2.15¢, 1¢ less than if the proposed contract with the Western Wisconsin Company is made by the town for industrial service, the price per kilowatt-hour will not be increased and the town will have a substantial saving upon the entire operating bill. The board permits the establishment of the 2-cent rate upon an experimental basis, and beginning June 1 the rate for electricity at Westfield will be 7 cents per kw-hr. for lighting, 4 cents per kw-hr. for less than 500 kw-hr. per month motor service, 3 cents for 500 kw-hr. to 2000 kw-hr., and 2 cents for more than 2000 kw-hr.

The Supreme Court of Massachusetts has issued a decision recognizing the Haverhill Gas Light Company's franchise transferring its franchise and property to the Haverhill Gas Company without special authority from the legislature and sustaining the local and district light commissioners' late decision in which the board refused to grant the Haverhill Gas Company authority to issue stock to accomplish this transaction. The Gas Light Company had undertaken directly to transfer its rights to the corporation of its assets granted to it by municipal authority to lay its pipes in public ways. It was contended that the new corporation had licenses and permits to act in its own right in maintaining such pipes to be sold to it. The decision by Chief Justice Rugg, points out that without legislative authority the company cannot sell its property and franchise to another party in such a way as to take away its power to perform its public duties, and that the power to enter into a corporation with the special privileges and immunities personal to the particular organization is not transmissible. Stone & Webster, the controlling interest in the case, contended that the Gas Light Company was not undertaking to sell or transfer any of its franchises but to surrender them. The court holds, however, that in its essentials the act would be the same as a direct sale.

A decision has been handed down by the Supreme Court, written by Judge Hammond, in the case of the Fall River Gas Works Company versus the Gas and Electric Light Commission, denying the issue of a writ of certiorari in which the proceedings of the board shall be set forth to the court in relation to the refusal of the commission to authorize the company to issue five shares of additional stock to meet the cost of plant extensions. The company, after paying a dividend of 10 per cent of its net operating income, had retained its profits to amount exceeding the outstanding obligations incurred in making the extension of the plant, and instead of applying these profits to the discharge of these obligations it distributed them among its stockholders in the form of five extra dividends to be paid as per cent dividends. Upon this matter the board dismissed the petition. An important principle in the court's finding was that the said profits were not legal income of the company operating the gas and electric works of the Fall River Gas Works, Southern RY Co. to finance the plant, and instead of the issue of stock in the public service company, these dividends should be taken away from and deposited into and in favor of public service. The Gas and Electric Light Commission's refusal to determine the general question of the propriety of the company in the distribution of the board's finding had some legal significance attached to it. The court holds that the corporation has no right to distribute its lawfully gained surplus in dividend.



## Current News Notes

**AN ELECTRIC SIGN A MILE LONG.**—Controller Morris, of the Hamilton (Ont.) Board of Control, has proposed that an electric sign a mile long and about 100 ft. high be erected on the face of the Hamilton Mountain, bearing the words "Hamilton—Cheap Power." Such a display would be seen for miles out across the lake, and the proposal is that it be got ready for Centennial Week.

\* \* \*

**LONG-DISTANCE WIRELESS TELEPHONY.**—On account of the success attending the efforts to communicate by wireless telephony between Berlin and Vienna over a distance of about 375 miles, it is reported that attempts will soon be made to cover a distance of 750 miles. The experiments just completed were carried on at the Nauen station, west of Potsdam, and the receiving station at the Technological Museum in Vienna.

\* \* \*

**BUSINESS ADMINISTRATION OF MUNICIPAL AFFAIRS.**—The village of River Forest, near Chicago, has engaged a municipal superintendent in the person of Mr. Karl M. Mitchell, who has been a division plant superintendent of the Chicago Telephone Company. He is employed to conduct the affairs of the village on the economical and service-giving basis of a well-managed commercial enterprise. His salary will be \$1,800 a year, and he is to superintend the public service with the aim of securing businesslike efficiency.

\* \* \*

**KEOKUK PLANT TAKES INITIAL LOAD.**—The first commercial service from the twenty-five-million-dollar Keokuk water-power plant (described in these columns May 31) was delivered to Keokuk, Ia., and to Hamilton and Warsaw, Ill., last week over the 11,000-volt circuits from the generator buses. One of the fifteen 10,000-hp hydraulic units furnishes the lighting, motor and street-railway service for the three cities. Already the 110,000-volt transmission line to St. Louis has been tested, and within a month Mississippi hydroelectric energy will be transmitted to St. Louis and other river cities.

\* \* \*

**LOWER TELEPHONE TOLLS IN NEW YORK.**—Beginning with the month of July there will be put in force a general revision of telephone toll rates, the schedules for which have just been filed by the New York Telephone Company with the Public Service Commission, Second District, New York, and the Board of Public Utilities Commissioners of New Jersey. The company declares that, based on present volume of traffic, the new rates will effect a saving to telephone users of \$650,000 per year. At the same time a new system of charging for overtime calls will be inaugurated. Instead of charging for fractions of five minutes' overtime as additional calls, the charge will be graded according to the actual number of minutes of the connection.

\* \* \*

**"NO CURENT OF ELECTRIC.**"—A sad tale of disappointment is contained in the following communication received by a La Crosse (Wis.) electrical firm from a farm customer. The son of the soil, it seems, had ordered a lamp fitting while under an impression somewhat similar to that of the Kansas farmer who bought a motor to do his farm work, although there wasn't a power wire within 25 miles. The Wisconsin agriculturist "came back" as follows: "Dear Sir this letter is to acknowledge to you of the receipt of your two ball adjusters but in addition I will make you understand that I misunderstood you. I thought that it was a lamp by itself and not a apparatus which is of no use to me as I have no curent of electric so you see. I want to send them back to you again and you send my money back to and nothing more to say your trully."

## SOCIETY MEETINGS

**MEETING OF THE LOS ANGELES SECTION, A. I. E. E.**—At the meeting of the Los Angeles Section of the A. I. E. E. held at the Hollenbeck Hotel on May 27 Prof. R. W. Sorenson, of Throop Polytechnic Institute, Pasadena, Cal., spoke on "Some Values of Wave-Form Analysis." Large diagrams of wave-forms with different harmonies were mounted on the walls of the room, and these, with several examples of work done by the oscillograph and analyses thereof, were described. The next meeting of the section will be held in September, when the 1913-1914 season begins.

\* \* \*

**MEETING OF NATIONAL ELECTRICAL CREDIT ASSOCIATION.**—The annual meeting of the National Credit Association was held at the University Club, Chicago, June 7. Representatives from the various local sections were present and the attendance generally was all that could be expected. Increased activities on the part of the members were reported with corresponding benefits. Luncheon was served at the club and in the afternoon an automobile ride around the city was provided. Mr. John H. Dale, of the Dale Company, New York, presided at the opening session of the association.

\* \* \*

**ROUTING OF PHILADELPHIA SECTIONS OF A. I. E. E. AND I. E. S.**—A joint outing of the Philadelphia sections of the American Institute of Electrical Engineers and the Illuminating Engineering Society was held on June 7, on the grounds of the Philadelphia Electric Company's Athletic Association. About 100 members and guests were present. A baseball game between members of both societies ended in a tie. After the ball game Professor Franklin, of Lehigh University, gave a talk on "Baseball Curves" on the club house porch. Supper was served on the lawn. The music was furnished by the Philadelphia Electric Company's orchestra.

\* \* \*

**ILLUMINATING ENGINEERING SOCIETY AND THE GAS INSTITUTE.**—During the annual meeting of the American Gas Institute, to be held in Richmond, Va., in the week of Oct. 13, a joint session will be held with the Illuminating Engineering Society. Among the papers to be presented will be the following: "Some Phases of the Illumination of Interiors," by Mr. Preston S. Millar, president of the Illuminating Engineering Society; "The Importance of Direction Quality and Quantitative Distribution of Light in Illumination," by Mr. M. Luckiesh, Cleveland, Ohio; "Gas Lighting of Interiors," by Mr. C. A. Luther, Chicago, and "Street Lighting by Gas," by Mr. F. V. Westermaier, Philadelphia, Pa. The exact date of the joint meeting has not yet been set. Mr. W. J. Serrill, Broad and Arch Streets, Philadelphia, is chairman of the special committee of the Illuminating Engineering Society on the joint meeting.

\* \* \*

**ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION CHICAGO MEETING.**—The Illinois Electrical Contractors' Association will hold its semi-annual convention at the Hotel La Salle on June 20 and 21. Mr. William McGuineas, of Chicago, president of the association, will preside. Friday morning will be devoted to an opening session, at which various details connected with the industry will be discussed. The remainder of the convention will consist of executive sessions, at which delegates to the national association and officers for the state section will be elected. An interesting report is expected from the license committee, which has attempted to secure a law which shall require every contractor in Illinois to have a license. Mr. John Cuthbert, of Chicago, chairman of the entertainment committee, has made arrangements for an automobile trip, baseball game, banquet and dance on Saturday afternoon and evening.



## Substation of Stockholm Municipal System

**Design and operating features of latest substation with 9000-kw motor-generator equipment and 30,000-amp-hr. storage battery. By E. Andreason**

UNTIL 1903 electrical energy for lighting and motor service in the city of Stockholm, Sweden, was supplied by the Brunkeberg steam-power station. From this station, which was erected in the year 1892, direct-current energy was delivered at a pressure of  $2 \times 110$  volts to a three-wire underground network in a limited district of the city. In order to meet the increasing demand for electrical energy the Värta steam-power station was built in the years 1902 and 1903. This station, described in the issue of the *Electrical World* for Dec. 8, 1910, generates and distributes to the substations three-phase energy at a pressure of 6000 volts.

The generating equipment of the Värta station has been gradually increased, so that, at the end of this year, after present extensions have been completed, the station will contain three steam-engine-driven and two turbine-driven 1500-kw generators, two 6000-kw turbo-generators and one 7500-kw turbo-generator.

At the time the Värta station was built the old Brunkeberg station had a generating equipment consisting of three 500-hp and two 250-hp engine-driven units operated in parallel with a storage battery rated at 10,000 amp-hr., and there was no space available for further extensions. Furthermore, the method of producing energy by means of small-sized steam-engine-driven units requiring a comparatively large staff of attendants, with high costs for coal transportation, was found rather uneconomical compared with the new plant, with its excellent coal-handling facilities and with the new system of distribution. It was, therefore, decided to convert the Brunkeberg station into a substation and at the same time change the distribution pressure from  $2 \times 110$  volts to  $2 \times 220$  volts. This work, which was started in March, 1911, has been completed.

### MACHINE ROOM AND EQUIPMENT

The machine room is 100 ft. by 44 ft. and has a height of 36 ft. Ample provision has been made for natural light through large side and ceiling windows. Ventilation is obtained by natural draft. The cold air is taken in through two large ducts in the wall between the machine room and the storage battery building, the heated air escaping through the sky windows. The large side windows are not intended for ventilating purposes and are always kept closed, in order to relieve the neighborhood, as far as possible, from the disagreeable humming of the motor-generators.

The equipment will ultimately comprise six 1500-kw motor-generator sets. At present three sets are installed.

These motor-generators consist of a 6000-volt, 25-cycle induction motor, the motor of which is phase-converted and provided with special starting resistors, and a 1500-kw, twelve-pole direct-current generator with commutating poles and compensating winding. The two machines form together a three-bearing unit mounted on a common base and running at a speed of 900 rpm. The generators are also used for storage-battery charging without booster, and hence the pressure can be regulated between 440 volts and 600 volts. The motor-generators are guaranteed to operate with a full-load efficiency of 90.5 per cent and 90 per cent at 600 volts and 440 volts respectively.

In a smaller machine room in another part of the building two 500-hp motor-generators are installed, the direct-current pressure of which can be regulated between 220 volts and 300 volts.

These sets are connected one on each side of the system, as can be seen from the accompanying diagram of connections. They can therefore also be used as bus-bar units.

### STORAGE-BATTERY EQUIPMENT

The storage-battery building consists of five bays, each having an area of about 42,000 sq. ft. and a height of 9.8 ft. These five floors are divided into portions for two storage batteries, each rated at 15,228 amp-hr. at the three-hour discharge.

At present only one of these batteries is installed. This consists of 270 cells, 135 on each side of the battery. The charge and discharge is controlled by end cells and central switches. These switches are motor-driven and controlled from the operating panels. On each side of the battery there are provided fifty end cells. There are twenty-six contacts per switch and two cells per step.

The battery is the largest yet installed in Sweden. Each cell is 2.2 ft. by 6.5 ft., with a height of 3.6 ft., and contains twenty-five plates. The total weight of the battery is a little more than two tons.

The battery is principally intended for handling the peak load, but is also used upon its capacity. In case of failure of the generating plant or of the motor-generators the battery can be called upon to give a discharge far above its normal rating. This fact was also taken in consideration in choosing the construction. Between the cells the connections are made up of two contact bars, each having a cross-section of 4 in. by 1 in. Each of the terminal connections at the contact bars, which may have to carry extremely high currents, is made up of one part by one contact bar. The substation of the contact bars is also designed for normal use. These bars

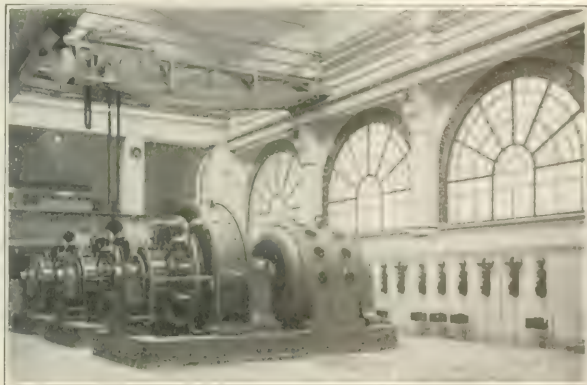


FIG. 1—INTERIOR OF BRUNKEBERG SUBSTATION

having a cross-section of 9 in. by 0.5 in., and the inner ones, which are in circuit only during light load, are made of one 8-in. by 0.4-in. bar. The total weight of copper for the battery connections is about 30 tons.

Ventilation of the battery rooms is attained by means of a large "Sirocco" fan, placed in a brick housing on the top of the building. This equipment is sufficient to provide a

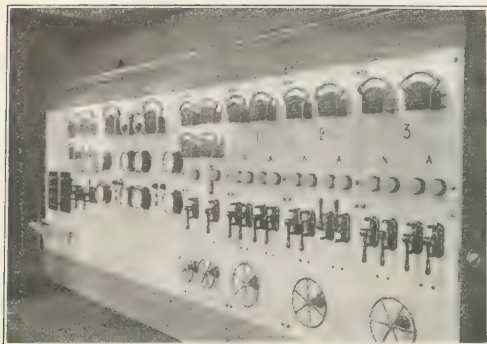


FIG. 2—DIRECT-CURRENT SWITCHBOARD

total change of air in all the five rooms every eight minutes.

The 6000-volt alternating-current and the direct-current switch gears are placed in the basement below the machine room. The former occupies nearly two-thirds of the floor area. It may be noted, however, that the desks for the direct-current feeder connections are located in another part of the building, as will be described later.

There are two sets of three-phase busbars, carried along



FIG. 3—BUS STRUCTURE

a concrete wall. The buses can be divided into sections by means of sectionalizing knife switches, each section being arranged for the connection of one motor-generator set and three incoming or outgoing feeders. At the ends the two sets of busbars can be connected, thus forming a closed ring. Along the other side of the concrete wall the oil switches are placed in a row. These can be connected to

either of the two sets of buses by means of double-throw disconnecting switches placed in the spare room between the upper and lower busbar compartments. The disconnecting switches are operated from the busbar side, but are provided with a mechanical signaling device, showing on the oil-switch side of the wall whether the disconnecting switch is in "off" or "on" position. The normal rating of the oil switches is 300 amp, and the safe rupturing load is guaranteed to be at least 20,000 kw. The switches are solenoid-operated and of the top-connected type with separate oil vessels. In order to prevent dangerous surges when switching in motors and outgoing feeders, the oil switches are fitted with charging resistors placed in the oil vessels.

The oil switches are connected directly to the motor end of the motor-generator sets, and to the feeders through disconnecting switches placed in the ceiling. From there the leads are brought through another concrete wall to a compartment containing series and shunt instrument transformers and protective devices and end belts.

The control switches for the oil switches are mounted on cast-iron boxes, bolted to the machine-room wall, as shown in Fig. 1. These boxes also carry pilot lamps, voltmeters and ammeters, and below are mounted the relays for automatically tripping the oil switches.

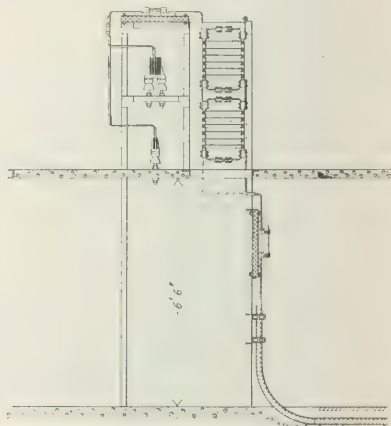


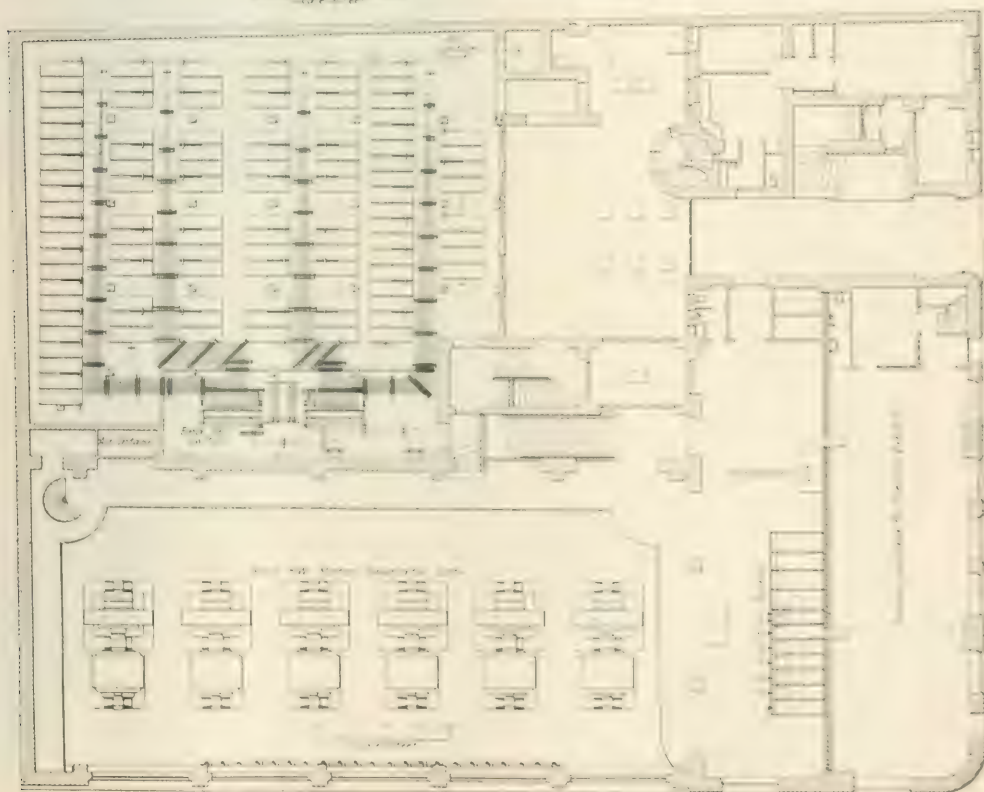
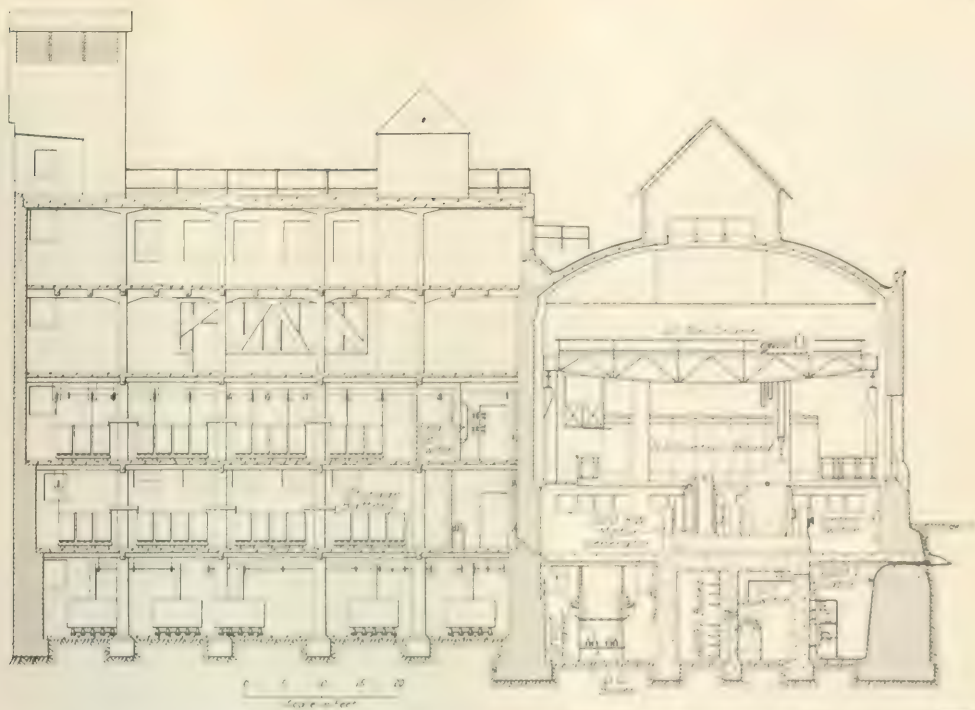
FIG. 4—SECTION OF DISTRIBUTION BOARD

All oil switches and other apparatus as well as buses are installed in individual fireproof compartments having 1.6-in. brick walls with channel-iron frames.

The framework of the switch gear, the covers of the series and shunt instrument transformers and the secondary transformer windings are carefully grounded.

The direct-current switch gear is erected in an aisle about 15 ft. wide between the foundation wall and a supporting concrete wall, which serves as partition between the 6000-volt alternating-current and the direct-current switch gears. In the middle of this aisle is a steel framework construction which is horizontally divided through a 4-in. reinforced-concrete floor, the room below this floor being used for buses and the space above for circuit-breakers. The buses are supported by heavy porcelain double insulators, placed on channel irons at a height of about 2.5 ft. above the floor.

The direct-current buses have been designed for the ultimate rating of the substation. Fig. 8 shows the estimated maximum load curve for the station when fully equipped—that is, with six 1500-kw and two 500-kw motor-generators at full load, together with two 5076-amp batteries, one 1500-kw motor-generator being idle for reserve purposes. The shape of this curve is derived from the maximum day-load curve of 1911.



FIGS. 5 AND 6—SECTION AND PLAN OF BRUNKEBERG STATION.



The two outer buses seen in Fig. 5 are the station buses and the two inner ones are the charging buses. In order to reduce the stresses on insulators and connections caused by temperature expansions and contractions, expansion joints, built up of their copper blades, have been inserted in the buses, as shown in Fig. 3.

The generator circuit-breakers are of the solenoid-oper-

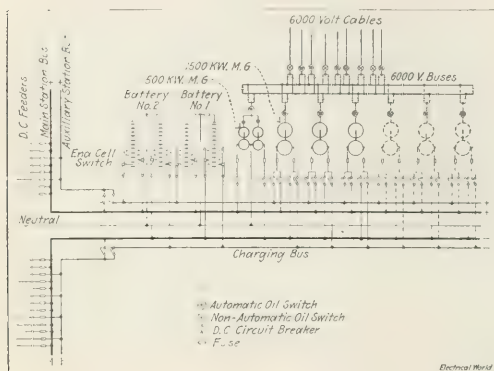


FIG. 7—DIAGRAM OF CONNECTIONS

ated, carbon-break, laminated type of very substantial construction. They are separated from each other by brick barriers and are easily accessible from the mezzanine floor. These circuit-breakers are not automatic, such protection being obtained in cases of short-circuits or heavy overloads by means of silver-wire fuses. For each generator there are four circuit-breakers, two for the connection to the station buses and two for the connection to the battery-charging buses. The circuit-breakers are designed to carry a continuous load of 4000 amp without undue heating.

The direct-current control boards are installed in a room at the end of the machine room, as shown in Figs. 5 and 6. It is open against the machine room, into which a balcony

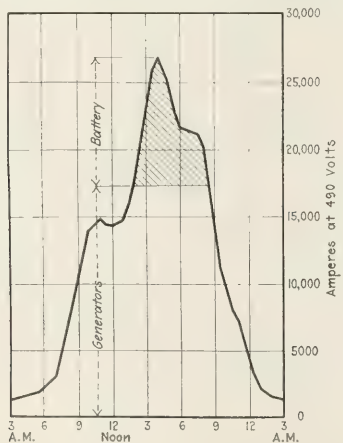


FIG. 8—ESTIMATED MAXIMUM LOAD CURVE

extends. The control boards are made up of white marble panels on steel framework. Referring to the illustration showing the switchboard, the three panels to the right are for the three generators. Each of these panels contains a handwheel for the field rheostat, which is placed on the floor back of the panel, four control switches with pilot lamp for the four generator circuit-breakers, and ammeter

and voltmeter. The next panel controls the generators of the two 500-kw sets, and the two following panels the battery. The latter carry push-buttons for the motors operating the end-cell switches, indicators showing the position of the contact yoke of these switches, voltmeters indicating the pressure at the feeding points of the distributing network and battery ammeters. Provision has been made on these two panels for the apparatus and meters of battery No. 2. The next panel contains ammeters for showing the total output of the station and four switches connecting the auxiliary buses to either the station buses or the charging buses. The last panel is devoted to the fault-indicating devices for the feeders and distribution network.

#### DISTRIBUTION SYSTEM

The connection of the outgoing feeder cables to the station buses is carried out on the distribution boards placed in the basement beneath the direct-current control room. As previously mentioned, the basement is divided into two stories by a mezzanine floor, as is shown in Fig. 4. Two distribution boards are provided for each side of the system; one being arranged for forty feeders and the other for sixteen feeders. The upper portion of the boards carries the two station buses. In addition to the main station

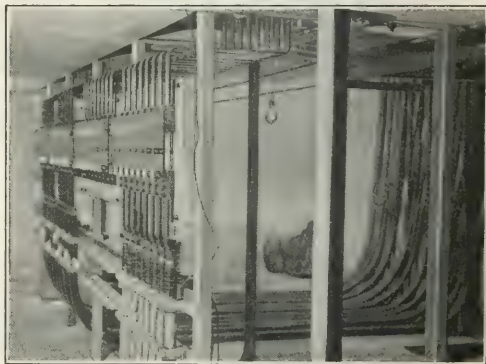


FIG. 9—LOWER PORTION OF DISTRIBUTING BOARD

buses there are two auxiliary buses which, by means of circuit-breakers placed in the direct-current switch gear, can be connected either to the main station buses or to the charging buses. When battery charging is not taking place these auxiliary buses, which are connected to feeders with large voltage drop, can be switched over to the charging buses, and their voltage is thus regulated independently of the main-station-bus voltage by the charging end-cell switches. By this arrangement a better regulation of the distribution-network voltage is attained and the need of regulating resistors in the feeders is largely reduced. In addition to the buses the upper part of the boards carries the ammeter shunts, the fuses and the regulating resistors.

The lower part of the distributing boards, shown in Fig. 9, contains the emergency switches by means of which the cables can easily be disconnected from the buses.

The installation was designed under the supervision of Mr. Decker, chief engineer of the Stockholm municipal power plant. The motor-generators were furnished by Luth & Roséns Elektriska Aktiebolag, Stockholm; the storage battery by Accumulatorenfabrik A. G. Hagen, Germany; the oil switches by Nya Förenade Elektriska Aktiebolaget, Ludvika, and the direct-current circuit-breakers by the latter concern and by Allmänna Svenska Elektriska Aktiebolaget, Västerås. The control switches and apparatus and the iron construction for the switch gear were made at the machine shop belonging to the works.

## Design and Operating Features of Motor-Driven Pumps

By CHARLES A. CARPENTER

The usual conditions to be met in selecting motor-driven centrifugal pumps allow very little flexibility in arrangement. The problem may be generally stated, as follows: The pump must deliver so many gallons per minute against a total head of so many feet, including a suction lift not to exceed so many feet, with an efficiency not less than so much per cent. The speed in r.p.m. is then fixed by the type of current and the motor desired, as explained below. Other factors to be considered are maximum horse-power required and the starting characteristics. In order to meet all these requirements, careful design and good engineering are absolutely essential. It is proposed to indicate in this article some of the engineering features and some of the difficulties. It is not the purpose to explain technical design but to point out what the user of motor-driven pumps should know.

The several types of motors available for centrifugal-pump drive are readily brought to mind and their operating

cheapest and usually the most dependable unit must be granted, but it does not appear to be generally accepted that a one-design type is unsuited for fixed-speed work.

The following discussion of laws for centrifugal pumps of homologous design with accompanying curves, examples, etc., should make this clear.

At constant, or nearly constant, efficiency, between limits of a one-design type, these laws are true.

The speed varies as the square root of the  $43 = 20$ .

$$N_1/N_2 = \sqrt{h_2/\sqrt{h_1}}, \text{ or } N_1 = N_2 \sqrt{\frac{h_2}{h_1}} \quad (1)$$

The power varies as the  $3/2$  power of the head.

$$P_1/P_2 = h_1^{3/2}/h_2^{3/2}, \text{ or } P_1 = P_2 \left( \frac{h_1}{h_2} \right)^{3/2} \quad (2)$$

The power varies as the square of the diameter

$$P_1/P_2 = D_1^2/D_2^2, \text{ or } P_1/D_1^2 = P_2/D_2^2 \quad (3)$$

The speed varies inversely as the diameter.

$$N_1/K = D_1/D_2 \quad (4)$$

Substituting (1), (2) and (3) in (4), and simplifying, letting  $P_u = 1$  water-horse-power and  $h = 1$  foot-head, then for any condition

$$K = \frac{N \sqrt{P}}{h} \quad (5)$$

That is, one particular design for best effect and at ideal conditions has one value for  $K$ .  $K$  is unit speed (the speed at which an exactly similar pump at similar rating would give 1 water-horse-power at 1 foot-head) and is the constant generally used by water-turbine engineers.

Consider various problems where 60-cycle current is to be used—squirrel-cage motors with speeds of 1725, 1125 and 860 r.p.m.

Suppose one design of pump has  $K = 100$ , then

$$100 = \frac{1725 \text{ water-hp}}{h^{3/2}}$$

Water-hp =  $\frac{Qh}{3960}$ ,  $Q$  = gallons per minute,  $h$  = total head in feet.

$$h^{3/2} = 17.2 \sqrt{\frac{1}{3960} Q \sqrt{h}}$$

$$h^{3/2} = \frac{17.2}{\sqrt{3960}} \sqrt{Q}$$

Converting to logarithmic equations,

$$4.5 \log h = 8.873392 - 10 + \log Q, \text{ at } 1725 \text{ r.p.m.}$$

$$= 8.506741 = 10 + \log Q, \text{ at } 1125 \text{ r.p.m.}$$

$$= 8.27132 = 10 + \log Q, \text{ at } 860 \text{ r.p.m.}$$

These equations are plotted in Fig. 1 from the figures in the accompanying table.

$Q$	$10 + \log Q$	$10 + \log Q$	$10 + \log Q$	$h$	$h^{3/2}$
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00
1.00	0.0000	0.0000	0.0000	0.00	0.00

It is quite obvious that only speed conditions can be met by such a pump with fixed speeds, and hence a design with one value of  $K$  cannot be used for best results with motor drive.

In Fig. 2 various unit speeds,  $K$ , desired are plotted for a constant head of 20 ft. for varying ratings, and for the three speeds chosen above. The lines show the wide variation in design needed.

Computations for Fig. 2 are herewith tabulated.

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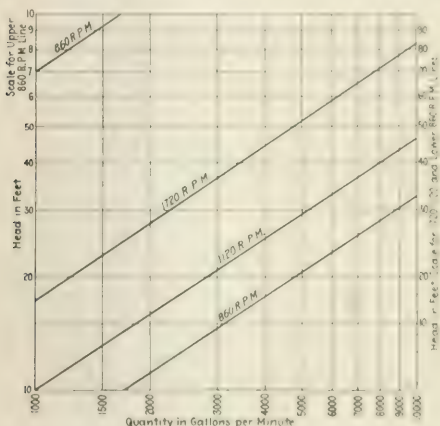


FIG. 1—CAPACITY-HEAD CURVES

characteristics are well known. Alternating current is most frequently available.

It may be said that a constant-speed motor is generally used, and as the current is largely fixed by local conditions, the motors can differ only as to make, speed and horse-power. All three of these affect the price, but make and speed are not usually determining factors. The horse-power required is important, since it represents yearly operating cost. Consequently efficiency and the horse-power characteristics of a pump are of prime importance, determining as they do the size of motor and the energy consumed. Higher efficiency means at once less energy and, barring faulty horse-power characteristics, a smaller motor.

Considering the question of speed, mostly as regards alternating-current motors, the r.p.m. must conform to certain standards. The necessity for high-grade correct design can now be explained by considering certain pump relations. In many classes of machinery a design when once developed can be produced in several sizes, and this line may prove acceptable for all usual and corresponding conditions. This is quite true of centrifugal machinery when adjustable speed is possible. It is not true for fixed speed—that is, motor-drive work. In fact, motor-driven pumps must be somewhat of special design for each particular problem. That an established-design-type line of machinery makes the most simple problem for the manufacturer and thus the

$$K = \frac{N \sqrt{P}}{h^{1.16}}$$

$$= 1720 \sqrt{\frac{1}{3960}} \sqrt{Q}$$

$$h^{1.16}$$

$\log K + 0.75 \log h = \log 1720 - 0.5 \log 3960 + 0.5 \log Q$   
 Let  $h = 30$  ft.  $Q = 100$  gal./min.

When  $Q = 10,000$  gal. per minute  $K$  becomes 213.24, 138.84 and 106.61 respectively for the speeds chosen.

These facts show that special design is necessary, high efficiency is desirable, and that the horse-power characteristics, including the maximum horse-power and the starting horse-power, must be such that the motor cannot be dangerously overloaded, and the starting load must not produce undue starting current or surges on the line.

If it requires considerable engineering skill and shop research to develop one design of pump capable of giving high efficiency and with desirable characteristics, how much more skill must it require and how much more investigation must be necessary to produce a pump when fixity of speed

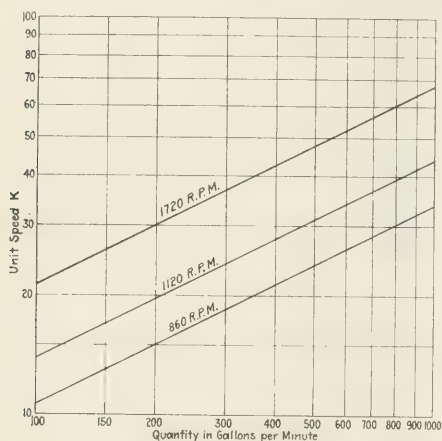


FIG. 2—CAPACITY-UNIT-SPEED CURVES FOR 60-CYCLE MOTORS

compels the design of an original type for nearly every case.

It should now be evident why high-grade motor-driven centrifugal pumps are expensive and why they cost more to build than do turbine-driven or engine-driven units, which can run at various speeds. When test curves are available recourse to unit-speed comparison will enable an engineer to estimate if his conditions require a radically different design. If such be the case, he should investigate the ability of the manufacturer to produce a machine which

$\log K$	$K$	Speed
1.328839	21.324	1,720
1.142529	13.884	1,120
1.027809	10.601	860

would meet his requirements. He would do well to insist on a guarantee like the one stated in the opening paragraph, leaving the particular speed to the manufacturer, but insisting that at the speed chosen the capacity, pressure and efficiency mentioned shall be obtained simultaneously.

In the case of turbine drive binding guarantees are not necessary. Here high speed is an asset on account of lessened steam consumption, and the designer should not be hampered with speed or efficiency requirements, but

should be required to furnish guarantees as to steam used per water-horse-power-hour, or, what amounts to the same thing, output in millions of foot-pounds of work done per 1000 lb. of dry steam.

## The Effect of Temperature on the Puncture Voltage of Cable Insulation

By FRED R. LUFKIN

The effect of temperature upon the puncture voltage of cable insulation has recently been investigated in a series of tests at one of the leading technical schools in the country. Several different rubber compounds were tested over a range of temperature of from 0 deg. to 100 deg. C. at intervals of about 10 deg. Because of the inherent tendency for the puncture voltages to vary on samples apparently similar in all respects, at least fifteen samples were tested to determine a representative value for each point on the final curve. Each sample was over 5 ft. in length. It was immersed in a tank of water and the requisite temperature was obtained by controlling the temperature of the water. At the higher temperatures some trouble was experienced on account of escaping steam until use was made of an improvised condenser, consisting of a straight 2-in. iron pipe 6 ft. long inside of which was a 1-in. tin tube through which cold water flowed and against which the steam was directed.

The test results showed that for each rubber compound there is a critical temperature at which the puncture voltage is a maximum. This maximum point occurs at different temperatures for the respective grades of rubber. For the entire five insulations the critical point was found to be between 40 deg. and 80 deg. C. One particular grade which represents a high quality of rubber had its maximum puncture voltage at 70 deg. C. This maximum voltage was 30 per cent greater than at 20 deg. C. At 100 deg. C. the puncture voltage value exceeded the 20 deg. C. value by about 12 per cent. Other compounds showed about an equal or a slightly decreased puncture voltage value at 100 deg. C. as compared with 20 deg. C. While these tests may not be entirely general, they deserve consideration on account of the similarity in the results obtained with the different grades of rubber. It may be possible that other rubber compounds will be affected to a greater extent by temperature changes.

From the practical standpoint such tests should be of value in establishing more accurate and reliable safety factors in cable installations. For the sake of complete continuity of service an adequate safety factor is imperative, but if this is larger than is necessary the investment charges will be high. The above tests indicate that the safety factor is increased rather than diminished by the heating of the cable up to a certain point. During the average test at the factory the temperature is probably not far from 25 deg. C. Under working conditions the temperature may rise to 75 deg. C., which is the allowable limit for rubber insulation.

In underground construction unusual conditions sometimes exist. In designing a multiple-conductor cable for underground use it is already recognized that extreme care must be exercised, or a temperature of 75 deg. C. and higher may easily be exceeded on account of the poor ventilation. Although the tests here noted did not extend over a very wide range, yet the downward slope of the curve for the higher temperatures seems to show that the temperature effect might readily become in some measure responsible for certain of the failures that have occurred in installations of this character. Further investigation will be interesting in showing the behavior of the puncture voltage over wider temperature ranges and also the value of the critical temperatures for other insulations.



## A Convenient Form of Continuous-Current Artificial Line

By A. E. KENNELLY

The distribution of voltage and current on long alternating-current lines in the steady state is most conveniently realized and practically demonstrated by the use of artificial lines in the laboratory. While the theory of these distributions finds simple and natural expression in hyperbolic functions, the experimental facts are revealed most simply by means of measurements on artificial lines composed of uniform sections of resistance, inductance, capacitance and leakage.

In making electrical measurements on alternating-current artificial lines, especially if the attenuation is low and the frequency relatively high, the experimental results may appear anomalous or even incredible to the student who is not familiar with the subject. It is, therefore, desirable that a preliminary series of tests should be made on a continuous-current artificial line, in order that the student may familiarize himself with the underlying principles and formulas, under conditions thus reduced to their simplest elements. The formulas relating to sectional artificial lines are known to be algebraically the same, whether continuous or alternating currents are used. In the former case, however, the formulas employ real or one-dimensional quantities

values may be selected at will in the construction of an artificial line, a four-section line is represented in Fig. 4 and a four-section  $\Pi$ -line in Fig. 5, each employing the series resistances and shunt conductances which are here selected.

While it would be possible to construct two distinct artificial lines, one with T-sections and the other with  $\Pi$ -sections, and to make (small) connections to give a line of

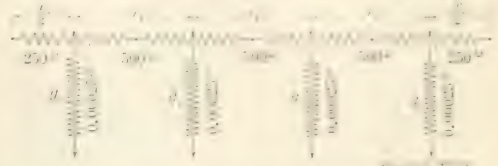


FIG. 4—FOUR-SECTION T-LINE

section resistances be arranged that they could be connected by means of plugs, either as a T-line or a  $\Pi$ -line, at will. The box is shown in plan view in Fig. 1. It is made of hard wood that has been impregnated with paraffin wax. Its dimensions are 27 cm (10.6 in.) long, 17.8 cm (7 in.) wide, and 10.1 cm (3.9 in.) high. Its weight is 4.8 kg (10.5 lb.). The coils of wire mounted in it are all of No. 32 AWG. The  $\Pi$ -line connections with double-throw

switches are arranged so that they could be connected by means of plugs either as a T-line or a  $\Pi$ -line, at will.

The line coils are series coils of 250, 500, 1000, and 250 ohms each, and are connected between terminals a and c of each section. The leak coils are shunt coils of 0.00025 siemens each, and are connected between terminals b and c of each section. The plug connections for a  $\Pi$ -line, the coils being shorted, are made by means of the 250-ohm coils of the first, second, and third sections. The sections

are made up and separated by their loose ends (isolated wire) terminating at plugs at each end. That is, instead of using binding posts and wire nuts, the coils are parts of connection plugs. The brass strips for the insertion of connection plugs are bored in the plate a and c of each section. All the other section plates have no holes only. Above are given some of those for individual choice in laboratory construction.

The three  $\Pi$  and  $\Pi$  artificial lines are shown. Every artificial line of uniform T-sections or  $\Pi$ -sections corresponds identically to some particular "natural" line of uniformly distributed series resistance and shunt leakage. The agreement is perfect, and will be true for all the lines

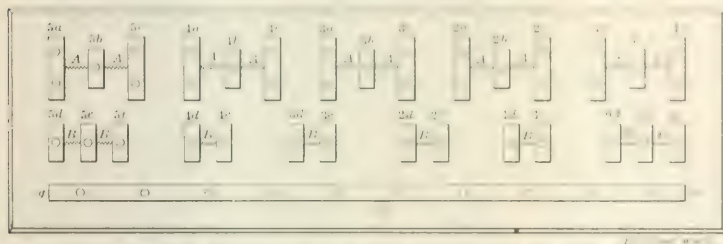


FIG. 1—PLAN VIEW OF ARTIFICIAL CONTINUOUS-CURRENT LINE ARRANGED FOR ONE, TWO, THREE, FOUR OR FIVE SECTIONS EITHER OF T'S OR  $\Pi$ 'S

ties only, whereas in the latter case they employ complex, plane-vector or two-dimensional quantities. It is manifestly easier to solve and apply one-dimensional than two-dimensional formulas. After the student has been able to satisfy himself by trial of the accuracy of the formulas in one dimension, with continuous currents using real numbers and real hyperbolic functions, he turns with greater insight and confidence to the vastly more numerous, yet equally definite, solutions with alternating currents, using complex numbers and complex hyperbolic functions.

A simple and convenient form of continuous-current artificial line, constructed of simple series and shunt resist-

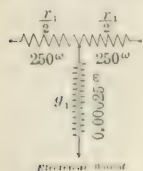


FIG. 2—SINGLE T-SECTION

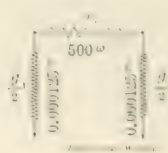


FIG. 3—SINGLE  $\Pi$ -SECTION

ances, as designed by the writer, is shown in Fig. 1. It provides for five sections, either of T's or  $\Pi$ 's. A single T-section is indicated in Fig. 2, and a single  $\Pi$ -section in Fig. 3. In the series, or line, path of either section there is a total resistance of  $r_s = 500$  ohms, and in the total shunt, or leak, paths of either section there is a total conductance of  $g_s = 0.00025$  millimho (0.00025  $\epsilon$ ). The sectional numerical

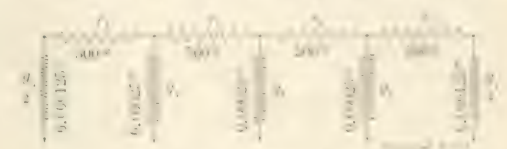


FIG. 5—FOUR-SECTION  $\Pi$ -LINE

values are the same, and the same for the natural lines of the same type. The agreement is perfect, and will be true for all the lines

terminal and junction points, both on the artificial line and on the smooth corresponding line, when the terminal conditions are the same on both. This is true whether emfs are impressed at one end only, at both ends simultaneously, or at some junction point also. Corresponding propositions apply to alternating-current lines operated at a single frequency; that is, free from harmonics, when the sections include series impedance and shunt admittance.

One advantage in using the particular values of resistance and conductance selected in the artificial line here described ( $r_s = 500 \omega$ ,  $g_s = 0.00025 \omega$ ) is that the complete distributions of voltage and current over a five-section T-line or  $\Pi$ -line with these values has been worked out, both by Ohm's law and by hyperbolic functions, for the case of 100 volts applied at one end, the other being freed, grounded or put to ground through  $750\omega$ . The results were published in the *Electrical World* for Aug. 10, 1912. These results have been checked by laboratory measurements on this artificial line.

Fig. 6 shows a photograph of the box connected as a five-section T-line.

By connecting a storage battery to one end of the line, leaving the other in any of the three states above mentioned, the potential along the line can readily be investigated by means of an ordinary continuous-current potentiometer. It is preferable to apply not more than two volts to the line at any point, so as to keep the potentials within



FIG. 6—CONNECTION BOX

direct measuring range of the ordinary potentiometer, as otherwise corrections may have to be made for the effect of a multiplier acting as an extra leak on the line'. In order to measure the line current at any point, the drop of potential can be measured across some 250-ohm line coil at the point. Similarly, the current in any leak can be computed from the potential observed thereat and the conductance of the leak. One observer at the potentiometer can unaided make all the measurements and also their records, but two observers taking measurements and records alternately make a suitable team.

Various combinations may also be used of simultaneously applied emfs at the two ends of the line. The computations are all very easily made by the established formulas, using ordinary tables giving hyperbolic functions of a real variable.

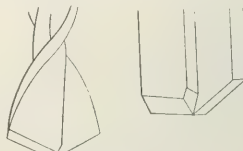
The writer desires to express his indebtedness to Messrs. H. G. Crane and F. W. Lieberknecht in the construction and tests of the particular artificial-line box which is here described.

<sup>24</sup>"Disturbances of Potential and Current Produced in an Active Conjugate Network by the Application of a Leak Load," by A. F. Kennelly, *Electrical World*, Dec. 28, 1912, Vol. 60, No. 26, pages 1373-1376.

## Power Saving of Vaulclain Drill

In the usual type of drill there are four distinct cutting edges. The actual cutting, however, is done mainly by the two edges extending from the outer circumference to points near the center. At the central portion of the drill are the two shorter cutting edges constituting the "chisel point." These do not cut freely, and introduce stresses tending to split the drill.

A paper read before the American Society of Mechanical Engineers, at New York, described the new Vaulclain type of twist drill, which has two radial cutting edges and



HEAVY-FEED DRILL

in which the usual chisel point of such drills is eliminated. As the sketch shows, this is accomplished without central thinning of the drill and without weakening the cutting edges. In this "heavy-feed" drill the stresses due to the chisel point are absent and the arrangement of the cutting edges is such that a greater thickness of metal is secured at the center of the drill, adapting it to heavy feeds and the most economical results in drilling.

Comparative tests with the Vaulclain and regular types of

COMPARATIVE TESTS OF REGULAR AND VAUCLAIN DRILLS

Kind	Feed per Revolution	Speed, R.P.M.	Inches per Minute	Hp. Expended	Per Cent Saving
Regular...	0.00599	300	1.797	10.86	
Regular...	0.02	87	1.740	10.30	
Vaulclain .....	0.02	87	1.740	5.03	51.2
Vaulclain.....	0.00599	300	1.797	4.73	56.4

drills indicate a saving with the former of over half the horse-power expended with the latter type. Care was taken that the different drill tests should be alike in quality of drill steel, heat treatment and tempering. The material, which was a tough forging grade of steel of about 0.45 carbon, was worked in each case with 1 9/16-in. drills.

## New Hydroelectric Plant at Bend, Ore.

A hydroelectric plant at Bend, Ore., has been built recently for the Bend Water, Light & Power Company. The station is on the bank of the Deschutes River, which is peculiar in that there is only about 2 ft. variation in its level during the entire year. Arrangements have been made for the installation of four generating units with a total rating of 2000 hp. Only one 500-hp, 2300-volt General Electric generator, driven by an S. Morgan Smith water turbine, has been installed for the present. The station is designed to operate on a 14-ft. head with flow in the river of 1200 cu. ft. per second. The dam is about three-eighths of a mile long. Electricity will be supplied to local consumers and to the milling industries in the vicinity. The town of Bend has 2000 population and is at the north end of one of the largest pine forests in the world. This water-power development offers some interesting details as a considerable number of water-power sites have been withheld on account of irrigation schemes which are being developed in this region. McMeen & Miller, of Chicago, engineers, designed the installation and have had charge of the construction.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Recording Thermometer to Show Need for Electric Fans

During a heated spell at Muncie, Ind., last year Mr. T. F. English, manager of the Muncie Electric Light Company, installed a Bristol electric recording thermometer in his showroom window to show graphically the extreme noon temperatures. On several days the unusual heat crowded the stylus off the edge of the 100-deg. chart scale. A seven-day card was used, so that passers-by might compare each day's record with the preceding day's temperatures. A card on the meter read "Don't suffer with the heat when an electric fan will keep you cool all day and night for less than five cents' worth of electricity." Along-



ELECTRIC DEVICES ADVERTISED BY MEANS OF A TEMPERATURE RECORDING GAUGE

side of the recording thermometer were exhibited an electric fan, a fireless cooker and several electric irons and other hot-weather devices.

## A 33,000-Volt Distribution Belt for Toledo Factories

To supply service to the important factory district which fringes the city of Toledo, the Toledo Railway & Light Company is preparing to build a 33,000-volt belt transmission line extending entirely around the city at an average distance of from 3 to 5 miles from the business center. This transmission belt will be 34 miles in circumference and is to be sectionalized and fed at several points by radial lines leading from the company's Water Street generating plant in the heart of the city. Later it is planned to build a large station on the belt line itself, as an important industrial load is assured in the territory to be reached.

Some 25,000 kw of demand is now ready awaiting service in this factory district, and it is expected that the connected load carried by the belt will shortly reach 50,000 hp in motors. The prospective customers to be reached include shipyards, glass factories, bridge plants, blast furnaces and railroad shops. One of the latter will have a connected load of 2500 hp.

Throughout its length the transmission belt will parallel

the belt-line railroad of the Toledo Terminal Company, which connects with all the railroads entering the city. Accordingly a large number of factories have been located along this transfer railroad, making the latter's right-of-way the focus of a great industrial district surrounding the city.

A-frame steel towers 45 ft. to 75 ft. in height will be employed on tangent sections, together with anchor towers at dead-end points, angles, etc. Spans will vary from 80 ft. to 400 ft. in length. No. 10 stranded copper wire is to be used, carried on pin-type insulators. By means of switch



MAP SHOWING TOLEDO BELT LINE

towers the belt will be broken into several sections, each supplied by a radial feeder line from the central power house. In case of trouble any section can thus be isolated. Taps will be taken from the 33,000-volt belt to substations located in the midst of groups of factory customers.

## Electric-Iron Sales in Kokomo, Ind.

By O. M. Rourke

The Indiana Edison & Light Company today is saving 200,000 residential lighting customers. Efforts on electric distribution systems in this city have started approximately 200,000 sales, thus leaving a remainder of 200,000 yet to be made before an electric meter is placed on the home of every electric light user. During the coming season it is the expectation to reduce the number of two-wire to probably 30 per cent of the total number. A final section of the scheme now under the city's auspices is being considered, may prove of interest.

First of all, however, selected what was considered the best iron in the market had the price set at \$1. This price proved to be rather low, so a trial was made. The method used is the free-running, multiple, extreme water-raising plan. The meter makes such a difference with the flow, regular monthly rates the arrangement has been very effective. In-



cause the readers easily reach the mistress of the house, a person who must be consulted before the iron is left.

There are certain times of the year when electric irons sell by reason of natural circumstances, and at these times the meter readers are required to consult every lady with reference to the iron proposition. With few exceptions each lady, when approached in a manly and businesslike



DELIVERING ELECTRIC IRONS IN KOKOMO, IND.

manner, consents to have an iron delivered to her home for a free trial. It is highly important to have each iron operate in a most satisfactory manner, a result that is insured by using good irons.

Supplementing the efforts of the meter readers several hundred circular letters have been mailed to consumers who during the past month failed to use enough energy to equal the monthly minimum charge made by the company. The purpose of the letters is to inform the consumer that with an iron in service use would be made of all of the energy paid for. The company has also employed women operators for window demonstration only, and local newspaper and slide advertising has been regularly employed.

Up to date the company has succeeded in placing over 200 of the irons, and they are continuing to be accepted at the rate of fifteen per day. According to past experience pertaining to the free-trial system, approximately 80 per cent of all trials develop into sales.

The writer contends that the purchase of an electric flat-iron is a liberal education to the user. It brings this person face to face with the electric proposition in a thoroughly practical fashion and paves the way for additional electrical devices. It has a broadening influence upon the user's attitude toward the central station and its products. No central station should overlook the merits of this little device as a gilt-edge revenue getter.

### An Electric Ball-Game Window Display

A lamp and fan window display installed by the Kentucky Electric Company of Louisville is at present arousing a great deal of enthusiasm among the "fans" of the Kentucky metropolis.

The window is laid out to represent a baseball diamond with a team of tungsten lamps defeating a nine composed of graphitized-filament units. The actual playing of the last half of the ninth inning is carried out with the lower-efficiency units at the bat. Descriptive placards recount the results of the game up to this point and show that the graphitized lamps have been so sadly "walloped" that the tungstens are forced to concede them the retirement of seven men instead of three before they will consent to play the last half inning of the game.

The players are represented by "men" ingeniously made out of duplex wire, 60-watt tungstens being used as heads for one team and 60-watt graphitized lamps for the other. The tungsten team are provided with caps of blue color, while their competitors wear red. The umpire, a frosted lamp, is the only "man" who remains lighted during the game. The plays are effected by the operation of a thirteen-point flasher concealed beneath the platform.

In the course of the game brilliant field work is done by the tungsten and all the men on that team are brought into action one or more times during the half inning. One of the ingenious stunts is the "fanning" of one of the losing team's players. The grand stand is constructed the full length of the diamond, and on this are displayed about a score of electric fans of various types. These fans are all connected to the flasher and made to show their enthusiasm by revolving for a short period when the more brilliant plays are made. On the retirement of the last man about half of the fans get into action, waving paper handkerchiefs to demonstrate their delight!

Local flavor is injected into the display by giving the tungsten players the names of members of the Louisville local baseball team. The opposing players are referred to as the "has-been" team. The electric fans are also named after many prominent local citizens who never fail to appear at the ball park when the Louisville team is at home.

The Kentucky Electric Company has issued a "Ky-El-Co Extra" on the game. It is in the form of a miniature newspaper page, got up as a sporting edition and describing in detail the play which can be witnessed in the window. The little sheet contains advertising for the company and is illustrated with cuts of fans and lamps.

### June Advertising for Central Stations

When the marriage licenses in New York City were ranging around the 300 mark on Saturdays and holidays the New York Edison Company took advantage of the opportunity presented, realizing that a June bride who receives electrical wedding gifts will make a strong protest if she is required to reside in an unwired home. The twofold value of the accompanying advertisement, which was print-

## Electrical Wedding-Gifts



Gift problems are  
always perplexing



Perhaps you can find a happy solution at our Display Rooms. A wide range of prices

Always "At Your Service"

### The New York Edison Company

General Offices      Phone Worth 3000

55 Duane Street

Branch Offices for the Convenience of the Public:			
Address	Phone	Address	Phone
424 Broadway	Spring 9890	124 W 42d St	Bryant 5262
126 Delancey St	Orford 1860	27 E 125th St	Madison 4520
		345 E 149th St	Madison 3140

All Branch Offices (excepting Broadway) Open Until Midnight  
Night and Emergency Call Bryant 5151

ADVERTISEMENT FROM NEW YORK DAILY PAPER

ed in the daily papers during the month of June, is therefore apparent.

Since June brides are not as a rule entirely confined within New York City, there would seem to be ample opportunity in this line of advertising for companies elsewhere which have domestic-appliance showrooms and in whose territory there still remain a few unwired houses.

## Comparative Cost of Horse-Drawn and Electric Vehicles in Delivery Service

An interesting paper relating to the cost of upkeep of horse-drawn vehicles against electric vehicles was read at the spring meeting of the American Society of Mechanical Engineers at Baltimore, Md., May 26-23. The author,

TABLE I.—HORSE-DRAWN VERSUS ELECTRIC VEHICLES

Electric Trucks		Horse-Drawn Trucks	
2500 lb. truck		Investment	\$1,000.00
Investment	\$2,200.00	Depreciation	\$100.00
Maintenance, repairs, interest and depreciation	\$100.00	Depreciation	\$100.00
Labor (one operator, two laborers)	1,200.00	Labor	\$1,000.00
Total	\$2,300.00	Total	\$1,200.00
5-ton truck		Investment	\$1,000.00
Total	\$2,300.00	Depreciation	\$100.00

Mr. Walter R. Metz, superintendent of buildings in the United States Government Printing Office, Washington, D. C., was delegated to make a study of the question in the fall of 1910 in certain government departments and private firms, and to submit a report on the advisability of replacing the existing horse and wagon service by electric

vehicles both in cases of replacement and in new cases, form in Table II.

More extensive data are given by Mr. Metz in connection with the practice of the Government Printing Office at Washington. In Table III are shown figures comparing the annual cost for electric and horse-drawn vehicles at

TABLE II.—COMPARISON OF HORSE-DRAWN AND ELECTRIC VEHICLES

Type of Vehicle	Annual Cost				
	Horse-Drawn	Electric	Horse-Drawn	Electric	
2500 lb. truck	\$1,200.00	\$2,300.00	5-ton truck	\$1,200.00	\$2,300.00
Investment	\$1,000.00	\$2,200.00	Investment	\$1,000.00	\$2,200.00
Depreciation	\$100.00	\$100.00	Depreciation	\$100.00	\$100.00
Labor	\$1,000.00	\$1,200.00	Labor	\$1,000.00	\$1,200.00
Maintenance	\$100.00	\$100.00	Maintenance	\$100.00	\$100.00
Total	\$1,200.00	\$2,300.00	Total	\$1,200.00	\$2,300.00

3000 lb. carrying capacity. It is stated that one of these electric trucks will, in general, replace two of the two-horse wagons of the same nominal carrying capacity. Table IV shows a similar comparison involving questions

TABLE III.—EXPENSE OF OPERATING HORSE-DRAWN AND ELECTRIC VEHICLES

SINGLE HORSE CARTS		ANNUAL COST				
	\$1000.00	1910 \$1000.00	1911 \$1000.00	1912 \$1000.00	1913 \$1000.00	1914 \$1000.00
Investment horse cart harness etc	\$1000.00					
		Less: Depreciation				
Maintenance and repairs	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00
Depreciation	0	0	0	0	0	0
Interest on investment	0	0	0	0	0	0
Total	\$1000.00	\$1000.00	\$1000.00	\$1000.00	\$1000.00	\$1000.00

trucks. It was estimated, from the information obtainable, that an annual saving of \$11,000 would be effected by making such substitution, and, in spite of the fact that the change was made gradually, so that for the first year the service was carried on with both classes of vehicles, the saving during that time was in the neighborhood of \$12,000.

The naval gun factory at Washington operated, among other vehicles, a 2500-lb. electric truck, furnished by the

McCrea and Ford in addition to two. Figures in Table V are given costs of operating electric vehicles of different carrying capacities, together with amounts of mileage and energy consumption.

In describing the equipment used by the Government Printing Office, Mr. Metz stated that the electric trucks

TABLE III.—ANNUAL COST OF HORSE-DRAWN AND ELECTRIC TRUCKS

Two horse 5000 lb. Cart		2500 lb. Electric Truck	
Expense	\$1,100.00	Expense	\$1,100.00
Maintenance and repairs	\$100.00	Maintenance and repairs	\$100.00
Depreciation	\$100.00	Depreciation	\$100.00
Interest	\$100.00	Interest	\$100.00
Labor	\$2,400.00	Labor	\$2,400.00
Total	\$3,800.00	Total	\$3,800.00

McCrea Motor Company, of Ohio, and a 5-ton electric Studebaker truck. The first named took the place of five single-horse carts, and the latter displaced two two-horse wagons. The comparison between the annual costs of these trucks and of the vehicles which they displaced is given in Table I.

The experience of a large private company which oper-

TABLE V.—ELECTRIC VEHICLE DATA

Type of Vehicle	Annual Cost		
	2500 lb.	5000 lb.	10000 lb.
Investment	\$1,000.00	\$1,000.00	\$1,000.00
Depreciation	\$100.00	\$100.00	\$100.00
Labor	\$1,000.00	\$1,000.00	\$1,000.00
Maintenance	\$100.00	\$100.00	\$100.00
Total	\$1,300.00	\$1,300.00	\$1,300.00

were supplied by the Union Horse Vehicle Company, of Cleveland, Ohio, and the battery equipment by the Electric Storage Battery Company, of Philadelphia, Pa. His paper gives a valuable and interesting account of his experience of the Government Printing Office with the new mode of service, and also of the grounds of change from the old to the new setting.

# Illumination and Wiring

## Library Illumination

By F. A. VAUGHN

The library in any community should reflect the intellectual and artistic standing of its constituents. This reflection should be a magnified rather than a decreased image of the original, however, and thus would differ materially from physical reflections, which must, by the optical laws, always be subject to reduction by the action of reflection coefficients of less than unity. The coefficient of the above metaphorical reflection phenomenon, however, should be greater than 100 per cent, in order to set a higher standard, for educational reasons, than the original intellectual level might demand.

The points which have largely occupied the attention of the committees and individuals in charge of these structures are the outside and inside architectural features, the books and the force of employees. This is natural, for those in charge are usually not in close touch, or perhaps in full sympathy, with the more utilitarian features involved.

A beautiful library with a comprehensive catalog of

like exhibition with high-intensity light sources, in their eye-shocking nudity as generally placed within the range of vision, has already been found largely to counteract the efforts to secure good illumination therewith. More satisfactory results are being obtained by means of diffused-lighting equipments either by direct illumination from units properly placed and shielded with diffusing glassware or



FIG. 1—REFERENCE ROOM FROM MAIN FLOOR

literature is bound to be an unattractive and unused luxury unless it also embodies comfortable and sufficient heat, ventilation and illumination.

The importance of these utilitarian features does not always receive due consideration, but after completion of the library they force themselves upon the attention of the occupants by their conspicuous absence. Many architects, even, have not a full appreciation of them or an expert knowledge of them sufficient to secure the best modern results. Through the co-operation of the architect and the consulting engineer, however—if the consulting engineer will co-operate to the extent of sufficiently submerging his ideas of the physical features and efficiencies into the artistic conceptions of the architect—splendid results can be obtained.

This is particularly true in the case of illumination because of the fact that illuminating engineering has recently become a real profession. Its importance is rapidly being realized by the general public, who have so patiently suffered ocular discomfort for many years, and this realization is testified to by a general demand for better illumination conditions.

It is, for instance, now realized that glare from any source when acting directly upon the retina of the eye exercises a strong depressing influence upon the ability to see clearly or comfortably. The alluring moth-and-flame-



FIG. 2—REFERENCE ROOM, SHOWING CENTRAL LIGHTING UNITS

by indirect illumination produced by sources entirely hidden from view. Good authorities state that eye strain is responsible for headaches, forms of nervousness and other ills, and it is highly fitting that mature consideration should be given to its elimination in the schools, homes and libraries.

In the home the individual tastes as well as visual abilities or deficiencies can be consulted, but in the public library a far greater factor of safety must be applied and great flexibility is important since the requirements of numerous individuals must be met.

As an example of the accomplishment of the object by



FIG. 3—MARGINAL LIGHTING UNITS IN REFERENCE ROOM

the indirect system of illumination, attention may well be called to the illumination of the reference room, catalog room and other portions of the Milwaukee Public Library. These rooms are in the library building at Milwaukee, which was erected approximately thirteen years ago and which had originally a lighting installation embodying a supplementary form of indirect cove lighting from the tops of the super-



capitals of the columns. Owing to the low efficiency of the lamps and reflectors used this installation was inadequate as viewed by modern demands. On account of the decided soiling of the walls and ceiling by insufficiently washed incoming air for heating and ventilation, it was considered also desirable to redecorate the building.

The illumination installation was planned before the de-

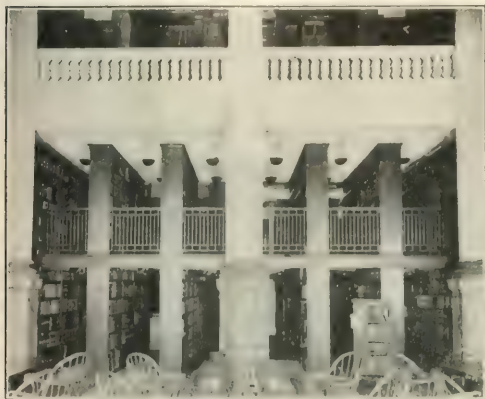


FIG. 4—LIGHTING UNITS UNDER MEZZANINE FLOOR

cision to decorate was reached, so that the resulting maximum obtainable illumination is relatively high, and the adjustability referred to later is an important feature. This building is supplied with electricity by an isolated plant in the basement generating continuous current at 110 volts.

Figs. 1, 2 and 3 show that the large central reading area of the reference room is illuminated by the marginal series of smaller indirect units above the balcony and by three large central indirect fixtures, which throw light upon the ornamental ceiling. The larger units are composition inverted domes of special design, each containing eight 150-watt tungsten lamps equipped with proper mirrored glass re-



FIG. 5—ILLUMINATION IN READING ALCOVES

flectors. These units are so arranged as to diffuse the light by reflection from the ceiling practically uniformly over the reading plane. Each of the smaller balcony units contains one 400-watt tungsten lamp. The length of suspension and the reflector are so chosen that while proper illumination of the bookstacks on this balcony is secured an overabundance of illumination at this point is avoided and a considerable

portion of the light from these units is superimposed on the illumination in the central area. Since the larger units in the center are so wired and controlled that each can be turned on separately at full or half brilliancy, and the smaller units can be controlled separately, a wide range of intensity can be secured over the central reading area.

The average horizontal illumination on the plane of the table tops, where all of the equipment is placed, is approximately 5 ft.-candles, the variation downward from this value being secured as noted above.

The balcony type of unit is also utilized at either end of the lower floor. The attendant's desk is shown in the central background of Fig. 1. The average horizontal intensity furnished here is approximately 3.6 ft. candles, and no desk lamp is needed.

The illumination of the bookstacks, both on the main and mezzanine floors and on the balcony described above, is obtained by means of a special arrangement of indirect illumination, which is a feature that is believed to be entirely novel in the illumination of a library. By the method employed greater diffusion of the light is secured over the vertical surfaces of the books, with a greater uniformity of illumination, and specular reflection from the backs of



FIG. 6—LIGHTING IN CATALOG ROOM OVER CARD FILES

leather-bound books and glossy labels and titles is minimized.

The light sources for the units above the mezzanine floor are hung from the ceiling under the balcony, as shown in Figs. 4 and 5. These units consist of spun metal, finished in olive enamel exactly matching the bookstack finish. Each unit contains one 60-watt tungsten lamp with proper reflector equipment.

The illumination of the reading areas between the bookshelves as well as bookstack illumination at those places is accomplished by two larger spun-metal units in each bay, as shown in Fig. 2. Each unit contains two 60-watt tungsten lamps with reflector equipment.

The bookshelves on the main floor under the mezzanine present a considerably greater problem. The mezzanine floor is constructed in thick glass. This material does not make a suitable reflecting surface for indirect illumination and hence a second coat of suitable color and surface texture was applied to the under surface of the glass floor to obtain an efficient reflecting surface. Units were designed to fit the existing conditions of bay size space and low ceiling height, and the result shown in Fig. 2. Some light is allowed to pass through the glass ceiling to assist in uniformly illuminating the lower shelves of the stacks above. The units have also been equipped with tungsten lamps with reflector equipment.

The catalog room, shown in Fig. 6, is also indirectly lighted by units of the same type as those used on the balcony of the reference room, except that in each one of six of them use is made of one 250-watt tungsten lamp and in two of them use is made of one 400-watt lamp. The arrangement is such that a unit hangs in each alternate recess of the highly ornate ceiling, producing artistic and efficient illumination. Owing to the number and position of these units it is impossible to stand in such a position that



FIG. 7—EAST SIDE BRANCH OF MILWAUKEE PUBLIC LIBRARY

a shadow from the body will be cast upon the vertical surfaces of the cards in the files.

All units are equipped with mirrored-glass reflectors selected to accomplish the effect desired in each case. The general results accomplished are the illumination of these areas without the presence of the glare from any source of light in the range of vision and the elimination of practically all shadows on the books or elsewhere. As all lamps are screened from view specular glare from the calendered paper and other glossy reflecting surfaces is greatly minimized.

These results were accomplished by the illuminating engineers through the study of the requirements and conditions. Co-operation with the library building committee, the librarian and the interior decorator made it possible to produce a harmonious combination throughout the building.

The east side branch of the Milwaukee Public Library is established in a rented building, and considerable thought and ingenuity has been displayed by the chief librarian in planning this branch. Economy and simplification are the watchwords, and the prime motive is to promulgate the beneficial functions of the library privileges at minimum trouble and expense.

The lighting equipment is therefore the minimum necessary for successful operation. All fixtures are portable and as simple as possible. The bookstacks are merely wooden-box units which can be stacked on one another in any manner desired. The heating and illumination have had the same careful consideration that they receive in more permanent institutions. The illuminating units consist of simple, inexpensive indirect fixtures, shown in Fig. 7.

This branch installation is a notable example of what can be accomplished inexpensively by co-operation between library authorities and engineering experts. In both the main library and branch library installations the illumination is eminently satisfactory for the purposes of the public.

The new installation in the reference room of the main library affords a connected load of 18.7 kw. This equipment replaces the original and unsatisfactory installation of approximately 26 kw. However, the energy consumption of the entire main library installation is now approximately

50 kw-hr. more per day than previously. This paradox is explained by the desire of the attendants to utilize the light whenever possible on account of the satisfaction which is afforded by its use.

### Immediate House-Wiring Facilities in Springfield, Ill.

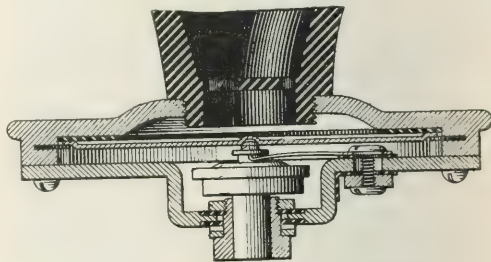
When contracts are secured in house-wiring campaigns it happens not infrequently that the prospective customer's enthusiasm for electric service is cooled by delay in securing the service. In order to eliminate this cause of complaint the Springfield Light, Heat & Power Company of Springfield, Ill., has recently enlisted the services of several electrical contractors. Solicitors are sent out to secure contracts for house wiring and hanging of fixtures, and these contracts, when secured, are turned over to the contractors for immediate execution. The electric-service company carries the accounts and gives the contractors a commission. Sixty contracts were secured in three weeks and each customer received immediate attention.

### Recent Telephone Patents

#### IMPROVED TELEPHONE INSTRUMENTS

The electromagnetic type of telephone receiver differs from the usual type in that the permanent magnet is replaced by an electromagnet. With such an instrument a weight must usually be added for the positive control of the switch lever of the support. The disposition of this weight and of the other parts of such a receiver are the chief points covered in a patent granted to Mr. O. M. Leich, of Genoa, Ill., and assigned to the Cracraft-Leich Electric Company. The electrical unit is self-contained, a single-core iron-clad coil furnishing two poles to be presented to the diaphragm. This whole unit is held in place in the flare of the casing by the clamping action of the ear-cap. The weight occupying the tubular end of the casing has a central bore and is clamped in place by an insulating bushing which passes through the small end of the casing and threads into the bore of the weight. The cords pass through the weight and bushing.

A receiving instrument patented by Mr. E. A. Graham, of London, England, is of the loud-speaking type with the usual flaring horn. For noisy locations it has in addition two ear-tubes terminating in ear-caps. These normally hang down out of the way. They may be swung up to cover



CROSS-SECTION OF TELEPHONE TRANSMITTER

simultaneously both ears of the user. The instrument includes a signal lamp and suitable switching keys.

The accompanying illustration shows a section of a transmitter for which a patent has been granted to Mr. C. E. Scribner, of Jericho, Vt. It will be noted that the stud of the front electrode does not extend through the diaphragm but instead fits into a small recess. The diaphragm is held on its seat and the stud is held in place by the pressure of a single flat spring pressing against a collar upon the stud.



This patent has been assigned to the Western Electric Company.

Mr. David H. Wilson, of Chicago, is the patentee of a transmitter which has two opposed diaphragms in a vertical flange. Between these is mounted a cylindrical box, the cover of which telescopes over the body. The top and bottom respectively carry one or more carbon studs extending toward each other in a loose body of carbon granules. The sound to be transmitted is led to both diaphragms simultaneously, and as these approach and recede the resistance of the transmitter is varied.

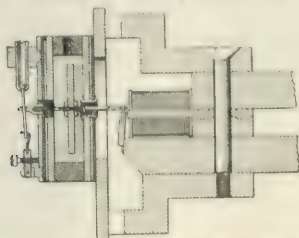
The transmitter invented by Mr. C. N. McGoogie, of Algonia, Wash., is of the differential type. This transmitter, the patent for which has been assigned to the Globe Telephone Company, has two diaphragms with the sound tube leading between them. Each diaphragm connects with the stud of one or more differential microphone buttons. In each of these a middle movable electrode is arranged midway between two stationary electrodes, the space being filled with granules of carbon. The middle electrodes of one group are connected in parallel to one pole of the battery, those of the second group being connected to its second pole. The outer stationary electrodes of one group are connected in parallel to the inner stationary electrodes of the other group. The transmitting induction coil primary is connected between the two groups of stationary electrodes. When at rest the currents are divided so that the induction coil is between equipotential points. In action the varying resistances cause varying currents to be produced in the induction coil.

#### COMBINED TELEPHONE AND TELEGRAPH SYSTEM

There has been suggested for telephone transmission purposes an inductive conductor such as a twisted pair of wires each of which is used from one end only. Transmission along such a conductor is due solely to the electrostatic relation of the two conductors of the pair, there being no conductive connection between them. Such a conductor has been adopted by Mr. I. Kutsee, of Philadelphia, to the purposes of simultaneous telephony and telegraphy. This is accomplished through the use of polarized relays sensitive to small current impulses.

#### REPEATERS

The accompanying illustration shows details of the receiving and magnetic parts of a telephone repeater which has been patented by Mr. J. J. Comer, of Chicago. The receiving coil acts upon an armature which in turn is secured to the movable electrode system of the microphone button. The spindle is supported by the armature and by a suspension link, passing through stuffing boxes to enter the cham-



DIFFERENTIAL MICROPHONE REPEATER

bers. The air-gap at the receiver is adjusted by the tension on the link at the left, and this in turn is controlled by the two adjusting screws.

Mr. S. G. Brown, of London, England, has invented apparatus for amplifying telephone waves. The important feature lies in the control of the retransmitting contact. This is a single contact arranged before an electromagnet energized by a steady current through the contact. The result is that when the current is closed the contact is light-

ened by a steady pull until the contact resistance causes a diminution of the current to a point where it balances. The receiving current acts on the contact while so balanced.

A repeating system invented by Mr. C. D. Lindbrake, of Providence, R. I., differs from the above in the substitution of so-called negative and positive resistors together with resistors of ionized gases. The circuit arrangements are such that one current charges and another discharges the response of the negative and positive resistors, interference being avoided by the action of the ionized gas resistors.

#### REPEATING DEVICE

A paper tape, recently shown at New Orleans by Mr. R. W. Bogart, Jr., A single piece of sheet metal is bent out and bent in like a wave, and carrying the wave to secure it to the transmitter. A roll holder is provided above the transmitter and a feeding blade below. A roll of paper completes the device.

## Letter to the Editor

### Compensation of Phase Difference

To the Editors of the Electrical World

SIR:—I have been interested to read in *THE ELECTRICAL WORLD* published an analysis of an article by Mr. A. Scherbius on the compensation of the phase difference in induction motors which appeared in the *Elektrotechnische Zeitschrift* for Oct. 17, 1912. Mr. Miles Walker, engineer of the British Westinghouse Company, has also published several articles on this subject.

It may be of interest to note that a machine operating in accordance with the principle of connecting a suitable condenser in the same circuit was described by the author before the International Society of Engineers, Paris, in January, 1903. This apparatus seems absolutely analogous to the phase advancer of Mr. Scherbius.

The device has not, however, been patented in this country, as have been several patents issued from the work of Mr. Maurice Lemoine. Moreover, there would not be the utility of such a patent, although the latter may not have been justified.

In my communications of Jan. 7, 1903, I stated: "Among the principal ideas of Mr. Lemoine is that of the synchronous generator of polyphase currents. This machine is based upon the following principle: 'If an induction motor is converted into an alternating current synchronous motor, it is necessary only to make the rotor turn at a speed exceeding the synchronous speed in order to furnish power to the external circuit; the motor itself furnishes the synchronous current.' Mr. Lemoine has shown that such a rotating current may be furnished by the synchronous field its winding is connected to a generator or to another apparatus performing the function of a condenser. The example, one can close the circuits of the rotor on a continuous current impressed externally to the synchronous generator at a phase lag amount of a number of degrees or at a phase lead of a number of degrees, to turn slowly or quickly, thus the rotating field created by the current themselves. The armature should be suspended by non-magnetic materials the reluctance of the core. The core may be stationary or may revolve with the rotor." Thus, I think, I defined the apparatus of Mr. A. Scherbius.

In 1903 the second published synchronous generator at the Thomson-Houston works to establish these principles. As a convenient means for starting the synchronous motor, use was made of a large hand or foot wheel around the induction armature.

Yours faithfully,

W. C. CROFT (E. I. E. E.)

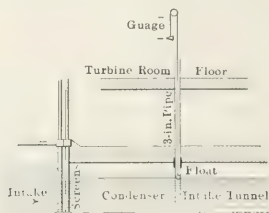


# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Float Gage to Indicate Condition of Intake Screens

In an Ohio central station where the screens protecting the condenser-intake line are rather inaccessible considerable trouble is experienced with leaves and rubbish collecting in the intake and interfering with the flow. As this condition often arises with little warning and the screens

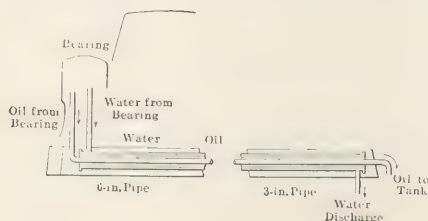


FLOAT INDICATING CONDITION OF SCREENS

themselves are difficult to inspect, a scheme has been rigged up to show, by means of a float, any fall in level in the intake line due to clogging of the meshes. A 3-in. pipe was introduced into the tunnel and a float inserted therein connected by a cord to a pointer on the turbine-room floor. Any restriction of the screen area is indicated by a fall in the water level from which the suction line to the condenser is taken. Warning is thus given the attendant before the screens have had time to clog badly and embarrass the plant, since a very slight fall in level is detectable by the gage. The stationary screens are now to be replaced by sections of traveling screens 4 ft. wide and of  $\frac{1}{2}$ -in. mesh. This mechanism will be driven by a 2-hp motor. A 1-in. pipe in which a number of holes are bored will free the screen of rubbish by the impact of small streams of water played on the under side.

## Extra Cooling of Turbine Bearing Oil

A 4000-kw horizontal turbine-alternator set which has been in service in an Illinois power plant for several years has given trouble owing to insufficient cooling of the bear-



PLAN FOR EXTRA COOLING OF TURBINE BEARING OIL

ing oil. Although ample cold circulating water is provided, the oil nevertheless leaves the bearing at 135 deg. to 140 deg. Fahr., indicating that not enough heat-transfer surface was provided in the bearing alone. The plan adopted to cool the oil further before it is returned to the receiv-

ing tank is shown in the accompanying sketch. The oil outlet pipe had already followed the base of the machine for a distance of 30 ft., and around this 3-in. pipe it was only necessary to jacket on a 6-in. pipe through which the circulating-water return could be passed. Baffles were introduced in the larger pipe to insure better heat transfer. An improved plan might have been to run the water through the inside pipe and the oil through the annular space without, but this would have required special fittings which the arrangement as adopted avoided. Oil-discharge temperatures of 80 deg. to 85 deg. Fahr. are expected from the jacketed return pipe.

## Rehabilitating 4400 Flood-Immersed Meters at Dayton

Of the 7500 customers' meters which the Dayton Power & Light Company had in service at the time of the flood, 4400 were installed in basements or first stories in the inundated districts. All these meters, therefore, were not only water-



FIG. 1—SCRUBBING MUD FROM METER PARTS WITH TOOTH-BRUSHES

soaked for periods of seventy-two hours or more but had their delicate interior parts coated with layers of fine mud and silt, carried in by the water. Of the 1500 direct-current meters, 1400 were thus affected, while about half of the 6000 alternating-current meters were rendered useless for the time being.

As soon as service was restored and customers' premises could be reached men were dispatched over the regular meter-reading routes to disconnect and bring in all meters which suffered by the flood. The downtown direct-current section was handled first, in addition to the meters of the large alternating-current customers in outlying districts.

As the direct-current meters were brought in the cover of each was removed and a hose turned on the parts, inside and out, to wash off the mud and silt adhering everywhere. Covers were then replaced and the meters laid to dry on top of the boiler flues in the power plant. Next the whole

mechanism was taken apart and brushed with toothbrushes to remove remaining mud. Meanwhile the registers were being cleaned in wood alcohol. In some of the meters the swelling of fiber parts had broken the fine wires of armatures and resistances, although many meters came



FIG. 2—BOILING METERS IN OIL TO REMOVE MOISTURE

through unharmed by the wetting. Where the last traces of mud could not be removed by the toothbrush process, a coating of shellac was applied to the interior to prevent flaking of the silt. After being reassembled the meters were all adjusted and tested for accuracy within 2 per cent before being sent out for customers' service.

By the time the 3000 alternating current meters were reached a number of improvements had been added to the rehabilitation process. On arrival at the repair room these meters were torn apart, registers, disks and magnets being removed. Registers and disks received a kerosene bath and were scrubbed with toothbrushes. Covers, backs and windings were meanwhile washed with water to remove the mud, and the covers and bearings were then piled up to dry in a steam-heated hot room containing a bank of high-pressure steam coils. This room was kept at 150 deg. to 160 deg. Fahr. Laminations and windings were meanwhile



FIG. 3.—PILE OF MEETERS (CUBES) AWAITING REASSEMBLY.

immersed in the bath in a transformer oil heated by steam coils at 60 lb. pressure. The salts were left in the bath until all "boiling" ceased as this "boiling" indicated water coming off. As the oil in the tub was heated by the 60-lb. steam to a temperature well above 212 de-

Edgar's house prospered, keeping the old house dry. With ten minutes' notice, he could dry the house in an all-day fire. The same effective method of drying by fire was also at that time applied to many other cases of dampness, including timber structures, but it was not until it had become impossible to dry out by any other means.

After removal from the ice bath the swimming pool water mixture was placed in the dry case quickly, being careful to avoid mixing with the water and the vapour and under a hot lamp kept in the draft of chimney heat it was found that all stress of swimming was gone, even after the water parts.

[illegible]

The meters rehabilitated in this way were of several types—the single phase alternating current meters included Westinghouse types C and O A and General



FIG. 4.—SUNLIGHTING OF THE TROUSERS OF HALLWAY MEN.

[illegible]

### Effect of Power-Factor on Generating and Transforming Apparatus

Early Jordan (1989) noted a positive effect on the regulation of the generalized flux on the conductance of transpiration. The flux is positive in leaves in the sun in all developmental stages when measured under the same conditions. Thus, the amount of  $\Delta$  generated, the maximum, varied with amount of stress power (total or local) and is also low in regions not under stress and in regions with low transpiration. The same is true of transpiration efficiency,  $\Delta$ . However, since the "flux" of  $\Delta$  generated could be held constant in terms of leaf surface and fluxes, leaves from trees have been distinguished by the long-term positive generally negative transpiration measured field versus with suppressed field  $\Delta$  in trees.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

*British Standardization Rules for Electric Machines.*—The new standardization rules which have been provisionally adopted by the council of the British Electrical and Allied Manufacturers' Association. Section 1 deals with standard pressures and frequencies. The standard frequencies are 50 and 25 cycles per second. The standard high-pressure systems for alternating-current work are operated at 2000, 3000, 6000, 10,000 and 20,000 volts. The standard generator pressures are 115, 230, 460 and 525 volts for direct-current generators and 440, 550, 2200, 3300, 6000 and 11,000 volts for alternators. The standard low pressures at consumers' terminals are 110, 220, 440 and 500 volts for direct current and 100, 200, 400 and 500 volts for alternating current. Section 2 deals with high-pressure tests and insulation resistance; section 3 with types of machines. The following classification of rotating machines is recognized: (1) open, (2) protected, (3) inclosed-ventilated, (4) (a) pipe-ventilated, (b) pipe-ventilated with "forced draft," (5) drip-proof, (6) totally inclosed, (7) flame-proof. These different types are defined: Section 4 deals with rating. Two classes of rating are recognized—continuous rating and short-time rating (for intermittent working). The continuous rating is the output which a machine or a transformer will give for a period sufficiently long to attain practically constant temperature rise and otherwise comply with these regulations. Unless otherwise specified, any machine rated to operate between two limits of pressure shall have its ampere rating determined upon the high pressure. The short-time rating is the output which a machine or transformer will give for one hour, one half-hour or other specified period and comply with these regulations. These ratings are called one-hour ratings, half-hour rating and other specified rating respectively. Machines with two or more fixed speeds are to have a definite rating for each speed. Variable-speed machines are of two classes: (a) Machines rated to give the same output throughout the entire range of operating speed. In such machines the heating tests should be made at the lower limit of speed and commutation tests at the upper limit of speed. (b) Machines that are not rated to give the same output at all speeds. These machines should have ratings specified for both minimum and maximum speeds. Section 5 deals with overloads. Section 6 deals with heating. The temperature rise of electrical machinery, both rotating and static, is to be taken as the difference between the cooling-air temperature and the temperature of the machines after giving their normal rated output for the following periods: (a) For machines with continuous rating, until the temperature rise is practically constant; that is, until the rate of increase of temperature rise does not exceed 1 deg. C. per hour. (This condition will usually be reached in less than six hours, except in the case of oil-immersed transformers.) (b) For machines with short-time rating, after working continuously for the period defined by the rating. For machines with continuous or with short-time rating and designed to operate under ordinary conditions of cooling—that is, designed for an air temperature of 25 deg. C. (77 deg. Fahr.)—the following temperature rises are the highest permissible at the normal full load: (a) Machines having unobstructed ventilation: all windings, 40 deg. C.; cores in which windings are em-

bedded, 40 deg. C.; commutators and slip-rings, 55 deg. C. In general, the temperature rise by increase of resistance should not exceed 55 deg. C. for alternator field coils or 60 deg. C. for shunt field coils of direct-current machines in this class. (b) Machines having partially obstructed ventilation: all windings, 47 deg. C.; cores in which windings are embedded, 47 deg. C.; commutators and slip-rings, 55 deg. C. In general, the temperature rise by increase of resistance should not exceed 65 deg. C. for shunt-field coils of direct-current machines in this class. (c) Machines of the "totally inclosed" class: all windings, 55 deg. C.; cores in which windings are embedded, 55 deg. C.; commutators and slip-rings, 55 deg. C. In general, the temperature rise by increase of resistance should not exceed 70 deg. C. for shunt-field coils of direct-current machines in this class. The temperature rise of the transformers is to be measured at their rated full-load output. It is permissible, however, to reduce the time of test by running for a time on an overload in current and pressure, then reducing the pressure to normal and maintaining it at this until the required standard-rate temperature rise is obtained. The limit of permissible temperature rise at the rated full load is as follows: oil-cooled, by resistance or by thermometer in the oil, 50 deg. C.; air-cooled, by resistance or by thermometer, 50 deg. C. Special notes are added on the heating of machines for tropical conditions, special heat-resisting materials, the measurement of the cooling-air temperature, and correction for altitude.—*London Electrician*, May 16, 1913.

*British Standardization Rules.*—A critical review of the proposed standardization rules of the British Electrical and Allied Manufacturers' Association and an editorial on the same subject. The importance of co-operation, especially with the engineering standards committee, in order to get a result really satisfactory to both manufacturers and users, is pointed out, and it is held that the agreement should be made international. The use of thermometers is criticised, also the specification of temperature rise instead of temperature.—*London Electrician*, May 23, 1913.

*Terminology.*—E. J. BRUNSWICK.—An article giving a list of names and terms applicable to dynamo-electric machines and transformers. This terminology is proposed in the name of a committee of the International Society of Electricians in Paris tentatively, to elicit discussion.—*La Lumière Elec.*, May 10, 1913.

*Notation.*—E. J. BRUNSWICK.—An article giving an outline of a system of notation and symbols for representing graphically electrical quantities, etc., in central stations, on transmission lines, and also in substations.—*La Lumière Elec.*, May 17, 1913.

### Lamps and Lighting

*Dresden.*—A. STRAUSS.—An illustrated article giving statistical data on the development of the public lighting system of the city of Dresden. Up to 1905 arc lamps with pure carbon electrodes were almost exclusively used. They were in the next few years gradually displaced by flame-arc lamps, which reached their maximum of favor in 1911. Since 1908, however, metallic-filament lamps have come into use at a steadily increasing rate and tungsten lamps of large candle-power (400 cp to 1000 cp) are now replacing the arc lamps.—*Elek. Zeit.*, May 22, 1913.



**Metallic-Filament Lamps.**—A note on a recent British patent (No. 26,289, 1912) of the Westinghouse Metallfaden Glühlampenfabrik. Metallic filaments of great length are made compact by forming into a helix which is prevented from liability to stretch by the inside diameter of the helix being not greater than the diameter of the filament.—*London Elec. Eng'g*, May 22, 1913.

**Rendering Tungsten Ductile.**—A note on a recent British patent (No. 19,288, 1912) of the Westinghouse Metallfaden Glühlampenfabrik. The metal is heated to over 2000 deg. C. and placed in an inert gas at between 50 and 150 atmospheres, where it is allowed to cool very slowly during from five to ten hours.—*London Elec. Eng'g*, May 15, 1913.

**Long-Burning Flame Electrode Arc Lamps.**—G. W. Roosa.—An illustrated article giving notes on alternating-current and direct-current flame-arc lamps, their performance and characteristics and their mechanical operation.—*Elec. Journal*, June, 1913.

#### Generation, Transmission and Distribution

**Bordeaux.**—J. REYVAL.—An illustrated article on energy supply in Bordeaux. The author first describes the installations of the Energie Electrique du Sud-Ouest and the general high-tension system of Bordeaux and surroundings and then passes over to the low-tension power supply in Bordeaux for traction, lighting and power purposes. The article is to be continued.—*La Lumière Elec.*, May 17 and 24, 1913.

#### Traction

**Single-Phase Traction in France.**—E. BARTH.—The first part of an illustrated article on the single-phase traction system in the district of Haute-Vienne, of which the city of Limoges is the center. Energy is supplied from a water-power plant at 30,000 volts, but at the station in Limoges the voltage is reduced to 600 volts for operation in the city itself and to 10,000 volts for operation outside of the city. There is no substation outside of Limoges. Single-phase series-commutator motors are used, of the series-compensated type.—*La Lumière Elec.*, May 24, 1913.

#### Installations, Systems and Appliances

**Electricity Supply of Greater Berlin.**—BRUNO THIERNACH.—An illustrated review of the electric supply stations in operation at present in Greater Berlin and their tariffs. The Berlin Electricity Works supply energy in all the eighty-six cities or towns, but within a radius of 15 km (9 miles) there are fourteen other electric supply companies with their own power stations. Twelve of the sixteen companies are owned by municipalities; the other four are private companies. But the Berlin Electricity Works alone, which are privately owned, sell seven times as much energy as all the municipal stations together. The author gives in tables a review of the different tariffs in use with the different companies. The fundamental rates for lighting range in general between 2 cents and 7.5 cents per kw-hr. and for motor service between 4 cents and 2.5 cents. The same company charges very different rates in adjoining districts. For instance, part of the municipalities of the districts of Niederharnim and Teltow pay to the Berlin Electricity Works only 2.75 cents per kw-hr. for motor service (2.5 cents with overhead wires), while in other portions of the same districts, as well as in the city of Berlin, 4 cents is charged. Various discounts are allowed. Almost all tariffs are intended for lighting and small motor users only, and the companies make special agreements with large consumers. Various points of the tariffs in use are criticised by the author. It is also emphasized that, as the total rating of all works together is about 173,000 kw, three large power plants at proper points within the area and each of 80,200 kw rating would be sufficient to provide all the power and could do this in a highly economical way. As the situation now is there are twenty power stations, not one of which is extensive enough to be called a large power plant

in the modern sense. Further, there is competition between the different companies. A large modern power plant can be built at \$40 per kw, while the power plant of the city of Neuköln, recently erected, cost \$40,000,000 with a rating of 37,000 kw. But on paper per kw. it shows the waste of money in the present system. Although the fuel consumption in Berlin is far in excess of most stations, it would be so in the case of most stations. Further, the overhead charges in Berlin and other companies are necessarily higher than if there were one company and one management. In the course of the discussion it will be decided what in the future will be the relation between the Berlin Electricity Works and the city of Berlin. The author emphasizes that, however this relation may be regulated, the new agreement should permit a uniform lighting and motor service supplied by Greater Berlin from a few large plants at some future date.—*Elek. Zeit.*, May 22, 1913.

**Paris.**—On March 21, 1907, the Union des Secteurs of Paris first received official recognition, and on Jan. 1, 1914, the Compagnie Parisienne de Distribution d'Electricité will absorb the six existing supply companies. The onerous conditions on which its concession has been granted include payment of 10 per cent per annum of the gross receipts (nominally as rental for that part of the distributing system belonging to the municipality), with a sliding scale increasing this rent, the minimum annual payment being \$500,000. The whole property will be taken over by the municipality in 1920 without payment, or in 1924 on payment of the balance not then provided for by the statutory sinking fund. The authorized tariffs are 9.6 cents per kw-hr. for lighting and 5.8 cents for motor service. A further condition made was that two generating stations should be erected, one in the north, the other in the southwest of Paris, both on the banks of the Seine, and to be interconnected electrically. Some data are given on the equipment of these two stations. The northern station has 50,000 kw rated capacity and accommodates eight 10,000-kw to 15,000-kw turbo-alternators and three 3750-kw converter sets for station and auxiliary supply. The southwestern station is of 25,000-kw present and 50,000-kw ultimate rating.—*London Elec. Review*, May 16, 1913.

**Protection of Electric Lines.**—MARIO BUFFA.—An illustrated description of a device which immediately and automatically cuts off the supply of energy from a station by opening the circuit-breaker at the beginning of the line as soon as there is an accident, either in the form of an earth connection or a contact of a high-tension wire with a low-tension wire, etc. It is presupposed that the line must have a neutral point connected to earth either directly or through the electromechanical of a voltage-limiting device. The arrangement is shown in Fig. 1. The three busbars at the beginning of the line are connected to three self-induction coils which are star-connected. Their center is connected to the earth plate *T*. A small three-phase transformer without a secondary circuit may be used for this purpose in order to increase the value of the center *T* of a star-connected system of induction coils connected to earth at the end of the line. In series with the three conductors of the line there are three coils of inductance of the same magnitude rate. The same inductance rate has another secondary circuit which is connected to *T* and will operate a circuit breaker as soon as current in a fault line steadily passes through *T*. Under normal conditions the sum of the three currents in the primary coils *F* of the symmetric transformer is zero. *T* and *T'* are practically of the same potential and no resonance takes place between them. But if a fault line should break the plate *T'* will assume an alternating potential which is the mean of the potential of the two secondary conductors. There will be a current between the earth plates *T* and *T'*. The sum of the three primary currents will not be zero if the symmetric transformer will no longer be zero and current will pass through the electromechanical through *R* and will operate the circuit breaker. In the case of an insula-

tion fault of insufficient magnitude should occur by contact of a point of the line with a low-tension network having a point connected to earth, a current will pass through the earth plate  $T_1$  and the fault and the apparatus will operate the circuit-breaker since the sum of the three primary currents in the coils  $A$  of the symmetric transformer will no longer be zero. The mathematical theory of the arrange-

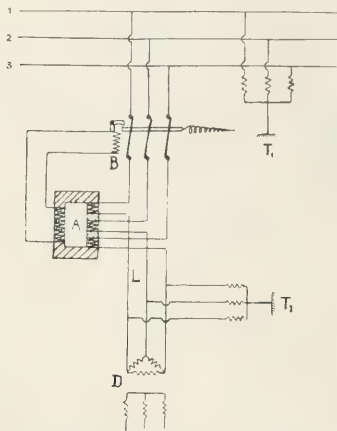


FIG. 1—ARRANGEMENT FOR LINE PROTECTION

ment is explained at length.—*Bulletin de l'Association des Ingénieurs Electriciens sortis de l'Institut Electrotechnique Montefiore*, March 10, 1913; *La Lumière Elec.*, May 24, 1913.

*Use of Transformers with Mesh-Connected Secondaries for Earthing Three-Phase Systems.*—G. W. O. HOWE.—In Fig. 2 the busbars are supplied with energy from an un-earthed generator  $G$ , which may be either star-connected or mesh-connected. The earthing device consists of a three-phase transformer or three single-phase transformers, star-connected on the primary side and mesh-connected on the secondary. The neutral point is directly earthed with

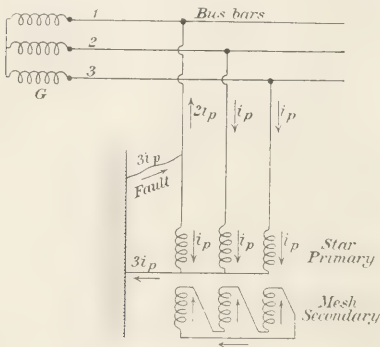


FIG. 2—CIRCUITS OF THREE-PHASE TRANSFORMER WITH MESH-CONNECTED SECONDARY

no limiting resistor. Normally the primary current taken by this transformer will be negligibly small—for example, the no-load current—while no current at all will flow in the secondary winding. The current which now circulates in the secondary mesh is necessarily the same in each limb, in magnitude and phase, and since for all but the lightest loads the primary and secondary ampere-turns of

a transformer are equal and opposite, the primary currents must not only be equal but also in phase, that is, flowing simultaneously toward or away from the neutral point in each limb. If the primary current is  $i_p$ , the earth current is, therefore,  $3i_p$ , which returns to the system by way of the fault. The current taken from the busbars will, therefore, be  $i_p$  in the two uninjured phases and  $2i_p$  in the earthed phase, the latter being 180 deg. out of phase with the former. The author determines the value  $i_p$  on a dead earth and shows that the current in the earth connection is three times the current which would be taken by the transformer if short-circuited in the ordinary manner by connecting the corners of the mesh. The earth current on a dead short-circuit may be, therefore, from fifty to a hundred times the normal full-load current of the transformer. This can, however, be limited to any desired extent by inserting inductance or resistance anywhere in the mesh-connected secondary circuit. The author then determines the value  $i_p$  when the fault has a certain definite resistance.—*London Electrician*, May 23, 1913.

*Extinguishing Arcs.*—BURSTYN.—A brief note on a recent paper read before the Berlin Electrical Society on a new method of extinguishing the arc which is being formed when a contact is broken. The feature of the method is to impress high-frequency currents on the arc *in statu nascendi*. These high-frequency oscillations are taken from an oscillation system consisting of a suitable condenser with short connecting wires. Special choking coils are unnecessary. By impressing these high-frequency currents on the direct current to be broken, there will be moments at which the current is zero when the arc will be extinguished if the contacts are constructed so as to carry off the heat quickly. The author shows that in this way a current of 40 amp at 440 volts can be broken with a distance of a few millimeters between the contact pieces almost without spark. The method is being applied to interrupters, relays, etc.—*Elek. Zeit.*, May 22, 1913.

*German Central-Station Statistics.*—G. SIEGEL.—A review of the official statistics of the (German) Association of Central Stations for the year 1911. It comprises figures of 282 German stations and 65 stations in other countries. The steady increase of transmission systems is pointed out. While in 1910 there were 99 stations which supplied energy to more than two cities or towns, there were 132 in 1911. The number of towns supplied with electricity was 3153 in 1910 and 4722 in 1911. The area of supply from a station is increasing correspondingly. In 1910 the mean distance between the station and the furthest consumer was 8.76 km (5.25 miles) as the crow flies, while in 1911 this mean distance was 10.8 km (6.5 miles). The largest distance was 99.2 km (60 miles) in the case of Zurich. Seven stations transmitted energy over distances greater than 50 km (30 miles). In 1910 there were sixty-nine stations which bought 178,000,000 kw-hr. from other stations. In 1911 there were ninety-four stations buying 313,000,000 kw-hr. From 1910 to 1911 the connections increased by 13 per cent for lighting, by 20 per cent for motor service and by 40 per cent for lighting motor service charged at the same rate. The total connections have increased 18 per cent. As to fuel consumption, on the average 0.101 watt-hr. was produced per calorie in 1911 (the figures varying between 0.046 watt-hr. and 0.18 watt-hr. per calorie), against 0.119 watt-hr. per calorie on the average in 1910. The cost of operation (excluding water-power stations) varied between 0.49 cent and 7.95 cent per kw-hr. The average value is 2.325 cents against 2.49 cents per kw-hr. in the preceding year. The kilowatt-hours sold per 1000 inhabitants increased by 24 per cent over the preceding year; the mean figure is 43 kw-hr. per 1000 inhabitants. There is a tendency to reduce the rates. The mean receipts per kilowatt-hour were 5.75 cents in 1910 and 5.525 in 1911. The total receipts increased by 16.5 per cent on the average.—*Elek. Zeit.*, May 22, 1913.



### Wires, Wiring and Conduits

**Wiring.**—The new regulations on wiring materials, switches, fuses, etc., which are to be voted on at the 1914 meeting of the German Association of Electrical Engineers and which are to go in force on Jan. 1, 1915, are here published.—*Elek. Zeit.*, May 22, 1913.

**Fuses.**—A note on a recent British patent (No. 20,663, May 15, 1913) of the British Thomson-Houston Company and the General Electric Company of this country. These fuses are for low-current circuits and consist of pads of yielding refractory material with a number of fusible rods of threads passing through them, arranged in various ways, sometimes in conjunction with blocks of carborundum or other material of negative temperature coefficient of resistance, which vary the proportion of the current passing through the fuse according to its magnitude.—*London Elec. Eng'ng.*, May 22, 1913.

### Electrophysics and Magnetism

**Experiments with Flames.**—B. TITCHEM. If the ends of two wires connected to a battery of at least 12 volts are held in a flame—for instance, the flame of a candle—with a difference of several millimeters between the two ends, carbon is deposited on the wire forming the negative pole and this carbon deposit increases and gradually forms a bridge between the two wires. The current which flows through the flame at 220 volts is about 0.0001 amp, and hence is insignificant. This provides a method for producing lamplack. It may also be used as a means for determining which of two poles is positive and which negative. If the two wires are subjected to an alternating-current voltage, lamplack is deposited on each of them in the form of little trees, and the points and bridges of these trees begin to oscillate with the frequency of the current. The explanation is that the carbon tree is a current-carrying conductor in the magnetic field of the earth. In order to determine the frequency from these oscillations, a disk with some radial slits is placed on the axle of a small motor the speed of which can be measured. The speed of the motor is then so regulated that on looking through the slits in the rotating disk the two oscillating wire ends seem to be at rest. In this case as many slits pass before the eye per second as there are oscillations of the wire ends in the same time. If the two wires held into the flame are fixed and held stationary with a definite distance between their ends, the flame changes its form when a voltage is impressed on the wires. As long as the current is open the flame is long and narrow, but as soon as the circuit is closed the flame becomes shorter and fatter. The flame flickers instantaneously on the potential variations. This phenomenon may, therefore, be used for telegraphy, and the author thinks it is especially a useful for military purposes since very thin wires are sufficient to carry the very small current required.—*Elek. Zeit.*, May 22, 1913.

### Electrochemistry and Batteries

**Electrode Holders.**—A long illustrated article describing the principal types of electrode holders for use in the European electric furnace practice with additional notes on joining and dimensioning electrodes.—*Metall. and Chem. Eng'ng.*, June, 1913.

**Primary Battery.**—A. J. FAUSE. A note on a ferric chloride cell which the author has found very useful for experimental work. It is a zinc-carbon cell with ferric chloride round the carbon and a saturated solution of sodium hyposulphite (for the excitant) round the zinc. The combination gives 1.5 volts, and as the resistance of the solutions is low a considerable current is available. The current is constant as long as the ferric chloride solution is kept saturated. This is easily effected by having lumps of the iron salt in the porous part, which, of course, readily dissolve. The carbon electrode is made up of a number of short carbon plates so as to form a grid, the top ends of which support lumps of ferric chloride. The zinc need

not be amalgamated and is better left plain.—*London Electrician*, May 23, 1913.

### Units, Measurements, and Instruments

**Thermoelectricity.**—O. D. POPE. A long illustrated paper on the thermoelectric effect.—*Metall. and Chem. Eng'ng.*, June, 1913.

**Iron in Measuring Instruments.**—M. DELAYE-DUBOIS-SKY. A paper on the use of iron in electrical measuring instruments.—*London Electrician*, May 23, 1913.

### Telegraphy, Telephony and Signals

**Central Battery System.**—VICTOR J. BAUMANN. A description of a new central-battery system in which when a subscriber calls up the exchange an automatic device at the exchange connects the subscriber with one of the operators who then connects to the subscriber. So there is no direct connection in the usual way. The operator can thus never get more than one call at a time and the lines are uniformly distributed among the different operators so that they are kept uniformly busy. The system is claimed to permit from 15 to 14 per cent of savings in operating cost.—*Elek. Zeit.*, May 22, 1913.

### Miscellaneous

**British Electrical Engineers in France.**—The British Institution of Electrical Engineers has held a meeting at Paris. The attendance of French engineers was large. The work was done by the British. Some of the papers were read and interesting experiments were made. No further details are yet known.—*London Electrician*, May 23, 1913.

## Book Reviews

**Tratado de Física y de las Técnicas de la Electricidad.**—J. A. GARCIA. Published by the Editorial de la Universidad de Madrid. Price, 6 reales.

A very carefully prepared treatise on the electrical properties of matter, containing many interesting examples of computed induction, resistance, etc., for each line. Hypothetical questions are included in their full solution. Very many diagrams and tables are included in their full effect. The treatment constitutes therefore an interesting intermediary between the ordinary non-technical treatises of French engineers and the primary technical treatises of American engineers. Some of the terms employed in the book appear to be new and not in complete accordance with those usually employed. The language is employed to denote what is generally known here as "resistance variation." The book will be valuable to students of the electrical engineering profession.

**Tratado de Física y de las Técnicas de la Electricidad.**—J. A. GARCIA. Published by the Editorial de la Universidad de Madrid. Price, 6 reales.

This is a well-stuffed manual volume of a series by the same author. It deals with the scientific principles of the various forms of electricity and its applications, including electrochemistry, lighting, heating, motors, signaling, wireless telegraphy, vacuum tubes, miscellaneous applications, hygiene, electrotherapeutics, radiography, radiotherapy and phototherapy, radio, telephony and necrology. The book is strongest on its physiological, therapeutic and medical side, but contains a considerable and condensed and abstract amount of work done and published during the year in the numerous other branches above mentioned.

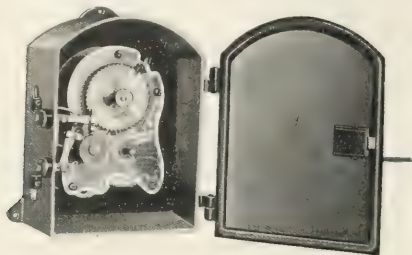


# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Electric Time Switch

The time switch illustrated herewith was designed by the Campbell Electric Company, Lynn, Mass., for a special purpose in connection with mining machinery, but can be used for many other purposes where it is desired to make electrical connections for certain spaces of time at regular intervals. The duration of time of connections may be

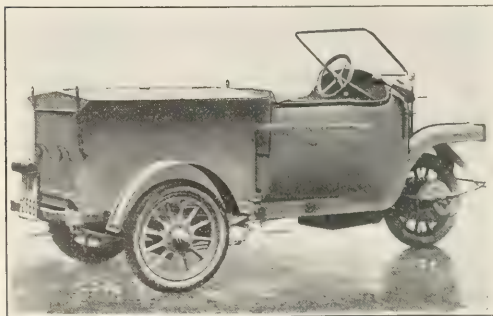


INTERIOR OF TIME SWITCH

varied to suit conditions. With this particular instrument the circuit is closed for ten seconds and then opened to be turned on again after fifteen seconds. This operation is repeated for twenty-four hours on one winding.

### Electric Tractor for Refuse Removal

In Europe considerable attention is being paid to the modernization of sewage collection and disposal methods, and it is probable that as the tendency to congregate in large cities increases and the congestion in such areas increases, the methods and apparatus employed in connection



THREE-WHEEL ELECTRIC TRACTOR

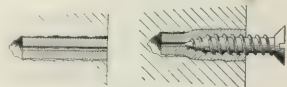
with such work will become more and more specialized. A very good example of the care and ingenuity in design which is being displayed in this connection is found in a new type of electrically propelled motor dust car built by the Elektromobil-Fabrik Gebhardt & Harhorn, of Schöneberg, Berlin.

Tipping of the body is effected by lifting the lever next

to the driver's seat, the balance being so maintained that this tipping action can be easily performed by the driver. In this way the services of only one man are needed for driving the car, loading and unloading. The cars are therefore very useful in collecting the refuse previously swept up from the streets. The rear of the car is supported on two wheels, while a single wheel carries the front end. Energy is supplied by a battery of forty cells of 80 volts terminal pressure sufficient to enable the car to cover about 50 miles with one charge of the battery at a speed ranging from 12 to 15 miles per hour. The motor is built solid with the front wheel, which it drives through reduction gearing. The vehicle can be reversed by means of a special switch. Energy from the main battery is also used for sanding the streets when required, the sand distributor being operated by a small electric motor. The refuse container at the rear of the car is detachable and in its place an extra seat can be fitted, the car being then adaptable for carrying passengers or inspectors.

### Fiber Screw Plugs

The so-called "Rawlplug" is a tube of stiffened fibers for fixing screws into brick, plaster, stone or any other hard material in which a hole can be drilled or "jumped." When the screw is driven in the plug expands, filling the hole as



FIBER EXPANSION PLUG

will be seen in the illustration. This plug replaces the manufactured wood plug or plugs cut by hand, and its cost is said to be only a fraction of that for the wood plugs. It is sold by the Sun Electrical Company, Ltd., 118 Charing Cross Road, London.

### Tungsten-Lamp Dimmers

The introduction of tungsten lamps has necessitated a change in design of commercial theater dimmers. The carbon-filament lamp when cold has a very high resistance. This resistance gradually becomes less as the temperature of the filament is increased, owing to an increase in voltage across the lamp terminals. In the tungsten lamp the action is exactly opposite. The cold tungsten filament has a very small resistance, but the resistance increases rapidly with the rise in temperature. The rapid change in the resistance with the change of candle-power makes the tungsten lamp extremely sensitive to even a slight variation of voltage, and for this reason dimmers designed to control tungsten lamps must be built with a considerably greater number of steps than is necessary with the carbon-filament lamps.

Experimenting is said to have shown that it is not possible to dim a tungsten lamp without a visible flicker if the potential across its terminals is changed by more than 1 volt per step, as the dimmer resistance is cut out of circuit.

It is also important in work of this kind that the dimmer contacts should operate very smoothly. It will be readily appreciated that a tendency to stick on the contacts would inevitably cause the operator to move across several steps at a time. That is, the moving arm of the rheostat would jerk from one point to another and skip several steps at a time, thus producing a flicker.



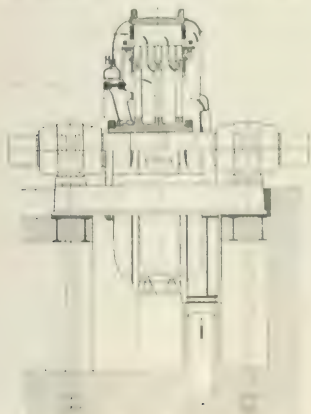
DIMMER FOR TUNGSTEN LAMPS

A dimmer designed by the Ward Leonard Electric Company is held to meet these conditions. Tungsten lamps may be dimmed by it from full light to darkness without the slightest flicker. The plates are 17 in. in diameter and may be banked for mounting either on top of the board or in any other of the many styles used in theater work.

The construction, with 110 steps of control, gives a variation of 1 volt per step through the whole range of dimming.

### Large Direct-Current Motors for Rolling-Mill Service

The application of electric drive to large reversing rolling mills is of comparatively recent date, as little attention was given by electrical engineers to the possibilities presented by rolling-mill industry until this form of energy had been introduced into almost every other branch of



CROSS-SECTION OF MOTOR SHOWING AIR EXITS

machine construction. During the early stages of development the units were comparatively small. However, a recent installation made by the Allgemeine Electricitts Gesellschaft at Hildesheim embodied a unit capable of producing a torque of 270 meter tons, or about 15,000 hp. The accompanying illustration shows a section through this motor and indicates the path taken by the cooling air,

which is fed to the machine under pressure after passing through air filters.

The difficulties encountered in the erection of machines of this size are by no means small, especially when the transportation facilities necessitate that the rotor be constructed in halves and the rotor winding be inserted and the armature bands of binding wire be wound upon the rotating element at the erection site. It is of interest to note that the total length of binding wire required for a rotor of this size is approximately 3.5 miles.

### Trackless Trolley Bus at Merrill, Wis.

Following the example set in England and on the mainland continent, the Merrill Railway & Lighting Company of Merrill, Wis., has recently put a trackless trolley bus into operation. On the route, which is about 2000 ft. long, the bus passes over the tracks of three street railroads and over a long bridge. The bus makes a round trip on this route every ten minutes and transfers passengers to the company's trolley cars at both end of the route.

The bus itself is an eighteen-passenger, single-operator vehicle of the polyaxial type and is equipped with a 300-volt, 12-hp. series motor and a free-stop controller.



EXHIBITION PASSENGER TRACKLESS BUS

controller and resistors. The motor drives a jack shaft through a universal shaft and bevel gear and the rear wheels are driven from this jack shaft in chains. Energy is taken from an overhead positive trolley and the return circuit is furnished by a negative trolley bar beside it, as shown in the accompanying illustration. Long trolley poles of special design allow a lateral freedom of movement of from 10 in. to 20 in. on both sides of the sliding wire, thereby insuring rapid response through the street cable. The bus weighs 40,000 lb., is 13 ft. 6 in. long and 6 ft. 6 in. in length and 6 ft. 6 in. in width. Long, flat springs and solid rubber tires add to the comfort of the passengers.

Although the vehicle has been in operation long enough to secure running experience, it is estimated that these data will compare very favorably with the test results which have been obtained in England, that is, 10 cents per car-mile.

It is stated by Mr. E. A. King, secretary of the Merrill Railway & Lighting Company, that the trackless trolley bus can be operated at a saving of 10 cents per car-mile over the cost of operating a trolley car along the same route. Under the conditions for operating trolley cars it would be necessary to have the roadway, bridge and railroad crossings in close proximity to the road to be added the

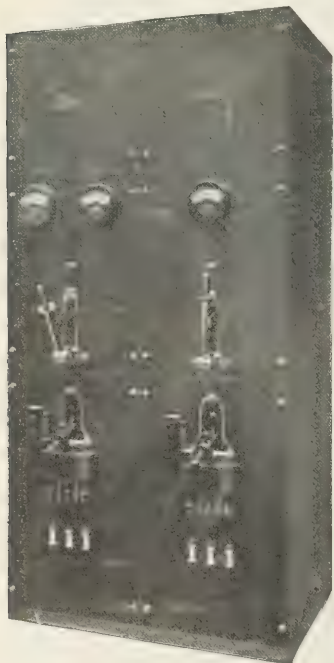
interest and depreciation charges on a track investment of \$7,000.

The trackless trolley bus was designed and manufactured by the Field Electric Bus Company, 135 Broadway, New York City, and is equipped with an Edison storage battery.

### Totally Inclosed High-Tension Switchboards

A new line of "foolproof" switchboard panels has been designed by the General Electric Company, 67 Queen Victoria Street, London, E. C. Among the points of novelty in this equipment is the inclosure of the disconnecting switches and busbars in a separate chamber on top of the compartment. In earlier types of such switchboards there was the possibility of coming into contact with some live section of the busbars or switches when access was gained to the compartment. In this improved pattern the live parts are partitioned off by solid metal barriers. Cleaning and adjusting can therefore be carried out with absolute safety.

The second point of importance is that the disconnecting links are firmly locked in position during the time the panel is in commission. The operation of the switches from the front of the board is also a valuable feature since it does away with the necessity of opening the doors to isolate a particular part. The interlocking of the various pieces of apparatus is, however, so arranged that it is impossible to open or close the circuit with the links, the opening and closing of the circuit being done only by the oil switch.



INCLOSED SWITCHBOARD

Neither marble or slate enters into the construction of the board, the busbars, terminals and isolating links being supported on porcelain insulators. The framework and panels are of boiler plate. No special foundations are required, and this, together with the fact that the whole of the gear is concentrated in the panel, greatly reduces the erection cost.

### Gymnasium Illumination

Gymnasium activities are largely carried on by artificial illumination, especially in Y. M. C. A. organizations and the playground parks of the large cities. Several popular gymnasiums are operated under the supervision of the Chicago West Park Commission, the one at Holstein Park being illustrated herewith. This gymnasium is 36 ft. wide

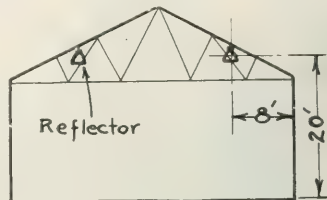


FIG. 1.—CROSS-SECTION OF GYMNASIUM SHOWING REFLECTOR POSITIONS

and 60 ft. long, with a balcony at one end projecting about 8 ft. into the room. The general arrangement of lighting units as indicated by the plan and section shows twelve outlets 20 ft. above the floor and about 8 ft. from the side wall. The so-called "X-Ray Bee-Hive" reflectors, inclosed in coarse wire baskets, provide, it is said, perfect illumination for the room. With 150-watt lamps for each reflector there is a consumption of 0.83 watt per sq. ft. The particular reflector installed comes down well over the lamp and thus shields the filament from view.

The clear definition of detail in the illustration indicates that there is plenty of light in the room and that it is properly and evenly distributed. There is also a remarkable absence of halation of glare about the light units. This is accounted for only by the fact that a direct view

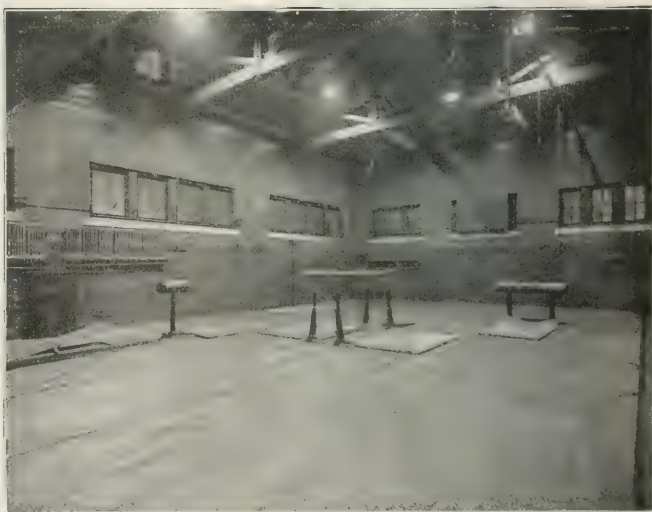


FIG. 2.—GENERAL ILLUMINATION OF GYMNASIUM

of the lamps is almost entirely cut off by the deep reflector. Wire guards protect the reflectors from damage to balls and swinging apparatus, but their presence does not affect the lighting results. The fastening for the guard is independent of the reflector support. This prevents any vibration or jar due to striking of the wire being transmitted to the lamp and reflector.



### Automatic Telephone System

Rights for the new Betulander automatic telephone exchange system recently developed in Sweden have been acquired for all other countries by the Marconi Wireless Telegraph Company, London, which has built a model exchange for demonstration purposes. Although resembling the familiar American Strowger system in some re-

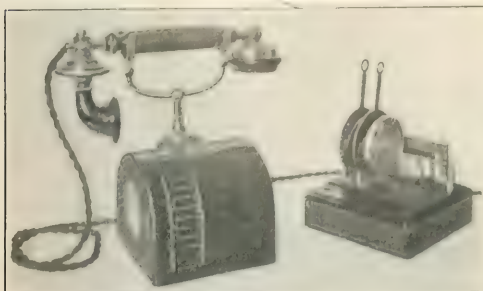


FIG. 1—SUBSCRIBER'S INSTRUMENT SET

spects, the Betulander equipment differs in that the horizontal field of the Strowger switch is not employed. Any line selector and connector switch can also be removed from the rack without even loosening a screw. Connections are made by contacts on the mounting plates registering with springs fitted on the rack. This arrangement not only greatly facilitates and accelerates repairs and maintenance but it introduces simplicity and flexibility which will allow the equipment of an exchange to be in exact agreement with the actual number of working subscribers' lines.

The subscriber's apparatus, shown in Fig. 1, consists of an ordinary telephone hand set combined with an "actuator" or impulse sender. This particular instrument is

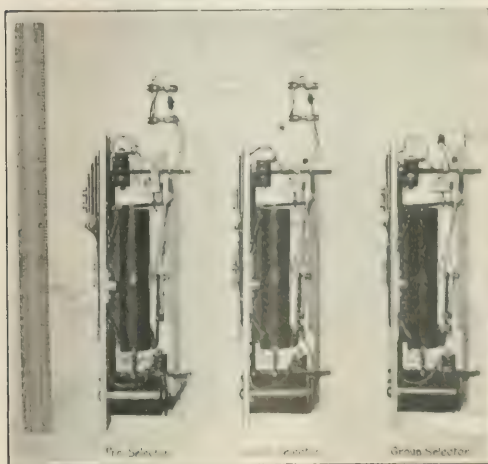


FIG. 2—SELECTORS WITH VERTICAL MOVEMENT

made for two-digit numbers only but the same type is used for any number of lines. To make a call the levers are pulled over against the figures of the desired number, and when the subscriber takes the receiver from the hook the levers return to their initial position and send successive impulses to the exchange.

At the exchange each subscriber's line is fitted with a

set of three line selectors. One selector completes the ringing current to the subscriber's line and the remaining three receive the incoming impulses and transmit them to the various selectors. The pulses and connections are assembled together in blocks of ten sets each.

The selectors shown in Fig. 2 have vertical movement only and require only three electromagnets, two of which are inserted in the same circuit. The third of these electromagnets a line wire is assigned, and the operation and release of the selector is effected by a suitable arrangement of reeds. The third electromagnet is operated from a local circuit through two contacts of one of the other magnets. In each position it is held the magnet out of the circuit both during the movement of the selectors (during movement) and when holding steady. The selectors are connected as shown in Fig. 3 to give a full ten. The pulses also enter the selector fields to select the various lines and trunks in sequence. A group from which a pre-selector and a unit-selector have been removed is shown the correct field in Fig. 4.

In large exchanges a pre-selector is used which chooses an idle trunk in a group selector for the first light. This selector operates only during the waiting time holding the paper hole to gravity. A second magnet over a set of horizontal wires to which the trunks are connected and which are in a position on the trunk the



FIG. 3—DIAGRAM OF CONNECTION BETWEEN SUBSCRIBERS

third electromagnet is the bottom of the selector, which operates against a spring wire, which is engaged so that the wipers are pressed hard against the horizontal wires. The subscriber's instrument is then connected through the pre-selector to a group selector, which now transmits to the first series of impulses with out to the connector, the pre-selector in the meantime has been automatically locked by position and disconnected so that when it has not been affected by subsequent impulses. Have been released first of selectors leaving permanently no longer shall come in the position of the next group that will be the type received to the next series of impulses and so on. The selector is then connected through all of the selector selectors to find the desired subscriber.

If the use of the called subscriber's line, the next group immediately returns to normal and sends the return of all other selector in the series. When there is no line the connection. This feature is in design in an advantage of the system as the selector of particular does not have to wait for the calling subscriber to hang up his receiver, and a connection is made with the pattern of trunks can be replaced. The number "two" back signal is given with a two digit group. The movement of either of the telephone is in each back position of all of the selectors in their normal position to a complete movement.

In the diagram of Fig. 31 two subscribers' instruments are represented by numbers 248 and 045. When he desires

to call, subscriber 645 first sets up the number desired on his actuator and lifts the telephone from the switch hook. An impulse is transmitted over the line *A* to the relay set *B* belonging to the calling subscriber, which in turn operates the subscriber's pre-selector *C*. This pre-selector automatically and instantaneously selects the first idle line of the group of trunk lines *E* assigned to the group of subscribers to which 645 belongs. Assuming in this case that the first free line is the second trunk, the connection is thereby extended to the corresponding "hundreds" selector in the group *F*. This selector receiving the first group of impulses sent out by the actuator will be stepped up to the third position, selecting the "hundreds" group in which the called subscriber is located. The connection is now extended to an auxiliary "hundreds" selector. This is one of the group of ten (shown at *G*) to which all subscribers between the numbers of 600 and 699 have access when calling for any number between 200 and 299. The auxiliary "hundreds" selector immediately operates to find a trunk line connected with an idle "tens" selector, which in this case is assumed to be the fifth. The connection is now extended to a "tens" selector, the fifth in the group *H*. The second set of impulses sent out by the subscriber's actuator serves to operate this "tens" selector, stepping it up to the

this position connection is completed and the complete connection is shown in dotted lines.

In the diagram are also shown the selectors which are brought into operation when a call is made between the same two subscribers in the reverse direction; that is, from subscriber 238 to subscriber 645. The completed connection is shown in heavy lines.

### Small Motor-Driven Refrigerating Plants

The use of ice to produce cold is for various reasons diminishing. Under the best of circumstances, much ice goes to waste because of the inherent difficulties of keeping

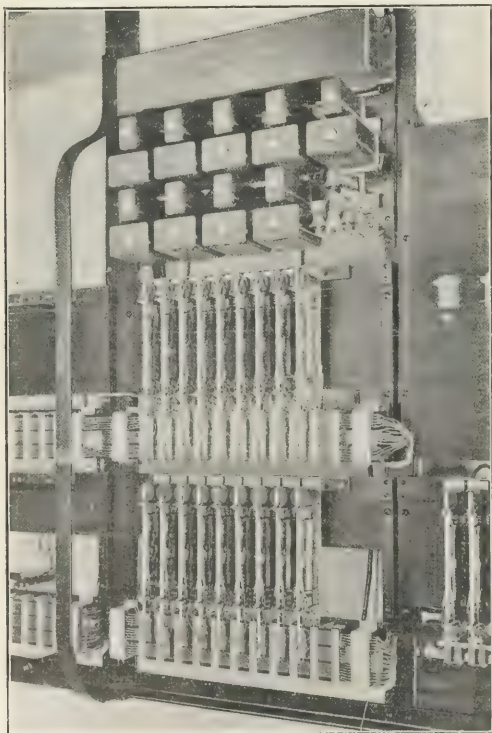


FIG. 4—PANEL WITH SELECTORS REMOVED TO EXPOSE CONTACT FIELDS

fourth position and thereby selecting the ten 30 to 39 of the hundred 200 to 299. Corresponding to the fourth position of the "tens" selector are ten "units" selectors *J*, all of which have access to numbers 230 to 239. As the fifth "tens" selector was used, the connection is extended to the fifth "units" selector, which is operated by the last set of impulses and is stepped up to complete the connection. In



SMALL REFRIGERATING PLANT

it properly. Where there is ice there must be dampness, and damp wood, sawdust and drains are liable to be germ-laden. The temperature produced by ice cannot be easily regulated, and the maximum degree of cold that can possibly be produced is not sufficient for many purposes.

Mechanical refrigeration supplies dry cold of any desired degree; the temperature produced can be readily varied to suit different purposes, and experience goes to prove that, under average conditions, mechanical refrigeration is cheaper than ice.

The electric motor permits the use of mechanical refrigeration in very small units, which need little attention. Ice-cream plants find them far superior to the old salt-and-ice mixture for freezing and hardening the cream. Large industrial plants use them for cooling drinking water, which is pumped to fountains in all parts of the works. The florist finds for them a special application for preserving flowers and preventing buds from opening until wanted for sale. Modern apartment houses supply each tenant with a mechanically cooled refrigerator.

The cost of operation varies, of course, with conditions, the principal items of the operating expense being for electrical energy, water, oil and ammonia. The last two are small, as little oil is needed and one supply of ammonia should last a year or two.

The cost of energy depends on the size of the plant, it being customary to allow 2 hp in motor rating per ton of refrigerating capacity. The illustration shows a Brecht refrigerating machine driven by a 10-hp Westinghouse motor.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Fan Exports.**—The Hunter Fan & Motor Company, of Fulton, N. Y., announces that sales of fans for export to Asia and South America have shown an increase this year over those of former years. The larger Asiatic shipments have been to India, and Brazil has placed the larger orders from South America.

**Train Dispatching by Telephone.**—Telephone train dispatching has been found satisfactory by the Erie Railroad on the lines east of Buffalo, and at the present time this method is in operation on the section between Port Jervis and Hornell, N. Y. It is planned to extend this service and installation work is now in progress on the Buffalo division.

**Activity in Sales of Heating Devices.**—J. H. Bunnell & Company, of 20 Park Place, New York City, claim that they are having excellent sales of their line of Pelouze electric heating appliances. Their fan season is not yet well launched. One of this concern's specialties is its line of wireless telegraph apparatus, and good sales of this line are also experienced at present.

**Firm Market in Mica.**—Recently interviewed as to present conditions in the mica business, Mr. Oskar Melowsky, of Melowsky Brothers, New York, stated that the market is firm and that he does not look for any further rises. He thinks that because of the unsettled condition of the tariff some of the larger buyers are holding off. Another large New York dealer, who would make no formal statement, said that conditions in general are satisfactory.

**Condenser Orders from the Far East.**—Orders for condenser equipment for export are being filled by the Allinger Pump & Condenser Company, of New York, the shipments being destined for Hawaii and the Philippine Islands. Recent domestic orders for pumps and condensers have been well distributed over the United States, and the sales in these lines so far this year have shown a substantial gain over those for the corresponding period of 1912.

**Generating Equipment Increased.**—There is being installed at the present time, at the Spartanburg plant of the South Carolina Light, Power & Railways Company, a 2,000-kw general electric steam turbine generator unit and Babcock & Wilcox boilers and De Laval pumps. As mentioned in our issue of May 24, this station will supplement a larger hydroelectric plant at Gaston Shoals, and the unit now being installed will bring the capacity of the steam plant up to 4,500 hp.

**Expansion of Electric Service in Ohio and Pennsylvania.**—A new central station of 2,000-hp rating has just been completed and put in operation at Lowellville, Pa., about half way between Youngstown, Ohio, and New Castle, Pa. The plant is owned by the Shenango Valley Railway & Light Company, which controls twenty-six public utility properties in this vicinity. A high-tension transmission line connects the cities of Youngstown and New Castle and it is stated that an addition of over \$200,000 to the gross revenue of the company has been made through the contracts closed since the completion of the Lowellville station.

**Possibility of Extensive Electrification by the Pennsylvania Railroad.**—It is reported that Gallitzin, Pa., has been chosen as the site for an immense generating station on which work will be started shortly by the Pennsylvania Railroad. This location, a little west of Altoona, is said to be close to large coal fields owned by the railroad company and which will be developed in connection with this project. Energy supplied by the Gallitzin station will be used at first for operating switches and for lighting, but it is believed that the company plans to use it later in operating electric trains on the line between Altoona and Pittsburgh, Pa.

**Belden Factory Extended.**—In order to save the expense of weighing, labeling and rewinding and the loss in breakage and theft of transformer material in handling loose coils, there is a growing feeling among manufacturers of electrical apparatus to purchase a considerable amount of wire in the form of coils. A special effort to meet this demand has been made by the Belden Manufacturing Company, of Chicago. As the representative of a very complete equipped coil department. During the present year additional space has been taken and the company's factory enlarged by 175 per cent the new space being devoted largely to the increased production of standard and custom-made coils in the form of bobbins and drum windings.

**Big Engineering Work Progressing in Brazil.**—Supplementing the notes in the Jan. 14 and May 17 issues of the *Electrician* in connection with the recent import of equipment of 6 per cent convertible preferred stock by the Brazilian Traction, Light & Power Company, Ltd., it is of interest to observe that contracts concerning work to be finished at the Government's Santa Americana premises. There is under construction a power house for generating the water of the Uruguai River into a constant supplying the 32,000-hp generating station at Rio das Lages, Brazil. This station is to be constructed on the left bank and when complete will be 144 m. in length. The company will have a total of \$2,000,000 in the Brazilian currency.

**Special Searchlamp Order from California.**—The Carlisle & Finch Company, of Springfield, Ohio, is the recipient of an order for a considerable lot of the same of California, an unusual and interesting order. In the Salinas & Santa Catalina Islands, in the Pacific Ocean there are a great many flying fish and the fishermen are constantly made by Mr. Joseph M. Ayer, a resident of Ayer's Cove, that these fish are attracted by the light from a searchlamp and will fly through the beams of light at some distance. Advantage is to be taken of this phenomenon to add to the attractions of a popular amusement by exposing the fish with a powerful searchlamp. The above company will furnish the fishermen the necessary searchlamp and auxiliary electrical apparatus for the service.

**Maryland Companies Consolidate.**—According to some advisers a number of public utility companies in and about Hagerstown, Md., have been asked under the name of the Hagerstown & Potomac Railway, which has been authorized by the Public Service Commission of Maryland to issue common stock to the amount of \$2,000,000 and 1 per cent bonds to the amount of \$1,000,000, for redemption of substantial bonds of the consolidated companies, possession of these assets and good location of some properties. These properties, consisting of various lines and water power plants are all located in the counties of Frederick and Washington, Md. The financing will be managed by Miles & Peck, Inc., of Saratoga, N. Y., who will have charge of the financing of the properties and their future development.

**Merger of Pennsylvania Public Utilities.**—A considerable number of gas and electric properties in eastern Pennsylvania were offered last week, when the Philadelphia Electric Gas & Light Company, the Schuylkill Central Gas Company and the Camden & Mount Airy Electric Company asked for the merger of the northern electric holding company which is controlled by H. H. Walbridge & Company of Wall Street, New York. The merger would be effected by the Philadelphia Electric Company, the Camden & Mount Airy Electric Company, the Schuylkill Central Gas Company, the Philadelphia Electric Gas & Light Company and the Camden & Mount Airy Electric Company. Both gas and electric lines are being supplied to the northern and city service.



has been greatly improved. The consolidated companies will be managed through the New York office.

**Utah Securities Corporation Prospering.**—The properties controlled by the Utah Securities Corporation showed for the month of April gross earnings of \$136,005 and net earnings of \$81,623.

**Germantown Concern Growing.**—The Wirt Electrical Specialty Company, of Germantown, Pa., has recently made additions to its plant which give to the press department an increase in floor space of 8000 sq ft.

**Salary Increases for Toronto Hydro-Electric Employees.**—Following considerable agitation among the employees of the Toronto Hydro-Electric Commission for an increase in wages, there was recently granted by the commission a general raise, affecting a large number of electrical workers.

**Individual Electric Drive for Grinders.**—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., is supplying a line of alternating and direct current motors in sizes of 3 hp and 5 hp for use on an attractive type of double-disk grinding machine recently put on the market by the United States Electrical Tool Company, of Cincinnati, Ohio.

**Costly Central Station Blaze.**—A recent fire at the plant of the West Penn Traction Company at Connellsville, Pa., which supplies electricity for light and power to Fayette, Westmoreland, Washington and parts of Allegheny and Armstrong Counties, crippled the industries and caused the suspension of trolley traffic for about twelve hours. The fire destroyed eight transformers valued at \$50,000.

**Floods Help Power Companies.**—Two local lighting plants at Lafayette, Ind., namely, the Merchants' Electric Light Association and the Indiana Lighting Company—have taken advantage of the recent floods to make a change from their former 220-volt direct-current service to three-phase alternating current. This change affects quite a large amount of motor equipment, but is reported to be progressing rapidly.

**Street-Lighting Plans at Fort Wayne, Ind.**—The city of Fort Wayne, Ind., has just awarded to the Hanna-Brackenridge Company the contract for installing five light ornamental posts on three of the business streets, similar to posts now in use in other parts of the city. Besides this, as a sample installation, a number of ornamental posts, each bearing a single magnetite-arc lamp, are being erected by the same company.

**Stromberg-Carlson Reorganization.**—Since last July the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has been liquidating its preferred stock, preparatory to the formation of a new company to carry on the business. Just when this reorganization will be perfected is not known, but the company's present condition is shown in the statement issued by it to the effect that its business has increased every month since last July.

**Motor Drive for a Sawmill and Planing Mill.**—The electrical department of the Hanna-Brackenridge Company is now installing 300 hp in motors in the sawmill and planing mill of the Perrine Armstrong Company, at Fort Wayne, Ind. Individual drive is being used wherever possible, and the installation is to be a model one in every respect. Fort Wayne Electric Works motors are being used, and energy will be obtained from the Fort Wayne & Northern Indiana Traction Company.

**Consolidation of Selling Organizations.**—The Canadian General Electric Company, Ltd., which owns and controls as subsidiary companies the Canada Foundry Company and the more recently acquired Canadian Allis-Chalmers, Ltd., has decided to consolidate the selling organizations of the two latter companies, dropping the name "Canada Foundry Company, Ltd.," and conducting the selling organizations of both companies under the name of "Canadian Allis-Chalmers, Ltd."

**Shurlock Sockets Taking Well.**—It is stated by Pass & Seymour, Inc., of Solvay, N. Y., that they are having a tremendous sale of their Shurlock lamp sockets in isolated plants, hotels and office buildings. One of the larger installations made recently was that in the Union Central Life Insurance Building, in Cincinnati, Ohio, where upward of 4000 of these protecting sockets were placed. At the

Central Y. M. C. A. Building in Cleveland, Ohio, there are 1500 sockets of this type used.

**Western Electric Branch in New Orleans.**—In order to secure the advantage afforded by its proximity to Southern jobbing centers, particularly those in the Mississippi Valley, the Western Electric Company has leased the three-story building at 309 and 311 Magazine Street, which after being remodeled will be occupied as its New Orleans branch. It is claimed that local jobbers in that vicinity are especially pleased with this arrangement, as it will facilitate the handling of their business by maintaining within easy reach a very complete stock of certain classes of electrical supplies.

**Generating Station Projects in Pennsylvania.**—Three new generating plants are soon to be built in Pennsylvania. The contract for a power station and pump house at Yardley has been awarded by the Philadelphia & Reading Railway to the Fred. A. Havens Company, of Philadelphia. A 30,000-hp hydroelectric station to cost \$1,000,000 will be erected at Williamsburg by the Penn Central Light & Power Company. Communication between this plant and the company's headquarters at Altoona will be maintained by wireless telegraph. McClenethan Brothers, of Readville, broke ground at Naginoy on May 29 for a 1000-hp generating station which will be laid out with provision for future expansion.

**Stone & Webster Properties Show Decided Gains.**—The summaries from the annual reports of twenty properties controlled by Stone & Webster and scattered all over the country, from New England to Florida and Texas, show decided gains in net earnings. The average increase in the net earnings on these properties for the fiscal year ending April 30 was slightly over 12 per cent. The greatest per cent increases were attained by the Dallas (Tex.) Electric Corporation and the Galveston-Houston (Tex.) Electric Company, each showing a gain of 44 per cent in net earnings. The actual combined increase of net earnings for the twenty companies was about \$1,110,000. The largest gain was \$278,255 by the Galveston-Houston Electric Company and the heaviest loss was \$26,969 by the Jacksonville (Fla.) Traction Company. Another feature worth noting specially in connection with these annual statements was that material additions were made to their surplus by fifteen out of the twenty properties.

**Have Outgrown Their Present Factory Accommodations.**—Mathias Klein & Sons, of Chicago, Ill., manufacturers of linemen's tools, inform us that their business has increased to a point where it cannot be adequately handled with their present factory accommodations and that they are planning to move into larger quarters about Aug. 1. The new factory at Kedzie and Belmont Avenues, now in process of erection, will consist of a main building, 52 ft. by 140 ft., three stories in height, and of a forge shop of fireproof construction, 62 ft. by 161 ft., with an addition, 40 ft. by 70 ft., for boiler and engine room and gas plant, and another addition, 20 ft. by 62 ft., for storage of steel. Power will be developed by a 16-in. by 36-in. Murray Corliss engine with a belt transmission to the forge shop. Power for the machine-shop grinding machinery and assembling shop will be furnished by a 100-kw generator and a number of motors, this equipment being supplied by the Western Electric Company. A producer gas plant of ample capacity will supply fuel for the forging, annealing and tempering furnaces. These changes will not affect the executive offices, which will remain as at present at 562 West Van Buren Street, Chicago.

**Electric Drive in India.**—A large contract for motor and transformer equipment for use in the textile and flour mills in the Bombay district, India, has recently been secured by the British Westinghouse Electric & Manufacturing Company, of Manchester, England. The energy for these mills is to be supplied from the mains of the Tata Hydroelectric Power Supply Company. The motors ordered are all of the Westinghouse "A-I-F" slip-ring, protected type, operating on three-phase current at 2000 volts and 50 cycles. There are 207 of these motors on order at present in sizes ranging from 50 bhp to 500 bhp. The motors are to be directly coupled to the line shafting in the majority of cases, and will have speeds of 290 and 365 r.p.m. Motor switch

pillars of the Westinghouse type "S" pattern are to be supplied, along with liquid controllers for starting. The transformers ordered are three-phase, oil-immersed, self-cooled units, arranged to reduce the voltage from 6000 to 2000. Of these there are sixty-four in all, twenty-two of 500-kva rating, fourteen of 600 kva, twenty-one of 700 kva, and seven of 900 kva. This equipment will be installed in thirty-one mills in the Bombay district.

**Electrical Development in Japan.**—The use of electricity by the Japanese for power purposes and for street lighting is said to be very large. A prominent American railroad man, on his return recently from a trip through Japan, expressed surprise at the extent of this development and that of railway facilities.

**The Energy Supply Business in Michigan.**—The Commonwealth Power Railway & Light Company, operating in the State of Michigan, controls at the present time seventeen hydroelectric generating stations, aggregating 70,000 hp installed capacity, and seven steam-driven generating plants, with a total capacity of 99,000 hp. Sales of electricity for power purposes in Michigan have increased about 20 per cent a year for several years, and during the fiscal year ended Feb. 28 the combined sales for commercial lighting and power purposes amounted to 277,128,062 kw-hr. A total of 905 miles of high tension transmission line is operated by the company, and its net earnings for the year ended March 31 were \$5,532,252.

**Asbestos Consumption Large in the United States.**—The United States and Canada combined yield a good part of the world's annual output of asbestos. Georgia, Vermont and Wyoming are the states which mine asbestos, but the Canadian production greatly exceeds that of this country. However, the United States, besides using all of its own product, imports the larger part of the Canadian output, the manufactured asbestos finding wide application as an insulator against heat and electricity. According to a recent report of the United States Geological Survey, the domestic production of asbestos in 1912 was 4403 short tons and the imports from Canada were 71,426 tons, or 61 per cent of the total Canadian output and 81 per cent of the Canadian exports.

**American Traction Engines in Demand Abroad.**—From Fairbanks, Morse & Company, of Chicago, who manufacture internal-combustion engines, steam and power pumps, railway supplies, electrical machinery and windmills, and who maintain branch offices in London and Buenos Aires, the following statement bearing on the export situation is obtained: "Our export business this year has thus far been very satisfactory, showing a very gratifying increase over last year or any previous year, in fact, and the outlook for the immediate future is in every way promising. This is particularly the case with reference to our engine lines, especially our oil traction engines, also as regards our line of railway supplies. In our electrical apparatus the foreign business so far this year has not been relatively as good as in the other lines, but we have some fair prospects for future business in that line."

**Extension of Transmission Line in Ontario.**—The Hydro-Electric Power Commission of Ontario has decided to start work at once on the St. Thomas Windsor transmission line. The route of the section from Chatham to Windsor has been selected, running through Tilbury, and the erection of the poles will now go ahead briskly. The commission has not decided upon the route between St. Thomas and Chatham and is securing further data to enable a choice from the five routes under consideration. The commission has also authorized the purchase of Wausdell Falls, from which energy will be generated to supply the municipalities of Beaverton, Cannington, Brechin, Sunderland and Woodville, which have signed contracts securing this supply. The City Council of St. Catharines, Ont., recently decided to turn to the commission for its supply of energy for industrial purposes, and there is a possibility that its street-lighting load will be given to the commission also.

**Tariff Thought to Have Little Effect on Electrical Industry.**—Figures were shown recently supporting the claim that the proposed changes in the tariff would have small effect on the electrical industries of the country. Comparing exports and imports of electrical machinery, apparatus, and supplies, it was stated that the value of imports suf-

ficiently important to be recorded by the United States Bureau of Foreign and Domestic Commerce runs about \$500,000 per annum, while the total production of electrical goods in this country during the same year is about 2,000,000,000. It was asserted, furthermore, that repeated attempts of foreign manufacturers to establish branches in this country had met with unsatisfactory results, but nothing was shown to prove that similar attempts aided by a reduced tariff would result the same way. Several of the leading American manufacturers of electrical goods, notably the General Electric Company, the Western Electric Company and the Westinghouse Electric & Manufacturing Company, have not made branches abroad, and it is considered foreign countries are American electrical goods. It is the success of these companies which makes possible the sound condition of the American electrical industry. This supremacy is attributable to the large amount of pioneer and research work done in this country along electrical lines, and to the fact that better conditions are made to make the greater efficiency of the machinery being constructed expected of foreign laborers.

### May Statement of Copper Producers' Association

Comparison of the last report of the Copper Producers' Association, issued May 8, with figures for the preceding month shows the following changes:

Stocks on hand in the U. S. at end of month.	May	April
Produced in U. S.	1,172,000	1,172,000
Imported from foreign	1,172,000	1,172,000
Exported to foreign	1,172,000	1,172,000
Stocks on hand in the U. S. at end of month.	1,172,000	1,172,000

### Industrial Securities

Security	Price	Dividend	Yield
Aluminum Co. of America	100	10	10%
Am. Electric Works	100	10	10%
Am. Locomotive Works	100	10	10%
Am. Machine Works	100	10	10%
Am. Rolling Mills	100	10	10%
Am. Steel Works	100	10	10%
Am. Traction Engine Works	100	10	10%
Am. Wire Works	100	10	10%
Westinghouse Electric & Mfg. Co.	100	10	10%
W. & A. Electric Works	100	10	10%

### NEW YORK METAL MARKET PRICES

	— June 3 —		— June 10 —	
Commodity	Price	Change	Price	Change
Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
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1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
1000 lb. Standard 1000 lb. case	100	0.00	100	0.00
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## Personal

**Mr. Henry L. Doherty** returned from Europe last week. While in England Mr. Doherty placed \$3,000,000 City Service Company's five-year 7 per cent bonds with investors.

**Mr. B. W. Duncan**, formerly with the St. Joseph (Mo.) Railway Light, Heat & Power Company, has been appointed superintendent of the City Light & Traction Company of Sedalia, Mo., vice Mr. D. F. Webster, resigned.

**Mr. B. F. Pearson**, general superintendent of the Southern California Edison Company, of Los Angeles, Cal., is absent on an extended trip through Europe. He will first visit his old home in England and then travel on the Continent.

**Mr. Edwin H. McFall**, who was for seventeen years president of the National Automatic Fire Alarm Company of Louisiana, will assume his duties on July 1 as resident manager of the New Orleans branch of the Western Electric Company.

**Mr. Frank H. Mott**, of Jamestown, has been appointed secretary of the Public Service Commission, Second District, State of New York, as successor to Mr. John S. Kennedy, whose resignation was announced in these columns on Feb. 8, 1913.

**Mr. E. B. Burritt** has been elected secretary-treasurer of the American Electric Railway Association as successor to Mr. H. C. Donecker, who resigned from the association to become assistant general manager of the Public Service Railway of Newark, N. J.

**Mr. Thomas N. McCarter**, of the Public Service Corporation of New Jersey, of Newark, N. J., had a testimonial dinner tendered to him at Delmonico's, New York, June 2, by the directors of the company in celebration of the tenth anniversary of the organization. On behalf of the officers and directors Mr. McCarter was presented with a silver punch bowl which was concealed during the dinner under an imitation birthday cake in which ten candles had been stuck.

**Mr. Lawford Grant**, president and managing director of the Canadian British Insulated Company, Ltd., Montreal, Que., representative of the British Insulated & Helsby Cables, Ltd., of Prescott, Lancashire, England, and honorary secretary of the Institution of Electrical Engineers, has resigned his post as managing director to take up an important position with the Eugene F. Phillips Electrical Works, Ltd., Montreal, Que. Mr. Grant will in all probability retain the presidency of the Canadian British Insulated Company, Ltd.

**Mr. H. E. M. Kensit**, who for some time past has been attached to the water-power branch of the Canadian Department of the Interior at Ottawa, Ont., has been appointed city commissioner at Prince Albert, Saskatchewan. Prior to his employment by the Dominion government, Mr. Kensit, who is a member of the Institution of Electrical Engineers and the American Institute of Electrical Engineers, was engaged in investigating and reporting on various projects in Canada and the United States for the firm of Smith, Kerry & Chace of Toronto.

**Prof. Arthur J. Rowland**, director of the School of Engineering, Drexel Institute, Philadelphia, and identified with Drexel as professor of electrical engineering and in his present capacity since the foundation of the institute in 1892, is widely talked of as the probable successor to Dr. Alexander MacAlister, who resigned as president of Drexel Institute on June 5. Professor Rowland has the active support of the engineering alumni, and as it is by their work and standing that Drexel is best known, it is likely that the board of trustees will give due weight to their recommendation.

**Mr. Eugene Holcomb**, who resigned from H. M. Byllesby & Company on April 1, has associated himself with W. T. McCaskey & Company, of Lansing, Mich., who control the new Continental Utilities Company. Mr. Holcomb is vice-president and general manager of both organizations. The firm of W. T. McCaskey & Company is organized to do engineering and public-utility management. The Continental Utilities Company at present owns and operates, through W. T. McCaskey & Company, electric-service properties in smaller towns in the States of Michigan, Indiana, Ken-

tucky, Iowa, Missouri and Minnesota. Mr. Holcomb, who was lately manager for the Consumers' Power Company at St. Paul, is president of the Minnesota Electrical Association.

**Mr. C. H. Baker** has been appointed mechanical engineer of the Public Service Electric Company, Newark, N. J. Mr. Baker was graduated from Lawrence Scientific School in 1902 and since then has been identified with Westinghouse, Church, Kerr & Company as construction engineer, the Brooklyn Rapid Transit Company as power-station inspecting engineer, the New York, New Haven & Hartford Railroad as assistant chief engineer of its Cos Cob plant, and the Hoosac Tunnel power station of the Boston & Maine Railroad and the Berkshire Street Railroad as chief engineer.

**Mr. W. N. Gorenflo**, general manager of the Gulfport & Mississippi Coast Traction Company, who was recently elected president of the Mississippi Electrical Association, was born at Biloxi, Miss., in 1877. Graduating from public school there, he entered the Mississippi Agricultural and Mechanical College at Starkville, completing the mechanical course in 1899. After entering the oyster-canning business and later becoming assistant cashier of the Bank at Biloxi, he helped organize, in 1903, the Biloxi Electric Railway & Power Company, becoming its first secretary and manager. In 1905 the company was sold to the Gulfport & Mississippi Coast Traction Company, and in the following year Mr. Gorenflo was made general superintendent of the system.

**Mr. Weldon Winans Freeman**, who was elected chairman of the Hydroelectric and Transmission Section of the National Electric Light Association at its convention in Chicago last week, is at present general manager of the Alabama Interstate Power Company of Birmingham, Ala., having resigned as vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn a year ago. Mr. Freeman was born in Exeter, Ont., June 8, 1872, and entered the service of the Edison Electric Illuminating Company of Brooklyn, in 1889, as a stepographer. He rose to the position of private secretary to the general manager, and then by steady steps became assistant secretary and then secretary, treasurer and finally vice-president and general manager. His promotion carried with it similar promotion in companies allied with the Edison company, in all of which he is held in the highest esteem both by his business associates and by the employees of the company. Mr. Freeman is a past-president of the Association of Edison Illuminating Companies and the National Electric Light Association and is a member of the following societies: The American Institute of Electrical Engineers, the Illuminating Engineering Society, the New York Electrical Society and the Canadian Society of New York.

**Hon. Adam Beck**, chairman of the Hydro-Electric Power Commission of Ontario, sailed last week for a six weeks' visit to England in search of relaxation and where also several electrical matters will require part of his time. As the leading exponent of municipal ownership and operation of public utilities in Canada the career of the Hon. Adam Beck has been watched with very much interest, because he has aroused enthusiasm in the movement as much from the admiration which his personality inspires as from his unselfish services to the cause which he has espoused. His father, a German, founded the town of Baden, Waterloo County, Ont. Mr. Beck was born there on June 20, 1857, and was educated at Rockwood Academy and Tassie's Grammar School at Galt. In private business he is a manufacturer of veneering, thin lumber and cigar boxes, with factories in London, Toronto, Montreal and Winnipeg. Mr. Beck was Mayor of London in 1902-1904 and has represented that city in the Legislature since 1902. He was appointed commissioner in 1903 to develop Niagara energy, became president of the Union of Municipalities in 1904, introduced the Niagara power bill in 1906 and has been chairman of the commission since his appointment to that office in June, 1906. He is entitled to the prefix "honorable," as he has been a Minister without portfolio since February, 1905. Besides his work in connection with the Hydro-Electric Power Commission of Ontario, Hon. Adam Beck is a leading spirit in the battle against tuberculosis, is a member of well-known social clubs and as a horseman is as prominent in New York and London as in Toronto.



## Construction

### New England

**PORTSMOUTH, N. H.**—Bids will be received by the U. S. Navy at the Yards and Dock, Navy Department, Washington, D. C., until June 21, for furnishing and installing electric hoisting machine and accessories for elevator in naval prison, Navy Yard, Portsmouth. Plans and specifications may be obtained on application to the Engineer. H. R. Stanford is chief of bureau.

**CHILMARK, MASS.**—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 15, for installing an electrical distribution and street lighting system at the city hospital, Chilmark, Mass., to cost about \$1,000. Specifications may be obtained on application to the Engineer. H. R. Stanford is chief of bureau.

**FALL RIVER, MASS.**—The contract for the ornamental lighting system for a period of five years has been awarded by the Mayor, under the terms of which the city is to pay two-thirds of the cost and the remainder to be paid by the merchants on the Fall River Light Co.

**FALL RIVER, MASS.**—The American Printing Co. of Fall River will install an electric power plant in connection with its weekly press. The equipment will include two 100-hp General Electric motors, two 1500 kw General Electric three-phase, two-pole generators with governor board equipment and three transformers. George P. Gilmore is engineer in charge of the work.

**PALMER, MASS.**—The Central Manufacturing Co. of Palmer expects to make miscellaneous small low-voltage and 110-volt line and quantities of material for distribution centers for region customers. H. M. Parsons is manager.

**SOUTHBRIDGE, MASS.**—The Webster & Southbridge Co. is contemplating improvements to its system in Southbridge. It now costs \$15,000, and in Brimfield, involving an expenditure of about \$20,000, extending its transmission lines through to Southbridge and Brimfield, a distance of over 8 miles. Another line will be erected through Cambridge to Charlton Depot.

**SPRINGFIELD, MASS.**—The City Council has appropriated \$34,000 to build a new heating and lighting plant at the observatory and to convert the present boiler room into a boiler. A new boiler house will be erected, a new furnace and a new battery of boilers constructed.

**KINGSTON, R. I.**—Bids will be received by the Board of Control and Supply, Room 18, State House, Providence, R. I., until June 15, for additions to the power plant for the Rhode Island State House. Plans, specifications and drawings for which are on file in the office of the Board of Control and Supply. William A. Stoddard is engineer.

**PROVIDENCE, R. I.**—The Narragansett Electric Co. of Providence has decided to erect a large addition to the Roger Smith power house at a cost of about \$40,000.

### Middle Atlantic

**BROOKLYN, N. Y.**—Bids will be received by Bruce S. Thompson, commissioner of water supply, gas and electricity, Room 1001, No. 31 Park Row, borough of Manhattan, until June 15, for the furnishing and delivering wet connection sleeves and tapping sleeves required to complete the contract abandoned by the Interior Electric & Marine Co. Blank forms and copy of contract, including specifications, may be obtained upon application to the office of the department.

**RUFFALO, N. Y.**—Bids will be received by Frederick G. Ward, commissioner of public works, Room 5, Municipal Building, Buffalo, until June 18, for electrical work, erecting and plumbing required in the erection of a new bedroom, two-pole, radial building, to be located on Sears Street, near Broadway. A separate and distinct contract must be submitted for each of the following items: (a) the erecting of electrical work, telephone system, lighting system, and (b) lighting, insulating, radiation etc., wet plumbing, drainage, gas piping, etc. Plans and specifications may be seen at the office of the Buffalo building commissioner, Room 5, Municipal Building, where blank forms of proposals may be obtained.

**RUFFALO, N. Y.**—Bids will be received by Frederick G. Ward, commissioner of public works, Room 5, Municipal Building, Buffalo, until June 18, for construction of a new two-story brick building, to be known as engine house No. 31, and located on Chicago Street, near Bailey Avenue. A separate and distinct contract must be made for the following divisions of the work: (a) Masonry, including iron work, plastering, paving, etc.; (b) carpentry, including drainage, fuel water, etc.; (c) roofing, sheet metal, gas piping, etc.; (d) electrical work, wiring, lighting fixtures, etc.; (e) plumbing, drainage, gas piping, etc. Plans and specifications are on file at the office of the Buffalo building commissioner, Room 5, Municipal Building, where blank forms of proposals may be obtained.

**SENECA FALLS, N. Y.**—The Central New York Gas & E. Co. will erect at once 87 ornamental street lamps, to cost \$10,000, in Seneca Falls. R. C. Smith is superintendent.

**SOUTH GLENS FALLS, N. Y.**—The Board of Village Trustees has signed a contract with the Electric Co. of N. Y. & N. E. Co. of Hudson

County, not to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**BLANPAIN, PA.**—The Pennsylvania Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**COLEBROOK, N. H.**—The Colebrook Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**NEW BEDFORD, MA.**—The New Bedford Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**PHILADELPHIA, PA.**—The Philadelphia Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**PHILADELPHIA, PA.**—The Philadelphia Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**PITTSBURGH, PA.**—The Pittsburgh Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

**ROCHESTER, N. Y.**—The Rochester Electric Co. has been awarded a contract to construct a new power plant in the town, to build a new line and to install a new distribution system in the town. (Continued on page 1336.)

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Tenders will be received through agents only. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. (file No. 11,067).

WASHINGTON, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until June 20 for the installation of two electric passenger elevators in the patent and old post office buildings, Seventh and F Streets, Washington; installation of inclosures therefor, suitable penhouses for elevator machinery, excavating, etc., in accordance with plans and specifications copies of which may be obtained on application to the chief clerk of the department. Award will be made subject to appropriation by Congress to meet the expense of the work. Lewis C. Laylin is assistant secretary.

WASHINGTON, D. C.—Tenders will be received until July 16 at the office of the Deputy Postmaster General, Adelaide, Australia, for supplying telegraph and telephone materials, including magneto and trembling bells, galvanometers, magneto and common battery, switchboards, copper binders and tapes, jointing sleeves, wire insulators, cells, zincs, iron or steel tubular poles, etc. Bidders not resident in Australia shall name an agent in that country to receive notifications of acceptance and other notices under contract. For further information address the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. (file No. 11,073).

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, for furnishing at the various navy yards and naval stations the following supplies: Portsmouth, N. H., Schedule 5549—3500 ft. insulated electric cable. Annapolis, Md., Schedule 5532—one alternating-current generator, one Diesel oil engine and one direct-current oil-engine-driven exciter unit, switchboard for lighting and power plant and one motor-generator set. Brooklyn, N. Y., Schedule 5555—seven vertical simplex-feed pumps and flushing and fire pumps; Schedule 5538—one three-motor electric traveling crane; Schedule 5540—one 10-ton electric gantry crane. Charleston, S. C., Schedule 5539—gate shear, complete with motor drive. Mare Island, Cal., Schedule 5543—one searchlight. Applications for proposals should designate the proposals desired by number.

## North Central

CARO, MICH.—An ornamental street-lighting system will be installed in the business section of the city, replacing the present arc lamps. The cost of the new system is estimated at \$1,600, \$1,000 of which will be paid by the city and the remainder by the Business Men's Association.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Pwr. Co. contemplates the construction of a substation at Wealthy Street and Indiana Avenue, to cost about \$18,000.

IRON RIVER, MICH.—The Menominee Range Pwr. & Devel. Co. has been reorganized under the name of the Iron Range Lh. & Pwr. Co. It is understood that the plant will be enlarged and the transmission lines extended to all outlying districts. The officers of the company are: Nelson E. Fisher, president; E. A. Van Ornum, vice-president; I. W. Byers, secretary; Ellsworth S. Coe, treasurer.

ROSCOMMON, MICH.—The municipal electric-light plant and pumping station was recently destroyed by fire, causing a loss of about \$5,000.

ALLIANCE, OHIO.—The Alliance Gas & Pwr. Co. expects to erect within the next six months a complete new power house and to purchase from 15,000 ft. to 20,000 ft. of No. 6 and 8 wire and from one to three carloads of poles for distribution system, also transformers, lamps, etc., and electrical appliances and supplies.

ANNA, OHIO.—The board of managers of the municipal electric-light plant expects to purchase some additional transformers within the next few months. T. S. Price is clerk of board.

CANTON, OHIO.—The City Council is considering reorganizing the street-lighting system and will submit the following proposition to the Canton Gas & El. Co., which furnishes the lighting service: To abolish all the 275 arc lamps on the moonlight schedule and put 75 of them on an all-night schedule at \$60 per lamp per year; to substitute 100-watt tungsten lamps for the other 200. The street-lighting service now costs the city over \$41,000 per year and provides for 501 arc lamps on an all-night schedule, 275 arc lamps on a moonlight schedule and about 50 100-watt tungsten lamps.

CLEVELAND, OHIO.—Bids will be received at the office of W. H. Kirby, secretary to the director of public service, 104 City Hall, Cleveland, Ohio, until June 19, for steam-driven and motor-driven electric generators and rotary converters for the municipal electric-light plant, plans and specifications for which may be obtained at the office of the engineer of construction, Room 319, City Hall. W. J. Springborn is director of public service.

LANCASTER, OHIO.—The City Council has decided to call a special election to submit to the voters the proposition to issue \$125,000 in bonds for the installation of a municipal electric-light plant.

MONTPELIER, OHIO.—The city of Montpelier expects to purchase within the next three months one 110-kva, two-phase, 60-cycle, 2200-volt engine-type generator, one horizontal compound air compressor (about 1000-ft. capacity) and to drill four 8-in. wells and erect a 35,000-gal. water storage cistern and also an addition to building. A. E. Waymire is superintendent and chief engineer.

MOUNT STERLING, OHIO.—The installation of gas engines to replace the steam engines in the municipal electric-light plant is under consideration by the Board of Public Affairs. J. S. Core is secretary of board.

NORWALK, OHIO.—If granted a new franchise for lighting, the Cleveland Southwestern & Columbus Ry. Co. will make improvements to power plant equipment and distributing system, involving an expenditure of about \$20,000. C. G. Taylor is superintendent.

PLYMOUTH, OHIO.—The Board of Public Affairs expects to purchase within the next 30 days one 100-hp gas engine, two 75-kw, 60-cycle, three-phase generators, one three-panel switchboard with necessary instruments for power circuits for above generators; transformers, lighting arresters, etc., for 3 miles of transmission line. F. W. Kirtland is vice-president of board.

PLYMOUTH, OHIO.—Bids will be received by the Board of Trustees of Public Affairs of the village of Plymouth until June 26 for furnishing and installing two alternating-current generators and one three-panel switchboard, specifications for which are on file at the office of J. S. Smith, clerk of board, and designated as Bid No. 1. Bids will also be received on the same date for furnishing one two-panel switchboard and one 75-kw alternating-current generator, designated as Bid No. 2. The board will also receive bids for one 100-hp vertical gas engine.

PADUCAH, KY.—The Boosters' Club has accepted the proposition of the Paducah Lh. & Pwr. Co. to erect and maintain 80 25-watt tungsten lamps on Broadway from First Street to Ninth Street at an annual cost of \$1,650.

ROCKPORT, KY.—We are informed that the Rockport Coal Co. has decided not to install an electric-light plant at present.

TELL CITY, IND.—The City Council has awarded the contract for the installation of an ornamental street-lighting system to cost about \$4,000.

BLOOMINGTON, ILL.—The Union Gas & El. Co., of Bloomington, has increased its capital stock from \$900,000 to \$1,000,000.

CHICAGO, ILL.—The investigating committee of the County Board has recommended that a power plant be constructed at once on South Lincoln Street in connection with the new hospital, to cost about \$246,000.

CHICAGO, ILL.—Bids will be received by Ray Palmer, city electrician, 614 City Hall, Chicago, Ill., until June 19 for furnishing the Department of Electricity with No. 19 B. & S. gage paper-insulated and No. 16 B. & S. gage rubber-covered, lead-covered fire-alarm cable, in accordance with specifications on file in the office of the city electrician, in approximately the following amounts: 6000 ft. of 5-pair cable; 9220 ft. of 15-pair cable, 12,500 ft. of 30-pair cable, and 1200 ft. of 50-pair cable. Proposals must be made out on blanks furnished by the city electrician.

CORTLAND, ILL.—The Village Board has awarded a contract to the Chicago, Aurora & DeKalb R. R. Co., of Aurora, to light the streets of the village for a period of ten years. The contract calls for 36 lamps.

ELGIN, ILL.—The Council is considering the question of issuing bonds for the installation of a municipal electric-light plant. Chapman Inc., of Chicago, is consulting engineer.

HOMER, ILL.—Work will begin in the near future by V. S. Thompson, owner of the local electric-light plant, on the construction of a new plant in the western part of the town. The equipment will include a 250-hp boiler, already purchased. The present plant is located in the eastern part of the town.

JACKSONVILLE, ILL.—Commissioner Brennan of the Department of Public Property has asked the City Council for an appropriation of \$10,000 for the purchase of an engine and generator to be installed at the Widen-Daub Wells and for a new pump at the Morgan Lake pumping station. Following the declaration by Commissioner Newman that a stock company could be formed to take over, rehabilitate, maintain and operate the municipal electric plant until the city can get a bond issue for that purpose, Commissioner Brennan was instructed to receive bids for the proposed improvements and report same to the City Council. At a special election held in April the proposition to issue \$50,000 in bonds for improvements to the municipal electric plant was defeated.

MACOMB, ILL.—The City Council has awarded the Central Illinois Pub. Ser. Co., of Mattoon, Ill., a ten-year contract for lighting the streets of the city. The contract provides for the installation and maintenance of 90 magnetite arc lamps in the residence district and maintaining 30 ornamental lamp standards carrying five-lamp clusters (one 60-watt lamp and four 40-watt lamps) in the business section.

MANITO, ILL.—The Village Board is contemplating the installation of a municipal electric-light plant in Manito.

MASON CITY, ILL.—The Commercial Club has decided to install ornamental lamps in the business section of the city.

PEORIA, ILL.—The contract for the electrical work in the nine-story annex to the Shipper & Block department store in Peoria has been awarded to the D. F. Lackey Electrical Co., of Peoria, at about \$10,000.

JANESVILLE, WIS.—Plans are being prepared for the construction of an exchange building, to cost \$40,000, for the Rock County Tel. Co.

LAKE MILLS, WIS.—The City Council has entered into a contract with The Milwaukee El. Ry. & Lt. Co. (represented by Philip Grossman) to furnish electricity to operate the municipal electric-light plant and water-works system for a period of three years. The company, it is understood, will extend its transmission line from Watertown to the



fort, crossing the Avalon Road between the Crawfish and the Rock Rivers, with branches running to Lake Mills and Johnson Creek. The contract calls for completion of the line by Sept. 15. A 24-hour service will be furnished.

**NEW RICHMOND, WIS.**—The Council has instructed the electric light committee to make new systems and to cooperate with the Commercial Club relative to the installation of an ornamental street-lighting system on Main Street.

**CHOKIO, MINN.**—The Village Council is considering a proposition submitted by the Otter Tail Pwr. Co., of Fergus Falls, to furnish electrical service in Chokio. The company asks for a franchise to furnish electricity for lamps and motors and a contract for street lighting and offers to furnish 15 lamps, one incandescent lamp and one arc lamp at \$600 per year with an all-night service.

**JULIUS, MINN.**—The Great Northern Pwr. Co. has decided to purchase a 20,000-hp hydraulic turbine to be installed at this place. The turbine will be placed for the new turbine at once, but the installation will not be completed until next summer.

**MINNEAPOLIS, MINN.**—The Twin City Rapid Transit Co., of Minneapolis, is contemplating the installation of a 1,000-watt generator at the Twin City line station.

**RENVILLE, MINN.**—The Montevideo El. L. & Pwr. Co., of Montevideo, has applied to the City Council for a franchise in Renville.

**ROCHESTER, MINN.**—Plans have been prepared for the installation of an ornamental street-lighting system, incandescent lamps on Fourth and Zumbro Streets.

**ROSEAU, MINN.**—Bids will be received by P. H. Buran, clerk, until June 20 for the construction of a power house, electric light plant and water-works system in accordance with plans and specifications prepared by Leonard Peterson, of Thief River Falls, which may be seen at his office and at the office of P. H. Buran, clerk.

**BURLINGTON, IA.**—The City Council has ordered all telephone, telegraph and electric-light wires placed underground in the business district.

**DENISON, IA.**—The City Council is considering the terms of a new franchise for the lighting company. It granted a new franchise, the present Denison El. L. & Pwr. Co. agrees to make extensive improvements to its plant and system.

**OSKAN, IA.**—Application has been made to the Board of Commissioners by Harry Bullard for a franchise to install and operate an incandescent plant in Oskan.

**PRESTON, IA.**—The City Council has granted a franchise for installation of an electric-light plant and has approved contract for street-lighting. The contract provides for ornamental street lights on large blocks. The J. J. Maier Electrical Co. will install the lights.

**SHELLSBURG, IA.**—The installation of an electric light system in Shellsburg is under consideration.

**VALLEY JUNCTION, IA.**—The City Council has decided not to purchase electricity to operate the proposed municipal electric light and water plant, but will install an electric generating plant, which the town is now being prepared.

**FARMINGTON, MO.**—The contract for erecting a concrete chimney (4 ft. by 80 ft.) for the municipal electric light and water works plant has been awarded to the Walter Construction Co., of Chicago, Ill. The city is sinking another well and also to develop its municipal water works. C. M. Thomson is superintendent.

**OREGON, MO.**—Bids are being called for the installation of equipment for the municipal electric light plant. An order for all material has been purchased for the plant. Martin K. Moore is superintendent and chief engineer.

**POPPLAR BLUFF, MO.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 15, for construction, including mechanical equipment, incandescent lighting fixtures and appliances, of the Grand Stores building at Poplar Bluff, Mo., drawings and specifications for which have been obtained at the above office or from contractors at site at Poplar Bluff. C. Wendroth is supervising architect.

**COGSWELL, N. D.**—The Cogswell El. L. & Pwr. Co. is about to purchase within the next six months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**FINLEY, N. D.**—The Finley El. L. & Pwr. Co. is about to purchase within the next four months one 10-hp to 15-hp generating unit, consisting of engine, generator and one 10-hp to 15-hp generating unit, for its plant. Frank E. Curry is superintendent.

**GRAND FORKS, N. D.**—The Grand Forks El. L. & Pwr. Co. is about to purchase within the next six months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Grand Forks El. L. & Pwr. Co. is about to purchase within the next six months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Grand Forks El. L. & Pwr. Co. is about to purchase within the next six months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**LAKOTA, N. D.**—The Lakota El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Lakota El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**ST. THOMAS, N. D.**—Bids will be received by N. S. R. Patterson, city auditor, until June 21 for furnishing and installing material and equipment for municipal electric light plant, including: (1) one 10-hp to 15-hp engine installed on site, with one 10-hp to 15-hp generator, for its plant.

one 10-hp to 15-hp engine installed on site, with one 10-hp to 15-hp generator, for its plant. The Lakota El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**BIOT, N. D.**—The Biot El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Biot El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**MOOREHEAD, N. D.**—The Moorehead El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Moorehead El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**TRUTH, N. D.**—The Truth El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Truth El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**HEARTHROP, N. D.**—The Hearthrop El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Hearthrop El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

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## Southern States

**HOUSTON, TEX.**—The city of Houston, Tex., is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Houston El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

**HOUSTON, TEX.**—The Houston El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant. The Houston El. L. & Pwr. Co. is about to purchase within the next three months a 10-hp to 15-hp generating unit, consisting of engine and generator, for its plant.

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**BASTROP, LA.**—Plans are being considered to enlarge the municipal electric-light plant and water-works system. J. K. Skipworth is Mayor.

**VIVIAN, LA.**—The Vivian Oil Co. is contemplating the construction of a power house to cost about \$50,000.

**CLEVELAND, OKLA.**—The city of Cleveland is contemplating the installation of a new electric-light plant.

**HENNESSEY, OKLA.**—The Hennessey El. Lt., Pwr. & Ice Co. has installed a 55-kw, 2300-volt, three-phase generator directly connected to an 80-hp Fairbanks-Morse solar-oil engine and switchboard for same. The company also expects to purchase within the next six months equipment for a series street-lighting system, consisting of 30 250-watt tungsten lamps. The property is leased to and operated by the Tathwell Co. T. H. Tathwell is general manager.

**OKEMAH, OKLA.**—The city of Okemah expects to purchase within the next three months one 150-hp engine directly connected to a 120-kw, three-phase, 60-cycle, 2300-volt generator, with a 15-kw exciter, and switchboard for above generator, to panel with 60-kw generator, voltage regulator and recording wattmeter. F. M. Peyton is superintendent.

**DALLAS, TEX.**—The Northern Texas Trac. Co. contemplates the erection of a terminal building in Dallas, the basement to be used as a substation (equipped with motor-generators) to distribute electricity to operate street cars and for lamps and motors in the business district in connection with the underground system now being installed. The Stone & Webster Management Assoc., of Boston, Mass., has charge of the company.

**DALLAS, TEX.**—The Board of Municipal Commissioners is considering the question of establishing a municipal electric-light and power plant in connection with the Turtle Creek pumping station for the purpose of furnishing electricity to the pumping station (probably other stations) and the new City Hospital establishment system, including the Union and Tubercular Hospitals. It is proposed to install a generator at the pumping station, to cost from \$500 to \$1,000. Leon M. Taylor is city electrician.

**FORT WORTH, TEX.**—Arrangements are being made to double the output of the Fort Worth Pwr. & Lt. Co. on the Trinity River at Main Street. A new smokestack (duplicating the present 265-ft. stack) will be erected and eight new boilers with a total rating of 4000 hp will be installed. Additions to the building will be necessary for the installation of the boilers. Beginning Sept. 1, electric light and power service will be furnished to the residents of Diamond Hill and Riverside.

**SANDERSON, TEX.**—E. McGinley is contemplating the installation of an electric-light plant here, to cost about \$10,000.

**WHITESBORO, TEX.**—At an election held recently the proposition to install a municipal electric-light plant was carried.

## Pacific States

**ABERDEEN, WASH.**—The City Council is considering the proposition of establishing a municipal electric-light plant at the headwaters of the Wynoochee River, 25 miles distant, to cost approximately \$2,000,000. A new and large water system is included in the project. Nearby cities, including Hoquiam, Cosmopolis and Montesano, will be asked to join in the project.

**SPOKANE, WASH.**—Several important power sites have been secured recently by A. D. Perrine, of Salt Lake City, Utah. Mr. Perrine, it is said, represents Eastern capitalists who propose to build an electric railway between Spokane and Wenatchee.

**PORTLAND, ORE.**—The City Council has granted the Northwestern El. Co. a 25-year franchise to install and operate a central steam-heating plant in Portland. The plant will be located in the basement of the new Pittcock Block and will cost about \$300,000.

**ALHAMBRA, CAL.**—Bids are being received by the city trustees for furnishing and installing a complete fire-alarm system according to plans and specifications now on file in the office of O. M. Caulk, city clerk.

**ANTIOCH, CAL.**—The contract for the erection of a reinforced substation and power house on the transmission line of the Great Western Pwr. Co., of San Francisco, near Antioch, where the line spans the San Joaquin River, has been awarded to the Reardon-Crist Construction Co., for \$8,000. This is one of the five substations planned in this county.

**GRASS VALLEY, CAL.**—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 30 for construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office at Grass Valley, according to plans and specifications copies of which may be obtained at the above office or from the custodian of site at Grass Valley. O. Wenderoth is supervising architect.

**HOLTVILLE, CAL.**—The Holton Pwr. Co. is planning to extend its system into the Coachella Valley and is erecting a transmission line to Banning to connect with the high-tension transmission line which the Edison company is building to that city. The head office of the company is in the Colorado Springs, Colo., office.

**LOS ANGELES, CAL.**—The Board of Supervisors has awarded the Pacific Lt. & Power Corp., a contract for the installation of ornamental

street lamps in Laurel Canyon from Sunset Boulevard to Lookout Mountain Park.

**OROVILLE, CAL.**—The Oro El. Corp., of Oroville, which is planning to resume work at the Belden power-house site and on the reservoir in Humboldt Valley, is also planning to erect a high-tension transmission line from Colusa to a point on the Northern California Pwr. Co.'s line.

**PASADENA, CAL.**—The contract for installing the ornamental street-lighting system on Los Robles Avenue is reported to have been awarded by the city commissioners to B. F. Kierulff, Jr., of Los Angeles, at \$22,130.

**SAN FRANCISCO, CAL.**—Bids will be received until June 18 by the Board of Public Works for furnishing and installing a motor-generator set in the carhouse of the Geary Street municipal railway.

**SAN FRANCISCO, CAL.**—The Board of Supervisors has adopted a resolution instructing City Engineer O'Shaughnessy to submit plans and estimates for a partial development of the city's Tuolumne County resources at Lake Eleanor. It is proposed to utilize the power for street lighting and operating the Geary Street Railroad.

**SAN FRANCISCO, CAL.**—The Pacific Gas & El. Co., of San Francisco, expects to erect within the next 12 months three power houses having an aggregate output of 40,000 kw and one substation of same capacity. The company will also erect 110 miles of double-circuit tower transmission line; 35 miles of single-circuit tower line; 25 miles of single-circuit pole line, all having a potential of 110,000 volts. Contracts for equipment have been placed. P. M. Downing is manager.

**BONNERS FERRY, IDAHO.**—The City Council has instructed the Bonners Ferry Wtr. & Lt. Co. to replace all incandescent lamps on Main Street with arc lamps.

**CASA GRANDE, ARIZ.**—The construction of a central power plant in Casa Grande is under consideration by the Casa Grande Valley Water Users' Association for the purpose of furnishing electricity to the farmers of the irrigation district for pumping purposes. It is proposed to install a 500-hp unit with provision for installing additional units as required.

**BOULDER, COL.**—The Highland Pwr. Co., recently organized, expects to erect a hydroelectric power plant in Lakewood. The proposed plant will be equipped with three waterwheels, Repogle waterwheel governors and three alternating-current generators. From 28 to 30 miles of transmission lines will be erected; 35-ft. cedar poles will be used. I. N. Bair, of Boulder, is secretary and treasurer.

## Canada

**VANCOUVER, B. C.**—The Campbell River Pwr. Co. will soon begin work on the construction of the first unit of its large power plant on Vancouver Island. The plant when completed will have an output of 300,000 hp and will cost about \$15,000,000.

**THE PAS, MAN.**—Tenders will be received by H. H. Elliott, M.D., secretary and treasurer of the town of The Pas, until July 1 as follows: (A) Furnishing, laying, etc., 18,400 ft. of vitrified sewer pipe (24-in. to 6-in.); (B) trenching and laying approximately 14,300 ft. steel pipe (12-in. to 6-in.), setting valves, hydrants, etc.; (C) erection of power house; (D) erection of pole line; (E) furnishing and erecting motors, pumps, piping and air compressor; (F) furnishing poles, wires, line material, etc. Plans and specifications may be seen at the office of Murphy & Underwood, consulting engineers, Ross Block, Saskatoon, Sask., and at the office of the resident engineer, The Pas. A complete set of plans and specifications for any contract will be forwarded on deposit of \$25, and a set covering all contracts on a deposit of \$100, which will be refunded upon return of the plans.

**AMHERST, N. S.**—The power plant of the Maritime Coal Ry. & Pwr. Co. was completely destroyed by fire on June 1, causing a loss of about \$25,000.

**BROCKVILLE, ONT.**—Tenders are being asked by the Light and Power Department for the installation of cluster lamps on Main Street for a distance of about 1 mile.

**ST. CATHARINES, ONT.**—Owing to the Cataract Pwr. Co., of Hamilton, being unable to supply the city with electrical power for power purposes the City Council has decided to secure the electricity from the Hydro-Electric Power Commission of Toronto. The Council also rescinded the first two readings of a by-law to renew the street-lighting contract with the Cataract Pwr. Co., which was to have been voted upon May 31.

**TORONTO, ONT.**—Tenders will be received by Burke, Horwood & White, architects, 28 Toronto Street, Toronto, until June 20, in bulk or separately, for the following work in connection with the Hudson's Bay Company's department store, Vancouver, B. C.: Steam fitting, electric wiring, plumbing, refrigerating, vacuum cleaning, sprinklers, steam-driven generating units, turbine generating units, steel smokestack, suction ash conveyor and pneumatic gas tubes.

**MURRAY BAY, QUE.**—The Labrador El. & Pulp Co. expects to put in service within the next two months a 140-hp generating unit, consisting of a 140-hp Wheelock engine connected to generator. J. O. Duguay is manager.

**YORKTOWN, SASK.**—The contract for the construction of the power house for the municipal electric-light plant has been awarded to Ritchie & Waters.

### Miscellaneous

**PANAMA.**—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until July 7, for furnishing steel doors, gratings for batteries, etc. Blanks and general information relating to this circular (No. 780) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 414 Whitney General Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

**BOGOTA, COLOMBIA.**—S. A. We are informed that Yanigas & Rueda, of Bogota, would like to receive estimates and information for electrical equipment for a 500-hp plant and also for general electrical and mechanical equipment for several power plants.

## New Industrial Companies

**THE ACOUSTIC & DICTOGRAPH COMPANY,** of New York, N. Y., has been incorporated with a capital stock of \$1,000,000 to take over the General Acoustic Co. of New York, and to deal in electric and other appliances. The incorporators are: John F. Jacobs, Franklin H. Mills and Edgar M. Souza, all of 111 Broadway, New York, N. Y.

**THE CARROLL ENGINE COMPANY,** of Elmont, N. Y., has been incorporated with a capital stock of \$250,000 by John D. Carroll, Edward M. Lowman and Joseph Beach, 1000 Walnut Street, Elmont, N. Y. The company proposes to manufacture engines and mechanical devices.

**THE COLLINS SWITCH & SIGNAL COMPANY,** of New York, N. Y., has been incorporated with a capital stock of \$15,000 to manufacture and install electric signal systems. The incorporators are: James Laing, of New York; Oscar J. Hove, at Westchester; and Philip Hanzwohl, of Brooklyn.

**THE LASZIO ELECTRIC SIGN COMPANY,** of New York, N. Y., has been incorporated with a capital stock of \$10,000 by Louis Hart, Harry Allen Mendelson and Guadalupe Angelo Sellar, 227 East Eighth Street, New York, N. Y.

**THE UNITED ELECTRIC FUTURE & SUPPLY CO.,** of Cleveland, has been incorporated by Fred Desberg, M. J. Roan, I. Grohs, F. C. Morman and John W. Willdis. The company is capitalized at \$10,000 and proposes to manufacture and deal in electric and gas fixtures.

## New Incorporations

**ATKINS, ARK.**—The Atkins El. L. & Pwr. Co. has been granted a franchise with a capital stock of \$15,000. The incorporators are: W. H. Jones, L. L. Evans, William Jones, Jr., and others.

**WOODLAND, CAL.**—The Pwr. & Freighting Co., of Clear Lake, is a subsidiary of the Yolo Wtr. & Pwr. Co. has been incorporated with a capital stock of \$1,000,000 by E. H. Larson and W. A. Rablert.

**ASHTON, IDAHO.**—The Ashton & St. Anthony Pwr. Co., Ltd., has been incorporated with a capital stock of \$250,000 by A. Whitten, J. M. Capps, N. N. Holm and E. M. Harris. The company proposes to mount a power plant 3 miles west of Ashton.

**BURT, IA.**—The Burt El. & Pwr. Co. has been incorporated with a capital stock of \$15,000. The officers are: E. M. Groom, president; M. J. Mann, vice-president; and C. B. Chapman, secretary and treasurer.

**PORTLAND, MAINE.**—The Portland Chamber & Electric R. R. & Lt. Co. has been organized under the laws of the State of Maine with a capital stock of \$3,700,000 for the purpose of constructing, leasing and operating electric railways and furnishing electricity for lamps. Philip I. Jones is president and James C. Fox, treasurer, both of Portland.

**NEW YORK, N. Y.**—The Martin Morris & Pwr. Co. has been incorporated with a capital stock of \$100,000 to deal in gold, silver, lead and iron mines. The incorporators are: J. W. Vignone, president; M. Martin and Louis A. Servatius, of 10 W. 10th St., New York.

## Trade Publications

**STREET RAILWAY LAMPS.**—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, has just issued Bulletin 18A, devoted to street railway lamps. It contains numerous data compiled especially for street railway engineers.

**SWITCHES.**—In a twelve-page Bulletin, No. 1, published by the Delta Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., high-tension pole top switches for electric railways are described and described and the details of construction are given.

**GRAPE BARS.**—A folder has been issued by Gallagher & Company, 501 West 145th Street, New York, which illustrates and briefly describes their dumping, shaking and stationary grates, feed plates and other castings. The Acmex oxygen arch plate and bar grates are also referred to.

**WIRING DEVICES.**—"The Electrician," No. 86 has been published by the

H. E. Price Company, 100 Broadway, New York, and contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**GAS TAPES.**—The Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**PLAT TAPES.**—The Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**CORROSION OF IRON AND STEEL.**—The Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**MULTIPOINT VALVES.**—The Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**CONDENSERS.**—The Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

**LIGHTING DATA.**—A comprehensive compilation, bearing the title "Industrial Lighting," has been issued by the Electrician, No. 86, published by the H. E. Price Company, 100 Broadway, New York, contains a description of the 1111 wiring devices, which are designed for use in connection with the new gas. P. S. Latham, secretary, is in charge of the new devices.

## Business Notes

**WESCO SUPPLY COMPANY.**—The W. P. Wescott Company, of New York, has been organized under the laws of the State of New York with a capital stock of \$1,000,000 for the purpose of supplying electrical materials.

**THE BARGE TOWING COMPANY.**—The Barge Towing Company, of New York, has been organized under the laws of the State of New York with a capital stock of \$1,000,000 for the purpose of towing barges and other vessels.

**THE ELECTRIC STORAGE BATTERY COMPANY.**—The Electric Storage Battery Company, of New York, has been organized under the laws of the State of New York with a capital stock of \$1,000,000 for the purpose of manufacturing and distributing storage batteries.

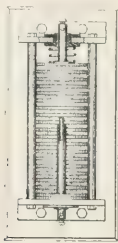


# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 3, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

- 1,063,179. **PROTECTING ELECTRIC MOTORS**; G. A. Burnham, Cliftondale, Mass. App. filed March 30, 1911. Tripping means operated on overload and underload, with means preventing operation of overload operating means by starting current.
- 1,063,182. **TROLLEY WIRE HANGER**; J. Christensen, Evans City, Pa. App. filed Dec. 26, 1911. Arch construction with a trolley wire support which clamps the hanger wire up against the underside of the arch construction.
- 1,063,193. **COMBINED TELEGRAPH AND SIGNALING SYSTEM**; E. R. Gill, Yonkers, N. Y. App. filed Oct. 21, 1910. Selective telephonic signaling system combined with a system of multiplex telegraphy.
- 1,063,206. **THIRD-RAIL ELECTRIC-RAILWAY SYSTEM**; M. M. Marx, New York, N. Y. App. filed June 12, 1912. Sectionalized third-rail which is in circuit only when train is passing.
- 1,063,237. **WELDED RECEIVER**; V. Anderson, New York, N. Y. App. filed April 3, 1912. Pole pieces are electrically welded to the ends of the bi-polar magnet and a cup is clamped between the pole pieces and the magnet.
- 1,063,249. **PROTECTOR**; P. E. Erikson, New York, N. Y. App. filed March 16, 1909. To provide ground connection upon abnormal potential in live circuit; two discharge plates, one of copper and the other an alloy of copper, with an intermediate thin sheet of insulating material having an opening therethrough.
- 1,063,259. **MAGNETIC WHEEL**; J. O. Heinze, Jr., Detroit, Mich. App. filed June 19, 1912. Non-magnetic ring in the wheel tread to cause the rail to form a part of the magnetic circuit and a magnetizing element sleeved on the hub of the wheel.
- 1,063,265. **ELECTRIC SERVICE BOARD**; P. N. Joleen, Chicago, Ill. App. filed Aug. 25, 1911. Individually removable apertured rectangular plates forming a portion of the side walls of the cabinet behind the panelboard.
- 1,063,270. **WELDED RECEIVER**; J. J. Lyng, Yonkers, N. Y. App. filed April 3, 1912. Pole pieces with forked ends which are electrically welded to the bar magnets and clamp the cups between the pole pieces and the bar magnets.
- 1,063,280. **PROCESS OF PRODUCING LOW-CARBON FERRO-ALLOYS**; J. M. Morehead, Chicago, Ill. App. filed Sept. 24, 1907. First produces ferrochromium high in carbon and then subjects the product electrically heated above 1600° C. to the action of oxygen.
- 1,063,303. **ELECTRICAL RESISTANCE**; E. Thompson, Swampscott, Mass. App. filed, July 13, 1909. Disk of boron and a metallic disk of good heat conductivity in contact therewith.



1,063,303.—Electrical Resistance

- 1,063,325. **RAILROAD SIGNAL**; A. W. Bower, Derby, Col. App. filed Dec. 2, 1910. Magnets operate a "caution" semaphore arm.
- 1,063,341. **PROCESS OF PRODUCING LOW-CARBON FERRO-ALLOYS**; I. R. Edmonds, Niagara Falls, N. Y. App. filed Sept. 24, 1907. Produces ferro-alloy high in carbon and then subjects product electrically heated above 1600° C. to action of oxidizing gas.
- 1,063,357. **PROCESS OF ELECTRIC WELDING**; M. Lachman, New York, N. Y. App. filed Oct. 17, 1906. Makes a T-weld by inserting a tongue on one part into groove in other part, passing current through the parts and forcing them together.
- 1,063,361. **TELEPHONE SYSTEM**; O. M. Leich, Genoa, Ill. App. filed March 27, 1911. Subscriber's instrument responsive to currents of one polarity only and means associated with the trunk circuit to impress current from the branch exchange on the subscriber's signal-receiving device of a reverse polarity to that impressed by the central exchange.
- 1,063,369. **CIRCUIT-CONTROLLING THERMOSTAT**; J. F. McElroy, Albany, N. Y. App. filed June 1, 1911. Thermostat with movable contact tongue and retaining magnets for said tongue in shunt circuits.
- 1,063,377. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; C. H. Norwood, Chicago, Ill. App. filed Jan. 4, 1913. Electromagnetic mechanism for locking the circuit controller of the motor whose operation is to be delayed until another motor has worked through a definite cycle.
- 1,063,392. **GAS LIGHTER**; J. K. Rush, Syracuse, N. Y. App. filed Dec. 29, 1911. Gas valve is rotated step by step successively to open and close off the gas and the movable igniting terminal returns to its starting position independently of the valve.
- 1,063,396. **MEANS FOR INCREASING THE SPEED OF TRANSMIS-**
- SION OF SIGNALS OVER TELEGRAPH AND CABLE LINES**; G. Seibt, New York, N. Y. App. filed Oct. 12, 1909. A portion of the core of the conductor is reduced in diameter and a resistance coil is connected to this reduced portion and to ground or return.
- 1,063,400. **SYSTEM OF ELECTRIC-MOTOR CONTROL**; T. Varney, Pittsburgh, Pa. App. filed Sept. 18, 1911. Two-motor system for hoists and ore bridges; motors are connected in independent circuits for operation in one direction, in a single circuit for operation in the opposite direction and in independent local circuits for braking.
- 1,063,417. **PROCESS OF MAKING COMPOUND HOLLOW-METAL BODIES**; E. G. Cook, Brooklyn, N. Y. App. filed Feb. 14, 1912. Electrodeposits a metal coating upon a plastic core form, applies a plastic form on this metal coating and then electrodeposits an outside coating on the second plastic form.
- 1,063,483. **REFRACTORY CONTAINER**; E. Weinstraub, Lynn, Mass. App. filed April 11, 1912. A molded envelope for a furnace operating above 1700° C., consisting of compressed, self-bonded boron nitride, which is inert, infusible and substantially a non-conductor of electricity at the highest obtainable temperatures.
- 1,063,496. **ELECTRIC INCANDESCENT LAMP**; E. G. Royer, Paris, France. App. filed Feb. 4, 1911. Filaments arranged in superposed horizontal planes with filaments in the upper planes located between every two filaments in the lower plane.
- 1,063,501. **SLEET SCRAPER FOR TROLLEYS**; M. J. Brennan, Tompkinsville, N. Y. App. filed July 27, 1911. Scrapers reversibly clamped upon the trolley wheels and having a limited swinging movement with the trolley wheel, one member having a scraper and the other being grooved to slide along the wire.
- 1,063,535. **ELECTRIC HEATING DEVICE**; W. S. Hadaway, Jr., New York, N. Y. App. filed Sept. 11, 1911. Electrically heated roll; heating units positioned within a chamber in the roll by a shaft which extends into the chamber and a cap which closes the end of the chamber.
- 1,063,557. **SHUNT-CIRCUIT TILTING DEVICE FOR MERCURY-VAPOR LAMPS**; R. Kuch, Hanau, Germany. App. filed May 23, 1910. Device effects an automatic repetition of the tilting motion until the lamp becomes lighted.
- 1,063,591. **BLOCK-SIGNAL SYSTEM**; W. B. Potter, Schenectady, N. Y. App. filed Jan. 22, 1910. Polarized track relays connected across the insulated rail joints and the track circuits are closed by resistances cross-connecting diagonally opposite rails of adjacent blocks.
- 1,063,599. **TELEPHONE REGISTER AND LOCK-OUT DEVICE**; C. V. Richey, Washington, D. C. App. filed Sept. 19, 1912. When called subscriber answers, the operator sends ringing current over the line to calling subscriber, which actuates register to register the connection.
- 1,063,601. **ANTISETTLE MOUTHPIECE FOR TELEPHONES AND SIMILAR INSTRUMENTS**; M. Rosenwald and J. C. Doran, New York, N. Y., and Danbury, Conn. App. filed Oct. 21, 1911. Mouthpiece, held by spring fingers, stretches a cover over the diaphragm.
- 1,063,608. **SYSTEM OF REGULATION**; E. T. Shaw and J. M. Naul, Pittsfield, Mass. App. filed Oct. 11, 1912. An automatic device shunts one of the parts of the field winding of the motor by a resistance when supply voltage is low and opens the shunt when the supply voltage is high.
- 1,063,614. **ELECTRIC HEATER**; W. Stanley and H. M. Smith, Pittsfield, Mass. App. filed Jan. 6, 1909. A base secured to the bottom of the receptacle carries an annular heating unit which fits up into an annular bent-up portion of the bottom of the receptacle.
- 1,063,623. **ELECTROPNEUMATIC BRAKE**; W. V. Turner, Edgewood, Pa. App. filed Aug. 23, 1911. Valve mechanism for effecting application of the brakes, electric and pneumatic means for effecting operation of the valve mechanism and a handle by which the brakes may be controlled by either the electric or the pneumatic means.
- 1,063,651. **ATTACHMENT FOR MAGNETOS**; W. S. Burnett, Milwaukee, Wis. App. filed April 12, 1909. Electrical selective instruments at different substations are operated to secure results at one station to the exclusion of others.
- 1,063,691. **ELECTRIC SIGNAL FOR RAILWAYS**; H. J. and F. T. Jones, Baltimore, Md. App. filed June 17, 1909. Train traveling below a predetermined speed is permitted to enter a block already occupied without operating the brakes.
- 1,063,711. **ELECTRIC SAFETY SIGNAL DEVICE**; J. A. Schellenger, Harrisburg, Ill. App. filed May 26, 1911. For mine shafts; circuit closure on the car may be operated to bridge a pair of conductors on one wall of the shaft and thereby give a signal to the engineer.
- 1,063,749. **MOLD FOR ELECTROTYPING PROCESSES**; A. J. Tizley, New York, N. Y. App. filed March, 1912. Series of superposed celluloid foils and a metallic fabric embedded between the foils near the impression face and following the sinuous shape of the impression.
- 1,063,760. **PRODUCTION OF LONG STABLE ELECTRIC ARCS**; J. Zenneck and K. Vollmer, Jena, Germany. App. filed May 13, 1912. Maintains a current of gas possessing a whirling motion around an electric arc which is subjected to the action of a magnetic field.
- 1,063,827. **FEEDER SUPPORT**; C. J. Mullin, New York, N. Y. App. filed March 31, 1906. Conductor grips supported by the side walls of the conduit frictionally engage the conductor so that slipping of the conductor is prevented and the weight of the conductor is imposed upon the side walls of the conduit.
- 1,063,854. **PUSH-BUTTON SWITCH**; C. A. Clark, Hartford, Conn. App. filed Nov. 21, 1911. Rack and pinion switch-actuating device.
- 1,063,893. **PROCESS FOR MAGNETIC SEPARATION OF ORES OUT OF SLIMES**; B. Schwerin, Frankfurt-on-the-Main, Germany. App. filed March 12, 1913. Adds to the slimes an electrolyte of an electrical character the opposite of the character of the ore to be separated and subjects the slimes to magnetic separation.





ment of the appliance-sales field altogether, and sales at a profit—certainly the committee has selected the sane and just course. In protecting its own interests the central station of to-day could never afford to call off its highly specialized commercial staff and to leave solely to the dealer and wireman the important development work of adding energy-consuming devices to its system. The public has long come to look upon the central station as a dependable adviser in its electrical problems. The customer, too, places additional confidence in the usefulness and durability of a device behind which the utility company stands. But the sale of an appliance at a fictitiously low price in order to benefit elsewhere from the sale of energy it consumes is hardly in accord with the modern spirit of equity which has its most literal expression in rate-making. To handle the average electrical stock involves an overhead charge of 22 per cent, and the committee wisely recommends that sale prices be set at an advance of 33 per cent over cost. The merchandising experience of years has shown that not price but selling effort controls volume of sales—an experience which is repeating itself in new-business departments every day. With maintained prices the interests of the outside dealer are protected, unhappy friction is eliminated, and valuable co-operation is secured in quarters where it is important. At a single stroke, therefore, adoption of this policy can transfer the appliance-sales department from the debit to the credit side of the ledger and, putting all hands at work in friendly rivalry, accomplish the widest possible distribution of appliances.

### Electrically Operated Locks

The electrical installation at the locks and dams of the Charles River Basin at Boston, described elsewhere in this issue, illustrates in the fullest degree the convenience and reliability of motor service in the important work of passing vessels rapidly between large bodies of water at different levels, and indicates the possibilities of electric energy distribution on waterfronts crowded with shipping and traversed by heavy street railway and highway traffic. The improvements effected within the last few years at the basin are familiar to all visitors to Boston who have had time to see anything of the city's topographical progress, and it is interesting to reflect that the extensive applications of electricity at the harbor end of this beautiful and constantly freshening sheet of water have been made so unobtrusively that probably not one person in ten thousand passing the installation dreams that in and about the locks are fifty-two motors of nearly 400 hp combined rating, supplying the manifold needs of gate operation, pumping, draw-bridge movement, capstan and signal service which are associated with the efficient administration of the plant. The volume of traffic passing through the locks required over 6000 openings in the last fiscal year, and the average time required to pass a vessel was about four and one-half minutes, thanks to the accelerating capabilities of electric motive power—the concentration of control in a single operating tower permitting by remote-control devices the simultaneous movement of separated apparatus—and the reliability of the energy supply from two central stations and the local electric railway feeders.

From the central-station point of view, the off-peak characteristics of the service are attractive, since by regulation of the War Department the lock openings must be outside the morning and evening rush hours on the railway system and since these to a considerable degree include the afternoon hours of heaviest demands upon the lighting systems which share in the supply of electricity. Again, the traffic is much lighter through the lock in the winter season, and while the demands for energy are intermittent, the actual investment required in generating equipment to handle such a load must be practically negligible. It is significant that the use of electric motors in place of hand operation on the filling gates of the small-boat lock cuts the time of locking a boat through from fifteen to three minutes, besides reducing the labor cost of such service by 33 per cent. There is no question that the saving in the installation as a whole by the use of the motor drive is so great as to make any other method of operation now unthinkable under the congested conditions prevailing in and about the northerly approaches to the city.

### High-Tension Direct-Current Traction

One of the very important papers read at the joint meeting of the Institution of Electrical Engineers and the Société Internationale des Electriciens in Paris was that by Mr. L. Gratzmuller on the present status of electric traction with high-voltage direct current, abstracted in this issue. His discussion is in part theoretical, dealing with conditions which beset the design of motors for such service, and in part highly practical, in his treatment of existing installations. A very noteworthy feature of his treatment of motor design is the admirable generalization of motor theory so as to include in the fundamental matters dealt with all asynchronous machines whether of the direct-current or the alternating-current type. From this point of view his paper is peculiarly instructive and illuminating.

With respect to actual practice, Mr. Gratzmuller recounts the work that has been done by various companies in various parts of the world toward the realization of high-tension direct-current traction. Tried at first merely by putting ordinary 600-volt motors in series, the improvements in design which have come about through the use of commutating poles have rendered it possible to build powerful motors for much higher voltage. Mr. Gratzmuller is of the opinion that 1200 volts per motor is a value that can be reached with perfect safety, as indeed it has been here and elsewhere. One of the foreign installations which he records as actually in service works with 1500 volts per motor, and another with even 1800. Whether these pressures could be advantageously employed in motors of very large size in which the current to be commutated is great is another matter. The author thinks that 3000 volts direct current on the working conductor is about as high as is likely to be reached for some time. At this limit it is evident that very large locomotives cannot be conveniently utilized so long as the current must be taken from a suspended wire. Hence the indications point to the limitation of such practice to cases in which a third-rail gives the necessary current-collecting capacity. It is

therefore safe to conclude that, at least for some time to come, the direct-current high-voltage system will be developed alongside the single-phase and three-phase systems as is now the case, each system being selected with special reference to the work to be done.

It is notable that practically all the large electrical manufacturing companies, whether on the whole favoring one or another of these systems, actually do install any of them when occasion seems to render it desirable. Incidentally it appears that the difficulties of suitable speed regulation are far from negligible in using the high-voltage direct-current motors. Various ingenious plans for obtaining this economically have been developed. The battle of systems is likely to go on for some time to come. When long and important lines are to be considered high voltage on the working conductor seems to be imperative, voltage high enough in fact to enable powerful locomotives to be used without recourse to third rail construction. At the present time this seems severely to handicap direct-current traction in this particular field, but it is evident that the last word on commutating pole construction has not yet been said and it may turn out to be more satisfactory in high-voltage working than now seems likely. At all events experience has shown that thoroughly successful traction on a large scale can be carried out, conditions favoring, by high-voltage direct current, by the single-phase or by the three-phase system widely used abroad. The chief question now is which one of these is best fitted for a particular task of electrification. No one need hesitate in the present state of things at any of the engineering difficulties of heavy electric traction, provided only that he is willing to make the most of the methods available. The difficulties which now check railway electrification on a large scale are not technical but financial.

### Long Distance Radio-Telegraphy

There have been many occasions upon which a ship setting out to sea has attempted to hold wireless communication for the longest possible time with some radio plant installed on shore. As a rule, the effort has been to determine the greatest distance over which signals could be heard or exchanged, and little attention has been paid to the reliability of signaling attainable at the end of the test or to the intensity of signals at distances less than the maximum. The two series of tests referred to by Mr. John L. Hogan, Jr., in an article on "Quantitative Results of Recent Radio-Telegraphic Tests Between Arlington, Va., and the U. S. S. *Salem*" in this issue, are almost unique in that the measurements taken from hour to hour have made possible an engineering study of the variation of signal intensity as the distance between radio stations was increased. The data secured in this were sufficient to permit the establishment of empirical coefficients to apply in a general law covering radio transmission, which is stated in the paper of Dr. Austin referred to, and the tests recently completed have given a number of additional relations, from which Mr. Hogan has extended the earlier work and evaluated the constants applicable to the most modern types of radio apparatus.

In the article in this issue it is shown that the same functional relation which had been found between attenuation, wave length and shorter distances holds for separations up to 4250 km (2642 miles). The only great disagreements between measured signal intensities and those calculated from the theoretical relation occurred when the ship was not very far from Arlington and therefore became absorptive effects were prominent. It is shown that in transmission from ship to shore on 2000 m wavelength the agreement is not so good as on the longer waves, in the opposite direction, and this may indicate that the wave length has at the other end wave length more absorption is not strictly accurate. Nevertheless from the present data it would be unwise to overthrown the expression involving a mode of variation previously defined by work with other considerably different wave frequencies, since the few discrepancies may be attributed to the natural uncertainty of measurement caused by atmospheric and other conditions.

The marked nonuniformity of the atmospheric medium used, as compared to the ether conductivity between, and the great difference in intensity between night and day signals, even upon wave-lengths as great as 3500 m, are especially worth of note. In addition to these, one of the most important points emphasized by a part of Mr. Hogan's paper is that bearing upon the intensity of signal required for regular radio communication. In Dr. Austin's comparison of output of present telegraph current system times as large as that necessary to produce a single sounder sound which just permits that to be distinguished from dashes, is needed to determine the "good hearing" between two stations. The data yield important information engineers seem to indicate that a current slightly greater than this is desirable for receipt of messages even under favorable conditions of "static" and interference, while satisfactory communication through average conditions requires very much larger current power.

The comparison indicating distances which had separate two intercommunicating high-powered stations at the design now installed at Arlington are based upon the average amplification of the receiver used. There should be considerable cause for this this being very low, possibly an apparent or subjective sensitivity of the receiver signals good worker, and therefore that even the largest currents quoted may be greatly exceeded by receiving a signal with difficulty at two or three miles. Such cases are not likely to be uncommon when the received waves become quite feeble, so that in the special apparatus known used signals and great signaling towers will naturally be required.

It is furthermore, that the great progress recorded has produced the making of new measurements in these directions for the purpose of measuring the absorption of waves of all the various periods in long-distance radio work, and that the experimental branch of the subject has been made possible, at least in a small way. It is equally unfortunate, however, that the several interests which have had long opportunities for working with communications have not been in the continued publication of some of the best work in this branch during up to the present time, and phenomena, such as those of radio absorption by day and night and great distances.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Change in Management of General Electric Company

At a meeting of the board of directors of the General Electric Company held on June 13 Mr. C. A. Coffin, president of the company since its organization, resigned and was thereupon elected chairman of the board of directors. Mr. E. W. Rice, Jr., vice-president of the company, was chosen as the successor to Mr. Coffin. No other changes have thus far been made in the management of the company.

### The Retirement of Mr. Coffin

By THOMAS A. EDISON

You inform me that Mr. Coffin has resigned the presidency of the General Electric Company and you ask for an expression from me. My opinion is that Mr. Coffin has for years been the principal asset of his company, a great personality, a master of modern business organization and truly one of the great captains of industry. For twenty years he has been promising me to take two hours off and come over to see my laboratory. But pressing engagements, etc., have delayed the visit. If he comes, I shall know that he really has resigned.

### Mr. Coffin as a Leader

By ELIHU THOMSON

Thirty years ago Mr. Coffin became interested in the electrical industry then just opening up. His sagacity, business ability and splendid courage in the face of great difficulties, his fine personality, his faith in the future of electricity, his ever-ready help and encouragement, so inspiring to those who were endeavoring to solve the new problems, gave to the Thomson-Houston Electric Company up to 1891 its position as a leading organization in the electric field. When in that year the Thomson-Houston Electric Company and the Edison General Electric Company combined to form the General Electric Company, Mr. Coffin became its president for the simple reason that no other man existed who was so fully equipped and so competent for the position. How well he has met the arduous tasks and duties of his position during the past twenty years is evidenced by the growth of the organization itself. It is the earnest wish of his friends that he may live in health for many years to enjoy the relief which he now takes.

### Mr. Charles A. Coffin

By E. W. RICE, JR.

It was my fortunate experience to meet Mr. Coffin about thirty years ago. I remember vividly this first meeting and the happy impression which I then formed of his inspiring personality, an impression that has but strengthened and deepened with the passing years.

He was one of a group of capable business men of Lynn who purchased the control of the little electric company started by Professor Thomson in New Britain in 1880. This company had been struggling along for two years under most discouraging circumstances; its financial resources were about exhausted; the future was dark and

uncertain; there was nothing but our childlike faith in the future of the industry to sustain us. At this critical time came the purchase by the Lynn syndicate.

We were amazed at Mr. Coffin's instant grasp of the business, engineering and manufacturing necessities and his wonderful faith in the magnificent future of the electrical industry. His influence seemed magical. Inspired by his intelligent enthusiasm, guided by his patient, wise counsel, difficulties vanished, work became a delight. Then began that loyalty and devotion to the upbuilding of an electrical enterprise the thrill of which can possibly be fully understood only by the fortunate participants.

The story of the constant growth of the company after its removal to Lynn and the addition of other organizations has been often told and is a part of the history of the industry. In the growth and development of the organization Mr. Coffin did everything possible to conserve that valuable asset, the human element—the inventors, salesmen, manufacturers and workmen. As a result, the new men were quickly absorbed and became as full of enthusiasm and loyalty as the "old employees."

The Thomson-Houston organization was largely active in the railway-traction and arc-lighting fields. Another great organization and business, the Edison General Electric, had meanwhile grown up based upon the inventions and engineering genius of Edison. Mr. Coffin clearly saw the great advantages which would result not only to the respective companies but to the electrical industry by a consolidation of these two organizations, and upon his initiative the union was finally accomplished. Within a few years after the consolidation complete unification was brought about with even increased loyalty, zeal and devotion to the new larger organization and to its enthusiastic leader.

Another important instance of his constructive ability was the agreement between the Westinghouse and General Electric Companies in respect to the exchange of licenses under their respective patents and inventions, by which an exhausting struggle over patents was terminated and millions of dollars saved from wasteful litigation. The most important result was the benefits which flowed from the fact that the engineers of both companies thus obtained complete freedom to select in every instance the best systems and design the forms of electrical machinery presenting the greatest advantage from both a mechanical and an electrical standpoint, which was of unparalleled advantage to the industry and to the public. I believe that the development of the electrical industry as we know it would have been delayed many years if this agreement had not been effected at that time.

Mr. Coffin has been without question the greatest single factor making for peace in the electrical industry. He was always quick to recognize the good qualities and work of the men of competing organizations and succeeded in changing hundreds of industrial enemies into the warmest of friends and companions. I consider him the greatest conservator of human energy in the electrical industry.

Mr. Coffin recognized from the beginning that the comprehensive development of the electrical industry was dependent fundamentally on securing the capital necessary for the growth and expansion of electrical undertakings, and his influence in educating investors to a correct appreciation of the value of securities of electrical enterprises has been

a most potent factor in bringing about the wonderful growth of the electrical public utilities which has taken place during the last thirty years, the service rendered by which contributes in such an important measure to the convenience and comfort of modern life.

While I cannot trust myself to do justice to his personal character, I am compelled to testify to the vivid impression made upon his close associates of many years by his quiet but wonderful courage in the face of the greatest difficulties and his uniform patience under the most trying circumstances. He naturally possesses all the intellectual qualities which popularly belong to great men, but greater than all is his compelling charm of personality and his deep sympathy for all that is worth while in human life and endeavor.

### Career of the New President

In the year 1880 Edwin Wilbur Rice, Jr., was called upon to make that momentous decision which so many young Americans have to make. He had just been graduated with first honors in his class in the Central High School of

Philadelphia. Two years previous to this time he had attracted the attention of Prof. Eldin Thomson, who then taught chemistry and mechanics in the high school, by his skilful amateur work in constructing telephone and telegraph instruments, induction coils and dynamos. Then the pupil fairly won the master's heart by his success in grinding and polishing glass specula and in silvering them by a new method orally communicated to him—a rare enough feat even after seeing it done many times.

Thus it happened that young Rice had free access to the store behind the baker's store where the earliest Thomson-Houston arc-light machines were being constructed, and thus it happened that in the summer of 1880 he was forced to choose whether he should go through college, with the prospect of a career which bade fair to be distinguished, or attach himself and his fortunes to the then infant industry of electric arc-lighting. With that coolness of judgment which has always continued to be one of his distinguishing characteristics, Mr. Rice turned his eyes resolutely away from the attractions which a college course presented and became Prof. Thomson's assistant and confidant in the American Electric Company at New Britain, Conn., then newly formed to manufacture arc-lighting apparatus under the Thomson-Houston patents.

The two years that followed, while fruitful in technical development, were far from showing the business prosperity in the new enterprise which had been anticipated, and Mr. Rice, while acting practically as treasurer of the electrical works, found time to wait armatures and otherwise to acquaint himself thoroughly with manufacturing details. Prospects grew brighter in the fall of 1882 when Messrs. H. A. Povear, C. A. Coffin and Silas A. Barten came from Lynn to purchase a lighting plant and ended by buying a majority interest in the American Electric Company, when they transferred to Lynn and renamed the Thomson-Houston Electric Company. Then followed two or three delightful years during which Mr. Rice was permitted to devote his energies to experiment and invention and during which

his name began to be familiar in the Patent Office, often in conjunction with Prof. Thomson's, for radical improvements in the electrical arc, though chiefly at this time in arc-lighting systems.

By 1882 the mounting genius of Mr. C. A. Coffin, who had become associated with Messrs. Povear and Barten on the removal of the works to Lynn, had begun to make itself felt in every direction, and the enterprise was growing with surprising rapidity. Under these circumstances the need of a superintendent of the works with an adequate technical knowledge of electricity began to be felt himself, and Mr. Rice, though still considerably under thirty years of age, was asked to accept this position. He hesitated for a moment, it was chiefly because his new field of labor would tend to break the chain of close association which had hitherto bound him to Professor Thomson. A short trial of the new duties was sufficient to show him about Mr. Rice that he was the right man for the place and also to convince him that his new responsibilities would not necessarily impair his fertility as an inventor. Besides his able and tactful management work was systematized, production was hastened and costs were cut down. To constant-current arc-lighting were quickly

added motor work, constant potential, incandescent and railway work, while the alternating-current transformer system of lighting was developed. Of all this expansion Mr. Rice was keenly a part, growing as the work grew, keeping abreast of the world's rapid progress in electrical science and in spite of his heavy daily task as superintendent, seldom failing to devote time to formulate new theories into practical inventions.

From the two friends who were employed in the Thomson-Houston factory at Lynn when Mr. Rice took charge in 1882, the number of men had grown to 3700 were at work there in 1892, when the next great change in his career took place, the Thomson-Houston and Edison General Electric Companies being consolidated into a new one, well known thereafter as the

E. W. RICE, JR.



General Electric Company, with Mr. C. A. Coffin as president and Mr. Rice as technical director. To follow his career after 1892 would be to write a history of the technical department of the General Electric Company. On June 20, 1894, he was elected to the office of chief general president of the company in charge of all its technical and manufacturing departments, scientific research, motor, fire president and in the retirement of Mr. Coffin, the unanimous choice of the directors as president.

It is worth while to look back upon the large and varied experience which Mr. Rice has had in the electrical field during the past twenty-eight years, during which he has been engaged, not only in scientific research, but in positions where his work passed out of that of only ideas or technical men of the world in looking out the path of least resistance for the advance of electricity in the arts. He has seen the despatch of the arc lamp displaced by more satisfactory combinations of electrical circuits. The responsibility for making the trolley system of the West End Street Railway at Boston a success and the most successful success, fell upon his shoulders. He has followed the growth of long distance power transmission, of power with its many domestic problems and has followed closely the electrical and mechanical development of the telephone system, in which



he has personally done much to insure its successful operation in commercial service. He has attacked successfully the weak point in distributing systems of polyphase currents at high voltage by the invention of an oil switch and the cellular system for separating buses and circuits now so widely used and which resulted in a switching system at once safe and simple. To him is also due the present system of alternating-current distribution and its subsequent conversion into direct current through rotary converters so largely used by Edison companies. He has been instrumental in the development of steam turbines and has witnessed the final overthrow of the reciprocating engine by the steam turbine in large central-station systems, and their erection in sizes as large as 30,000 kw. In fact, it was he who caused the adoption of the Curtis type of turbine and its subsequent development by the General Electric Company. Owing to his faith in the tungsten lamp and its final triumph, he caused investigations to be pursued with a view of obtaining a more rugged filament, which finally resulted in the present metallic-filament tungsten lamp which has been such a boon to the electric-lighting industry and a conspicuous milestone in the development of the art. His inventive genius is partially indicated in the statement that there have been granted to him more than 100 patents. However, while himself thus fertile as an inventor, Mr. Rice possesses to a conspicuous degree the valuable faculty of directing the inventive ability of others to meet the cases that are constantly arising in the industrial development of the art.

Mr. Rice is a member of the American Institute of Electrical Engineers, the Institution of Civil Engineers and the Institution of Electrical Engineers of Great Britain, a member of the Engineers' and University Clubs of New York, the University Club of Boston and the Pilgrims. After the Paris Exposition in 1900 he was created Chevalier of the Legion of Honor. In 1903 the degree of A.M. was conferred on him by Harvard University, and in 1906 Union College honored him with the degree of D.Sc. Mr. Rice was born at La Crosse, Wis., May 6, 1862.

### Government Suit Against Patent Monopoly

On June 9 United States District Attorney O'Brian filed suit at Buffalo, N. Y., in behalf of the Attorney-General against the Eastman Kodak Company, of Rochester, N. Y., alleging an unlawful monopoly in photographic cameras and supplies and praying for dissolution. Two corporate and four individual defendants are named in the bill. The Eastman Kodak Company of New Jersey is a holding corporation with a capital stock of \$35,000,000. The government charges that it owns the majority of the stock of the Eastman Kodak Company of New York, Kodak Limited, a London corporation, and also of the Canadian Kodak Company.

The government also charges that the Eastman company has bought control of many of its competitors and continues to operate them as independent concerns, thus controlling, it is said, 72 per cent of the business. In order to enjoy the Eastman patents, so it is charged, jobbers and dealers are required to purchase Eastman supplies, and the petition also recites that resale prices are unlawfully fixed on various products patented by the company.

President George Eastman of the Eastman company is quoted as saying that his concern is willing to adjust its business methods to meet the government's charges, operating its retail houses under its own name in all cases and abandoning its exclusive sales policy. Regarding the last matter, Mr. Eastman is reported to have made the further statement:

"One of the main points of this policy (respecting dealers in our patented goods handling no other similar goods) has been to prevent the substitution of goods that were

inferior to ours. However, desiring to avoid a long and expensive litigation, the waste of time of our most important men and the unsettling of normal business conditions, we are willing to meet the wishes of the government even on this point."

This action by the government is the first procedure against the fixing of resale prices on patented goods since the United States Supreme Court handed down its notable decision in the "Sanatogen" case on May 26 denying such right.

### A. I. E. E. Convention Entertainments

The technical program of the next annual convention of the American Institute of Electrical Engineers, to be held at the Hotel O-te-sa-ga, Cooperstown, New York, June 23-27, was given in our issues dated May 10 and June 7. Twenty-four papers upon a wide variety of subjects of interest to the electrical engineering profession will be read and discussed. The following events have been arranged by the entertainment committee for the enjoyment of members of the Institute and guests during the convention:

Monday, June 23, 9 p. m., reception and dance in the ballroom of the Hotel O-te-sa-ga, to which all members and their guests are invited.

Tuesday, 2:30 p. m., preliminaries in golf and tennis tournaments. A ball game will also be played on Tuesday afternoon.

Wednesday, 10 a. m., an automobile trip around Otsego Lake for the ladies; 8 p. m., ladies' bridge tournament.

Thursday, 10 a. m., court golf tournament for the ladies; 2:30 p. m., finals in golf and tennis tournaments; 4 p. m., steamer excursion on Otsego Lake.

The committee is arranging for suitable prizes in the various tournaments. A prize will also be given for the largest fish caught during the convention.

Many of the members from the New York neighborhood will take advantage of the opportunity to travel by boat up the Hudson River to Albany. The night boat reaches Albany in time to make connection with the train which arrives at Cooperstown before noon.

### Ohio Electric Convention

An unusually attractive program has been planned for the nineteenth annual convention of the Ohio Electric Light Association, which will be held at the Breakers Hotel, at Cedar Point, Ohio, on July 15, 16, 17 and 18. The first session will commence at 2 p. m. on Tuesday and will consist of an address by President J. C. Martin, of Wilmington, Ohio, the report of the officers, and an address and demonstration on "Cooking by Unity Load-Factor Electric Ranges," by Mr. Matthias Turner, of Cleveland, Ohio. The other sessions will commence at 9:30 each morning. On Wednesday, which is "commercial day," the following papers will be delivered: "Retention of Business of Dissatisfied Customers," by Mr. Thomas F. Kelly, of the Dayton Power & Light Company; "New Business," by Mr. J. E. North, of the Springfield (Ohio) Light, Heat & Power Company; "New Applications of Electricity as an Adjunct to New Business," by Prof. F. C. Caldwell, of the Ohio State University, and "Means of Developing and Diversifying the Present Load," by Mr. H. E. Armstrong, of the Tri-State Railway & Electric Company, of East Liverpool, Ohio. Mr. S. G. McMeen, president of the Columbus (Ohio) Railway & Light Company, will give an address on the subject "The Human Equation," on Thursday. Following his talk will be a report from the committees on meters and on long-distance transmission, by Messrs. A. H. Bryant and M. H. Wagner respectively. The fourth and last session will consist of addresses by Mr. James V.



Oxtoby, counsel for the Edison Illuminating Company of Detroit, on the subject of "Franchises," and by Mr. A. M. Seeger, of the Toledo Railway & Light Company, on "Illumination as a Commercial Product."

Entertainments of various sorts have been scheduled for the men and women who attend the convention. On Thursday evening the Sons of Jove will hold a rejuvenation, reunion and banquet.

### International Association of Municipal Electricians

The eighteenth annual convention of the International Association of Municipal Electricians will be held at Watertown, N. Y., Aug. 19 to 22, with headquarters at the New Woodruff Hotel. Among the subjects to be discussed in the papers presented at this meeting will be fire alarm and police signaling, electrical inspection, municipal lighting, electrolysis, joint use of poles, permissible voltages on overhead wires in cities, standardization of specifications for cables, and municipal ownership. A number of entertainment features are also planned for the delegates. For the convenience of those coming through New York city, special sleeping cars will leave the Grand Central Terminal at 9:30 and 11:30 p. m. Aug. 17 and 18, running through without change to Watertown. Mr. John W. Kelly, Jr., Camden, N. J., is president of the association, and Mr. Clarence R. George, Houston, Tex., is secretary.

### Commercial Section Executives to Discuss Ways and Means

The executive committee of the Commercial Section of the National Electric Light Association will hold a meeting at Association Island, Henderson Harbor, N. Y., on Aug. 7, although it is expected that most of the members will spend the entire week on the island. At this meeting tentative plans for the year's work will be discussed and many new features of Commercial Section work to be taken up during the year will be outlined. At the recent convention the small-company representation on the committee was increased, and it is the intention to devote much time and labor to the problems which confront the small stations during the coming year, under the régime of Chairman T. I. Jones, of the Brooklyn Edison company. Moreover, it is proposed to keep down the number of Commercial Section papers to be presented at next year's convention so as to give ample time for discussions. An active campaign is now under way to increase the interest and membership in the Commercial Section, and the details will be presented at the meeting on Aug. 7. The plan and scope of the publication work of the section will also receive attention as well as the adoption of by-laws.

### Five-Hour Outage on Ontario Hydroelectric System Due to Lightning

For the first time since the beginning of operations in September, 1910, the Ontario hydroelectric system experienced a serious and prolonged interruption on June 16, due to lightning. For fully five hours the entire district supplied by the Niagara transmission system of the Province was without electrical energy, and every industry and street railway within the 207 miles dependent for electricity on the Ontario hydroelectric system was stopped or discontinued and every householder using electricity inconvenienced. Interruption of service in Toronto occurred about 4:30 in the afternoon, while St. Thomas reported a break in the line at 2:30, and it was well on to 10 o'clock at night before the public lighting in the streets of Toronto was resumed.

A heavy storm passed over the country between Niagara and Toronto on Monday, and it is reported that two large insulators were struck on the line between Dundas and Port Credit. As is well known, the lines are in duplicate, but unfortunately both lines were struck, completely tying up the system. The western towns of Ontario—notably Berlin, Stratford, Woodbury, Preston, Ingersoll, Oakville and London—were the chief sufferers, most of the towns along the Ontario lake front having competing service. In St. Thomas the companies were forced into the office of a general passenger car agent. In Toronto, where the local hydroelectric system has about 19,000 customers, the inconvenience was hardly less annoying to stores, restaurants and theaters. The residents at West Toronto were left without an water supply as the interruption of service at the pumping station.

The Toronto Electric Light Company, Ltd., met the civic extremity by sending out three emergency crews and all available linemen to make repairs as quickly as possible with the service otherwise possible. Several theaters, hotels and other public places were supplied with emergency as well as a considerable number of residents on Avenue Road, the principal business thoroughfare. As all street lighting in Toronto is on the incandescent system, the Toronto Electric Light Company could be of particular service in the present, and the emergency was not abating fifteen minutes to 9:45 p. m. As a result of its prompt action, however, the Toronto Electric Light Company, Ltd., has received many letters of thanks and also a number of new customers.

The Ontario hydroelectric system has no steam-power reserve, depending on the water conditions for continuity of service. It was also noted at the meeting that, if there were any serious trouble, no steam reserve could be carried. No time was lost, and the trouble was such as to necessitate attention of the entire line before it was located and remedied.

### Railway Electrical Engineers at Atlantic City

The semi-annual convention of the Association of Railway Electrical Engineers was held at Atlantic City, N. J., June 16, coincidentally with the conventions of the Railway Master Mechanics and the Master Car Builders associations in session there during the week.

Mr. H. C. Meloy, of the Lake Shore & Michigan Southern Railway, acted as chairman in the absence of Mr. D. J. Cartwright, of the Lehigh Valley Railroad, president of the association. President Cartwright's official address, which was read by Secretary J. A. Andriano, Chicago & Northwestern Railway, Chicago, pointed out the accomplishments of the railway electrical engineers during recent years. Up to this time twenty-seven of its recommendations have been officially adopted by the Master Car Builders' Association, and the transactions of the society have received the recognition and approval of high officials in the railway field. In 1910 there were only 300 electrically lighted railway cars, which number has since been increased to 12,115 cars now in charge of members of the association representing an expenditure of \$3,000,000. Similarly the association membership, twenty-five in 1908, has grown to a present enrollment of 280.

In his own paper, Secretary Andriano spoke of the broadening of the association's work into other fields besides car lighting, including shop electrification, arrangement of means for illumination, etc. His business report showed the flourishing condition of the society.

### Important to Southern Electricians

Among the reports of committees submitted, chief interest was aroused in that on methods of charging storage batteries for the electric lighting of passenger cars, presented by Clarence E. R. Shaw, Pennsylvania Railroad.

The committee outlined six schemes of straight-storage charging, four for use with head-end systems, and six for axle-generator service. The principles, characteristics and relative advantages of each plan were described, and the majority of the committee recommended the following as best suited for standard use: Straight storage—constant potential with ballast resistor; ampere-hour meters and shunt-trip circuit-breaker on each car. Head-end—constant potential with ballast resistance; ampere-hour meters and shunt-trip circuit-breakers on each car. Axle-generator—constant battery current with voltage control; ampere-hour meter on each car to indicate charge condition of battery and show whether terminal charging is necessary.

The majority report was signed by Messrs. J. R. Sloan (chairman), F. R. Frost, H. C. Meloy, L. S. Billau, W. L. Bliss, W. E. Winship, H. M. Beck, H. G. Thompson and R. C. Lanphier. As a minority comment, Mr. R. Norberg opposed the straight-storage method recommended by the report, declaring that since the majority of batteries in car-lighting service are far from normal the scheme proposed might work more damage than good. While admitting the recommended method to be the best theoretically, he declared that for practical purposes under general service conditions the most desirable scheme is that of holding the charging current constant by adjustable resistance, while determining the ampere output by an ampere-hour meter. This meter should be designed to compensate for the cell efficiency, automatically shutting off the charge when completed.

Mr. J. H. Davis, Baltimore & Ohio Railroad, bore out Mr. Norberg's contention that the recommended method was chiefly of theoretical, rather than practical, value. Close record must be kept of the specific gravity of the electrolyte. The "fool-proof" qualities of the Edison battery recommend that cell, he thought, for railway use. Mr. L. S. Billau, Baltimore & Ohio Railroad, said that while no difficulty is experienced in getting operating reports, the labor and expense of obtaining these is sometimes excessive. Mr. E. W. Jansen, Illinois Central Railroad, recommended that values of both voltages and resistances be included in the committee's report, and Mr. Edward Wray, *Railway Electrical Engineer*, requested more detailed information concerning methods. Mr. Joseph A. Andreucetti, Chicago & Northwestern Railroad, doubted the possibility of rigidly fixing any standardized battery-charging method under the varying conditions of practice.

#### OTHER COMMITTEE REPORTS AND PAPERS

Brief progress reports were also submitted by the following members of committees: Head-end equipment, W. J. Bohan, Northern Pacific Railway; head-lamps, C. R. Sugg, Atlantic Coast Lines; illumination, L. S. Billau, Baltimore & Ohio; data and information, Edward Wray, Chicago; lamp specifications, J. L. Minnick, Pennsylvania Railroad; outside construction, H. M. Warren, Delaware, Lackawanna & Western Railway; standards, standardization and shop practice, E. W. Jansen, Illinois Central Railroad; wire specifications, W. A. Delmar, New York Central; terminal facilities, Alexander McGary, New York Central.

Mr. A. J. Sweet, of Milwaukee, Wis., illuminating engineer, has been retained by the committee on illumination to conduct a series of tests of illuminants, reflectors, arrangements, spacings, etc., which will be reported at the Chicago meeting in October.

At the afternoon session Mr. S. T. Dodd, of the General Electric Company, Schenectady, N. Y., delivered an illustrated talk on the gasoline-electric motor cars manufactured by his company, tracing their development in competition with other self-propelled units and describing the present 165-hp outfits which can attain high speeds and make runs of several hundred miles on a single charge of fuel.

Representing the Illuminating Engineering Society, Mr. G. H. Stickney, New York, appeared before the railway electrical engineers to ask for more active co-operation in the fields of illumination of cars and railway properties. He suggested joint meetings, the exchange of authors of papers, joint committees and representation on local committees. Mr. J. L. Minnick expressed approval of the plan, which, he said, would impart valuable information on lighting to the railway men, while at the same time it might give the illuminating engineers a more practical conception of railway requirements.

The annual convention of the Association of Railway Electrical Engineers will be held at the LaSalle Hotel, Chicago, Oct. 20 to 24.

#### The New York Electrical Society

A total of 275 members attended the visiting meeting of the New York Electrical Society recently held at the Woolworth Building. Mr. Charles E. Knox, consulting engineer, described briefly the electrical installation and elevator equipment of that building. The members were taken into the generating room, which contains two 500-kw, one 300-kw and one 200-kw reciprocating-engine-driven 250-volt generator unit. The building is equipped with a three-wire system, balancer sets being used to take care of the neutral current.

Two of the twenty-eight elevators were utilized to carry the members to the fifty-first floor, while a shuttle elevator carried them to the observation gallery on the fifty-fourth floor. The main elevators are of the gearless traction arranged for a speed of 700 ft. per minute. On account of the severe service to which the elevators are subjected use is made of an elaborate signaling system by means of which a dispatcher, whose sole duty is to start the cars at proper intervals, can communicate with each elevator operator at any time and thus prevent useless waste of time.

At the annual business meeting of the society held in connection with the visiting meeting the following officers were elected: President, Mr. H. H. Barnes, Jr.; vice-presidents, Messrs. S. S. Edmands, A. H. Lawton and Carl Schwartz; secretary, Mr. George H. Guy, and treasurer, Mr. Henry J. Hoeltge. Mr. Guy V. Williams was awarded the Barnes silver cup for securing the largest number of applicants for admission to the society during the season.

The secretary announced that Nos. 1 and 2 of the *Transactions* of the society have been printed and distributed, and two other issues will appear shortly. The publishing of the transactions represents a new and important departure in the society's activities.

No. 1 of the *Transactions* includes papers presented at the meeting of October, 1912, by Drs. Baskerville and Goldsmith, of the College of the City of New York, the respective titles being "The Chemistry of Tungsten and the Evolution of the Tungsten Lamp" and "Radio-Engineering at the College of the City of New York." The first-mentioned is of particular interest for its historical account of the development of the tungsten lamp. The paper by Dr. Goldsmith includes an illustration and description of the very complete wireless-telegraph equipment presented to the college by Mr. Gano Dunn.

The second issue includes a biographical sketch and portrait of the late Horatio A. Foster, Mr. Foster's paper (presented Nov. 25, 1912) entitled "Reminiscences of an Electrical Engineer," and an illustrated description by Mr. Carl Schwartz of the New York Central Terminal, a visit to which formed the program of the December meeting of the society.

The paper presented Jan. 30, 1913, by Dr. R. W. Wood, of Johns Hopkins University, on "Photography by Invisible Light" forms, with illustrations, the subject of No.



3. Issue No. 4 contains an illustrated account by Mr. William J. Hammer of the Rupert historical collection of incandescent lamps—more than 1000 in number—formed by the author, now the property of the Association of Edison Illuminating Companies, which has provided appropriate quarters for the collection in the Engineering Societies Building, where it may be seen by the public. This issue also includes the paper presented on the same date by M. Antoine Pollak describing the Pollak-Virag rapid telegraph which photographically records in letters the words of messages. The lecture by Mr. C. F. Lacombe, delivered at the March meeting, on New York City street lighting and fixtures is printed, together with numerous illustrations, in No. 5.

The April meeting furnished two excellent papers on flying machines, which form No. 6 of the *Transactions*. One of these, by Lieut. T. G. Ellyson, U.S.N., is of particular interest through giving a historical sketch of the development of the "flying boat" and accounts of its latest forms and achievements. The second paper, by Mr. E. A. Sperry, has for its subject the application of the gyroscope to the flying machine, the text being well illustrated.

The successful career of the New York Electrical Society since its organization in 1881 has abundantly justified its founders in the belief of the need of a society in New York City having for a purpose "to present in popular but none the less authoritative form the latest advances in the electrical and allied sciences and arts." This need has rather been heightened than otherwise since then by the establishment there of many purely technical societies, the work of which the New York Electrical Society admirably supplements by a popular treatment of many subjects that these bodies deal with primarily from the more strictly technical point of view.

Now that its *Transactions* are being printed regularly, there is a prospect that the society will receive the additional support necessary to make it definitely an institution like those in London, Paris, Berlin and elsewhere in Europe. The latter have become celebrated for their courses of lectures appealing almost equally to laymen and men of scientific pursuits. It is expected that, as a result of the efforts and example of Retiring president H. L. Doherty, supplemented by the generosity of his vice-president Willard F. Case, in publishing the *Transactions*, the society will receive the larger support which alone is needed to permit it to attain easily the rank of its successful sister societies in European cities.

## Joint Meeting of British and French Electrical Engineers at Paris

A joint meeting of the British Institution of Electrical Engineers and the French Société Internationale des Electriciens was held at Paris May 21 to 24. After the visitors had been welcomed by M. Berthelot, president of the French society, the following six papers on electric traction subjects were read in abstract and discussed.

### HIGH-TENSION CONTINUOUS-CURRENT TRACTION

In a paper by Mr. L. Graumüller were discussed the possibilities of development of high-tension direct-current traction systems. After sketching the history of such systems, the general problem was considered under the several heads of high-tension generation, use of overhead trolley conductors, motors and accessories, control, safety, etc. At 1200 volts and above, the motor-generator with its increased number of poles becomes available for generation. The cascade converter may be regarded favorably up to 10,000 to 12,000 volts. Its operation is excellent and its starting and compounding easy. The rotary converter is available for ranges up to 1200 volts. A dynamo with a single commutator will operate satisfactorily up to 1500 volts, or indeed at 3000 volts by adding a second winding and two

commutator, or one by means of putting two machines in series.

Railway-type mercury rectifiers are now being perfected and such apparatus with ratings up to 300 kw already built. Since the fall of pressure in these tubes is constant, the efficiencies obtained at high voltages are nearly unity. Pressures of 300 volts continuous current are likely to be the safe limit for some time to come. But even at this pressure, 300 amp is equivalent to a heater of only 1000 kw; it appears that powerful locomotives can be worked only where a thermal is intended to generate secondary surface and contact pressure.

The author also presented a theoretical and experimental analysis of synchronous motor use for railway operation, discussing problems of their design, sustained overcurrenting, stalling, induced motion, unbalanced motion, etc.

The paper includes a tabulation of practical installations of high-tension direct-current railway operation in America and on the Continent. The highest voltage here is that of the Butte, Anaconda & Pacific Railway, on which road 121 miles of track are electrified at 2400 volts direct current.

### SINGLE-PHASE TRACTION

In a paper read by Mr. Eugene Lemoine on single-phase traction various mechanical considerations, design of overhead conductors, and more detailed special questions being paid to the subject or pointed out both the traction and the series type. The motor concerned with to the Lemoine paper, the Mtd, have included the well-known Brownian series type, the Brown-Brown simple repulsion motor, the A. E. G. compensated repulsion motor, the Brown series motor with a transverse field for compensating the electromagnetic forces of short-circuit under the brushes, and the series motor with an elliptical field built by the French Thomson-Houston Company. On account of its weight the repulsion motor is found inferior at frequencies of 50 cycles per second. Owing to its smaller number of poles a greater amount of iron is required in this type of motor, with, consequently, less advantageous use of the material.

### DIFFERENTIATION OF THE CURRENT BY THE MOTOR

In a paper by Mr. M. Lemoine were discussed the plans for the electrification of the railway de Paris de St. Denis. The French government will defray the expense of the hydroelectric power plant, pipe lines, power house buildings and substations. While the Compagnie des Mtd will furnish the hydraulic and electric machinery and their accessories. The lines to be constructed have very steep gradients, which constitute one of the most factors that led to electrification. The practicable speeds range from 70 to 60 km per hour. Sixteen cycles, 12,000-volt single-phase current is to be used for operation. Of the six types of overhead equipment four are of the simple catenary type, the fifth is of the double catenary type, and the sixth is of the Mtd type.

The rolling stock consists of both locomotives and motor cars, the locomotives being especially suited for hauling long trains coming from non-electrified sections of the system. The locomotives have three driving axles, each a wheel on each axle, and are of the two locomotive, where weight 80 tons, carried is taken from the line by two groups of 40. An induction regulator controls the current. This commutator conductors. The working of this regulator is as follows: The regulator has two. The motor has one of the latter series motor type, having a variable speed and changing its speed of operation continuously when it runs, but when it is stopped, which is the speed corresponding with the chronometer. The paper is read in French and summarized in English by the author.

### ELECTRIFICATION OF THE PARIS SUBURBAN TRAM

Mr. A. N. Noyes presented a paper describing the electrification plans for the State railway suburban system in the vicinity of Paris. A method of obtaining conditions, such



hours, seasons, etc., has led to the use of a single type of electric car carrying 100 passengers including "straphangers." The author pointed out that the single-phase system affords considerable simplification in distributing arrangements by the use of static transformers in place of rotary-converter substations. It also accomplishes a saving in the number of attendants, improved efficiency and freedom from electrolysis troubles. With the direct-current system the equipment of the coaches is much lighter and less cumbersome, the acceleration is more rapid and the motors are more efficient. This system is also safer, since the current does not have to be taken above the floor of the car. The power house will be required to furnish 400 to 500 motor coaches with 650-volt direct current through a third rail paralleling the track. The substations will receive this energy as three-phase, 25-cycle, 15,000-volt alternating current. The third-rail collector shoe is to be of the under-running type. By the aid of an interesting control system a certain variation is permitted in the voltage of the direct-current supply.

#### RAILWAY ELECTRIFICATION PROBLEMS IN THE UNITED STATES

A paper by Mr. H. Parodi was devoted particularly to financial and operating results of railway electrification in America. The subject was divided under the three heads of suburban lines, main-line service and mountain railways. Among the tabulations of data given were an estimate of the cost of the New York, New Haven & Hartford single-phase electrification, an account of the working expenses of the New York Central electrification, etc.

From curves presented by the author it was shown that as the weight increases the cost of steam traction rises much more rapidly than does the cost of electric traction. The cost of maintenance and repairs to electric locomotives does not, on the other hand, seem to be directly affected by the gradient or by the drawbar pull. Thus there is a certain weight above which electrical working is much more economical than steam working.

Other interesting considerations result from electrification. With regenerative braking, track maintenance and brake-gear up-keep have been found to be reduced. Long gradients can be descended almost without the application of mechanical brakes. The saving in up-keep and repairs appears to be sufficient to pay for a considerable part of the initial cost of electrification.

#### PETROL ELECTRIC-MOTOR VEHICLE

A paper by Mr. J. B. G. Damoiseau contained a brief historical sketch of the earliest self-contained electric-propelled vehicles, which used steam prime movers, and was devoted largely to detailed descriptions of the gasoline-engine-driven motor vehicle of the Société Anonyme de Locomotion Électrique, the North Eastern Railway Company, the Dion-Bouton system, the Société Westinghouse du Havre, the Bergmann Elektricitäts-Unternehmungen Aktien-Gesellschaft, the Allgemeine Elektricitäts Gesellschaft, the General Electric Company, the British Thomson-Houston Company, the Swedish State Railway, the Pieper system and the Thomas petrol-electric system.

The advantages and disadvantages of the various types were enumerated and a discussion was included of the best fuels to be used. Initial cost and cost of operation were also discussed, together with figures giving the total expenses of running petrol-electric vehicles. The four types of independent motor vehicles now available are those driven by steam, storage batteries, gasoline engines with mechanical transmission and gasoline engines with electric transmission. Storage-battery-driven cars, declared the author, have not been abandoned, and gasoline engines with mechanical transmissions are not flexible. The desirable characteristics displayed by the gasoline-electric cars emphasize, however, the shortcomings of the steam units, so

that if the use of independent motor vehicles continues to develop gasoline-electric cars may preponderate.

#### Discussion

With Mr. W. Duddell in the chair, the discussion was opened by Mr. Mazen, who explained that the problem of electrifying the suburban lines of the Ouest État Railway was largely governed by the fact that the rush-hour traffic is about eight times that of the slack hours, whereas the usual ratio on suburban lines may be regarded as 3 to 1. The ease with which the power of the trains could be varied was of importance, consequently motor coaches have been employed, without trailers. For the Ouest État road, the newest trains will have four-motor coaches, totaling 640 hp per coach, which is equivalent to 9 hp per ton. Concerning the question of single-phase versus direct-current operation, Mr. Mazen admitted that single phase with an overhead conductor is excellent for single track and light traffic, but with large stations and several lines of rails the advantage is neutralized. But even in the case of ordinary double-track lines engineers are opposed to overhead construction, especially trolley wires suspended from span wires, for in the event of a derailment two or three posts knocked down would stop the whole line and temporary single-track working during the emergency would be impossible. At Batignolles and St. Lazare on the Ouest État system there are twenty and thirty lines of track respectively. Each track must be absolutely independent of the other, which is always possible in third-rail operation.

Mr. Robert T. Smith spoke chiefly on Mr. Parodi's paper, which, he said, was of particular value in showing why the electrification of railways offers a different problem in the United States from that in Europe. For suburban lines the engineering problems of electrification have been solved, and merely the commercial problems remain. In the case of hilly districts there is a critical gradient above which electric driving will always pay. In Mr. Smith's opinion either direct-current or single-phase is better than three-phase owing to the series characteristic torque obtained. Recuperative braking does not spoil the single-phase motor in other respects. There is an immediate future for electric traction for mining traffic in hilly districts. A 3500-volt direct-current line will be started in England soon. For general purposes, said the speaker, the actual strength of the drawbar is the limiting factor. Averaging 12 tons, this corresponds to a train weighing 2500 tons to 3000 tons.

Mr. Robert Hammond, speaking in French, offered his thanks and congratulations to the authors of the six French papers. The question of electrification, he said, is entirely an economic one, and he considered that it was largely dependent on plant costs.

Mr. Bochest spoke on Mr. Damoiseau's paper. He referred to the pioneer work of Heilmann and pointed to the large variety of uses which exist for "electric coupling." For the turrets on warships, for instance, a range of speed of 1:300 is desirable, while the masses to be moved are enormous. In such a case there might be a saving of 30 per cent in fuel by using electric drive.

Mr. Marius Latour said that since the contact surface on the commutator depends on the frequency, there is no doubt that the cost of maintenance of a 25-cycle system is nearly double that of a 15-cycle system. He contended that the use of auxiliary poles in single-phase motors introduces no complications. The single-phase system requires heavier locomotives but affords the advantage of a single contact wire. Mr. Latour regretted the separation of single-phase systems into two sharply divided schools of practice and advocated a combination of the best points of all the methods. He touched briefly, but without appearing very sanguine, on the ultimate possibility of employing a rotary converter on the locomotive, so as to enjoy the combined advantage of high-tension single-phase at a comparatively high frequency on the trolley, and the direct-current motor





since the operator does not know who is the calling subscriber. To make provision for this he proposed a signal-lamp board arranged to be visible over the entire exchange. Mr. Nash also pointed out that the operator should save about one second per call where the traffic distributor is employed, and that in consequence the equipment of the operator's position might be increased by three or four cord circuits. The next step would be to wipe out the multiple altogether.

#### ENTERTAINMENT, VISITS TO WORKS, ETC.

As a feature of the meeting, two of the largest generating plants in Paris were visited, namely, the St. Denis station and the so-called Triphase at Asnières, which latter however contains a large proportion of two-phase equipment as well. The St. Denis plant, a description of which has been published in these columns, is the larger of the two stations. Considerable interest was evoked by an 11,000-kw Brown-Boveri turbine set recently installed there. It is a 25-cycle machine generating at 10,250 volts and running at 750 r.p.m., and it has an overload capacity of 15,000 kw for half an hour. The other visits of the delegates included the tramway and railway depots and car sheds of the Compagnie Générale des Omnibus de Paris, the Metropolitan Railway and the Nord-Sud Railway and also the wireless installation of the Eiffel Tower.

### "Home Rule" Versus State Control of Illinois Public Utilities

An interesting public hearing was held on the evening of June 16 in the Capitol at Springfield, Ill., by the committee on public utilities of the State Senate. The question under discussion was the adoption of the Rapp bill creating a public-utility commission for the State of Illinois. This bill was originally drawn to cover interurban utilities, such as railways, telephone and telegraph service, while permitting cities of over 20,000 population to elect whether they should come under commission control as to local utilities, like gas, electric service, water supply and local telephone and street-railway service. However, the lower house cut out Article 6, containing this provision, making it a straight state-wide public-utility-commission law.

This action was extremely distasteful to the city administration of Chicago, which has had municipal regulation of utilities for the last eight years. A special meeting of the City Council was held on June 16, beginning at 9:30 a.m. Resolutions favoring "home rule" of public utilities and the restoration of Article 6 were adopted. It was also voted that all members of the City Council be urged to go to Springfield later in the day to present the city's case. In the brief debate Alderman Cullerton made the point that the city receives between \$900,000 and \$1,000,000 a year as compensation from local utilities.

Mayor Harrison, several members of his official family and about forty of the seventy aldermen went to Springfield during the day and appeared at the public hearing in the Senate chamber in the evening.

Senator Glackin, of Chicago, chairman of the Senate committee on public utilities, presided at the meeting. He is in sympathy with the "home rule" idea, and so declared himself in opening the meeting. He asked whether the Legislature was afraid to trust the people to control their own local affairs. He said that he expected the Governor to veto any measure opposed to home rule. Chicago had one-half of the utilities of the State and looked to the Senate for protection, he said.

Mr. W. H. Sexton, corporation counsel of Chicago, gave a history of the present legislative situation. He asked for home rule for Chicago, defining home rule as control by the City Council and not by a municipal commission.

Mayor Carter H. Harrison, adroit and self-possessed, made a strong appeal to the Senators to permit Chicago to retain its present system of municipal control. It would be reactionary, he said, to take away from Chicago home rule of public utilities. The Mayor thinks that the city has exercised its discretion well and cited the traction settlement ordinances of 1907, which have brought \$11,000,000 into the city treasury. He declared that traction conditions in Chicago compare favorably with those in Milwaukee and New York—cities where state-commission control obtains. Further, Chicago has obtained for itself 80-cent gas, and the Mayor has no doubt that a satisfactory settlement will be reached with the Commonwealth Edison Company in the pending readjustment of electric-service rates.

The Mayor was asked many questions. To Senator Walter Clyde Jones he said that no doubt a municipal commission or bureau would be created by the City Council unless adverse legislation prevented. Senator Dailey, of Peoria, cross-examined the Mayor as to political party pledges and as to possible conflict between state and municipal control as in the case of local and long-distance telephone traffic, for instance. Mayor Harrison expressed himself as welcoming state regulation of interurban utilities, such as railways, telegraphs and telephones, with home rule for all municipalities in the State, large and small. There would be no conflict, he thought.

Alderman Richert, chairman of the finance committee of the Chicago City Council, said that the men composing that body, each representing from 60,000 to 75,000 constituents, could be trusted.

Alderman Charles E. Merriam, the leading independent of the Chicago City Council, who is also professor of political science in the University of Chicago and widely known as a scholar in politics, supported his colleagues unreservedly on the home-rule proposition. He explained the *modus operandi* of municipal regulation in Chicago through the Council committees on local transportation and gas, oil and electric light. He believed that the city had secured better results than would have been obtained by a state commission, and cited the recent telephone-rate regulation in proof. A state commission would have less accurate knowledge of local conditions. He made the statement that City Electrician Palmer's report on electric-service rates recommended a bureau of inspection of electrical service. The public utilities of Chicago are capitalized at \$500,000,000 and have a combined gross income of \$100,000,000 a year. However, the city has not the power as of right to inspect the books of these corporations and to make physical valuations. The city, he thought, should have this power.

Governor E. F. Dunne was the last speaker. He expressed his belief in the principle of regulation of public utilities. He made his campaign largely on this issue. After election he aided in drafting the so-called Rapp bill. The Governor said that he sympathized strongly with the home-rule sentiment, not in Chicago alone, but in other Illinois cities. Chicago had been quite successful in municipal regulation. Large cities were better able to make rate investigations than small ones, having greater means and resources. A state commission was particularly useful in protecting small cities from the great utility corporations. The sentiment of Chicago should be respected. The Governor made it clear that he favored the bill as originally drawn, rather than as amended by cutting out Article 6, but he did not say that he would veto the bill if the Senate passed it as amended by the House.

The committee adjourned to meet at the call of the chairman. As the Legislature is to adjourn on or before June 21, it was still uncertain when this account was written whether the Rapp bill would be enacted into law at this session.

The bill was passed to second reading in the Senate on June 17, without reference to a committee.

## Public Service Commission News

### MICHIGAN COMMISSION

In granting the Northern Michigan Power Company authority to do business in the State, the Michigan Railroad Commission laid down the principle that capitalization must be based on investment rather than upon the earning power of the company. Application had been made for incorporation with a capitalization of \$10,924,166, but the commission decided that \$9,054,542 would be sufficient for the purposes of the company in covering its investment Authority to pay banking and brokerage fees was refused. The value placed on the flowing rights was not accepted and the sum for this investment was placed at \$1,450,000, instead of \$2,265,000, as asked. Sufficient funds were also allowed for expenses until the property is self-sustaining and capable of returning some profit on the original investment.

This company was originally organized to build a power plant on the Sturgeon River for the purpose of furnishing the copper-mining section of the upper Michigan peninsula with energy. The commission has sought to prevent the issue of more securities than is actually necessary to put it into good operating condition. It asserted that in the past stock and securities were issued up to the limit of the earning capacity of many companies and that the commission was established to prevent this practice. Lands and properties, the commission said, should be capitalized at a fair market value and the company should have an allowance to cover time and efforts between the dates of conception of the idea and completion of the plant.

### OHIO COMMISSION

The Sandusky Gas & Electric Company has appealed to the commission from an ordinance passed by the City Council of Sandusky reducing the charges for energy. The present rate is 8 cents per kw-hr. for the first three units and 5 cents for all above that. The new ordinance makes a flat rate of 5 cents up to 30 kw-hr. and 3 1/2 cents for all above that amount.

### MARYLAND COMMISSION

The Maryland Public Service Commission has received from its counsel an opinion in which the plan of the Consolidated Gas, Electric Light & Power Company, of Baltimore, to permit customers to purchase electrical devices and appliances by crediting the deficit on minimum electrical charges on the appliance purchase price is condemned. The opinion was the result of a protest from a user of electricity against having to pay \$2.20 in addition to what he had already paid for his electrical energy during the past twelve months. The company claimed that the consumer had a contract under a plan making a minimum charge of \$1 a month, and inasmuch as he had used only \$0.80 worth of energy during the year, it claimed \$2.20 due on the contract. The company offered this consumer the privilege of buying an electric appliance and agreed to credit the \$2.20 to the purchase price, and in his answer the commission's counsel says that the consumer is liable for the \$2.20, but he scores the company for offering to apply that amount on the purchase of an appliance.

### NEW YORK COMMISSIONS

The Public Service Commission for the Second District announces that it has by order entered June 12, 1913, required further and large reductions in telephone toll rates between points in the city of New York. The reductions now to go into effect provide a common 1-cent subscribers' toll rate between Manhattan, Melrose and Tremont, on the one hand, and all of the city territory except Long Island except Bay Side, Hollis, Springfield, Far Rockaway and Hammels, to which the rate will be 10 cents. Corresponding reductions are made from the upper Bronx. The commission commends the telephone company for its response to the investigating order, as the result of which

numerous reductions in subscribers' toll rates, aggregating a large sum, will be effected. Such action has been taken by the company without insistence on regular procedure in the case, with the submission of sworn testimony, thereby avoiding the expenditure of much time and labor in public hearings and the compilation of documentary evidence.

### MICHIGAN COMMISSION

In deciding against the Appleton Water Works Company in its appeal from a ruling of the commission, the Supreme Court has laid down some important principles for the valuation of a public utility plant. In its appeal the company contended among other things that the commission in fixing the value of the property for the purpose of sale had not based its valuation on the reproduction cost, but that it had accepted in place of its franchise and that no allowance for going value had been recognized. In regard to the question of going value the court held that it had been considered by the commission in arriving at its estimate inasmuch as the following facts had been carefully gone into: the estimate of the original cost not only those as to the cost of the reproduction and its value based on present prices but also those based upon the average of prices for five years; the testimony given in the rate case showing inadequacy in the present plant to meet the reasonable demands of the public service and the necessity of the immediate expenditure of a considerable sum to make the plant reasonably efficient; tabulated statements furnished by the company in the rate case which tended to show that the revenues of the plant had not been sufficient at any time to give more than an insignificant return upon the investment; complete information as to the condition of the physical property; the attitude of the public toward the concern and the probable growth of the city.

## Current News Notes

**NO REHEARING IN THE PEARL CASE.**—The United States Supreme Court has denied an application for a rehearing in the so-called "Saratoga" case, or *Thomas v. Standard Company versus O'Donnell*, in relation to the right to fix retail prices on patented articles. The decision which was made at length in an issue of June 14, stands as a final and binding such a proceeding when the publisher issues the title to the patented article at the retail price.

\* \* \*

**EXAMINATIONS FOR THE ELECTRICAL ENGINEER.**—The United States Civil Service Commission is offering a competitive examination for senior electrical engineers in all vacancies on the staff of the Interstate Commerce Commission. Salaries for these positions range from \$4,800 to \$4,800, and from \$1,800 to \$2,000, with experience. Applicants should have a thorough technical training, with several years practical experience in construction and operation of electrical powerplants, and should be "neat, confident and discreet, and of good speech and manner." Applications must be filed before July 1, 1913.

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**EXAMINATIONS FOR THE FOREST GUARDIAN.**—The Forest Service, United States Department of Agriculture, has just issued notices for the competitive examinations in the Prescriptive Treatment of the Gray and Black Mountain Grasslands, by Mr. Francis M. Bond, in charge of seed preservation. This is a three-two-day examination with one three-day and one-day examination in general about the history of seed and water use, and according to various prescriptive systems, and finally for observation in a pre-marked area in the Williams. The examination is a series of three questions and answers in the absence of contrary evidence, that the same conclusions are supported by the field work.



**ELECTRIC VEHICLES IN OHIO.**—Altogether 3610 electric vehicles are registered in the State of Ohio. Of this number Cleveland leads off with 1838, and other cities have the following: Columbus, 459; Toledo, 367; Cincinnati, 238; Youngstown, 116, and Akron, 99. The electric vehicles make up approximately 6 per cent of the total number of automobiles in the State.

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**ELECTRICITY ON FARMS IN SOUTHERN IDAHO.**—The rapidity with which the farmers in southern Idaho are adopting electricity to general uses on the farm has compelled the Great Shoshone & Twin Falls Water Power Company to construct many miles of new line during the early spring. Practically 75 miles of additional new lines are now being constructed or will be built for this purpose. The company has approximately 400 miles of high-tension lines in southern Idaho, all of which are situated in a progressive, rapidly growing agricultural community.

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**NEW YORK ELECTRICAL EXPOSITION, OCT. 15-25.**—An automobile or motor show will be held in conjunction with the New York Electrical Exposition to be given in the New Grand Central Palace, New York City, Oct. 15 to 25. Among the features promised for this year's exhibition will be the latest industrial electrical apparatus, therapeutic devices, electric vehicles, safety equipment, applications of electricity in agriculture, central-station and United States government displays, and a reproduction of the display made by Mr. Thomas A. Edison at the Paris Exposition of 1889. The general offices of the Electrical Exposition and Motor Show of 1913 are located at 124 West Forty-second Street, New York.

\* \* \*

**DENVER ELECTRICAL SHOW, OCT. 4-11.**—During the week of Oct. 4 to 11 an electrical and industrial exposition will be held in the Denver (Col.) Auditorium, free use of which has been granted the Colorado Electric Club by the Mayor of Denver. This exposition, which will be given under the Electric Club's sponsorship, is part of the club's present publicity campaign, which is intended to bring electricity and electrical men more prominently before the public and to keep them there. The Denver Auditorium contains 42,000 sq. ft. of floor space. Exhibit booths will be uniform in size and arrangement, each containing 122 sq. ft. Mr. L. M. Cargo, 1052 Gas & Electric Building, Denver, is chairman of the space committee.

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**ELECTRIC FEATURES OF THE WORLD'S LARGEST SHIP.**—Not the least important feature of the Hamburg-American ship *Imperator*, which has just completed her maiden trip across the Atlantic, is the wireless-telegraph equipment on both the main vessel and the motor-operated lifeboats. The motor-boat equipments have a working range of 200 miles, while the range of the main vessel equipment is 1500 miles. The ship has two reserve antennas and two receiving instruments for long and short waves, designed for news service and rescue work. The station is directed by three operators, one of whom is always at the key. The *Imperator* will be within direct communication with land all through the Atlantic crossing. The other electrical equipment is unusually complete. Energy is developed by five steam turbo-generators and one oil-engine-driven generator placed high above the water line on the boat deck for emergency lighting. The ship is lighted by more than 10,000 electric lamps. Electrical energy is employed for operating the four passenger and five provision elevators, the winches, pivotal cranes, call bells, heating, etc.

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**AND NOW THE MOTOR-DRIVEN SAFETY RAZOR.**—With motor drive supplanting other forms of power in every field, it is surprising that the safety-razor opportunity has thus far been so neglected. New-business getters inter-

ested in developing the early-morning load on their lines will, however, welcome the application proposed in the following letter received by a prominent motor manufacturer from an Arizona "cash clothier": "Dear Sirs:—I am interested in a patent safety razor which is operated by electricity. I have a motor about the size of an apple, attached to the handle of the razor for the purpose of trying the razor out. It works the razor beautifully, but this size motor is entirely too large and bunglesome, besides too expensive. We need motors about the size of a hen's egg, or half that size would be still better. It doesn't require one hundredth part of one horse-power to operate the device. I will explain so as to give you a clearer idea as to what we need. The blade in this razor has the old reaper bar movement; it moves back and forth across the guard; instead of pulling or scraping the beard as other razors do, it cuts across the beard, saw fashion. Now, we simply want enough motor power to make this blade move back and forth across the razor guard. There is no friction to amount to anything, so it requires but very little power. Please let me know the dimensions of the smallest size motor you can make, and give me an idea as to the price in 100 or 1000 lots. Very respectfully, E. B."

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### SOCIETY MEETINGS

**SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION.**—At Minneapolis, Minn., June 24 to 26, will be held the twenty-first annual meeting of the Society for the Promotion of Engineering Education. The Hotel Leamington will be headquarters for the association, the sessions of which are to be held at the University of Minnesota and in the West Hotel. A large number of papers and reports on educational subjects have been provided.

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**BROOKLYN SECTION, N. E. L. A.**—The fifth annual convention of the Brooklyn Company Section, N. E. L. A., will be held at the Oriental Hotel, Manhattan Beach, New York, June 25. The business session will begin at 2:30 p. m. and will be followed by a dinner at which addresses will be delivered by General George H. Harries, president of the Louisville Lighting Company, and Mr. W. F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn.

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**CALIFORNIA ELECTRICAL CONTRACTORS.**—The fourth annual convention of the California State Association of Electrical Contractors will be held at Santa Barbara, Cal., Aug. 13 to 16. The first two days are to be devoted to executive sessions, the third will be an open meeting, and the fourth will be given over to entertainment, ending with a rejuvenation of the Jovian Order. The aims of the society are purely educational, its purpose being to bring about a closer affiliation between contractors, jobbers, manufacturers and central stations. Mr. J. C. Rendler, Los Angeles, is president, and the secretary is Mr. W. S. Hanbridge, 1408 Merchants' National Bank Building, San Francisco, Cal.

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**NEW ENGLAND WIRELESS SOCIETY.**—At a meeting of the New England Wireless Society held at the Massachusetts Institute of Technology on Saturday evening, June 7, Mr. John L. Hogan, Jr., of the National Electric Signaling Company, presented portions of his Institute of Radio Engineers paper on the "Heterodyne Receiving System," which was abstracted in our issue dated June 14. In this reading, which was followed by a long discussion, the use of the "heterodyne" of Professor Fessenden in the Arlington-Salem tests was dwelt upon, rather than the theoretical aspects of the device. The newly elected president, Mr. W. E. Duncan, of the Waltham Watch Company, briefly addressed the meeting, which was the last of this season.

## Electrical Equipment of Charles River Locks

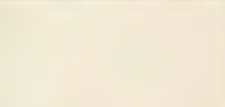
Extensive electric motor applications at the lower end of Charles River Basin for operating boat locks connecting the basin with Boston Harbor

**O**NE of the most notable inland waterway improvements completed in the East within recent years is the Charles River Basin at Boston, Mass., extending from tidewater at Boston Harbor to Watertown, 8 miles distant, and formed by the construction of an earth dam 1200 ft. long and about 20.5 ft. in height above mean low water at the foot of Leverett Street. Prior to the construction of the dam the Charles River was a tidalwater stream below the Watertown dam, but with the formation of the basin there came into being a lake with constantly freshening waters, the most important portion lying between the cities of Boston and Cambridge and providing an inland watercourse of surpassing beauty. In view of the industrial development at certain portions of the basin and its connecting waterways, it was necessary to provide access for barges and other seagoing vessels of moderate size by the construction of a lock between the basin and the harbor. The operation of the gates of the lock, the movement of filling gates, the movement of sluiceways and capstans, operation of the gates of an auxiliary lock for small boats, raising and lowering of a drawbridge on the dam for surface car and highway traffic, pumping and other auxiliary service are all handled by electric motors supplied in part with central station energy and in part by energy from the feeder circuits of the Boston Elevated Railway Company. Fifty-two motors, with ratings aggregating 30 hp. are in service the sizes varying from 150 hp. to 1

ARRANGEMENT OF THE LOCKS

The main lock is of reinforced concrete and is 43 ft. wide and 351.8 ft. long, having a depth over the sill of the downstream lock gate of 17 ft. at mean low tide and 21 ft. over the sill of the upstream gate at the normal tidal level. The concrete was placed in sections about 4 ft. long with expansion joints between, and for the purpose of carrying telephone and other wires there are embedded or run in these sections SIXTY four wrought iron pipes passing under the lock in long radius bends from five manholes on one side to a corresponding number on the other side. At each end of the lock is a gatehouse containing a recess for the reception of the gate, and the gatehouse at the downstream end is surmounted by a tower with an upper floor 4 ft. above the street level, which is the operating center of the entire installation. The tower is also the center of distribution for the dam and locks, the smaller lock being 30 ft. long, 10 ft. wide and with a depth of 3 ft. below mean low water. The tower also contains an electrically driven air

comprises a plant, a battery service, switchboard and main shaft. The main entrance is a full length by a small office, leading to the main room. Behind the main room, superintending electrical engineer and quarters of the Metropolitan Park Police. All the central-station service is supplied by the Edison Electric Illuminating Company of Boston with the exception of energy for motor service and lighting at sluice chambers located on the west side of the property, the latter being furnished normally by the Cambridge Electric Light Company. An emergency connection with the Boston Electric service is also provided on the west side. In general, the 575-volt service of the railway company is used in the operation of the drawbridge capstans, pumping and in the operation of the south gates and the sluiceways in the Boston Marginal conduit.

[illegible]



driven endless chains of unusual design, as shown in the accompanying photograph. As stated, each gate moves on a longitudinal axis into a recess in the lock wall, and the recess is housed in a room 77 ft. long and 48 ft. wide, this recess chamber also containing various pumps and remote-control apparatus in addition to the gate-operating motor equipment, air reservoirs and float gages. Two 50-hp, 550-volt Westinghouse crane-type motors are installed at the end of the chamber on concrete foundations, either being capable of operating the gate alone. The motors drive a shaft on the end of which is a spur gear driving an intermediate shaft, which in turn drives a main shaft extending across the rear end of the lock-gate recess. At either end of this shaft is mounted a sprocket, and over each sprocket passes a chain which is connected to an equalizer beam or whiffletree attached to the lock gate. At the opposite side of the lock gate recess, or that end adjacent to the lock, are mounted in suitable bearings two sprockets over which the chains, which are endless, pass. According to the direction of rotation of the motors, the lock gate is thereby moved across the lock or is withdrawn into the gate recess, thus opening it. Each motor is equipped with a solenoid brake overhung on the end of its shaft. The chains are built with triple links of cold-rolled steel having an ultimate strength of about 50 tons per sq. in. The chains are supported on steel tracks to prevent sagging, and the pins are of shafting stock, case-hardened, the wheel bushings being of phosphor bronze. Each chain travels on a track supported on columns resting on shelves on the walls of the gate recess.

Each gate is governed by a master controller located in the operating room in the tower of the lower lock gate-house. With this device the operator is enabled to turn on the current by one quick motion of the controller handle. A manual controller is also furnished for each lock gate-house and located in the recess chamber. When the gate is controlled from this point, the master controller in the tower is cut out by a switch located on a marble panel in

a remote-control cabinet located near the gate-driving motors in the recess chamber and shown in the accompanying photograph. The manual controller operates the motors in series only and is similar to controllers used in ordinary street-car service. Each lock gate is provided with an automatic limit switch which stops the gate-driving motors shortly before the gate reaches the closed position, and from the last-named point to the closed position it is possible to operate only at the slowest speed. The automatic limit switch also operates to stop the lock gate, through the controlling apparatus, in case the operating switch in the tower is left in the wide-open position on either opening or closing.

The equipment of the remote-control cabinet, with all the other automatic controlling apparatus in the installation, was supplied by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., and was specially designed for this service. The cab-

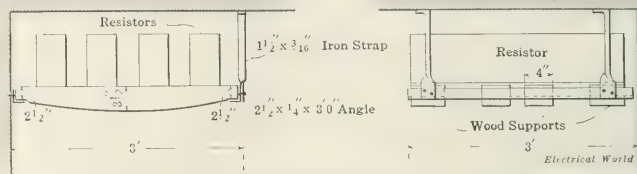


FIG. 2—METHOD OF SUPPORTING RESISTORS IN DIFFICULT CORNER

inet in the recess chamber at either end of the lock contains a three-panel switchboard carrying knife and contactor switches, relays and solenoid contact switches governing the operation of the lock-gate motors with close accuracy. The equipment includes horizontal switches cutting the master controllers in and out of service for either motor, motor cut-out switches, contactors governing the amount of resistance in each motor circuit, field circuit switches, accelerating relays and series-parallel connecting contactors. Overload and no-voltage release switches and shunt-break switches are also included.

#### OPERATION OF LOCKS

A departure from ordinary practice is found in the arrangement for filling the lock. In place of the installation of filling gates in conduits located to bypass the lock, the filling gates are mounted directly on the lock gates themselves. Thirteen gates are used in this service, all being of the non-rising stem type, with operating nuts situated about 20 ft. below the surface of the water. On the lower gate there are six filling gates, 3 ft. 10 in. x 4 ft. in

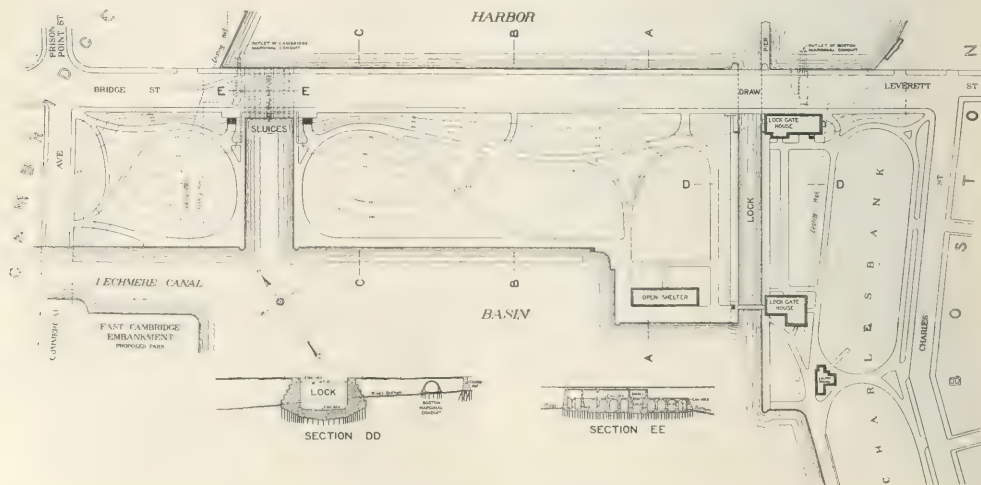


FIG. 3—GENERAL VIEW OF DAM AND LOCK

dimensions, giving a total area of about 92 sq. ft. The upper lock gate is provided with seven filling gates having a combined working area of about 90 sq. ft. These sluice-gates are gear driven by 3-hp, 220-volt Northern submerged type motors with ball-bearing operating stands and Cutler-Hammer limit switches. The motors are mounted on the tops of the lock gates and are ordinarily protected by a plank deck. They are controlled from the operating room in the tower and are wound for constant speed service. The control is such that the sluicegates on each lock gate are thrown in or out to move up or down by a double throw switch, the group of motors on each gate being connected in parallel. In case any gate becomes bound or stuck in operation it is automatically cut out by a circuit breaker, the remaining gates continuing to operate without hindrance. Each gate is provided with a limit switch which automatically stops it at the wide-open or fully closed position, and indicator lamps in the tower to be described later show the position of the gates as well as the position of each of the main lock gates during movement.

When these sluicegate motors were first placed in operation it appeared that the motors were working under heavy overloads, and each movement of the filling gates was accompanied by noise and jarring which became excessive on account of the tendency of the lock gates to vibrate. The result was the early loosening of bolts attached to the lock-

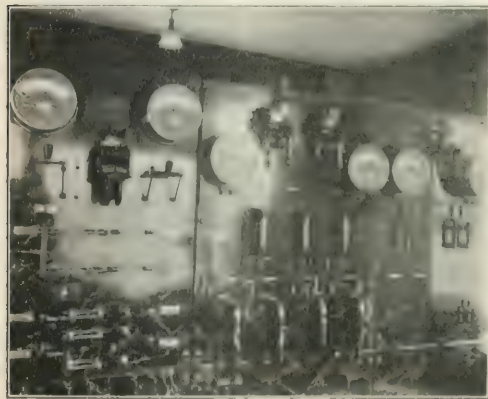


FIG. 4—MAIN SWITCHBOARD IN POWER OPERATING ROOM

gate structure, and troubles with the motors were also experienced. There had previously been made an attempt to overcome this difficulty by the substitution of cut gears for cast gears, and by increasing the amount of reduction in the gearing; but it was finally concluded that the trouble lay in improper lubrication of the operating nuts on the gates, these being under water and at the time lubricated only by the latter. The lock was pumped out and examination showed that the nuts and operating stems were wearing considerably. Several greases were tried, but none would adhere to the wet shaft. Then a heavy cylinder oil was utilized with temporary success, but the oil soon washed off and the former undesirable conditions returned. The problem was finally solved by the installation of a special grease cup arranged to advance a plunger in the cup at the rate of 1 in. for 144 gate openings, thus feeding a small amount of grease to the stem and nut at each movement. Provision was made for refilling at intervals of one to four months, and tests before and after the application of this device showed that there was a saving of from 15 to 18 per cent in energy consumption through its use. It was also noted that after the grease cup was installed the operation was practically noiseless. A soft grade of Albany grease is used in the lubrication of the stems and nuts.

The supply of energy to the filling gate motors is effected by trolley wires on the trolley supported by suspension ears attached to 0.5-in. by 3-in. iron bars hung from the ceiling by 0.5-in. rods. Each motor has an independent feed and a common return is provided, with connections for various auxiliary services in relation to the limit switches and indicating devices. The trolley stand is car-

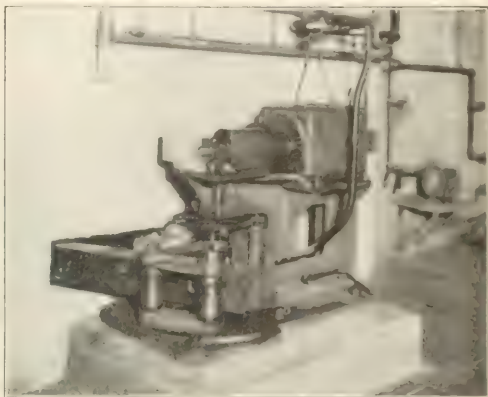


FIG. 5—MOTOR DRIVE FOR FILLING GATE

ried on the crossbar of the main gate, and is designed to support a double trolley frame.

Considerable work has been done to the channel above the lock to the harbor, the upper lock gate is provided with an opening gate, 4 ft. 6 in. high by 14 ft. in length, placed at about the lower end. This gate is of the double-door type and is operated by a 3-hp, 220-volt motor supplied with energy through a double switch which contains a manual controller handle, 200 ft. of the moving cable with an outlet to the control in the motor gate room, thus making it possible to operate the lower gate from the motor gate room.

Compressed air is supplied to each lock gate by two West-



FIG. 6—AIR COMPRESSOR FOR OPERATING MAIN LOCK GATES

inghouse water-cooled, frame-driven compressors connected with an air-water separator, the former being used to establish a driving air at the bottom of the main gates to facilitate separation of the bearings and the steering oil at 7 lb. per sq. in. into the bearings for lubricating the wheels upon which the gates are carried. Air is also used in cleaning the remote-control switch stations in the press-



chambers, in blowing out machinery and in operating a whistle signal at the tower for the guidance of drawbridge tenders, mariners and others. Each compressor has been designed to deliver 42 cu. ft. of air per minute at a pressure of 90 lb. per sq. in., and each motor is rated at about 12 hp and operates on the 575-volt circuit of the railway company. The air piping on the lock gates is connected to the charging system by hose couplings at each end of the lock gate recess, and in ordinary practice the air is forced into the gate system once a day for a period sufficient to establish the required oil pressure in the bearings. Air can be supplied to the gates only when the latter are fully opened or closed.

A steam-heating plant of two 48-in. horizontal-return tubular boilers designed for 125 lb. per sq. in. working pressure, equipped with a Sturtevant induced-draft fan, is in service for warming the gatehouses and preventing the formation of ice in and around the lock. To prevent the bearing faces on the gates from freezing to the masonry use is made of cast-iron boxes containing pipe coils which warm the bearing faces of the gates through hose connections in the recess chamber. To prevent the formation of ice in the recess in the lock wall into which each gate slides when opened, a pocket was left in the concrete between low

unwatered at an ordinary height in two and one-half hours. Each recess can be unwatered by electric pumping independently of the lock by the use of stop planks. Each pump motor is controlled at an adjacent panel carrying a circuit-breaker, starting switch and speed regulator. In each lock gatehouse a 2-in. centrifugal pump is installed in a sump near the main pump well, each small pump being directly driven by a Westinghouse motor of about 5-hp rating, wound for 220-volt service. The sump in the lower house handles the drainage from the lower pump well and the electric manholes on the premises and that from a wire and pipe conduit situated in the east wall of the lock and connecting the lock gatehouses. The sump in the upper house drains the pump well and also is used in taking care of stop-log leakage in case the recess has been unwatered independently of the lock. These motors are automatically controlled by float switches connected with the sumps.

At the upper gatehouse two inlets are provided between the Charles River Basin and the Boston Marginal Conduit, and normally these are closed. To enable the basin to discharge into the latter, two 7-ft. 3-in. by 8-ft. 6-in. sluice-gates have been installed equipped with 5-hp, 575-volt Northern direct-current motors, the motors being geared to the gate spindles and provided with automatic limit



FIG. 7—MOTOR OPERATING SMALL SLUICWAYS

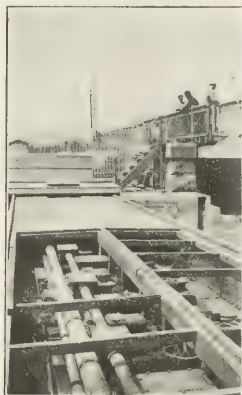


FIG. 8—TOP OF LOWER LOCK GATE AND GATE MOTORS



FIG. 9—SWITCHBOARD FOR EDISON SERVICE

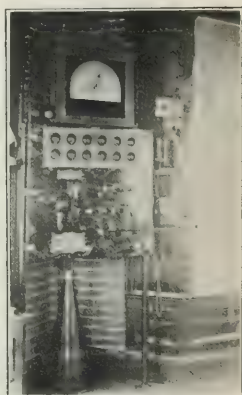


FIG. 10—SWITCHBOARD FOR OPERATING FILLING GATES

and high tide which is covered with a steel plate and gasket containing large steam coil radiators close to the plate. The lock gates are similarly warmed by steam coils placed in the top compartments close to the skin plates. Steam-heating service is also supplied to the small boat lock from the above boiler plant.

#### PUMPING EQUIPMENT

For pumping out the lock a 24-in. Worthington vertical volute pump, directly connected to a 150-hp, 575-volt General Electric direct-current variable-speed motor has been installed adjacent to the recess for the lower lock gate and a 14-in. Worthington pump of the same type with a 60-hp motor adjacent to the upper gate recess. The speed range of the larger pump is from 300 to 420 r.p.m., and that of the smaller one from 400 to 500 r.p.m. The larger pump has been designed for delivering 13,000 gal. per minute against a head of 30 ft., the rating of the smaller pump being 5000 gal. per minute against the same head. Each pump is installed in a concrete well. The well of the larger pump is connected with the lock by a 30-in. inlet and with the recess by a 20-in. inlet. That of the smaller pump is connected with the lock by a 16-in. inlet from the lock and with the recess by a 12-in. inlet. Both pumps discharge into the Boston Marginal Conduit, and the lock can be

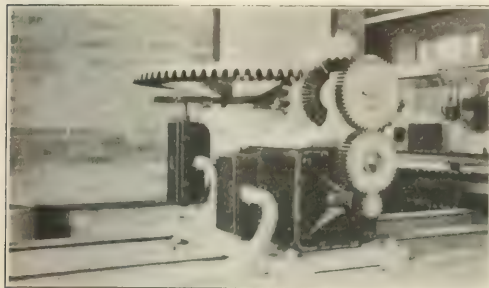
switches cutting off current at full closed and full open position, with overload and no-voltage releases. A third 5-hp motor of the same make is installed in a pit outside the building to operate a 6-ft. 4-in. by 6-ft. 6-in. main gate controlling the flow of water in the marginal conduit immediately above the inlets from the basin. The three gates are controlled at a motor-starting panel near the gate-operating mechanism, the panel containing manual controllers, indicating instruments and pilot lamps showing the position of the gate on the marginal conduit at all times.

Two electric dock capstans are installed on the east side of the lock near the gatehouses, each being driven by a 30-hp, 575-volt direct-current motor, through gearing. Provision has also been made for the future installation of motors on capstans on the opposite side of the lock, when necessary. The capstans are available for service in warping vessels through the lock and were installed to cut down to the minimum any delays resulting from opening the adjacent drawbridge during the passage of vessels into the basin. The lock is unique among structures of its kind in the United States on account of the mixture of fresh and salt water obtained in its operation. A stream flow of about 4 miles per hour is established when fresh water from the basin is admitted to the lock with salt water at basin level in the latter, and this is due to the difference in spe-

cific gravity of the waters and at times requires the use of an electric capstan to avoid delays in getting vessels into the basin. The unsettled state resulting from the mixing of fresh and salt waters lasts for fifteen minutes before the current ceases through gradual mixing.

## CONCLUDING REMARKS

The operating tower is about 13 ft. square, with 60 ft. dia.

FIG. 11. MOTOR GEARING AND FLOW EFFECTS ON THE  
OF SLUDGEAGE

dows in each side of the upper room commanding a complete view of the basin, harbor and lock. In the center of the room is a main switchboard extending around three sides of an 8 ft. by 30 m. rectangle, and in front of the windows are various controllers and indicating devices associated with the operation of the gates and drawbridge. Other switches and indicating devices relating to the movement of the lock-filling gates are placed between the windows, together with Winslow electric indicating float gages showing the height of water at all times in the basin, lock and harbor.

The main switchboard contains seven panels of marbleized slate with knife switches controlling the various local feeder circuits, with circuit-breakers, ammeters and voltmeter connections. Among the circuits cut in and out by main knife switches are those feeding the motors on the lock gates, filling gates, capstans, pumps and drawbridge, besides auxiliary circuits supplying energy to incandescent lamps on the premises, semaphore motors and lamps, signal lamps to master and manual lock-gate controllers, and leads to the remote-control contactor switchboards in the lock.



FIG. 12—CONTROLLER FOR CULCININ SYSTEMS.

gate houses, the switches are so arranged that the two lock gates cannot be operated simultaneously, and in this manner both manual and master controls of the lock gate cannot be used at the same time. A 250-watt watt-hour meter is installed on one panel to measure the lighting energy consumption of the offices and quarters used in the lower gatehouse by the personnel operating all the above

meter in the basement and taken to the main switchboard in lead-covered cables passing up the wire shaft previously mentioned which is 4 ft. square. The Edison service is likewise brought into the building from underground conduits and carried in lead-covered cables up the wire shaft to a meter installation located in the tower directly under the main operating room, motor and lighting service being subdivided at this point. From the Edison meters the cables lead to the buses on the main switchboard. All fuses on the Edison branch are of the enclosed type and are located at the rear of the panel. The main switchboard contains an emergency switch for stopping the power. Emergency circuit can be applied to the emergency end of the line in case of an interruption.

A back-illumination system is used to illuminate the ink and is fed in from one of the opening channels. The lamp was dropped in bits at five angles to the surface in series and then the same procedure in the following steps: "Recessed," "full opening," "3 ft.," "2 ft.," "1 ft." and "closed." Each set lighting arrangement is the gate results the corresponding oil. An indicator is connected to the back-illumination system and a relay circuit is connected to each set along with the control of the



10. 13—2000. *WINE, FARM & HOME ECONOMY*

to be 100% in both the short and long run, and consistent with the approach outlined in the manner in which the measure is constructed. The underlying approach is based on doing as little as possible to attribute the change in demand to the search. The main test proposed to be used is based on time series data. In 2003, several depressing news items in the media, some of the following:

Two drawings (marked 1 and 2) were identified as being of the same artist, namely the artist who had been found in the house of the Suburban, killing Jeff Spivey. These two drawings were made by a 22-year-old, self-styled 'Painter', Robert Campbell, who was arrested on 14 January 1968 for involvement in a robbery in Birmingham. Campbell was arrested with a self-made knife. Almost as soon as he was caught he confessed that the two drawings were made by him.

[illegible]



frame. The heaters in the tower are used when the steam boilers are shut down for the summer, and the tower operations are conducted in three eight-hour daily shifts. A small local switchboard panel is provided for the compressors in the tower immediately below the Edison service room. On the main floor of the lock-gate house building is a small machine shop containing a drill press driven by a 0.5-hp, 220-volt motor, a 16-in. lathe driven by a 2-hp motor, a milling machine driven by a 2-hp motor, and an emery grinder driven by a 0.25-hp motor, all directly connected.

To signal vessels about to pass into the lock two General Electric motor-driven semaphores are installed, one near the basin end of the lock and the other on a pier below the Elevated company's viaduct. Each of these semaphores is a two-position signal, with red and green bulls'-eyes and a 12-cp, 110-volt lamp for night service. The semaphore motors are operated by a hand switch in the tower of the lock-gate house and are wired so that only one can be thrown to the clear position at once. The heights of the arms vary from 13 ft. to 25 ft. above the ground, and each semaphore is connected with a signal lamp in the tower which shows the position of the arm at all times.

The small boat lock is equipped with two wooden gates at each end swinging on manganese bronze hinges and

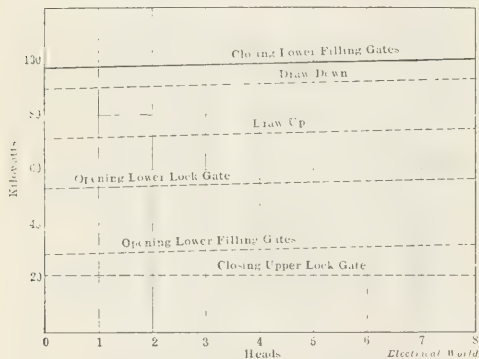


FIG. 14—CURVE SHOWING ENERGY CONSUMPTION FOR ONE COMPLETE OPERATION

operated by four 5-hp, 575-volt General Electric direct-current motors through gearing and a rack-and-pinion drive. The motors are provided with limit switches and no-voltage and overload releases, as in the installation at the main lock, and are operated from manual controllers mounted on the walls of the lock chamber. This lock is filled and emptied by 20-in. by 30-in. sluices at either end by-passing the main gates according to usual locking practice. The sluicegates are opened and closed by 1-hp, 575-volt Crocker-Wheeler direct-current motors through a chain and sprocket drive. The motors are suspended from the ceiling of the sluice chambers under the roadway and are provided with limit switches operating automatically at each end of the gate travel. These filling gates were originally hand-operated, but on account of the slowness of this method the electric drive was installed, with the result that the time of locking a boat through has been reduced from about fifteen minutes to three minutes and only one man is required per shift instead of three. The motors operating the filling gates are controlled by push-buttons mounted on the lock-chamber walls beside the controllers governing the lock gates. A winch was originally provided in one of the walls of the lock for handling the gates, the winch being chain-driven by a 1-hp, 575-volt motor and controlled by a contact lever extending through the lock wall.

Eight 7.5-ft. by 10-ft. sluicegates are installed in the dam, half being on each side of the small-boat lock, for discharging the waters of the basin into the harbor and thereby maintaining the basin level at a desirable elevation. Another sluicegate is installed in a sewer on the Cambridge side of the basin. Each gate is gear-driven by a 5-hp, 575-volt direct-current waterproof motor in a manner similar

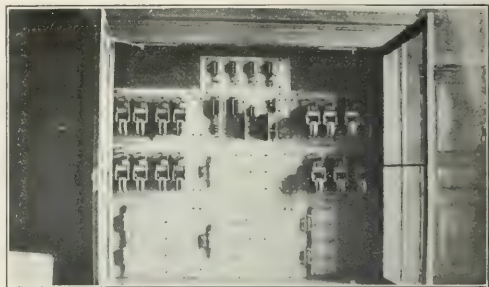


FIG. 15—REMOTE-CONTROL CABINET FOR MAIN LOCK-GATE MOTORS

to that employed in the operation of the sluicegates in the upper lock-gate house. The motors are governed by hand controllers mounted on marbleized slate panels located at two central points in the sluice chambers, and at these panels provision is made for controlling the supply of energy to the circuits of the motors operating the lock filling and emptying gates. An 8-in. centrifugal pump designed to deliver 1200 gal. per minute against a 30-ft. head is installed on the west side of the small boat lock in the sluicegate chamber. This pump is directly driven by a 10-hp, 575-volt General Electric waterproof motor, with a speed variation from 425 to 600 r.p.m., and it is used in unwatering the sluices and the small-boat lock, with final discharge into the harbor.

In the lighting of the various buildings and chambers tungsten lamps of from 15-watt to 60-watt size are liberally used, central-station service being employed for this work. At the upper end of the small-boat lock an electric sign is installed for indicating danger when the sluices are open by the use of five 16-cp lamps in a ruby-glass transparency.

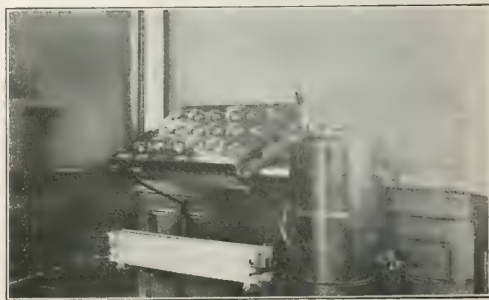


FIG. 16—MASTER CONTROLLER AND INDICATING LAMPS FOR UPPER LOCK GATE

Special precautions have been taken to prevent electrolysis. When the installation was first placed in service it was found that the concrete adjoining the bridge foundations and that next the steel girders carrying the street railway tracks on the bridge structure was damaged by electrolytic action, that next the girders being more or less pulverized. The bridge structure was at first positive to

the water by from 8 volts to 10 volts. The addition of copper to the railway ground return system reduced the potential drop to 3 volts or 4 volts, but as damage still occurred, the railway company installed insulating joints at the ends of the rails, making the water positive to the bridge by from 0.1 volt to 1.5 volts, according to the number of cars on the bridge. At present monthly readings of





the case of a "flat-top" antenna is equal to the geometric height. In an umbrella antenna the effective height is usually taken as the average elevation of the rib-wires of the structure.

$h_2$  = effective height of receiving antenna.

$I_s$  = antenna current at transmitter.

$I_r$  = antenna current at receiver.

$d$  = logarithmic decrement of wave trains per complete period.

$N$  = wave train or group frequency of signals.

$S$  = measurement of received signal intensity (called "shunt") which is the impedance which when connected across the terminals of a telephone receiver reduces the signal intensity to audibility (that is, to a point at which dots and dashes may be just differentiated).

$A_f$  = audibility factor, or the number of times audibility. This is approximately proportional to the square of the radio frequency current in the antenna, and to the current in the telephone circuit. It may be further defined as

$$A_f = \frac{R + S}{S}$$

where  $R$  is the impedance of the telephones, to received signals, and  $S$  is the shunt as defined above.

as shunt resistance, audibility factor, telephone current and antenna received current) having been determined, it became possible to check the new observations directly against relations developed from the data of the 1910 trials. The measurements upon which the above-quoted relations are based were made in the same way as those of the present test, except that telephones of a lower sensitiveness and tuning inductances of larger high-frequency resistance were used in 1910.

In both tests the Fessenden liquid barretter receiver was used as a standard, but in the 1913 work some of the readings at extreme distance were taken upon the heterodyne receiver. Procedure in this case was exactly the same as with the liquid barretter; that is to say, the audibility factor of the received signals was determined by shunting the telephones. It was found in receiving signals sent out by the spark sets that the heterodyne produced a telephone current variation averaging 4.65 times as large as that due to the liquid barretter alone. This value is the mean of all readings taken during the entire test, but under very favorable conditions the heterodyne's amplifying power on spark signals becomes much greater and the current variation ratio may equal 12 or 15 or even more.

An exact statement of the observations made during the

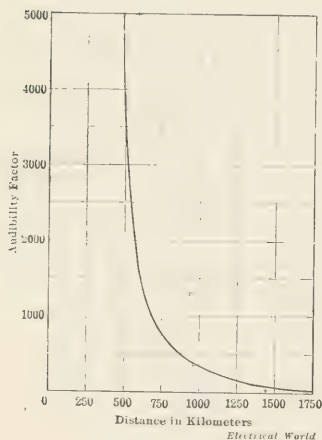


FIG. 2—SIGNALS FROM SALEM BY DAYLIGHT

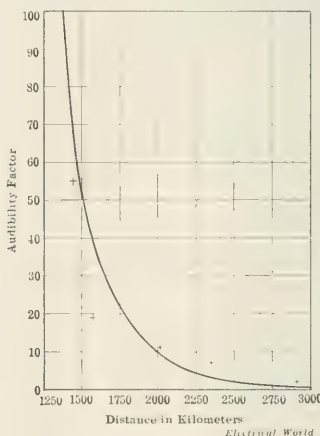


FIG. 3—SIGNALS FROM SALEM BY DAYLIGHT

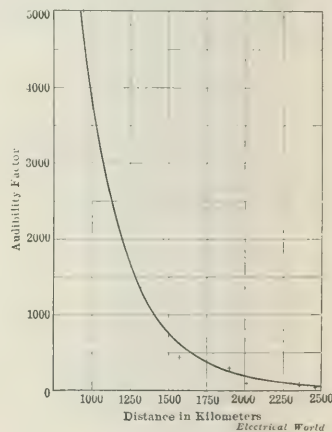


FIG. 4—SIGNALS FROM ARLINGTON BY DAYLIGHT

A series of somewhat similar trials were completed in 1909 and 1910 between the Fessenden high-power radio plant at Brant Rock, Mass., and the U. S. cruisers *Birmingham* and *Salem*, and from the measurements made at that time there has been derived a set of very convenient relations connecting a number of the above-named quantities\*. The conclusions from the 1910 tests were found applicable to distances up to 1000 miles, with various antenna heights, wave-lengths and sending antenna currents. The present test has given measurements which permit confirmation of the earlier work and which, when taken in connection with data from other experiments, define the relations between some new variables.

Measurements of signal intensity taken during the recent cruise of the *Salem* were made by the shunted telephone method after distances of some 300 miles were covered. With the louder signals received at shorter distances it was possible to secure readings upon a galvanometer placed in the telephone circuit of a firm-contact rectifying detector. The relations between various quantities involved (such

as shunt resistance, audibility factor, telephone current and antenna received current) having been determined, it became possible to check the new observations directly against relations developed from the data of the 1910 trials. The measurements upon which the above-quoted relations are based were made in the same way as those of the present test, except that telephones of a lower sensitiveness and tuning inductances of larger high-frequency resistance were used in 1910.

In both tests the Fessenden liquid barretter receiver was used as a standard, but in the 1913 work some of the readings at extreme distance were taken upon the heterodyne receiver. Procedure in this case was exactly the same as with the liquid barretter; that is to say, the audibility factor of the received signals was determined by shunting the telephones. It was found in receiving signals sent out by the spark sets that the heterodyne produced a telephone current variation averaging 4.65 times as large as that due to the liquid barretter alone. This value is the mean of all readings taken during the entire test, but under very favorable conditions the heterodyne's amplifying power on spark signals becomes much greater and the current variation ratio may equal 12 or 15 or even more.

An exact statement of the observations made during the

recent tests is necessary before conclusions can be drawn and the results compared with the 1910 work. First, taking up transmission from the ship to Arlington, Figs. 2 and 3 show the strengths of signals received at various distances, as measured by their audibility factors. The effective height of the Arlington antenna is 450 ft. and that of the *Salem* 130 ft. The wave-length used was 2000 m, and the average antenna current of the *Salem* in transmitting was 23 amp. All distances are expressed in kilometers, but may be converted into statute or nautical miles by the use of the chart in Fig. 1. The points plotted in Figs. 2 and 3 represent actual observations under normal daylight conditions. The loss of signals at 1900 km may be an instance of very marked selective absorption, but it is believed that an accidental change in circuit constants was responsible, since daylight signals were thereafter received reliably up to 2350 km (at which distance messages were exchanged), and because at the same time very loud signals from Arlington were received aboard the cruiser. The two readings preceding the 2910-km point may be considered as representing a period of high absorption, since no signals whatever were received. The curves shown in these two figures are calculated, as described below.

\*"Some Quantitative Experiments in Long-Distance Radio Telegraphy," by L. W. Austin; *Bulletin Bureau of Standards*, Vol. 7, No. 3, pages 1362-1363.

Measurements of the signals received at Arlington from the *Salem* at night were too uncertain to rely upon, since they were masked by very strong static disturbances which prevented the taking of any accurate readings. At a distance of 1220 km the night intensity was 1300 times audibility, at 1700 km 48 times audibility. An audibility factor of only 3 was measured when the ship was 3140 km away, and

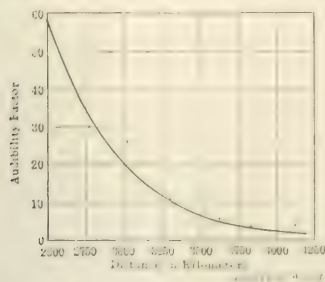


FIG. 5—SIGNALS FROM ARLINGTON BY DAYLIGHT

the same intensity was had over a distance of 3720 km, while on the first of two nights separating these readings signals were ten times audibility and on the second were not heard at all.

In signaling from Arlington to the ship still greater distances were covered, as would be expected. Arlington transmitted on a wave length of 3800 m, and used an average antenna current of 1.5 amp while short measurements were taken. Figs. 4 and 5 show daylight observations on the signal intensity in terms of audibility factor as measured on the standard detector. At the extreme distances shown were taken upon the heterodyne signals only, and these measurements divided by the average amplification factor, 4.65, are those shown in the figure. The curve drawn represents the theoretical energy and is seen to be in exceptionally close agreement with the observed values.

The signals transmitted from Arlington at night were received quite consistently aboard the *Salem* and are shown as the points of the solid curve in Fig. 6. Here the dash line is a smoothed curve giving a general average of the observations, while the dotted curves are calculated for different absorption values, as explained below. If results

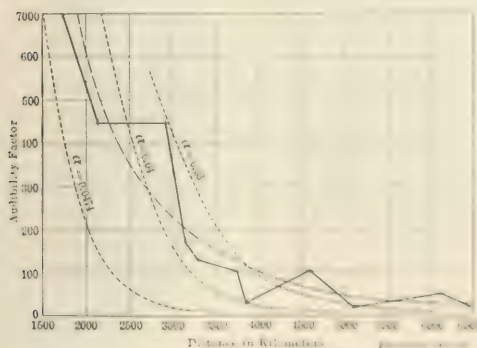


FIG. 6—SIGNALS FROM ARLINGTON AT NIGHT

be noted that on three nights (distances 3750, 400 and 6220 km) the actual value of received signals was very much higher than the average. When the *Salem* lay at Gibraltar, 6400 km from Arlington, signals from the spark transmitter at Arlington were received nightly and had an intensity of about 200 times audibility on the heterodyne.

The above stated results may best be interpreted by com-

paring them with the conclusions previously drawn by Dr. Austin. In his theoretical treatment an expression was given which defines the received antenna current in terms of the distance transmitted, the wave-length used, the heights of sending and receiving antennas and the sending antenna current. The original expression was stated for currents measured in amperes and lengths in kilometers, but it has been found that for convenience of computation it is best to have each term in the units normally used in receiving. In the present case giving the expression with its coefficients modified so that  $d$  and  $\lambda$  may be measured in feet, the distance in kilometers, the received current in microamperes, the sending current in amperes, and the wave length in meters:

$$I = \frac{150811 k S}{(4 \pi d)^2} \quad (1)$$

With the constants fixed as given by Austin found that a received antenna current of one microampere through a resistance of 25 ohms (the average  $2500 \Omega$ ) would give a noticeable signal. In connection with this calculation of results we selected  $4 \times 10^{-7}$  amp. as the given signal of sixteen times audibility on the above basis, which allowed good working distances between the two stations. In the present tests with instruments of better design and more sensitive detectors, the signal produced from

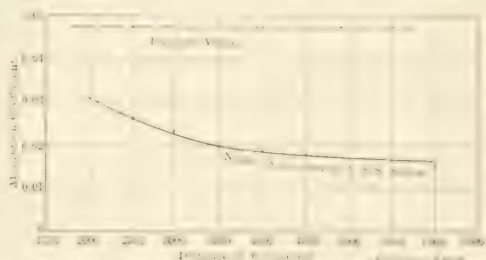


FIG. 7—SIGNAL ABSORPTION AS A FUNCTION OF THE DISTANCE

a given received antenna current was higher than before, but it is probable that the overall equivalent resistance of the receiving antenna current was about the same, since smoothness of the same degree was obtained with other windings, which led energy to the detector at a higher rate. It has been found with this new apparatus that an audibility factor of unity is had for an antenna current of about 1 microamp, or for received energy about one-fourth of that assumed by Dr. Austin. If this relation between audibility factor and antenna current is substituted into equation (1) we have the expression:

$$I = \left( \frac{150811 k S}{(4 \pi d)^2} \right)^2 \quad (2)$$

The curves plotted in Figs. 4, 5 and 6 are calculated from equation (2) and show the strength of received signal which would be assumed for any continuous distance by the various constants stated. The agreement between the observed values and the curves is exceptional and affords an excellent confirmation of the relation between the constants of equation (1) calculated by Dr. Austin and others. In this study on the present test their results are applied for the first time for a constant series of measurements taken between ship and shore (see graph) increasing distances up to 6200 km.

It should be noted that in order to secure agreement between the observations and the theoretical expression it is

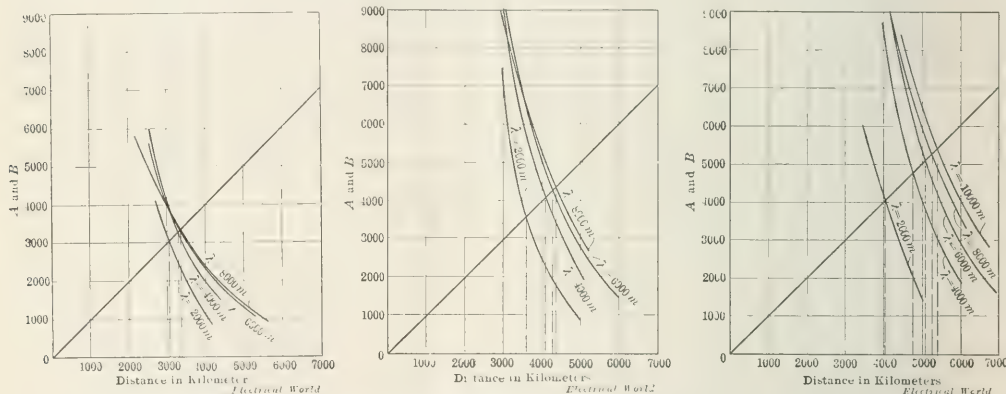
assumed that the antenna current is constant and the antenna height is constant. In the present case the antenna height is constant, but the antenna current is not constant, being about 1.5 amp.



necessary to change the value of the received current for a just audible signal, from 10 to 5 microamp. Other alterations in the original formula might be suggested, but it is believed that in changing the numerical relation of received current to audibility factor the proper modification has been made. To take up each of the other factors in turn, it is manifest that the value of  $I_s$  cannot be modified, since this expresses the transmitting antenna current as measured by a standard ammeter. The distance and the wave-length are equally well defined, and so there are left susceptible of alteration only the absorption coefficient and the effective antenna heights. By definition the effective height of the *Salem's* flat-topped antenna is fixed at 130 ft., since the downward leading-in wires are of negligible capacity. At Arlington the center of capacity is about 450 ft. above the ground, and if the effective height as used in equation (2) were made greater than this by an amount large enough to compensate for the increase in signals as compared to those to be expected upon the 10-microamp basis, it would become larger than the height of the tallest tower supporting the antenna (600 ft.), so that manifestly alteration of the equation cannot be made by a change of this value. The almost perfect agreement between observed signal

beginning of the test and equaled 0.0391 as determined by equation (3). It is seen that even this value is considerably less than the normal daylight attenuation coefficient.

In Fig. 6 the three dotted curves are calculated from equation (2) for absorptions of 0.0474 (the normal daylight value), 0.04 and 0.03 respectively. It is seen that the dashed curve showing average observed values crosses the last two of the dotted curves, and from this it appears that transmission at night does not follow the same law of absorption as that in daytime. The probability of this is further increased by a consideration of Fig. 7, which shows the effective absorption as a function of distance when successive values of the dashed curve in Fig. 6 are substituted in equation 3. If the law governing attenuation were the same for night as for day, the graph of Fig. 7 should be a horizontal straight line, although its constant value would probably be something less than 0.0474. It should be possible to determine the law of night variation by analyzing the data of Fig. 7 and substituting it in equation (2). Inasmuch as the measurements were taken on only one wave-length, however, the result would be of little value on account of its incompleteness. But it is hoped that the data will be of use in connection with future observations which may make it



FIGS. 8, 9 AND 10—DAYLIGHT SIGNALING DISTANCE BETWEEN TWO STATIONS OF THE ARLINGTON TYPE FOR AUDIBILITY FACTORS OF 500, 100 AND 25; WITH  $I_s = 100$  AMP, AND  $h_1 = h_2 = 450$  FT.

intensities and those calculated on the basis of a 5-microamp audibility limit at the long distances (when the absorption effect is a maximum) on wave-lengths of both 2000 m and 3800 m indicates not only that the value of absorption coefficient ( $\alpha = 0.0474$ ) is very nearly accurate but that the functional relation is correct as well.

If equation (2) is solved explicitly for the absorption coefficient, the following relation is obtained:

$$\alpha = \frac{1}{D} \log_e \frac{78.4 I_s h_1 h_2}{I_r \lambda D} \quad (3)$$

A further check on the form of the expression and the value of the coefficients may be made by determining the daylight absorption for each distance at which signals were observed. A set of these calculations shows an average absorption on the 2000-m wave of 0.0407 and on the 3800-m wave of 0.0560, giving a general average for all daylight readings of the test as 0.0483, which is in very good agreement with the value, 0.0474, given by Drs. Austin and Cohen.

The night observations shown in Fig. 6 are of interest in that from them may be obtained a notion of the minimum absorptions encountered during the test and also of the difference between the laws governing night and day transmission of signals. For the night trials the lowest effective absorption occurred at 6220 km, where its value was only 0.012. The greatest night absorption was present at the

possible to define this relation, which is at present very uncertain.

The approximate uniformity of the signals from Arlington at night indicates a nearly complete absence of reflection effects during the test on a wave-length of 3800 m. The great irregularities noted on the 2000 m wave transmitted from the *Salem* prevent use of those observations as a basis for calculations, and may be due not only to the static interference mentioned but also to transient reflections.

It has been seen that when the liquid barretter is used in connection with the modern receiving equipment the received signal has unit audibility factor for an antenna current of 5 microamp. A study of the receiving antenna current necessary to give various signal intensities, together with a knowledge of the possibility of reading signals of these various intensities through the different static and other disturbances which are encountered, will make possible deductions as to feasible working distances under various conditions. Practice has shown that with light static and interference messages can be read when transmitted from a spark apparatus using 1000 wave-trains per second, even though the received signal be only twenty-five times audibility (corresponding to a shunt of 200 ohms across Western Electric 2400-ohm telephones). Isolated groups of signals can be distinguished even though the audibility factor be considerably less than 25, but the transmission of messages

will be unreliable unless there is a complete absence of interference or atmospheric. If the received signal has an audibility factor of 100 (corresponding to a 50-ohm shunt), a good interchange of messages is possible; but for commercial telegraphing at high speeds of hand signaling and at an intensity which will permit copying received messages directly upon a typewriter, an audibility factor of about 500 is necessary. Upon a basis of 5 microamp for unit audibility the receiving antenna currents corresponding to the three intensities just stated are 50, 100, and 225 microamp.

In the test just completed, which was the first in which the heterodyne was used over long distances between ship and shore, it was found that a heterodyne amplification of 4.65 in audibility factor might be relied upon. The ratio of the signal intensity with the heterodyne to that without (using the same telephone) was considerably greater than the average when the received signals were weak, so that it is evident that with this instrument unit audibility may be had for something less than 2.5 microamp, when a persistent spark transmitter of the Arlington type is used. For the various degrees of communication ability described, the following currents would then hold: For reading messages, 12.5 microamp; for good intercommunication, 25 microamp; for commercial telegraphing, 56 microamp.

These current values are especially low when compared with those which would give equivalent signals upon any type of receiver other than the Fessenden heterodyne. Actually, they are quite conservatively stated, since they are based upon an amplification of less than 5, whereas the actual ratio may be three or four times that figure. The actual intensities of signals at which messages were copied during the test is not shown in Figs. 3 and 5, inasmuch as the heterodyne was used both at Arlington and aboard the *Salem* for the longer distances, and the points plotted are for liquid barretter operating normally. By multiplying the ordinates of these curves by the amplification ratio of a little less than 5, it is possible to learn the approximate signal strengths which occurred at the various distances.

The value of the heterodyne in its power to increase the effective signaling ability between a given pair of installations may be determined by comparing the distances over which it is possible to transmit messages consistently with it and with the regular receiver. Working from the ship to Arlington, the final official distance for transmitting complete messages was 1610 km (1000 statute miles), at which point the signals had an audibility factor of 88. Without the heterodyne this signal intensity would have been encountered at only 1400 km (870 statute miles). Signaling in the reverse direction, messages were read at 3830 km (2383 statute miles) on an audibility factor of 26 (the amplification ratio being something better than the average at this extreme distance). If the regular barretter receiver alone had been used, this limiting intensity would have been reached at 2900 km (1800 statute miles). It is obvious that except for very severe static disturbances the *Salem* could have transmitted more than 1000 miles to Arlington, but inasmuch as this distance was that fixed by the Navy Department for the limiting official test, no attempt was made to establish official communication under the same conditions at greater distances. In considering the increase of received signal by application of the heterodyne system, it must be recognized that this device does not operate in any sense as a telephone relay. Its fundamental principle of operation is that two high-frequency alternating currents of slightly different periods can mutually interact to produce an indication at an audible frequency but greater in amplitude than could be produced by the weaker of the two currents alone. For best effect there is required a high degree of persistence in both of the interacting oscillations, so that obviously highly damped discharges, such as those due to atmospheric excitation of the receiving antenna, are subject to much more feeble amplification than are persistent oscillations from a well designed radio transmitter.

The ideal condition for use of a heterodyne receiver requires continuous generation of oscillations at the transmitting station, and in receiving from a high-frequency alternator or arc sender the heterodyne responds to antenna currents still smaller than those quoted.

The establishing of relatively small received antenna currents for good audible response makes possible some valuable extension of the test record. In measuring the distance over which it would be possible to signal between two stations of the type installed at Arlington the very interesting effect upon official distance caused by changing the transmitting and receiving stations is noted.

Dr. Austin's paper gives a tabulation of the sending antenna current which would be necessary in order to permit a signal of unit intensity to be received at various distances at unit audibility conditions. The received current assumed, in this paper, is enough to give a unit field signal when the heterodyne is used, but on the basis of the old assumption (10 microamp for unit audibility) the required energy could hardly be considered enough to permit possible reading of messages. A part of the tabulation mentioned is reproduced.

SENDING ANTENNA CURRENT IN AMPERES

Distance in Statute Miles	100 M	1000 M	10000 M
100	1.0	1.0	1.0
1000	1.0	1.0	1.0
10000	1.0	1.0	1.0

Examination of this table shows a number of interesting points, such as the inadvisability of using very long waves for short or moderate distances, and these may be investigated further by putting equation (2) into such form that it may be solved for distance in terms of the other factors. Since  $D$  is expressed both as a coefficient and an exponent, there is no explicit solution, and graphics must be relied upon.

The equation is expressed as

$$D = \frac{3600 I_s^2 h_s^2}{\lambda^2 D^2 \sqrt{e}} = 0, \quad (4)$$

it is a simple matter to solve equations for distance in terms of wave-length or other quantities by considering the equation to have the form

$$A - B = 0, \quad (5)$$

where

$$A = H, \quad (6)$$

$$B = \frac{3600 I_s^2 h_s^2}{\lambda^2 D^2 \sqrt{e}}. \quad (7)$$

It is evident that in solving this equation the various values may be substituted into the right-hand member of equation (5), and that if  $A$  and  $B$  values can be found independently as ordinates in the same chart with  $D$  as abscissas. At the point of intersection of the  $A$  and  $B$  curves, which of course indicates equality of  $A$  and  $B$ , the solution of equation (4) there holds, and the distance desired for assumed values of the other quantities may be read directly from the abscissa below the intersection.

If there are assumed conditions for two stations at the Arlington type with effective heights varying 100 ft and sending antenna current varying 100 amp, which is not the maximum antenna current for the Arlington ship but a conservative value, by the use of equation (4) it is possible to calculate the distances at which a certain antenna current will be received on a similar or different wave-length.

Figs. 8, 9, and 10 are drawn from computations made on



this way and show strikingly the advantage of long waves for signaling over great distances. Fig. 8 shows the distances at which a very strong signal (500 times audibility) will be received on wave-lengths of 2000, 4000, 6000 and 8000 m. It is interesting to note that at these distances there is no advantage in using wave-lengths much longer than 6000 m. Fig. 9 shows the same points for a weaker signal (audibility factor equals 100), but one which is easily read except under the very worst conditions. The computations plotted in Fig. 10 are for the weakest signal upon which messages are clearly readable through light static or interference.

Before complete investigation can be made of the best wave-lengths, the effects of changes of group frequency and of wave decrement, etc., it will be necessary to secure and study more experimental data than are given herein. It is hoped that quantitative results of other transmissions over long distances will be forthcoming from time to time, and that by careful consideration of them it will be possible to fix beyond any doubt the actual numerical relations between all important quantities involved in the design of high-powered radio-telegraph stations.

### Watt-Hour Meter Error Due to Earth's Field

During tests made on a 15-amp watt-hour meter to determine the effect of the earth's field on its registration at light loads, Mr. C. B. Stelle, in charge of the meter department for the Springfield (Ohio) Light, Heat & Power Company, found discrepancies amounting to 1.25 per cent between 180 deg. positions, at 50-watt loads. The meter examined was of the General Electric C 15-amp type. Varying differences were discovered, depending on whether the meter was turned east or west, north or south, the maximum variation being observed, of course, between the latter positions. Mr. Stelle conducted the test to obtain evidence against the practice of bringing customer's meters into the shop for routine tests. To correct for the various stray fields likely to be present where the instrument is installed, each meter should be tested under the conditions of its every-day use.

### Damage Done by Cable Puncture in Kansas City

Men engaged in work involving the tearing up of city streets should know, of course, the exact location of underground pipes, conduits and wires belonging to public-utility

companies. Failure to possess this knowledge, or perhaps carelessness in execution, led to the accident illustrated herewith. Fig. 2 is a section of a three-conductor cable

believed to have been operated by a man employed by the gas company in searching for a leak in one of the mains. Several cables carrying about 1500 kw each are installed in tile ducts and tie the 6600-volt buses of the main generating station and one of the substations together. Each conductor in the cable is about No. 000 stranded, and while the drill did not absolutely sever any conductor, one phase

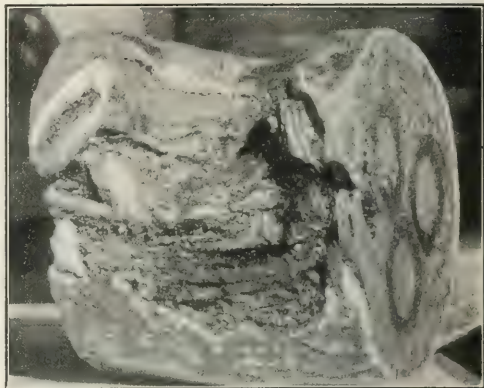


FIG. 2—SECTION OF INJURED THREE-CONDUCTOR CABLE

lead was evidently short-circuited to the lead sheath. The static interrupters gave an indication of the ground early on the morning when the cable is supposed to have been damaged. On account of the heavy load which the station was carrying at the time it was not considered advisable to cut out the cable, as it was hoped that the ground would not cause a permanent failure.

Previous to this a slight but not serious ground on another cable had been traced to a point in the gallery of the generating station. About twelve hours after the ground had been noticed on the cable in the street, the grounded phase evidently burned through the insulation to the other conductors and caused a terrific surge of current, which threw out the oil switches over the entire system. When this happened the cable in the gallery failed, evidently because of the increased voltage to ground, blowing out the walls of an air chamber, destroying series transformers, a 300-amp knife switch and other apparatus. A turbo-gen-

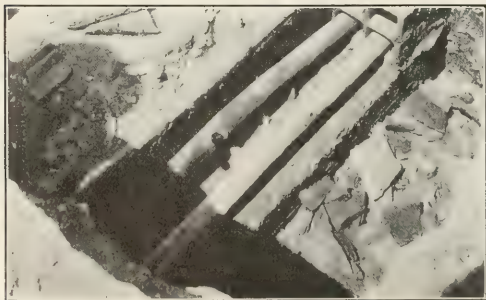


FIG. 1—CABLE EXPOSED FOR INSPECTION

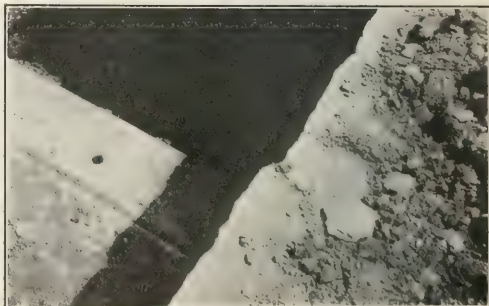


FIG. 3—POINT AT WHICH DRILL ENTERED CONDUIT

erator ruptured one terminal lead and disabled a switch. For eight minutes the entire city was without electricity, as the lighting company and the railway company are served from high-tension buses operated in parallel. During this time the ruptured cables were located and removed.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## Summer Electric Service for Office Building

During the months from May to October the private plant supplying heating service and alternating current energy to the new Railway Exchange Building, St. Louis, the largest office building in the world, will be shut down completely, and electricity to operate lamps and motors will be taken from the central station system of the Edison Gas Light Company, of St. Louis. The load transferred in this way will aggregate about 1,000 kw.

## A Ten-Thousand-Dollar Slogan Sign for Toledo

Through the Toledo Commercial Club the Toledo Railway & Light Company plans to present the city with a huge slogan sign costing at least \$10,000, the company to maintain and operate the display. Its publicity department is now conducting a slogan contest under the Commercial Club's auspices. Over 4000 suggestions for the best civic motto have already been received.

Operation of similar slogan signs in other cities has resulted in an improved public attitude toward the company, besides stirring up interest among national advertisers and local users of electric signs.

## "If It Isn't Electric, It Isn't Modern"

Several months ago the Dayton Power & Light Company adopted as a slogan the phrase, "If it isn't electric, it isn't modern." So thoroughly has this terse truth since been fixed upon the minds of the local public that the other day when a landlord advertised a dwelling for rent he took pains to add, with a praiseworthy regard for truth, "Modern, except electric light."

Later, with the owner's permission, Mr. T. F. Kelly, contract agent for the Dayton company, reprinted the advertisement in the company's display space, following it with the comment: "Landlords realize it is much easier to wire their houses when they are wired for electric light. Why not have your house wired at once? If it isn't electric, it isn't modern."

## Company's Duty to Maintain Service Once Started

Action was recently brought by Celia Hollander against the Westchester Lighting Company for turning off the gas supply to her premises, after refusing to receive her tender of the full amount of her indebtedness. A demurrer was filed by the defendants on the ground that the complaint failed to specify the amount tendered, and also failed to allege that the plaintiff's premises were within 100 ft. of the gas main. In overruling the demurrer Judge Thompson at a Special Term of the Supreme Court in Westchester County laid stress on the three points which here follow:



(1) Where a lighting corporation cuts off the existing supply to a customer, the burden is on the corporation to justify its act by showing an indebtedness which the customer has refused to pay or some other good and legal reason. (2) In an action to recover damages for discon-

tinuance of an existing supply of gas, it is presumed, in the absence of contrary showing, that the premises are within 100 ft. of the gas main. (3) Although there is a provision in the transportation corporation law whereby a gas company need not furnish service outside that limit, inasmuch as the service has once been installed it cannot be cut off on account of the position of the premises, the gas company being then the dominant force controlling the premises.

## Effective Electric-Vehicle Advertising at Boston

The accompanying illustration taken from one of a series of advertisements now being run in the Boston press under the auspices of the Electric Motor Car Club of Boston provides an effective contrast between the efficiency of the electric vehicle and that of the horse-driven wagon, and emphasizes the rapid increase in fleet equipment of many prominent firms since the earlier editions of the advertisement in the newspapers. The advertisement contrasts the slow speed, heavily loaded railroads, an inability to beat cold and sickness, irritated feed and stabling expense and high cost of depreciation on the part of the horse with the

**Profit or Loss**

**Which Typifies Your Haulage System?**

(Advertisement from motor magazine.)

efficiency of the electric truck for heavy duty, its low maintenance cost, "fuel" economy (freedom from repairs, simplicity of control and direction independent of weather conditions).

Thirty large New England firms are now using them, aggregating ten electric vehicles among them being the Edison Electric Illuminating Company of Boston, 650; four machine, American Express Company, 30; five, General Electric Company, 200; five, Ward Bakken Company, 20; four, National Express Company, 10; and four, Central Union of United Car and Storage (Department Store and Book Company). The market for electric passenger cars, four manufacturers of electric commercial cars and four passenger manufacturers participated in the latest weekly display advertising of the job, which is being extended to make a wider appeal to the part of business men and persons interested in motor transport service on the results now being achieved by the electric machine in the New England field. Everything points to a constant growth in this interest.



## Use of Storage-Battery Trucks and Cranes in Brooklyn

The storage-battery electric truck and crane has proved a saver of time, labor and expense in handling merchandise from all parts of the world at the piers and in the yards of the Bush Terminal Company in Brooklyn, N. Y. Briefly described, the apparatus is a flat car with a swinging crane



FIG. 1—HOISTING WITH ELECTRIC CRANE

operated by a 1-ton electric hoist at the forward end, while a storage battery supplies energy both for driving the vehicle and operating the hoist. Not only is the crane capable of hoisting material and depositing it wherever desired, but it is constructed to serve as a locomotive to haul flat cars as well. For simple hoisting the machine is brought into position, the brakes are set, and the vehicle remains stationary as the boom of the crane moves back and forth between the picking up and depositing points. By this method 300 castings, aggregating 65,000 lb., were unloaded from a gondola car in five hours; a box car was loaded with sixty-four 800-lb. barrels of plumbago in twenty-five minutes, and four cars were loaded in two and one-half hours, the latter work including "spotting" the cars.

When material has to be moved less than 400 ft., or in small quantities, the articles are lifted by the crane, conveyed to their destination by the vehicle and placed where

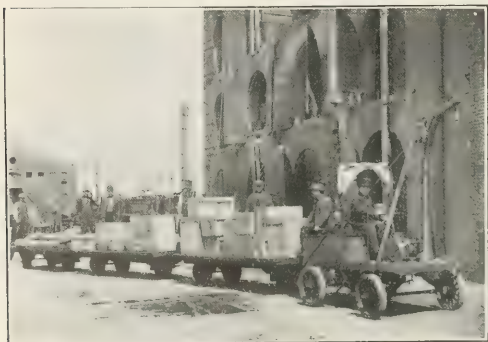


FIG. 2—BATTERY TRUCK USED AS LOCOMOTIVE

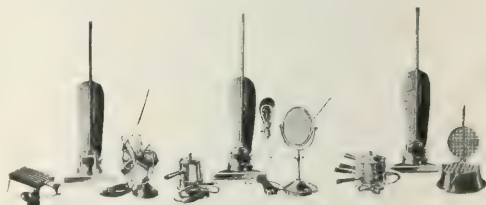
desired. By this pick-up-and-run method, sixty 800-lb. barrels of plumbago were moved 300 ft. in one hour, one helper only being required, and 150 300-lb. boxes of rubber were conveyed 75 ft. and loaded into a box car in fifty minutes. For shipping large quantities of freight over considerable distances the electric truck is used as a locomotive, drawing a train of flat cars on which it has placed

its own load. The cost of operating one of these electric-battery trucks at the plant of the Bush Terminal Company is about \$24 a week, including operator, interest, depreciation and electricity. It is figured that the cost of moving 1 ton (nine packages) 900 ft. is only 3 cents. The electric service at the Bush Terminal is purchased from the Edison Electric Illuminating Company of Brooklyn.

## A Thirty-Nine-Dollar Group Appliance Sale at Denver

During a recent thirty-day period the Denver Gas & Electric Company instituted a "group" sale of appliances by means of which the housewife could purchase any one of twelve groups of devices at a net price of \$39. The price of the three articles in each of the various groups totaled about \$50, but the company mailed to its customers engraved coupons good for \$11 applying on the purchase price for a limited period. The balance might then be paid \$3 down and \$3 a month, at the customer's discretion. In this way the transaction would be completed within a year.

Following were the groupings from which customers were invited to make their selections: (1) Ohio vacuum cleaner, electric iron, American toaster; (2) Ohio vacuum cleaner, American curling iron, "El Perco"; (3) Ohio vacuum cleaner, G. E. grill, "El Toastovo"; (4) Ohio vacuum cleaner, American "Perco," American curling iron; (5) Ohio vacuum cleaner, "El Chafo," "El Toastovo"; (6)



THREE TYPICAL APPLIANCE GROUPS IN DENVER CAMPAIGN

Ohio vacuum cleaner, American heating pad, American disk stove; (7) Ohio vacuum cleaner, Westinghouse 8-in. fan, "El Toastovo"; (8) Ohio vacuum cleaner, L. L. shaving mirror, American cup; (9) Ohio vacuum cleaner, American combination set, gas waffle iron; (10) Ohio vacuum cleaner, laundry stove, American electric heater; (11) Ohio vacuum cleaner, Reznor gas heater, L. L. water heater; (12) Ohio vacuum cleaner, Vulcan water heater, American disk stove.

## Electric Garage Equipment and Management

An interesting paper entitled "Electric Garage Equipment and Management," by Mr. H. M. Martin, of the H. C. & A. I. Piercy Contracting Company, was presented at a meeting of the Electric Vehicle Association of America in New York recently. The author remarked that, although the design of an ideal electric garage would seem to be an easy matter, yet considerable attention must be paid to its details. There are many points of difference to be considered between a garage for electric vehicles and one for gasoline automobiles. For instance, an electric vehicle cannot be successfully housed in a building which is kept at a temperature of less than 60 deg. Fahr., but the temperature is of much less importance where only gasoline machines are to be housed. Among the other points which the author considers of importance in the design are location, elevator service if the building is to have more than one floor, placement of posts, floor surfaces, lighting, charging equipment, ventilation, heating and machine-shop facilities.

The management of an ideal garage should be vested in a single head, a person of business ability and a technical knowledge of the industry. If for some reason there must be a choice between a good business man and the technical man, then it is the opinion of Mr. Martin that the business man should be chosen as the head and the technical man should be his trusted subordinate. The question of making repairs and minor adjustments for the garage customers gratis was thought to be largely a point for the judgment of the garage manager to determine, as it is a hard matter to draw a definite line of distinction between the repair which ought to be charged and those which should be free to the customer.

The paper was discussed briefly by Messrs. C. D. Marsh, S. G. Thompson, S. C. Harris, R. M. Lloyd, E. C. Roberts, P. Landman, A. D. Stevenson, F. W. Gough, F. B. Neely and F. F. Sampson. Acting Chairman C. D. Marsh stated that the association membership is now larger than ever before, twenty-five members having recently been added.

### Analysis of Motor-Service and Heating Costs in a Jewelry Factory

The jewelry factory of the Coddling Heilborn Company North Attleboro, Mass., is now operated by central-station energy from the local electric plant, the contract of the jewelry manufacturer having been obtained by Mr. William Plattner, local electrical manager, after a detailed engineering investigation of the former isolated-plant conditions. The test of commercial service has thoroughly justified the change to central-station drive, the customer reporting entire satisfaction with the motor equipment installed.

The factory was formerly operated by a 20-hp slide-valve engine supplied with steam from a 90-hp horizontal return-tubular boiler. No traps were used in the steam piping which supplied various parts of the factory with heat. A considerable annoyance was experienced from time to time at the slowing down of the rolling mill, polishing apparatus and steam-driven blower equipment, production being sensibly diminished under mechanical driving. The introduction of electric motors, however, speeded up the polishing tools enough to give about 13 per cent greater production, besides resulting in a better quality of work. All motors are of the

The heating bills totaled \$779 per year, divided as follows: January, 419; February, 378; March, 334; April, 279; May, 170; June, July and August, 0; September, 17; October, 257; November, 123; December, 410.

Under the conditions prevailing, the condensing factor of

TABLE II.—ANALYSIS OF HEATING SYSTEM

Estimated annual heat loss, Btu.		
Loss by	31 in.	16 in.
Exhaust steam		
Steam engine	100,000	100,000
Boiler	100,000	100,000
Radiators	100,000	100,000
Pipes	100,000	100,000
Valves	100,000	100,000
Fittings	100,000	100,000
Leaks	100,000	100,000
Total	600,000	600,000
Heat input	1,000,000	1,000,000
Heat output	400,000	400,000
Condensing factor	66.7%	66.7%

radiation was taken as 0.33 foot-candle of steam per hour for every 100 sq. ft. of radiative surface, giving a total of about 380,000 Btu. of steam condensed per hour, or 1,000,000 Btu. of steam condensed per year. From examination of the plant it appeared that an expenditure of 8 lb. of steam per pound of coal was required, giving approximately 20,000 lbs. of steam per year for the heating season of nine months, the steam pressure not exceeding 15 lb. per square inch.

#### STEAM REQUIRED FOR MECHANICAL SERVICE

The coloring room was equipped with nine electrolytic vats, each of 4 gal. capacity in a long wooden tank supplied from the steam pipes, the valves being open sufficiently to heat the water continuously throughout the day. There was also one large sink receptacle, heated at 100-hp intervals daily and run through a series of times, it being connected with a 1-in. steam pipe. A steam blower above the bathhouse, with screen for removing foam, although used intermittently, 8 hours per day, 11 1/2 in. steam was also connected directly to the steam supply pipe. The survey indicated the desirability of connecting the steam return of this sawdust box into the electrolytic room, so that the surplus steam could be utilized.

The plant also had a parking car connected with a 16-in. steam pipe, steam being required to keep the solution warm during the day. There had been a number of leaks of 1/2 in. to 1 in. in the steam pipes, and these were connected to a 1-in. steam pipe and used intermittently. The analysis of working conditions indicated the importance of connecting the drying box return pipe to serve with the heating box, and supplying steam through the box from the return instead of supplying the steam system in the engine room.

The second floor had three parking cars connected with a 16-in. steam pipe, and heated boxes 4 ft. 6 in. by 4 ft. 6 in. by 12 in. with 1/2-in. steam supply. As in the case on the first floor, a series connection of the drying-box return pipe with the hot box line recommended, located at the intermediate space in the engine room.

It was pointed out in the coloring room the variable opening of the hot water radiators to keep the water hot was equivalent to the continuous leaking off line steam valve. The surface of steam at a pressure of 15 lb. per square inch is 17.6 lb. per square foot square inch of surface. A 1-in. pipe has an outside area of 3.14 sq. in., so that the discharge is 5.51 ft. or 17.6 lb. per square foot or 17.6 lb.

TABLE I.—MOTOR EQUIPMENT FOR JEWELRY FACTORY

Service	Motor H.P.	Efficiency
First floor		
Scratch grinding and coloring	1/2	85%
current plating dynamo, three phase	1/2	85%
and one 1/2 in. exhaust fan	1/2	85%
Polishing bench, No. 1 blower, six phase	1/2	85%
Duplex power pump, engine	1/2	85%
Three rolling mills	1/2	85%
Two high-speed drills, three lathes	1/2	85%
Tub cleaning machine	1/2	85%
Emery wheel, double to 100 degrees	1/2	85%
Two drop hammers, 450 lb. and one two phase and two 75 lb. drop hammers, one two phase and one rotary shear	1/2	85%
Second floor		
Machine shop, including two engine lathes, one planer, one emery wheel, one cut-off saw, one lathe, one mill, one milling machine	1/2	85%
Four power presses, six inch speed motion	1/2	85%
Third floor		
No. 3 American gas turbine blower	1/2	85%

220-volt, three-phase 60-cycle induction type. The motor equipment installed is shown in Table I.

The total connected load of motors is 327 1/2 hp, representing an investment of \$668.

In this, as in many other cases where isolated plants are to be converted, the question of heating was an important factor, and on account of its interest to the motor-service solicitor, it is analyzed somewhat in detail in Table II.



of steam per ten-hour day. This gives a yearly output of 347,000 lb., figuring 300 days of operation.

Similarly, one large vat heated every four hours from a ½-in. pipe for an average of fifteen minutes at a time requires 6192 lb. per year. The steam blower over the acid cleaning vats, used five minutes at a time every fifteen minutes throughout the day of ten hours, requires a yearly input of 206,400 lb., based upon the above constant output of 17.6 lb. per minute per square inch of orifice at 15 lb. per square inch. The requirements of the entire plant were then summarized as follows, after determinations were completed for the rest of the equipment along the lines indicated: Coloring room, 347,400 lb.; vat in sink, 6192 lb.; steam acid blower, 206,400 lb.; pickling vat, first floor, 86,850 lb.; vats in sinks, first floor, 86,850 lb.; sinks, second floor, 86,850 lb.; total, 820,542 lb. for commercial service. On the basis of an evaporation of 8 lb. of water per pound of coal, there would be required for this work a yearly fuel consumption of 102,567 lb. of coal, or 46 tons of 2240 lb. each.

#### COST OF ELECTRICITY

The estimated cost of electric energy for this factory was \$66 per month, based upon a ten-hour day and service used 300 days per year. The average monthly consumption of energy determined was 2200 kw-hr., the average rate being 3 cents per kw-hr. The point was made that central-station service would be available at all times, and that a licensed engineer or fireman would not be needed so long as the steam pressure was kept below 15 lb. per square inch, since steam was not to be used for developing mechanical power. It was necessary, however, to equip the boiler with a sealed safety valve set at 15 lb. per square inch and approved by the State inspector of boilers.

The total cost of equipping the factory for electric driving was estimated as follows: Motors, complete, with bases, pulleys, labor, freight, \$668; wiring, fittings, switches and erection, \$160; pulleys, belting, shafting hangers, erected, \$80; drying boxes connected to vats, piping and labor, \$12; total, \$920.

The estimated yearly cost of operation, excluding fixed charges, was \$1,444.50, the items being as follows: Electrical energy, \$792; coal for heating, 59 tons at \$4.50, \$265.50; coal for commercial uses, sinks, etc., \$207; attendance, one-quarter of the time of one man at \$60 per month, inspecting motors, firing boiler, etc., \$180; total \$1,444.50.

#### New Rates at Marquette Municipal Plant

The Light and Power Commission of Marquette, Mich., recently established a reduced schedule of rates for service from the municipal hydroelectric plant. The new rates for residence and commercial lighting are as follows: First 200 kw-hr. per month, 5 cents per kw-hr.; next 100 kw-hr. per month, 4 cents; next 100 kw-hr. per month, 3 cents; over 400 kw-hr. per month, 2 cents.

The new motor-service rates placed in force at the same time were: First 200 kw-hr. per month, 3 cents per kw-hr.; next 200 kw-hr. per month, 2 cents; over 400 kw-hr. per month, 1 cent.

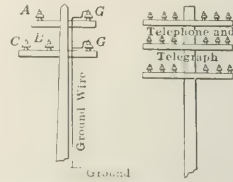
The former rates were 6 cents per kw-hr. for residence lighting and 5 cents for commercial lighting, reaching 3 cents to 2 cents per kw-hr. for long hours of use and for large installations. The old motor-service rate ranged from 5 cents to 0.75 cent per kw-hr., depending upon the amount of use.

The rate for street arc lamps is \$60 per year for all-night service. The commission has had a reduction of this rate under consideration, but reports no conclusion in the matter. There has been some public agitation in Marquette for a single flat rate per kw-hr. for all classes of consumers regardless of conditions of use, but the commission does not regard this as practicable under present conditions.

## Illumination and Wiring

### Ground-Wire Shields to Prevent Induction Trouble

The accompanying sketch shows the transmission-line construction adopted at the request of the owners of the telegraph and telephone lines, closely paralleling which a right-of-way had been secured for the 23,000-volt, 60-cycle circuit. The power-line delta was accordingly carried on



SHIELDING TELEGRAPH LINES AGAINST INDUCTION TROUBLES

the far side of the pole, the short-arm extensions on the telegraph side being used to support a couple of ground wires, one above the other, and each earthed securely at every seventh pole. Considerable fear had originally been expressed concerning induction troubles on account of the close proximity of the high-tension line, but after several years' operation no complaint has yet been made.

### "Cost Systems in Electrical Contracting"

"Cost Systems in Electrical Contracting" was the title of a paper prepared by Mr. Leo Dalkart, Moline, Ill., which was read by Mr. J. H. Warder before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers in Chicago recently. The author remarked that heretofore very few tabulated data have been compiled on the overhead charges connected with electrical contracting. The cost of the material and labor can be quite easily estimated on the unit basis, but charges which do not come under these heads have previously been levied on each job without much regard as to the proportion which each should share. Fixed charges on conducting a business should be levied on the various contract estimates according to the locality, the weather and the conditions under which the particular work is executed. The apportioning of overhead charges on different estimates should bear a certain relation to the time which is required to execute a contract.

Instead of levying a certain percentage charge on the total estimate to allow for overhead expenses, it would be better to proportion the charge on material and labor separately. The items of the overhead charges that depend directly on the material which is used should be summarized for previous years and a certain percentage assessed on the different materials during the following years. By a similar summary of overhead charges which can be traced to labor a certain charge per man-hour can be assessed on labor. Taxes, advertising and bad accounts can be divided pro rata between material and labor.

The author of the paper suggests that the overhead charges be plotted from month to month so that the need of a revision in the system of apportioning charges can be made at once and a policy for the ensuing year adopted. Several curves accompanying the paper showed the variation in freight charges, office supplies and vehicle charges during the different months of the year.

Among those who took part in the discussion of the paper were Messrs. R. H. Rice, J. H. Warder, A. S. Pardee, J. A. Wickum, S. Montgomery, C. D. Wesselhoeft, E. H. Free-





begin. In the second device a similar action is provided by slightly different means.

A type of supporting arm has been patented by Mr. W. C. Ude, of West Haven, Conn. The hook switch is omitted. The receiver arm actuates the moving springs when thrown into the proper relative position, a small hand-operated latch serving to maintain the circuit when the line is to be held. Release of the latch is effected when the ear is pressed against the receiver.

## Letters to the Editor

### Meters on Two-Phase Circuits

To the Editors of the *Electrical World*:

SIRS:—The second article on "Lamp Operation Due to Accidental Ground," which appeared in your issue of May 24, page 1098, while continuing the discussion from the standpoint of distribution, now opens up the question of metering. It would be interesting to know how the combined lighting and motor service, which is advocated as the best that can be used, would be metered. (See Fig. 2, page 1098.)

The entire installation can be completely metered by meters on the primary side—either one polyphase meter or two single-phase meters. If, however, the installation must be metered on the secondary side, and separately for motors and lamps, using (as is ordinarily done) a single-phase meter for the lamps and a polyphase meter for the motor circuit, then this scheme of wiring has certain very objectionable characteristics from the standpoint of unmetered current.

An inspection of Fig. 1 herewith indicates that the scheme of wiring as ordinarily metered would expose not merely an unmetered source of single-phase energy, as most combined systems are liable to do, but three unmetered sources of single-phase, differing from each other in phase or potential, and serving as a source of unmetered polyphase energy.

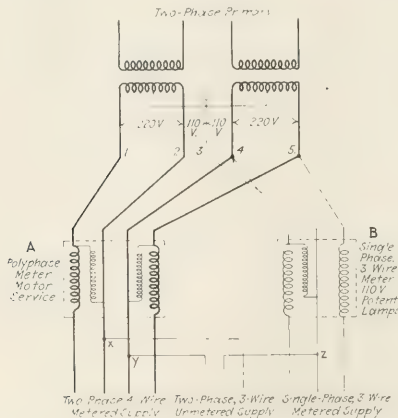


FIG. 1—DIAGRAM SHOWING TWO-PHASE, THREE-WIRE UNMETERED SUPPLY

The point Z in Fig. 1 need not be taken on the house wiring of the lighting meter, but may be any ground and produce the same results.

The three-wire lighting circuit could also be connected to wires 2, 3 and 4, if it was desirable to load partially each of the two service transformers. The lighting would then be polyphase, however, and would have to be metered with

a polyphase meter. The conditions of unmetered supply would remain substantially the same.

It is possible to meter completely such a system of wiring on the secondary side, but this arrangement of meters has certain disadvantages and is not advocated as ideal. (Fig. 2.) For the four-wire, two-phase motor-circuit supply it is necessary to insert a current coil of a meter in each of

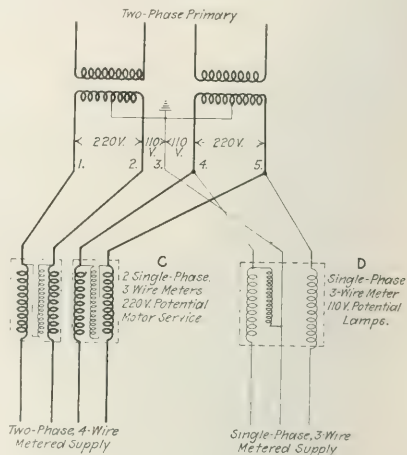


FIG. 2—ARRANGEMENT AVOIDING UNMETERED SUPPLY

the four wires. This can be done by two single-phase, three-wire meters with 220-volt potential coils. This arrangement is more expensive than polyphase metering and is not specially desirable from the registration and billing standpoints.

The strongest argument for this system of distribution would appear to be the uniform and minimum potential to ground measurable from all of the secondary wires. The system, however, should not be advocated as the best for general use except after a careful consideration of the metering requirements.

New York, N. Y.

FRANK V. MAGALHAES.

### Seamless Splicing Sleeve

To the Editors of the *Electrical World*:

SIRS:—With reference to the article entitled "Splicing Sleeve," on page 1276 of your issue dated June 7, attention should be called to the fact that the oval type of seamless splicing sleeve there described was first developed by Mr. Walter G. Clark. Mr. Clark experimented for a year or more, some seven or eight years ago, with this type of sleeve. He found that the question of annealing was of the utmost importance. A sleeve of this type if too hard will crack open on being twisted, and if too soft it simply will stretch open and give a joint of no particular strength. He finally developed a process of annealing—one which has been modified only slightly since—that insures an absolutely uniform product and makes it possible at the present time to supply a sleeve of this type which is guaranteed to be stronger than the incased conductor.

Sleeves of this type were recently purchased by the Isthmian Canal Commission for use on United States government transmission lines in the Panama Canal Zone, where atmospheric conditions are about as bad as they may well be owing to the heat and moist air.

E. G. HATCH,

Manager the Clark Electric & Manufacturing Company.

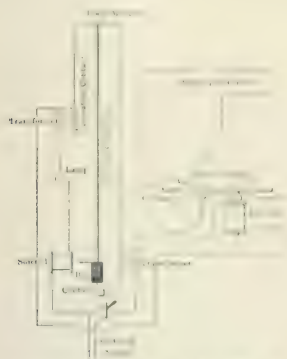
New York, N. Y.

# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Pendulum Counting Device for Testing Meters

For testing rotating-standard meters Mr. C. B. Stelle of the Springfield (Ohio) Light, Heat & Power Company, makes use of an improved pendulum counting device which considerably simplifies the process. Its application depends upon the fact that if  $T$  be taken as thirty-six seconds, the



ONE-SECOND PENDULUM AND COUNTER CIRCUIT FOR CONNECTING METER TO CIRCUIT

familiar meter expression  $\frac{3600 \times K \times R}{T}$  becomes simply

the product of the constant times the revolutions multiplied by 100, a result easily computed. The device shown in the sketch comprises a one-second pendulum and counter cam which automatically connects the meter in circuit for thirty-six-second test periods, thus fulfilling the above condition.

This apparatus avoids the use of a stop watch, with its accompanying human factor, and requires only one man to make the test. It also tests the rotating standard from start to stop each time, duplicating the conditions of the test meter's practical use. The Springfield company employs two rotating standards, one of which is calibrated every three days. No attempt is made to adjust the standard, but a calibration curve of its errors at varying loads is prepared.

The 30.5 in. pendulum shown consists of a wooden rod boiled in paraffine and carrying solder-filled bobs, the whole being hung from a four-wheel meter bearing. The slight impulse needed to keep the pendulum in continued motion is supplied by the solenoid winding at the left of the bob. A contact pin on the pendulum swings through a globe of mercury actuating the counter solenoid. To avoid destructive sparking at the contacts, which was at first experienced, these contacts simply close secondary windings of potential transformers whose primaries are in series with the solenoids and resistor lamps. As long as the secondaries are open the current passing through the solenoid is small, but when short-circuited enough current flows to operate the mechanism.

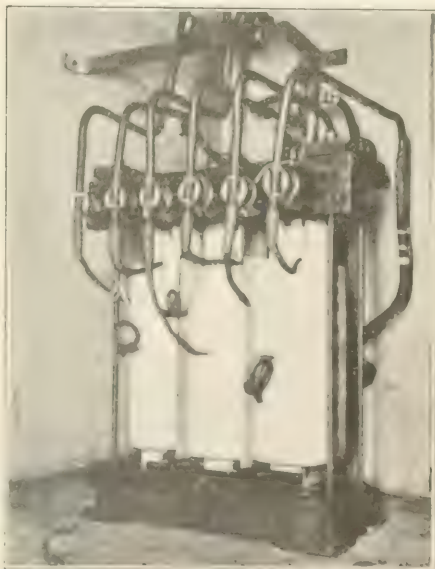
For the cam wheel a couple of meter disks were used, one having been filed with sixty teeth and the other having its periphery cut away for 20 so are equal to thirty-six of the

teeth. The wheel is then rotated through the interval of one tooth every second, completing a full rotation in one minute. For thirty-six seconds of this period the contact brush bearing on the cam surface closes the meter circuit, breaking it again automatically at the end of the period. By means of the double throw switch at the bottom the counting device can be disconnected while the pendulum continues in operation. This feature is useful while warming up a meter preparatory to making the test. In the right-hand position both pendulum and counter are actuated.

The mechanism at Springfield was built almost entirely of old meter and standard parts, and despite its home-made character, has proved extremely useful in carrying on tests.

## Substituting Reactors for Auto-Transformer Starters

After constructing a home-made reactor in its own shop and finding it very satisfactory when used for starting synchronous machines, the Kansas City Electric Light Company of Kansas City, Mo., has decided to make more



THE KANSAS CITY ELECTRIC LIGHT COMPANY HAS DECIDED TO MAKE MORE

extensive use of the apparatus. The original apparatus consisted of three reactors with windings connected to a single-phase transformer connected to the motor's primary section and secondary. On starting a machine the coils were connected in series with the motor's primary and the motor with electricity and arranged so that they were short-circuited only after the field of the synchronous machine



was excited, and so adjusted as to produce the lowest armature current reading.

Several advantages were noticed in connection with their use. At no time is the full line voltage impressed across the machine when the field is unexcited, because the power-factor is poor and the drop over the coils is considerable. Serious damage cannot result from the short-

other of each interlocked pair would be open at all times and yet the bell must ring if for any reason the closed member opened. The difficulty was, after a little thought, solved as shown, double contacts being provided at each switch and the pair connected in series. The oil switch which is open has its own signal contacts closed. Opening of the other switch closes its contacts and thus, completing the circuit, sounds the alarm.

## Maintenance of Electrolytic Arresters

By W. W. McCULLOUGH

The value of the aluminum-cell electrolytic lightning arrester for protection against lightning and abnormal voltage conditions depends upon the proper maintenance of the film on the surface of the plates making up the arrester. The maintenance of this film depends, first, on the temperature of the electrolyte, and, second, on the frequency of "flashing" or "charging." The operation of electrolytic arresters, given proper "charging," presents very little difficulty in climates where the electrolyte is not subjected for long periods of time to high temperatures. In semi-tropical countries with the arrester tanks exposed to the sun, however, it is extremely hard to keep up the film on the plates,

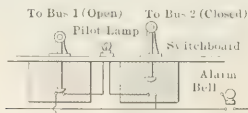


LIGHTNING-ARRESTER INSTALLATION

circuit of any of the windings, since the coils are in series with the machine terminals. When the field is excited the machine may slip one pole, and if reactance coils are in the main line leads, the process is accomplished more gradually as the current cannot rise to a high value through the reactance coils. A very gradual rise in speed results from the use of these coils, and yet the machine comes up to speed rapidly since the voltage rises as the current decreases. The time which is consumed in accelerating the machine from standstill to full speed ranges from forty-five seconds to sixty seconds.

## Alarm Circuit for Double-Throw Oil Switches

The switchboard of an Eastern power house was recently rearranged to provide for duplicate buses onto either of which the generators could be thrown by means of pairs of



ALARM CIRCUIT FOR DOUBLE-THROW OIL SWITCHES

interlocked oil switches. Later a circuit-breaker alarm and pilot-lamp scheme was applied to the single-throw switches on the board, so that upon the opening of any breaker a bell would ring and a lamp on its panel would be lighted. To extend this system to the double-bus section caused the station wireman some worry, because one switch or the

only a few hours being sufficient to dissolve the film immersed in the warm electrolyte.

This trouble has been remedied to a large extent on a 60,000-volt system in Florida by painting the arrester tanks white instead of black as originally furnished, advantage being taken of the increased heat-reflecting qualities of a white surface as compared with a black one. The photograph shows an arrester for 60,000-volt service with the tanks so treated.

## Counter-Emf Control of Storage Batteries

In the telephone field use has been made of the counter-cell principle of voltage control for regulating the terminal emf of storage batteries used with central-energy systems. Has this method ever been applied commercially for central-station batteries? With the large currents to be handled, such a scheme should save much of the investment in end-cell switches. L. F. G.

At St. Louis, Mo., such a 5750-amp-hr., 150-cell stand-by battery has been in service in a substation of the Union Electric Light & Power Company for a year. Six pairs of subtractive counter-emf cells are connected in series with each half of the battery, being short-circuited by magnet switches to raise the effective terminal voltage. The scheme avoids much terminal and end-cell copper. A similar battery equipment, but smaller, is being installed in the Public Service building of The Milwaukee Electric Railway & Light Company.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Reduction of the Excitation Time of Coils with High Self-Induction.** W. WELER. In short-circuit machines in which the magnetic flux is to be regulated it is often necessary to reduce the excitation time of the field coils as far as possible. Six different methods for accomplishing this result are described. The three most important ones are the use of a series resistance, the use of a counter-compounded excitation machine, and the use of an excitation machine driven by a motor the speed of which decreases with increasing load. *Elek und Masch. (Vienna), May 25, 1913.*

**Induction Law and Electron Theory.** K. FRIEDMANN.—The well-known mathematical formulations of the law of induction are in all cases applicable in principle although they are not of the same practical value of application in all cases. The electronic theory supports the conception of induction due to the cutting of lines of force. The e.m.f.s are induced right at those points of the conductors where lines are cut. One is, therefore, justified in distinguishing between active and inactive portions of the winding of generators. The magnetic lines of force are physical realities, though perhaps only phenomena of motion, like water waves. An application of the electronic theory is made to transmission of energy from the primary to the secondary of a transformer. *Elek und Masch. (Vienna), June 1, 1913.*

### Lamps and Lighting

**Lighting by Neon Vapor Tubes.** G. LANGE. An account of a lecture presented before the joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Electriciens in Paris. Neon has the peculiar property that it can be thrown into a state of luminescence by the application of much lower voltages than are required for other gases, for example, 13 volts as compared with 1000 volts for air. Moreover its spectrum in these respects is remarkably good. It gives an orange-red light, but unfortunately is deficient in the blue end of the spectrum, so that it departs considerably from the spectrum of daylight. Thus it lacks the part of the spectrum which is such a prominent feature of the mercury lamp, and the idea naturally arises that the light of one may be used to correct that of the other. Unfortunately this cannot be done by simply adding neon to a tube containing mercury. If that be attempted the tube starts glowing readily owing to the high conductivity of the neon, but the light from the neon very soon passes away and the spectrum of mercury alone remains. Therefore it is not possible to correct the light in this way by running neon and mercury tubes side by side. Another difficulty is that neon is very sensitive to impurities. In fact the presence of the smallest quantities of other gases renders a tube ineffective. It is, therefore, insufficient to fill a tube with pure neon, as impurities are given out by the electrodes. This difficulty has been overcome by connecting the tubes when first run to a vacuum vessel containing charcoal. The current is allowed to pass under these conditions for several hours, after which the charcoal may be removed the neon being thus purified. Still another difficulty was found owing to the volatility of the electrodes. This not only caused a deposit of metal upon the glass, but the electrodes absorbed the neon in the process, thus rendering

the tubes unworkable. The difficulty, however, has been overcome by increasing the surface of the electrodes, which has of course a disadvantage, tubes are now obtained with a life of from 1000 to 100,000 hours, holding 500 volts with a current of 0.5 amp. The potential drop at an electrode is about 100 volts, so that the longer the tube the lower the voltage drop. The current may be varied from 0.6 amp to 1.3 amp in a 45-mm tube, but the lower the current the smaller the light. A carbonized carbon lamp is proposed, used as a positive, and the power factor is about 0.8. Consequently with 500 volts one power is fed, with power in positive consumption of 10% watt per candle. If the loss in the transformer and the accompanying self-induction is taken into account, a specific consumption of 100 watts per candle seems to be obtained. The advantages over the Moore lamp are that the potential is low, the candle power per watt is greater and the efficiency is higher. The tube can be corrected by a second tube containing mercury, which, unlike the ordinary mercury tubes, work with the same current as the pure neon tubes. The specific consumption is then about 100 and so watt per candle. In an additional note on the subject it is stated that a gas that is superior may be obtained by running a neon tube in series with a mercury tube, gas in Paris. It was quite evident that the result was not particularly correct, for when the light was extinguished and the ordinary tube was turned on the white reflexes over the cover appeared quite green for a time. It is thought that the theory of such lamps will be employed in numerous industrial classes of illumination, such as large halls, etc., for advertising purposes, rather than domestic lighting. *London Electrician, May 10, 1913.*

**New York City Street Lighting.** C. L. FARRINGTON.—An illustrated article on the street lighting and houses of New York, the plan of development and present condition. *Electrical Engineer, June, 1913.*

### Traction

**Electric Locomotion of the Berlin Electric Railway.** L. C. BARTON. In the proposed electric equipment of the Berlin City and Ring Railway it is proposed to use electric locomotives in order to run the cars in tunnels exposed with steam locomotives. The author undertakes to show that there is a strong case and points out the superiority of motor cars over electric locomotives for the purposes in question. *Elect. Eng. (London), May 20, 1913.*

### Installations, Systems and Appliances

**Practical Design for Electrical Energy.** S. S. STEVENSON. The author thinks that an average installation in a 1000 ft. all steel building with a central station within three years should be allowed for and, therefore, requires that for simplicity of design the actual load should be only fifteen percent. On this basis he shows that most of the British electrical stations are operating at a loss with their present capacity for storage. He discusses the question whether the price of energy supplied to manufacturing concerns can be reduced. His final conclusion is that the price of energy is not too high, but the cost of energy is too high. To obtain 10% per cent of capital cost for interest and depreciation, say, at 8% per cent of installment, it is not possible to net more than 2.5 per cent, the present average, which is making a loss of 7.5 per cent of capital cost, and it requires something like 25 per cent of the



present value on the present load connections—that is, revenue should be 23.5 per cent of capital with works costs 34.5 per cent of revenue. This is the task ahead of the commercial electric supply engineer." In an editorial on the subject doubt is expressed whether it is correct to require that the period for loans should only be fifteen years for municipal stations. For certain classes of plant this may not be too short, but as an average it is thought to be far shorter than is really necessary. It is doubtful whether it would be possible to charge higher rates to manufacturers. "A supply authority cannot expect to sell electrical energy unless it can be clearly demonstrated that such a course is to the user's advantage. This may mean that the price that is quoted is of necessity low, but whether it is too low to be remunerative will generally depend upon the size of the undertaking giving the supply. It may be necessary to work for a time at unremunerative rates, and thus to provide for the future, but there is nothing uncommercial in this if it seems likely to have a successful issue."—*London Electrician*, May 16, 1913.

**Flat Rate.**—HANS BERGMANN.—An article on the development of the flat-rate tariff of the Upper Silesian Electricity Works. Right from the beginning, 1896, this company has permitted consumers to use a flat rate, and since 1906 it has been using devices limiting the power consumption in all installations where the flat rate is charged, the kilowatt-year being charged at \$75. In 1909 the flat rate was further reduced, since experiments had shown that in the installation using a flat rate the number of hours of use was very rarely more than 1500 a year. Under this condition the rate would have been \$60 per kw according to the meter tariff. The rate for the flat-rate tariff was, therefore, made \$61.50 for 1 kw, \$31.50 for 500 watts, etc. In installations in which it is proved that the electricity is used for more than 1500 hours a year these rates are increased by \$15 per kw. The number of installations using the flat rate has increased from 5200 in 1909 (receipts \$60,000) to 16,300 in 1912 (receipts \$196,000), while the number of installations using the meter tariff has decreased from 7800 in 1909 to 5100 in 1912. A possible danger is the greater use of electric heating and cooking apparatus, and if this takes place in this district it has not yet been decided whether it will be possible to retain the present flat rate or whether it will be necessary to increase it in view of the longer hours during which electricity will be used.—*Elek. Zeit.*, May 29, 1913.

**Austria.**—EMIL HONIGSMANN.—The first part of a statistical report on the condition of the electrical industry in Austria in 1912. On Jan. 1, 1913, there were in Austria 854 central stations with a total rating of 457,000 kw and total connections of 568,000 kw supplying electrical energy to about 2000 cities and towns. The connections included 5,000,000 incandescent lamps (230,000 kw), 43,500 arc lamps (22,250 kw), 65,700 motors (196,320 kw) and 2000 heating and cooking apparatus (11,230 kw). The author gives a review of the relation of the electrical industry to the general industrial life of Austria and gives extended tables of the import and export trade in electrical goods. The article is to be continued.—*Elek. und Masch. (Vienna)*, June 1, 1913.

#### Wires, Wiring and Conduits

**Installation Materials.**—The new rules of the German Association of Electrical Engineers on the construction and testing of installation materials, such as switches, fuses, sockets, pipes, switchboards, etc. The rules will be in force beginning with Jan. 1, 1915.—*Elek. Zeit.*, May 29, 1913.

**Cable Sheathing.**—A note on a recent British patent (No. 16,153, 1912) of the Weston Electric Company. To decrease the cost of cable sheaths, an alloy of approximately 99 per cent lead and 1 per cent antimony is used. The alloy is preferably formed by combining the metals

after they have been reduced to their natural state.—*London Elec. Eng'ing*, May 29, 1913.

**Overhead-Line Regulations.**—The revised model regulations of the (British) Board of Trade for overhead lines together with some explanatory notes.—*London Electrician*, May 30, 1913.

#### Electrophysics and Magnetism

**Efficiency of the Electromagnet.**—L. SCHUELER.—The first part of a mathematical paper in which the author gives the energy balance of the attraction of a load by an electromagnet. There is transformation of electric into mechanical energy. This transformation is double. The current passing through the winding of the electromagnet produces a magnetic field so that electrical energy is changed into magnetic energy, there being losses due to ohmic resistance and to the eddy currents in the iron core. The magnetic energy is stored within the magnetic circuit and especially in the air-gap. When the armature is attracted to the electromagnet the magnetic energy stored in the air-gap is changed into mechanical work while the magnetic energy in the iron core remains there. This is set free in the form of an arc when the circuit is broken and is thereby lost. The author discusses mathematically what happens while the armature is being attracted. The article is to be concluded.—*Elek. Zeit.*, May 29, 1913.

**Periods of Transformation of Uranium and Thorium.**—HERBERT N. MCCOY.—The period of a radioactive element can be calculated with considerable accuracy from its range and the ionization current of the unit weight. The period so found of uranium and thorium are  $5.0 \times 10^9$  and  $1.8 \times 10^8$  years respectively.—*Phys. Review*, May, 1913.

**Alpha-Ray Ionization.**—HERBERT N. MCCOY.—A paper in which a formula is developed for the alpha-ray activity of a lever of a radio-active solid as a function of its thickness. It is assumed that the air range of an alpha ray is diminished in its passage through the solid by an amount directly proportional to the distance it travels in the solid before emerging and that the ionization produced is proportional to the two-thirds power of the distance the alpha-ray then travels in air. The theoretical curve for the rise of activity with increasing thickness of the layer is almost the same as an exponential curve, although the fundamental equations are entirely different. It is shown that the activity of a film of any alpha-ray substance just thick enough to give maximum activity is 0.3 of the activity that the same material would have if spread on a flat surface in an infinitely thin film. The partial activities of a thick film which gives equal numbers of alpha-rays of ranges  $R_1$  and  $R_2$  are in the ratio  $(R_1/R_2)^{3/2}$ . It is found experimentally that the activities of films of  $U_3O_8$  were in good agreement with those calculated by theory. The weights per square centimeter of  $U_3O_8$  and of air which produce equal retardation of an alpha-ray are as 3.01 to 1. This ratio is approximately that calculated by the law, first stated by Bragg and Kleeman, that the stopping power of matter is approximately inversely proportional to the square root of the atomic weight of the material through which an alpha-ray passes.—*Phys. Review*, May, 1913.

#### Units, Measurements and Instruments

**The Constant of the Radiation Law.**—The Planck-Wien radiation law

$$E = C \frac{\lambda^{-5}}{e^{1/T-1}}$$

is of fundamental importance not only for the theory of radiation but for the practice of optical pyrometry.  $E$  is the radiation of the wave-length  $\lambda$ ,  $e$  the basis of natural logarithms,  $T$  the absolute temperature (= degrees Celsius

+273),  $C$  a constant depending on the instrument and  $c$  a natural constant. The knowledge of the value of  $c$ , is, therefore, very important. According to Lummer and Pringsheim  $c = 14,600$ , if  $\lambda$  is measured in microhms. The value of  $c$  has recently been redetermined at the Reichsanstalt by E. Warburg, G. Leithausen, E. Huka and C. Müller. Their result is  $c = 14,370 \pm 40$ .—*Ann. der Physik*, 4 Folge, page 609, 1913; abstracted in *Zeit. f. Beleucht.*, May 30, 1913.

#### Units, Measurements, and Instruments

**National Physical Laboratory.**—An account of last year's work of the (British) National Physical Laboratory. F. E. Smith has nearly completed the measurements necessary to determine the absolute value of the resistance of the international ohm, and his report indicates the high order of accuracy which may be expected. The laboratory standards of resistance have been again compared with those of the Bureau of Standards, the Reichsanstalt and the Laboratoire Central d'Electricité. The maximum difference is eleven parts in 1,000,000; the laboratory and the Reichsanstalt agree within one part in 1,000,000. The value found at the Bureau of Standards was one part in 100,000 greater. In the photometric division the most important researches have been the determination of the candle-power of a set of twenty-four tungsten lamps running at 1.5 watts per cp, an investigation for the Board of Trade into the visibility of ships' lamps, and a large number of tests for the engineering standards committee on metallic-filament lamps. Another series of investigations for the same committee has been made on the heating of lamp sockets, while much information has been obtained for the Admiralty on the dielectric properties of ebonite and mica. The following table gives a summary of the tests carried out at the laboratory during the last three years:

	1910	1911	1912
Electrical measurements	15	175	11
Electrostatics	1,779	2,157	5,811
Photometry	48	920	1,582
Thermometry	4	147	8,213
Optics	5,308	8,100	2,810
Metrology	10,126	17,004	11,000
Taximeters	28,197	29,175	10,218
Endowing	1	26	12
National tank	1	1	1
Observatory	1	1	1

As to work proposed for the year 1913, the report reads in part as follows: "Further measurements of resistance will be made with the Lorenz apparatus, and the coils will have their dimensions re-measured. The equilibrium of the Weston cell will be further studied, and if necessary a large number of cells containing free acid will be set up as secondary standards. A few of the new mercury standards of resistance will have their constants redetermined in order to detect any secular change. It is proposed to make experiments with the Ayrton Jones current balance having as their object the accurate measurement of the mean value of a variable current. A new magnetometer, suggested by Prof. Schuster, will be built. A determination of the mechanical equivalent of heat will be commenced. At present the values given for the equivalent when obtained by electrical methods differ by one part in 1000 from the values obtained by mechanical methods. For the wave meter it is proposed to improve further the apparatus for the production of the high-frequency oscillations. It is hoped to complete the low-reading marble inducto-meter and to improve the methods of testing the very small residual inductances which are found in good modern resistance coils. It is proposed to continue the investigation on the magnetic testing of rods and strips, including magnet steel tests, and incidentally the more accurate determination of the areas of search coils; while in connection with the research committee of the Institution of Electrical Engineers some ex-

periments on the steel most suitable for magnets may be undertaken. It is hoped to set up more sensitive vibration galvanometers, as experience has shown that, with a scale distance of 7 m, a good sharp light-spot can be obtained, with a sensitivity of 250 mm per micro-ampere at 100 cycles per second. The fixing of the unit of candle-power by a cascade method in tungsten-filament lamps operating at 1.5 watts per candle, is now complete, and work is in hand to ascertain the order of agreement with other similar photometric units and to bring the exact difference between the present lamp and the unit as obtained. A few details of this work need to be completed, as regards international comparison. It remains only to make the tests which are in hand with the Laboratoire Central, Paris. The intercomparisons during the past year with Germany and the United States have shown close agreement between the laboratories of these countries and Great Britain as to the part of tungsten lamps whose radiation is of the same hue as high-efficiency tungsten lamps. Preliminary work is in hand to ascertain the suitability of the Violle molten platinum standard as a primary standard of incandescent intensity, having regard to the more recent knowledge of the principles underlying the radiation from bodies of this nature. Work is contemplated in the direction of further perfecting the installation for measuring alternating current power. The increasing accuracy of specifications for electrical machinery renders the accurate calibration of test instruments a matter of considerable importance, and it is necessary that these calibrations shall be made both quickly and with precision. The steadiness of the supply obtained from running machinery is one of the factors which affect accuracy, and good results are obtained from the use of secondary standards for taking away current from the moving parts. Progress in the calibration of three-phase wattmeters the instruments have been used on three phase circuits with their series instrument transformers only, the shunt transformers having their ratios separately determined. Plans are now prepared for switch apparatus which will permit and meters to be tested on three phase circuits with both their series and shunt transformers in circuit. Additional standard secondary standard inductance meters are to be constructed to complete the series which have now been in daily use for the last four years. Other chapters of the report are devoted to the work proposed on the field of thermometry, metrology, optics, metallurgy and metallurgical chemistry. This article is to be concluded.—*London Electrician*, May 21, 1913.

#### Telegraphy, Telephony and Signals

**Loaded Telephone Line.**—A note on a recent British patent (No. 11,111) filed at F. A. Barker. To regulate the attenuation in telephone and telegraph lines according to the different frequencies, inductances are inserted at equal intervals. These are specially arranged compound circuits which may be tuned to transmit frequencies.—*London Electrician*, May 21, 1913.

**Wireless Telegraphy.**—A new patented system of the quenched-spark method of wireless telegraphy which is said to give exceptionally good results in tropical countries. It is stated that an efficiency of 10 to 20 per cent is obtained in transforming the primary electrical energy into useful radiated energy.—*London Electrician*, May 21, 1913.

**Wireless Telegraphy on the High Seas.**—An connection with the visit of the Hydrographic Bureau of Electrical Engineers to the wireless telegraph station at the Lifford Lough, Ireland. The method at present employed is what is known as the "one-quarter" system. In this method a spark is employed in the alternating current coil that the spark half occurs within the pressure during transmission is sufficiently high. The wave length wave periods provide a spark which occurs at every maximum of the alternating pressure wave, that is, twice in each complete wave, so that the spark frequency is double that of the



alternator. In the rare-spark method the spark gap is set too wide for a discharge to take place when the pressure due simply to the alternator and its transformer reaches its maximum value in each half alternation. The necessary pressure is then obtained by tuning the alternator circuit. For this purpose both inductance and capacity must be present, and the circuit must be tuned to such a frequency

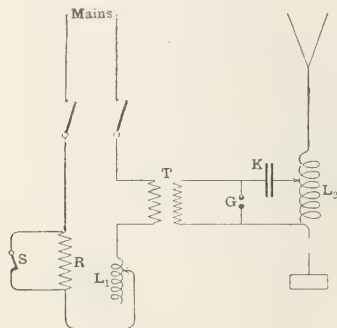


FIG. 1—CONNECTIONS OF MAIN CIRCUIT

that the pressure can build up conveniently. Thus the sparking pressure is not reached at the first maximum in the wave after closing the primary circuit, but in the present instance at the third. If  $K$  is the capacity of the secondary,  $L$  the inductance of the primary,  $m$  the transformation ratio and  $p = 2\pi f$ , then the condition of resonance is  $m^2 p^2 LK = 1$ . The primary frequency in the large installation is 42, varying up to, say, 46, thus giving a spark frequency of 28-30. The connections of the main equipment of 60-kw rating are shown in Fig. 1. Energy is taken from the public mains at 220 volts and 42 cycles. After passing through the switchboard it is taken to the primary of the transformer  $T$ , in series with which is the tuning inductor  $L$  and the resistor  $R$ . The resistor of  $R$  is such that when it is in circuit the pressure given by the secondary of the transformer is insufficient to cause a spark, and the method of signaling consists in short-circuiting the resistor whenever a spark is desired; the alternator circuit being thereby rendered resonant. The secondary of the transformer is taken to the spark-gap  $G$  and to the resonating circuit, including the capacity  $K$  and the inductance  $L_2$  in the aerial circuit. In addition to the main installation there is a small one of 10 kw on the rare-spark system, and also one of 22 kw giving musical sparks. A description is

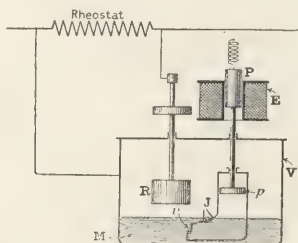


FIG. 2—RELAY DEVELOPED BY COMMANDANT FERRIÉ

finally given of the arrangement for giving the daily time signals. These are given directly from the observatory, the relay being connected to the observatory for this purpose and being thus actuated directly by the special observatory clock. This relay in turn brings into action a second relay, which short-circuits the rheostat, thus giving the necessary signals. The difficulty in a relay of this kind is

that it deals with considerable currents, and that the time taken for its operation must be quite definite if the signals are to have any serious value. Commandant Ferrié developed a relay shown in Fig. 2. It consists essentially of a vessel  $V$ , containing mercury  $M$  and a rotating electrode  $R$  which is above the surface of the mercury. The terminals of the rheostat are connected respectively to the vessel and to the electrode. The vessel contains further a small mercury pump, of which the piston is indicated at  $p$ . When the piston draws up it draws mercury in through the valve  $v$  into the pump, and when it is forced down it drives mercury out through the jet  $J$  against the rotating electrode. When this happens the rheostat is short-circuited and the spark passes. The piston  $p$  is actuated by the plunger  $P$ , forming the core of an electromagnet  $E$ . Normally the plunger is kept up by a spring and is pulled down when the electromagnet is energized by the relay connected to the observatory. In order to suppress sparking on the rotating electrode the vessel is filled with coal gas. It is found that the relay is quite definite, with a lag of 0.2 second between the closing of the circuit at the observatory and the passing of the spark at the aerial circuit.—*London Electrician*, May 30, 1913.

#### Miscellaneous

*British Electrical Engineers in Paris.*—A full account of the visit of the (British) Institution of Electrical Engineers to Paris and its joint meeting with the Société Internationale des Électriciens. Features of the technical sessions were discussions on electric traction and on long-distance energy transmission. An account is given of the many visits which were paid to the Asnières three-phase station, the 120,000-hp St. Denis station, the Eiffel Tower, etc.—*London Electrician*, May 30, 1913.

## Book Reviews

*SUR LES EFFETS PHYSIOLOGIQUES DES COURANTS ÉLECTRIQUES.* By Dr. G. Weiss. 86 pages, 26 illus. Paris: Gauthier-Villars. Price, 5 francs.

A valuable physiological series of researches on the effects of electric currents upon dogs. They were made systematically and with great care, using both electrical and physiological indicating and recording instruments. As a broad generalization it is pointed out that when the effect of the electric shock was to set up fibrillary tremor in the heart the animal promptly died. It was found that the alternating current was more dangerous than the direct current. A variation of frequency of the alternating current between the limits of twelve and seventy-five cycles per second had no apparent influence on the effects of the shock. The observations also indicate that while there is no appreciable danger to life from 110-volt alternating-current service in buildings when an accidental contact occurs between a person and the service, yet such service may be very dangerous if contact is made with large moist electrodes. For example, it is very unsafe to place wiring near metal baths in houses in such a manner that a person standing in the bath can come in contact with the circuit.

*TRANSMISSION-LINE FORMULAS FOR ELECTRICAL ENGINEERS AND ENGINEERING STUDENTS.* By Herbert Bristol Dwight. New York: D. Van Nostrand Company. 138 pages. Price, \$2.

This book gives the theories and working formulas of transmission lines in a brief manner. The subject is, of course, one of the most complex that can be treated, and it appears as if the author had successfully grappled with its difficulties. Whether it is possible to do justice in a brief treatise to problems so involved and complex is an open question.



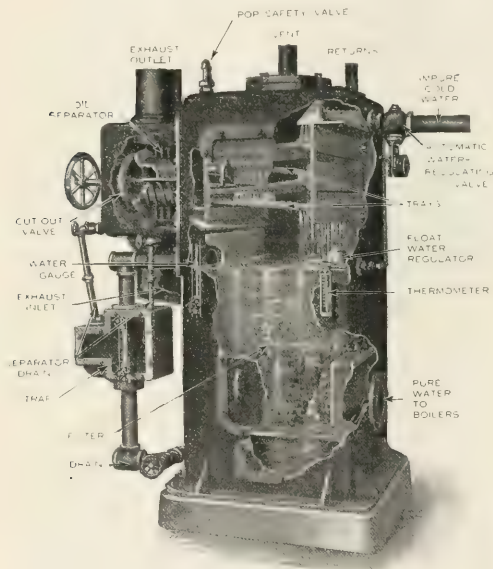


### Single-Casting Feed-Water Heater

The substitution of a single casting as the body of a feed-water heater for the customary built-up plate body does away with bolts and calked joints at all points except at the oil separator, the manhole and handhole covers and the pipe fittings. A feed-water heater called the Cookson one-piece heater which is being brought out by the Bates Machine Company, of Joliet, Ill., embodies this feature, and it is claimed that the increased solidity of construction gained will permit higher pressures without danger of leakage or bursting of plates.

The heater which is shown in the illustration has ample steam space, tray surface and filtering space and is provided with four manholes and hand-holes to facilitate cleaning. As cleaning doors are located on two sides of the heater, it can be made to fit into a limited space without causing complications in the piping.

An oil separator is provided for the heater in either of



FEED-WATER HEATER

two types, namely, the cutout-valve type, purifying all of the exhaust, or a separator which permits the heater to be piped on the induction or thoroughfare principle and purifies only a portion of the exhaust.

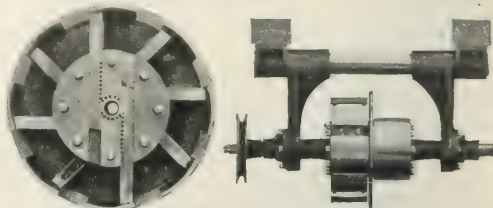
A steam trap and return opening are provided so that the heater may receive the wet steam from a steam-heating system if desired.

### Speed Regulator

A variable-speed jack shaft allowing a three-to-one range in speed is being put upon the market by the S. & S. Variable-Speed Gear Company, of 50 Church Street, New York City. The so-called "Scriven speed regulator" consists of two expansion pulleys bolted together and mounted on tubular shafts which are shrunk into side plates forming the outside of the built-up hub. The illustration shows the pulley with the side plate removed to illustrate the method employed in expanding and contracting the rim sections of the pulley.

The pinion shown in the center of the boss is in mesh with all of the spokes of both pulleys. There are two

spokes to each rim section, and as the pulleys are assembled right-handed and left-handed, turning the pinion expands the rim of one pulley and at the same time contracts the rim of the other. The spokes are staggered so that they do not interfere with each other, and as may be seen from the illustration, there is still two-thirds of the length of the spoke within the hub when the pulley is expanded to its



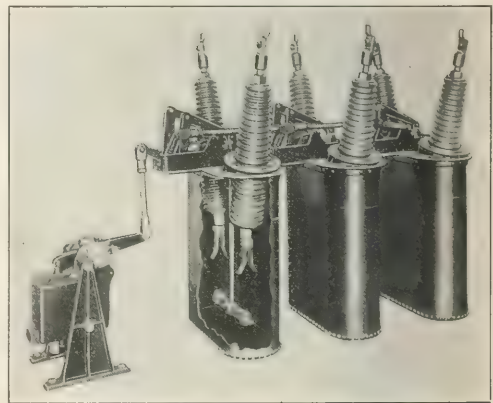
INTERIOR OF PULLEY AND REGULATOR COMPLETE

greatest diameter. When the operating wheel at the end of the jack shaft is turned the motion is transmitted through a tubular shaft to the pinion. It is claimed that the long pitch of the spiral grooves on this shaft eliminates the possibility of speed alteration due to vibration.

In operation the load is carried entirely by the two expansion pulleys and is equally balanced by the pinion, the running shaft being free to move back or forward until the strain from the load on each belt becomes equal. The tension on the two belts is always the same, for when the speed is changed one pulley takes up just the amount of belt length that the other looses, and the running shaft automatically swings into adjustment. It is claimed that the power loss with this type of speed regulator is much less than with other speed-varying devices.

### Self-Contained High-Voltage Oil Switch

The accompanying illustration shows an oil switch recently developed by the General Electric Company for use in central stations employing open wiring. Among the



SOLENOID-OPERATED, TRIPLE-POLE, SINGLE-THROW OIL SWITCH

most important improvements embodied in this switch are rearrangement of the bushings, reducing the size of the oil tank which is needed for any particular voltage, and a change to self-contained operating mechanism which makes the switches easier to install and allows the smaller units to be shipped completely assembled. The sliding-wedge type of contact which is employed obviates burning of the

working surfaces and keeps the contacts clean by a rubbing movement when the switch is operated.

The tank is made of boiler iron, lapped, riveted, reinforced and calked. The switch can be operated by hand, by a direct-current solenoid or by an air diaphragm and can be tripped automatically by the usual method.

### Motor-Driven Heavy-Duty Lathes

The motor-driven lathe here shown, which is a product of the Reed Prentice Company, Worcester, Mass., is built to withstand the strain of constant heavy turning. It is equipped with quick-change gear boxes giving fifty-four changes. Three reductions of motor speed are possible by gearing and ten changes by the controller, giving in all

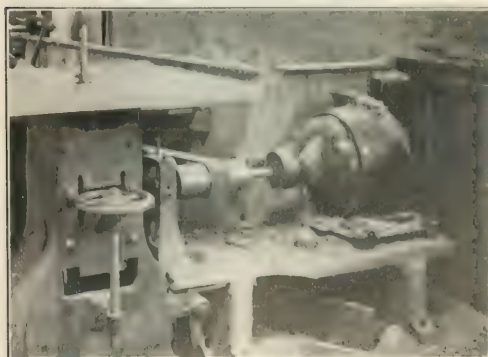


27-IN. HEAVY-DUTY MOTOR-DRIVEN LATHE

thirty spindle speeds. The fastest and slowest spindle speeds are 172 and 5.5 r.p.m., respectively. The apron feed-works are driven by worm and gears. There are double friction drives for lengthwise and cross feeds. The lead is equipped with thread cutting index. The hand wheel shown on the end of the motor shaft is used to turn the face plate in chucking the work to be machined. The machine is driven by a Westinghouse semi-inclosed 11.5-hp motor

### Motor Drive with Outboard Bearing

A good example of outboard-bearing motor drive, where jack shafting or direct coupling is not permissible owing to location of machine, is shown by the accompanying illus-



OUTBOARD BEARING WITH MOTOR DRIVE

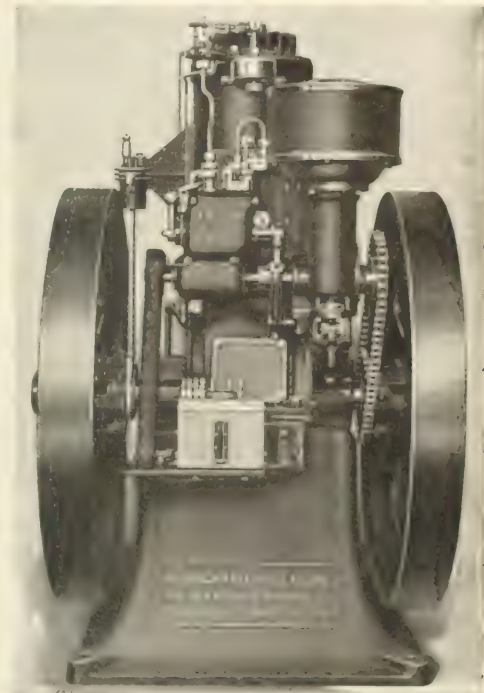
tration. An upright miller in a woodworking shop is driven by a 3-hp electric motor running at a speed of 1600 r.p.m. The armature shaft of this motor is connected with a 3-ft. shaft extension by a rigid coupling and is supported by an outboard bearing. This motor is entirely inclosed with iron covers and operates continuously at a temperature of less than 50 deg. C. Automatic control is utilized in

connection with wholly inclosed motors throughout the shop, reducing the danger of fire from arcs or sparking. The motor shown in the illustration was built and installed by the Diehl Manufacturing Company, of Elizabeth, N. J.

### Crude-Oil Internal-Combustion Engine

The Blanchard oil engine uses kerosene or light fuel oils on a modification of the Diesel principle, without the extremely high compression of the portable Diesel type.

The liquid fuel is injected into the combustion chamber after the charge of fresh air has been compressed. This fact is said to make the engine very economical at partial loads, while the explosion of the charge at every revolution gives a more even torque and allows the use of a smaller



20-HP SINGLE-CYLINDER OIL ENGINE

cylinder to produce a given power than would be required in the four-stroke cycle.

The illustration shows a single-cylinder engine of 20-hp with 10 in. bore and 10 in. stroke, fitted with flyball governor in the cylinder casting to the left at the right-hand flywheel. This engine is built with from one to four cylinders, and as there are two different sizes of cylinders standardized, 6 1/2 in. by 6 in. and 10 in. by 10 in., there are eight distinct sizes of engines ranging from 5 hp to 120 hp.

The crankshaft is built straight. As the intake port is covered by the piston except at the top of the stroke, the upstroke of the piston creates a slight vacuum in the combustion chamber and the open valves the piston. At the highest point the piston uncovers the intake port and permits the passage of air to fill the partial vacuum previously formed. Closing the intake port on the down stroke compresses the air to about 5 lb. per sq. in. At the lower end of the stroke the piston opens the transfer port and admits the pressure of this compressed air into the combustion end of the cylinder,



where it drives out the burned gases of the previous charge through the regular exhaust port.

It is said that this engine will operate on oil or any of the distillates obtained during the refining process with specific gravities between 26 deg. and 50 deg. Baumé. The grades between 30 deg. and 40 deg. Baumé are said to be the best. These oils must not contain over 0.3 per cent of sulphur if the combustion chamber is to be guarded against pitting. The makers stated that with any of the above oils the engine will produce 1 hp.-hr. on 0.1 United States gallon of fuel containing at least 19,000 lb. Fahr. thermal units per pound.

The governor is powerful and sensitive enough to hold the engine speed to a variation of about 2.5 per cent from no load to full load. This makes the engine particularly suitable for driving electric generators and other machines requiring close regulation. It is said to produce results so quickly that the variation in speed can scarcely be noticed before the engine is running at its normal speed again.

This engine is manufactured by the Blanchard Machine Company, Cambridge, Mass.

### Midget Ammeter and Voltmeter

In the midget ammeter or voltmeter here shown use is made of a tungsten steel magnet of unusually large size to obtain permanency and to improve the dead-beat operation of the instrument. This magnet has no pole pieces, the poles being accurately ground. This plan eliminates the magnetic joint between the magnet and the pole pieces and also increases the magnetic strength. The bases are of molded material to insulate the studs carrying the current through the switchboard or dashboard, and this material is used so that the magnetic strength may be unaffected. To obtain the greatest strength from the magnets the covers are made of brass instead of iron.

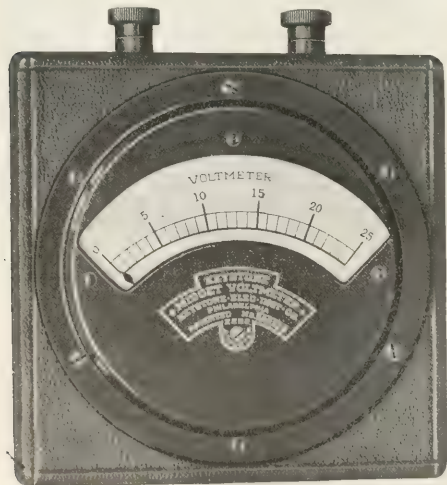
The aluminum coil form, 0.007 in. in thickness, on which the fine enameled wire is wound, swings in sapphire jewels

ment is subject to severe vibration. This light moving element also has the advantage that there is practically no weight on the pivots and bearings. Each instrument is equipped with a zero adjusting device by means of which the pointer can be readjusted to zero at any time from the outside of the case. These meters have been developed by the Keystone Electrical Instrument Company, Philadelphia, Pa., for use on switchboards.

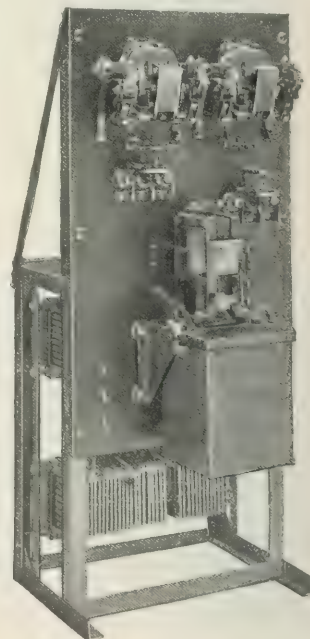
### Automatic Controllers for High-Voltage Motors

Motors connected directly to 2200-volt and 1100-volt systems are now coming into general use. At this high voltage it is especially desirable to provide automatic starting apparatus. For this purpose the Cutler-Hammer Manufacturing Company, Milwaukee, has designed a new line of high-tension automatic-control panels. One type is designed for use with motors driving reciprocating pumps, air compressors or other machines which must be started under full-load conditions and which require a starting torque equal to or in excess of the normal full-load torque of the motor. The other line, having the same appearance as that shown in the illustration, is designed for use with motors driving centrifugal pumps or machines of similar load characteristics starting under light-load conditions.

The acceleration is controlled by resistance in each of the three phases of the rotor, which is cut out, step by step, by double-pole magnetic switches under the control of current relays. By adjustment of the relays the starting current can be set at a predetermined value and the motor ac-



PORTABLE VOLTMETER



AUTOMATIC MOTOR CONTROLLER

between the poles of the magnet. The pointer is of aluminum tubing 0.012 in. in outside diameter and with a wall 0.001 in. thick. The whole moving element weighs only slightly more than 0.1 gram, or the weight of one common pin. With a moving element so exceedingly light the instrument is claimed to be absolutely dead-beat in operation, and the pointer is said not to oscillate, although the instru-

celerated in the shortest time consistent with this current. An oil-immersed, solenoid-operated, three-pole switch is also mounted on the panel which controls the high-tension motor primary circuit. Where used on water systems, air or vacuum systems, suitable accessories such as float switch, gage and diaphragm-type pressure regulators and vacuum regulators are available.

Westinghouse Apparatus in Wide Demand—In addition to those already mentioned, the following are all supplied by the Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa.:—  
This company manufactures centrifugal pumps. They were direct current pumps, and have been made in many kinds and sizes, and are especially favored by the Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa., for use in the following cases:—The Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa., has been awarded a contract by the United States Government to supply the following:—The Westinghouse Electric and Manufacturing Co., of Pittsburgh, Pa., has been awarded a contract by the United States Government to supply the following:—



Company, the South Covington & Cincinnati Street Railway Company, of Covington, Ky.; the Lehigh Valley Transit Company, at Allentown, Pa.; the Manhattan City & Interurban Railway Company, of Manhattan, Kan., and Messrs. Barnes & Payton, of Troy, N. Y. The apparatus ordered by the last-mentioned firm is for use in the Samaritan Hospital at Troy, N. Y.

**Phenomenal Sales of Insulated Wire.**—The Safety Insulated Wire & Cable Company, of New York, finds general business conditions in its line exceptionally good at present, the monthly sales figures for the past quarter showing increases of from 75 to 200 per cent over average figures. Last year's total sales amounted to about \$3,350,000, and to date this year sales amounting to \$2,200,000 have been made. Approximately 5 per cent of the total sales represent exports, and of these the greater proportion go to South America.

**New Power Equipment for the Toledo Railways & Light Company.**—Since control of the above company was gained by H. L. Doherty & Company, of New York, extensive additions to equipment have been planned. A 15,000-hp generating unit has been ordered from the General Electric Company for installation in the Water Street station, and the same order included about 2700 hp of boilers and other auxiliary equipment. There is now being built a 33,000-volt transmission line, 34 miles in length, which will skirt the city and supply energy to outlying industrial plants. Steel towers are to be used on this line, and it is understood that the company contemplates adding thirty cars to its rolling stock in the near future.

**Rush Orders for Transmission-Line Material.**—The Clark Electric & Manufacturing Company, of New York, reports that it has rush orders for its product of transmission-line specialties which will force it to work day and night shifts during the summer. For the first five months of this year sales were about 10 per cent larger than for the corresponding period of 1912, and the orders already secured seem to warrant the belief that for the rest of this year the factory will be worked to its full capacity. It is stated that over 5000 clamping sets of the various types manufactured have been furnished for use in the State of Pennsylvania alone, and that out of this number not a single defect or failure has been reported so far.

**Electrical Equipment at St. Thomas Railroad Shops.**—An emergency steam generating station and a locomotive repair shop are being erected at St. Thomas, Canada, for the Michigan Central Railroad. A 200-kw, 575-volt, three-phase, 25-cycle generating unit, driven by a reciprocating engine, the exhaust from which will be used for heating purposes during the winter months, will be installed. The greater portion of the electrical energy used in the machine shops and roundhouse will be purchased from the Ontario Hydro-Electric Commission through the municipal electric plant at St. Thomas. The emergency unit will be used only in the winter or in case the Ontario system becomes inoperative. In addition to installing about 1000 hp in motors throughout the new shop, the old equipment will be rehabilitated. The new repair shop will have about 50,000 sq. ft. of floor area. Construction work is being done by The Arnold Company, of Chicago.

**Apparatus for Use on the New York State Barge Canal System.**—Joint contracts were awarded a short time ago to the Lord Electric Company and to MacArthur Brothers Company, both of New York City, for the mechanical and electrical equipment of the Erie, Oswego and Champlain canals. This work includes the erection of twenty-eight power stations along the canal route, the supplying of machinery for operating lock gates and the installation of electric lights at various points. The two companies above mentioned as general contractors will complete all the masonry and field engineering work including the installation and wiring of electrical apparatus. The generators for the power stations and the motors for operating valves, lock gates and capstans, as well as the arc and incandescent lamps, are to be furnished by the General Electric Company. The Hyde Windlass Company, of Bath, Maine, and the Wheeling Mold & Foundry Company, of Wheeling, W. Va., hold a joint sub-contract for supplying the mechanical equipment for operating the lock gates and

valves, this work being so extensive that it was thought best to arrange for a combination of two large concerns on it. Through Messrs. Wonham, Sanger & Bates, of New York, hand-power cranes for the generating stations are to be supplied by the Whiting Foundry Equipment Company, of Harvey, Ill. The Camden Water Wheel Works, of Camden, N. J., will furnish waterwheels for the hydroelectric stations, and the arc-lamp poles, 293 in number, are to be made by the Electric Railway Equipment Company, of Cincinnati, Ohio. The canal engineers have designed special steel turrets to cover the operating machinery at the locks, and these turrets are to be fitted with signal lights to indicate the exact position of the valves and gates for some distance along the approach to the locks. The turrets are to be manufactured by James McKinney & Son, of Albany, N. Y. The general contractors state that they hope to have all the machinery installed ready to operate for the opening of the canal to navigation in May, 1914.

**Aluminum of Increasing Importance Industrially.**—A large increase in the consumption of aluminum in this country was observed in 1912, more than 65,000,000 lb. being used during that year, as compared to 46,125,000 lb. in 1911. This was accompanied by a large increase in the imports of that metal. In the powdered form aluminum finds application as a paint pigment, in explosives, in printing and lithography, and in a certain kind of welding. Aluminum foil is displacing tin foil owing to improved manufacturing methods. One of the recent developments, and one which is of particular interest to the electrical industries, is the production of a steel-reinforced stranded aluminum cable for use on transmission lines. It consists of six strands of aluminum wire surrounding a core strand of steel wire, and this type of conductor has been used by the Pacific Light & Power Company, of Los Angeles, Cal., on its recent transmission line extensions.

**Reduction in Tungsten Lamp Prices.**—As predicted exclusively in the *Electrical World* of April 26, the manufacturers of tungsten-filament incandescent lamps have arranged new price schedules, effective July 1, making a reduction in the list prices of tungsten lamps in standard package quantities of 12.5 per cent. The old and new prices of standard tungsten lamps follow:

TUNGSTEN LAMP PRICES

Package, Quantity	Rating, Watts	Old Prices (List)		New Prices (List)	
		Plain	Frosted	Plain	Frosted
100	10	40	43	35	38
100	15	40	43	35	38
100	20	40	43	35	38
100	25	40	43	35	38
100	40	45	49	35	38
100	60	..	..	45	49
24	100	90	97	80	87
24	150	1.35	1.45	1.20	1.30
12	250	2.25	2.40	2.00	2.15
8	400	4.15	4.40	3.65	3.90
8	500	4.55	4.85	4.00	4.30

**A Large Order for Storage Batteries.**—The Electric Storage Battery Company, of Philadelphia, Pa., has recently received an order for forty-three storage battery sets which will be used for street-railway service on one of the cross-town lines of the New York Railways Company. This is the second large order for batteries for traction purposes received from New York by the Philadelphia concern, the first being for ninety sets now in use by the Third Avenue Railway Company. Each of these sets consists of fifty-eight cells of type MV-29 "Hycap-Exide" battery, having a rating of 67 amp for six hours continuous discharge, at an average of 114 volts. The weight of each set, including the containing trays, is 4880 lb., and the installation is placed under the car seats, utilizing space that would otherwise be wasted. One of the particular advantages claimed for storage-battery cars is that they may be operated on steam roads where the interval between trains is sufficiently great. Storage batteries were furnished for a service of this nature to the Lewisburg, Milton & Watsonville Passenger Railway Company, operating over the Lewisburg & Tyrone branch of the Pennsylvania Railroad, between Montandon and Mifflinburg, Pa.

**American Companies Making Diesel Engines.**—Since the expiration of the Diesel patents last year there has been active preparation in this country for extensive manufacture of this type of internal-combustion engine. Among the concerns planning to put out these engines are the Busch-Sulzer Company, of St. Louis, Mo.; the Fulton Iron Works, also of St. Louis, Mo.; the Electric Boat Company; the Otto Gas Engine Company, of Philadelphia, Pa.; the Lyons-Atlas Company, of Indianapolis, Ind.; the Dow-Williams Diesel Engine Company, of San Francisco, Cal.; and the International Steam Pump Company, of New York.

**Mexican Telegraph Company Imports Cable.**—A few days ago there arrived in this country a shipment of 700 tons of submarine cable from Nordenham, Germany, destined for use by the Mexican Telegraph Company. This class of cable is not manufactured extensively in the United States, owing perhaps to several causes, among them the fact that the demand for the product is comparatively small and uncertain and that the gutta percha which forms an important part of the insulation has to be imported.

**Further Reports on Utah Securities.**—Supplementing the note of last week, reports have been received from the Electric Bond & Share Company showing for the Utah Securities Corporation gross earnings of \$44,363 for May and \$679,447 for the five months ended May 31. Net earnings for May amounted to \$21,300, and for the first five months of 1913 to \$398,410. These figures represent increases over the same items for last year of 22, 11, 52 and 14 per cent respectively.

**Annual Report of the Philadelphia Electric Company.**—In presenting the annual report of the Philadelphia Electric Company for the fiscal year ended Dec. 31, 1912, the following figures on the company's financial condition were given by President J. B. McCall: Gross earnings, \$7,071,497.47; operating expenses, \$5,385,307.69; cash dividends, \$974,668.99; total surplus, \$1,818,643.73. At the end of the year the company had 35,427 customers and a total commercial connected load, 45,427 equivalents, of 2,839,584, and, in addition, was supplying 20,800 hp to the street-railway companies. These figures represent in each case increases over those for 1911. During the year items were added to the construction account adding for an expenditure of \$2,594,687.00, and for the year 1913 there are further extensions and replacements planned.

**First Annual Report of Middle West Utilities Company.**—Considerable interest attaches to the first annual report to the stockholders of the Middle West Utilities Company, made by President Samuel Insull. The company was organized on May 15, 1912, and the report (made public on June 11) is for the period of eleven and one-half months ended April 30, 1913. Since the close of the fiscal year, however, the directors have authorized the issue of \$3,500,000 of three-year 6 per cent collateral gold notes secured by the deposit of bonds of subsidiary companies having par value of \$400,000. Of these notes \$2,000,000 will be sold immediately and the proceeds used to complete payments on properties heretofore contracted for and to provide funds for other purposes. The report is a satisfactory one. It shows net earnings equivalent to 4 per cent on the amount of common stock outstanding at the close of the fiscal year, as well as 6 per cent dividends on the preferred stock. If an amount of more than \$100,000 of surplus, which still remains in the treasuries of subsidiary companies, had been included in the report of the Middle West company, the net earnings would have been equivalent to 6 per cent on the common stock. The company owns public-service properties in the States of Indiana, Illinois, Kentucky, Michigan, Missouri and Oklahoma, as well as the New England States. Except in Michigan, there is one subsidiary operating company in more in each state. The subsidiary companies serve 774 separate communities, having a combined population of over 800,000. The gross earnings of these subsidiary companies from the date on which they were acquired in April 30, 1913, were \$1,680,000; operating expenses, \$844,500, leaving net earnings in proportion of \$835,500. Deducting from this \$801,625 for expenses in connection with the leaves \$430,435 as the net earnings accrued to securities of subsidiary companies held by the Middle West Utilities Company. The average time the properties contributed

to this result have been under the control of the Middle West Company is only nine months and Mr. Insull remarks that these results have been obtained largely under adverse operating conditions, which included within the acquisition of the properties. Other operating conditions are being improved rapidly by the completion of transmission lines and the replacement of numerous inefficient small generating plants by a limited number of modern, economical generating stations. The total income of the Middle West company for the period named (not including the item of \$100,000 in surplus in subsidiary companies) is \$911,960. This is made up of interest on bonds and debentures, dividends on stocks, interest on notes receivable, brokerage and profits from the sale of properties. The total operating expenses of the Middle West company were \$1,145,500. The surplus was produced in its entirety from which \$200,000 was paid in dividends to preferred stock, leaving a surplus of \$441,600. The total assets of the company amount to \$6,542,800, of which \$1,640,000 consists of securities, plants, contracts, goodwill, etc., on book value. The company had \$1,000,000 in cash on April 30. The capital stock authorized consists of \$12,000,000 in common and \$12,000,000 in 6 per cent preferred stock. Of this \$10,000,000 in common stock and \$4,000,000 of preferred stock have been issued. The accounts are audited by Arthur Young & Company, of Chicago, and Deloitte, Plender, Griffiths & Company, of London.

**Business of Brooklyn Utility Companies.**—The combined reports of the Kings County Electric Light & Power Company and the Kings Electric Illuminating Company of Brooklyn show for the month of May gross operating revenues of \$416,660, net operating revenues of \$308,907.20 and a net income of \$106,658. For the first two months of the year the figures for gross operating revenue were \$2,210,000, for total operating expenses \$1,441,110.84 and for net income \$768,889.26. Both of the companies show a very substantial increase over the corresponding figures for 1912.

## Industrial Securities

Company	Capital stock Outstanding	Earnings		Dividend	
		Per Cent	Amount	Per Cent	Amount
Algonquin Electric Light & Power Co.	\$1,000,000	10	100,000	10	100,000
Algonquin Electric Light & Power Co.	1,000,000	10	100,000	10	100,000
American Tel. & Tel. Co.	1,000,000	10	100,000	10	100,000
Chicago & North Western Electric Co.	1,000,000	10	100,000	10	100,000
General Electric	1,000,000	10	100,000	10	100,000
Midway Electric	1,000,000	10	100,000	10	100,000
Western Electric	1,000,000	10	100,000	10	100,000
Western Electric	1,000,000	10	100,000	10	100,000

Notes: See notes on page 374.

## NEW YORK METAL MARKET PRICES

Commodity	Unit	Price	Change
Copper	Per lb.	14.00	1/2
Lead	Per lb.	10.00	0
Aluminum	Per lb.	10.00	0
Steel	Per lb.	10.00	0
Iron	Per lb.	10.00	0
Gold	Per lb.	10.00	0
Silver	Per lb.	10.00	0
Platinum	Per lb.	10.00	0
Palladium	Per lb.	10.00	0
Rhodium	Per lb.	10.00	0
Iridium	Per lb.	10.00	0
Osmium	Per lb.	10.00	0
Vanadium	Per lb.	10.00	0
Nickel	Per lb.	10.00	0
Cobalt	Per lb.	10.00	0
Manganese	Per lb.	10.00	0
Chromium	Per lb.	10.00	0
Molybdenum	Per lb.	10.00	0
Tungsten	Per lb.	10.00	0
Zinc	Per lb.	10.00	0
Antimony	Per lb.	10.00	0
Fluorine	Per lb.	10.00	0
Bromine	Per lb.	10.00	0
Iodine	Per lb.	10.00	0
Chlorine	Per lb.	10.00	0
Sulfur	Per lb.	10.00	0
Phosphorus	Per lb.	10.00	0
Carbon	Per lb.	10.00	0
Silicon	Per lb.	10.00	0
Boron	Per lb.	10.00	0
Strontium	Per lb.	10.00	0
Barium	Per lb.	10.00	0
Calcium	Per lb.	10.00	0
Sodium	Per lb.	10.00	0
Potassium	Per lb.	10.00	0
Lithium	Per lb.	10.00	0
Ammonium	Per lb.	10.00	0
Magnesium	Per lb.	10.00	0
Aluminum	Per lb.	10.00	0
Iron	Per lb.	10.00	0
Steel	Per lb.	10.00	0
Copper	Per lb.	10.00	0
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Gold	Per lb.	10.00	0
Silver	Per lb.	10.00	0
Platinum	Per lb.	10.00	0
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Rhodium	Per lb.	10.00	0
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Nickel	Per lb.	10.00	0
Cobalt	Per lb.	10.00	0
Manganese	Per lb.	10.00	0
Chromium	Per lb.	10.00	0
Molybdenum	Per lb.	10.00	0
Tungsten	Per lb.	10.00	0
Zinc	Per lb.	10.00	0
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Fluorine	Per lb.	10.00	0
Bromine	Per lb.	10.00	0
Iodine	Per lb.	10.00	0
Chlorine	Per lb.	10.00	0
Sulfur	Per lb.	10.00	0
Phosphorus	Per lb.	10.00	0
Carbon	Per lb.	10.00	0
Silicon	Per lb.	10.00	0
Boron	Per lb.	10.00	0
Strontium	Per lb.	10.00	0
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Iron	Per lb.	10.00	0
Steel	Per lb.	10.00	0
Copper	Per lb.	10.00	0
Lead	Per lb.	10.00	0
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Carbon	Per lb.	10.00	0
Silicon	Per lb.	10.00	0
Boron	Per lb.	10.00	0
Strontium	Per lb.	10.00	0
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Ammonium	Per lb.	10.00	0
Magnesium	Per lb.	10.00	0
Aluminum	Per lb.	10.00	0
Iron	Per lb.	10.00	0
Steel	Per lb.	10.00	0
Copper	Per lb.	10.00	0
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Sulfur	Per lb.	10.00	0
Phosphorus	Per lb.	10.00	0
Carbon	Per lb.	10.00	0
Silicon	Per lb.	10.00	0



## Personal

**Mr. W. F. Bogue** has resigned as superintendent of the municipal lighting plant of Norwich, Conn.

**Mr. F. M. Peyton** has succeeded Mr. B. A. Little as superintendent of the municipal electric light plant at Okemah, Okla.

**Mr. D. F. Webster** has resigned as superintendent of the City Light & Traction Company of Sedalia, Mo., owing to ill health.

**Mr. Robert E. Rae** has associated himself with Stanley and Patterson, 23 Murray Street, New York, as sales manager of their factory lines.

**Mr. George L. Hatheway**, formerly in the New York office of Pass & Seymour, Inc., has been put in charge of the branch office at Toronto, Canada.

**Mr. Frank J. Sprague**, the well-known consulting engineer and inventor of New York, is at present sojourning in Italy in search of rest and recreation.

**Mr. Charles H. Chandler**, of Chicago, has been elected recently to the position of secretary of the Wirt Electric Specialty Company, of Germantown, Pa.

**Mr. M. H. Flexner**, illuminating engineer for the Commonwealth Edison Company, Chicago, was married on June 9 to Miss Marion Straus, of Chicago.

**Mr. George D. Leacock**, who has been with the Packard Company for three years, has been made manager of the Toronto office of the Canadian Moloney Electric Company, Ltd.

**Mr. H. H. Barnes, Jr.**, engineer for the General Electric Company, New York, and president-elect of the New York Electric Society, is spending a six weeks' vacation touring Europe.

**Mr. John L. Fay**, lately with W. N. Matthews & Brother as sales engineer, has taken the position of superintendent of distribution for the Union Electric Light & Power Company, of St. Louis, Mo.

**Mr. W. H. Atkins**, general superintendent of the Edison Electric Illuminating Company of Boston, Mass., recently returned home from a Mediterranean trip and a visit to Egypt and the Holy Land.

**Mr. Roy V. Wensley**, formerly in charge of substations for the Merchants' Heat & Light Company of Indianapolis, has been appointed superintendent of the People's Light & Heat Company at Indianapolis.

**Mr. H. H. Stephens** has been appointed manager of the Everett Gas Company, which controls the electric service in Snohomish, Wash., succeeding Mr. M. D. Spencer, former manager at Snohomish.

**Mr. Arthur Main**, formerly electrical engineer of the Hot Springs (Ark.) Water & Light Company, is now electrical engineer of the Mammoth Springs (Ark.) Power Company, which operates a large hydroelectric system.

**Mr. Delos F. Wilcox** will sever his connection with the Public Service Commission for the First District, New York, on July 1 and will engage in private practice as a consulting franchise and public-utility expert.

**Mr. B. R. Stephens** has resigned as general superintendent of the Choctaw Railway & Lighting Company, McAlester, Okla., but will continue as secretary, auditor and purchasing agent, with headquarters in St. Louis, Mo.

**Dr. Max von Recklinhausen**, director of the Westinghouse Company, Paris, France, well known for his work with mercury-vapor lamps and quartz-tube water-purifying apparatus, is visiting this country in the interest of his company.

**Mr. Henry L. Doherty** will be the guest of the city of Denver on June 20, at which time he will preside at the functions attending the opening of the Antero reservoir irrigation project, which is capable of supplying water to over 60,000 acres.

**Mr. Gunnar Tisell**, for many years associated with the editorial department of the *Electrical World*, sailed last week for Sweden, where he has accepted a position on the editorial staff of the *Teknisk Tidskrift*, an electrical publication issued from Stockholm.

**Mr. E. Thurnauer**, managing director of the French Thomson-Houston Company, arrived in New York Tuesday on the S. S. *Kaiser Wilhelm II*. Mr. Thurnauer is on a short business trip to this country in connection with General Electric affairs in France.

**Mr. C. B. Graves**, formerly third vice-president and general manager of the Manila (P. I.) Electric Railroad & Light Company, has been appointed general manager of the Mexican Tramways to succeed Mr. H. Harrsen, who has been elected managing director of the company.

**Mr. H. G. D. Nutting** has resigned his position as district manager for the Central Illinois Public Service Company, with headquarters at Paris, Ill. Mr. Nutting was formerly manager at Fort Atkinson, Wis., and served for a time on the staff of the Wisconsin Public Service Commission.

**Mr. H. E. Dunbar**, for twenty years superintendent of the South Hadley Falls (Mass.) Electric Light Company, has with Mr. A. T. Chapin formed the electrical contracting and engineering firm of Chapin & Dunbar. Mr. Chapin was formerly superintendent of the Foster Electric Company, of Boston, Mass.

**Mr. J. H. Bissell**, for the past seventeen months assistant treasurer of the Paducah (Ky.) Traction Company and the Paducah Light & Power Company, has been appointed treasurer of the Mississippi River Power Company at Keokuk, Ia. Mr. Bissell is succeeded at Paducah by Mr. F. B. Flahive, of Dallas, Tex.

**Mr. F. E. Hutchinson** has resigned his position as chief electrician of the Rock Island lines to become sales manager of the Moon Manufacturing Company of Chicago. Mr. Hutchinson had served in the electrical departments of the Pennsylvania and Louisville & Nashville railroads before joining the staff of the Rock Island.

**Mr. Harro Harrsen**, general manager of the Mexican Tramways, has been elected managing director of the company to succeed Mr. R. C. Brown, who has been elected vice-president of the company. Mr. Harrsen is also managing director of the Pachuca Light & Power Company and of the Mexican Steel & Chemical Company.

**Mr. George W. Magalhaes**, who has served a year as assistant sales manager of the Toronto (Ont.) Electric Light Company, Ltd., has been appointed general inspector of that company. Mr. Magalhaes was born in 1876 at Sao Paulo, Brazil, came to the United States in 1892 and has since made his residence in this country and Canada. He was graduated from the School of Mines, Columbia University, with the degree of electrical engineer, in 1897, and his record of work and experience since then is as follows: He spent two years laying out and installing electric storage batteries for central-station and street-railway service. The next two years were spent with the Electric Controller & Manufacturing Company of Cleveland, Ohio, designing and selling electric controllers for rolling-mill machinery, cranes and ore-handling apparatus. The six years following Mr. Magalhaes was in the employ of the New York Edison Company in the engineering department laying out and inspecting substations and inspecting the electrical contract work on Waterside station No. 2. He served two years as inspector for the department of water supply, gas and electricity of New York City, giving especial attention to the electrification of the Queensboro and Manhattan bridges and the public buildings on Blackwell's Island, and up to the time of his affiliation with the Toronto company he was Canadian representative of the L. K. Comstock Company, electrical contractor of New York.

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## Obituary

**Charles W. Morse**, president of the Gainesville (Fla.) Gas & Electric Company and a native of Haverhill, Mass., died at Gainesville on June 11 at the age of sixty. Mr. Morse at one time owned the gas plants at Marlboro and Quincy, Mass., and Rochester, N. H., and was one of the owners of the Amesbury (Mass.) Gas & Electric Light Company.

## Construction

## New England

[illegible]

## Middle Atlantic

AUBURN, MD.—D. J. Smith, at his residence at 1044 Broadway, has been elected for seven business blocks, 1044 Broadway, and 1045 Broadway, and 1046 Broadway, clerk at Auburn.

## North Central

biddel Mr. Carpenter



granted a franchise to furnish electricity for lamps and motors in Pearl City. A transmission line will be erected from Lena to Pearl City to furnish the service. W. Benfer, of Lena, is president of the company.

ROCKFORD, ILL.—Sealed bids for furnishing the material for the installation of thirty new arc lights, as per specifications on file, will be received on or before June 26. E. A. Wettergren is city clerk.

DE PERE, WIS.—The De Pere Lt. & Pwr. Co. has been awarded the contract for lighting the streets.

NESHKORO, WIS.—Preparations are being made by the Neshkoro Lt. & Pwr. Co. for the installation of an electric-light plant here. The equipment of the proposed plant will include one Samson waterwheel (rating not yet decided upon), one 150-kw, 60-cycle, 2400-volt vertical-type generator, purchased from the Electrical Machinery Co., Minneapolis, ten General Electric type transformers, four 30-kw, four 10-kw and two 5-kw; overhead-line material will consist of 500 cedar poles, No. 6 bare copper wire for 9 miles of three-phase transmission line; 100 Westinghouse type meters and 40 200-cp tungsten lamps for street lighting. C. T. Dahlke, of Neshkoro, is engineer in charge.

RANDOLPH, WIS.—Within the next month or two the municipal electric-lighting plant will purchase a 100-kw directly connected 220-volt generator. J. O. Jones is the clerk at Randolph.

RIPON, WIS.—Within the next two months the Ripon Lt. & Wtr. Co. expects to erect a 6600-volt transmission line to supply the village of Green Lake with electricity. The Green Lake Electric Company will handle the local distribution.

BARNESVILLE, MINN.—The municipal electric-light, water and telephone plant, of which H. H. Pierce is superintendent, is planning an extension to its water-works.

BEMIDJI, MINN.—We are informed that the plant of the Warfield El. Co. at Warfield was not destroyed as reported in the issue of June 7. The generator was burned out by the electrical storm and the coils have been replaced. C. W. Warfield is president and manager.

DETROIT, MINN.—The City Council has adopted a resolution authorizing 100 ornamental electroliers to be placed on Washington Street and Pioneer Street, bids for which will be received until July 7. E. J. Bestick is city clerk.

ELLSWORTH, MINN.—At a special election held recently the proposition to issue \$8,000 in bonds for the installation of a municipal electric-light plant was carried.

LAKE PARK, MINN.—A special election will shortly be held to consider issuing \$10,000 for the erection of an electric-light plant. Ira Shannack is clerk at Lake Park.

ONAMIA, MINN.—The village of Onamia has decided to call a special election to vote on the proposition of bonding the village for the purpose of establishing a municipal electric-light plant.

SPRING VALLEY, MINN.—The electric plant of the Spring Valley El. Lt. & Investment Co. is reported to have been purchased by the Rutledge Brothers, of Glencoe.

WINDOM, MINN.—A special election will be called to vote on the proposition to issue \$15,000 in bonds for improvements and extensions to the municipal electric-light plant and water-works system.

WOOD LAKE, MINN.—The question of installing an electric-light system in Wood Lake is under consideration; also securing electricity from Granite Falls is being considered.

ARMSTRONG, IA.—The City Council has planned to install fourteen additional street lamps.

CHARLES CITY, IA.—We are informed that the city of Charles City has decided not to establish a municipal electric-light plant and has made arrangements with the local lighting plant for lighting the city for a period of three years. John S. Bradley is city clerk.

EARLY, IA.—The proposition to issue \$7,000 in bonds for the installation of an electric-light plant will be submitted to the voters.

EAST PERU, IA.—The Peru El. Lt. & Pwr. Co., recently granted a franchise, will install an electric-light system. The equipment of the proposed plant will include a gasoline engine and a 220-volt direct-current Triumph generator; 100-watt Mazda lamps will probably be used for street lighting. The plant will have an output of 19 hp. F. A. Herweke is superintendent.

ELDON, IA.—Work on the new building of the Eldon electric-light plant, which will give twenty-four-hour service, is progressing, and the new machinery will soon be installed.

ESTHERWOOD, IA.—The electric-lighting plant is almost complete. Some of the apparatus has been installed, and it is expected to begin operation shortly.

LIPTON, IA.—The business men of this city have petitioned the City Council for boulevard lamps.

LYONS, IA.—The installation of an ornamental street-lighting system is contemplated by the Commercial Club. A tentative plan calls for erection of 50 standards to carry five-lamp clusters. The cost of electroliers is estimated at \$38 each. With four 60-watt lamps and one 100-watt lamp the cost would be \$55 per standard.

MILTON, IA.—Work has begun on the construction of the new power plant in Milton. The Town Council has awarded the company a contract for street-lighting. The contract provides for 30 lamps. Walsh Brothers, of Burlington, are interested in the company.

MONONA, IA.—The village of Monona has granted F. L. Wellman & Son a franchise to construct and operate an electric-light plant for a period of 25 years.

OSSIAN, IA.—H. Bullard, who will install an electric-light plant here to provide for street and commercial lighting, will shortly be in the market for a 25-kw generator, an oil engine, overhead line material and meters.

SIOUX CITY, IA.—The Baker Const. Co. plans the construction of an interurban line between Sioux City and Omaha. Construction work on the power dam at Niobrara, Neb., has been begun.

VALLEY JUNCTION, IA.—The Iowa Engineering Co., Clinton, Ia., has charge of the work of the construction of the electric generating plant to be erected here, plans for which are under way, as mentioned last week.

WASHINGTON, IA.—Bids will be received by the city of Washington, Ia., until June 23 for materials and supplies for changing and extending the municipal street-lighting system, including 87 three-lamp Cutter River-side ornamental lamp posts, 81 two-lamp posts, with extensions to take line 23 ft. above ground, 300 25-ft (6-in. top) cedar poles with not more than 5-in. crook one way, 36,500 ft. miscellaneous wire, 5050 ft. galvanized conduit, etc. St. Clair Lewis is superintendent.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Ry. Co. expects to purchase in the near future three 500-kva, 2300-4400-volt step-up transformers.

WATERLOO, IA.—The Citizens' Gas & El. Co. has purchased the property of the Crystal El. & Fuel Co. at the head of Sycamore Street, which will be used as a site for the new electric plant.

IBERIA, MO.—F. S. Ramsey and brother have recently purchased the Iberia Milling Co. and will install a dynamo and supply the town with electric light.

JOPLIN, MO.—The proposition to issue \$60,000 in bonds for improvements to the municipal electric-light plant and for extensions to the street-lighting system was defeated at an election held June 3.

ST. JOSEPH, MO.—The St. Joseph St. Ry., Lt., Ht. & Pwr. Co. has closed a contract with the Hammond packing plant of Armour & Co. to equip the plant for electrical operation. More than 600 hp will be required.

BELFIELD, N. D.—There has been some discussion in regard to establishing an electric-light plant at this place. The matter is now in the hands of a committee.

CANDO, N. D.—The Cando El. Co. is contemplating the purchase of a 300-line switchboard within the next 12 months. J. C. Rader is manager.

MOTT, N. D.—S. Stewart, proprietor of the Mott City Mills, is planning to install an electric-light plant. The equipment will consist of two 150-hp return-flue boilers, one 25-hp and one 75-hp Corliss engine, one 80-kw and one 50-kw, three-phase, 60-cycle, 2300-volt generator with necessary switchboard equipment and transformers, 100 meters, 50 incandescent lamps of 50 cp for street-lighting service. Mr. Stewart will carry a stock of electrical supplies, will do all house wiring and will carry household electrical appliances, etc.

NEW ROCKFORD, N. D.—A bond issue will be voted upon for the erection of a municipal electric-lighting system and water-works.

WIMBERTON, N. D.—An electric-light plant is being installed here by F. H. Etter to furnish electricity for commercial purposes and for street lighting. The plant will be driven by a kerosene oil engine. H. E. Dudley, electrical engineer, of Moorhead, Minn., has the contract for installing the plant.

ABERDEEN, S. D.—The Aberdeen Lt. & Pwr. Co. has completed and placed in operation a complete steam-driven central power station, equipped with two 500-hp Corliss engine-driven units. The company has recently connected up three 10-hp, 2300-volt General Electric motors directly connected to centrifugal pumps for fire service.

CANTON, S. D.—The Sioux Valley Pwr. Co., of Canton, S. D., expects to erect a transmission line to Inwood, Ia., and also a hydroelectric power plant at Beloit, Ia., within the next three months. The company expects to purchase within the next four months generators and water-wheels, waterwheel governors, complete switchboards, transformers, lightning arresters, insulators and wire. Charles H. Morgan is secretary.

CENTERVILLE, S. D.—The Centerville Milling Co. expects to purchase shortly one 60-kw, 60-cycle, three-phase, 2200-volt generator and exciter.

DALLAS, S. D.—B. H. Martin, owner of the local electric-light plant, is installing a new plant, which will be in operation by July, 1913, when a 24-hour service will be established. Mr. Martin expects to purchase within the next 30 days equipment for distribution and lighting system and electrical appliances and supplies.

FRANKFORT, S. D.—It is reported that bids will soon be asked for the installation of the proposed electric-light system, for which plans and specifications have been prepared.

HOT SPRINGS, S. D.—The Cheyenne River Pwr. & Irrigation Co., recently incorporated with a capital stock of \$50,000, contemplates the construction of a hydroelectric power plant near the falls of the south fork of Cheyenne River. The incorporators are: George A. Turner, John W. Parks and Henry Hartly.

**MITCHELL, S. D.**—At a special election on June 10 bonds to the amount of \$60,000 were voted for the erection of a municipal telephone plant. The City Council recently refused to renew the private telephone company's franchise.

**SCHUYLER, NEB.**—The Commonwealth Pwr. Co. has filed maps with the State Board of Irrigation showing its proposed Schuyler-Columbus power development. The company proposes to take water from the Loup River, 2 miles west of Columbus and connect it to the Platte River southeast of Schuyler. The reservoir and power station will be located near Schuyler. The Sharp-Moore interests, of Lincoln, Detroit and London, are said to be interested in the new enterprise.

**SIDNEY, NEB.**—At an election held recently the proposition to issue \$22,000 in bonds for an electric-light and steam-heating plant was carried.

**WILBER, NEB.**—Bids will be called for the construction of the proposed municipal electric light plant as soon as plans are completed. The proposed plant will be driven by steam power and will have an output of 125 kw. O. C. Martz, of Lincoln, is consulting engineer.

**WYMORE, NEB.**—The City Council has awarded contract for the purchase of an engine and two boilers, together with other equipment, for the municipal electric-light plant.

**CHERRYVALE, KAN.**—The Edgar Zinc Co. has decided to equip the Cherryvale smelter for electrical operation, for which it is understood that \$60,000 has been appropriated. Gas engines will be used to drive generators.

**HERINGTON, KAN.**—The city of Herington will call another special election to vote on the proposition to issue bonds for extensions to the municipal electric-light plant and for water-works. The cost of the works is estimated at \$50,000. The Berman Engineering Co., of Oklahoma City, has been engaged as consulting engineer to prepare plans and supervise the work.

**SCOTT CITY, KAN.**—The contract for construction of the municipal electric-light plant and water-works system has been awarded to the Alamo Engine & Supply Co., of Omaha, Neb., for \$33,867.

## Southern States

**MAXTON, N. C.**—The Maxton L. & Pwr. Co. is installing a small hydroelectric power plant about 1 mile from Maxton. The power will be driven by a Morgan Smith waterwheel. The company expects to purchase wire, meters and pole trimmings. The American Machine Co., of Charlotte, has charge of the work. J. J. Kessel, president of the Maxton company.

**ABBEVILLE, S. C.**—The city of Abbeville has just completed the installation of a 200-kw. condenser steam plant with superheater and is now installing an ornamental street-lighting system, material for which has been purchased. E. M. Anderson is superintendent.

**COLUMBIA, S. C.**—E. L. Mosley, of Columbia, would like to receive estimates on equipment for an electric plant to station and lamp, including gasoline engine.

**WASHINGTON, GA.**—Bids will be received at the office of the consulting architect, Treasury Department, Washington, D. C., until June 21, for construction, including plumbing, pipe fitting, heating, electric conduit and wiring, removing existing fixtures and appliances of the United States post office at Columbus, Ga. Plans and specifications may be obtained from the above office or from the custodian of plans at Columbus, O. Wendler is supervising architect.

**MIAMI, FLA.**—Mayor Waters has recommended the purchase of the electric-light and water plant by the city and extending the plant's lines into districts which are to be improved. J. N. Macfarland is superintendent of the Miami L. L. & Pwr. Co.

**NEWBERRY, FLA.**—Matter and machinery for the new municipal electric-light system and water-works and the proposed steam plant. The new plant will occupy a block between the railroad and the main highway. It will be installed one 80-hp. high-speed engine, one 100-hp. engine with steam boiler, exciter and direct-current generator, and will be connected to 100-hp. high-speed engine. The new plant will consist of 51 100-watt transformers and five 100-watt transformers with two 175-watt 175-watt, one 34-watt and one 175-watt transformers, and one pole line material for 4 miles. The plant will be built and will be built by the J. B. McFarland Co., 1001 First National Bank Building, Atlanta, Ga. J. C. Cook is engineer.

**SARASOTA, FLA.**—The Sarasota L. & Pwr. Co. has recently purchased one 150-kw. General Electric generator, one 100-hp. engine and generator (engine type), one 16-hp. engine, one valve gear, one engine and switchboard panel. R. E. Jackson is engineer.

**BEETS, TENN.**—The Beets L. L. & Pwr. Co. is considering the changing the street-lighting system from multiple to the series street-lighting system. No decision will be made until the summer, when the manager.

**ETOWAH, TENN.**—The Etowah L. L. & Pwr. Co. is considering the advisability of manufacturing gas engines in 1913. W. H. Price is manager of the company.

**FRANKLIN, TENN.**—When all other things are the H. H. L. & Pwr. Co. expects to begin the street-lighting system from gas and

oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**CHERRYVALE, KAN.**—The Cherryvale L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**MOOREVILLE, TENN.**—The Mooreville L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**WILBER, NEB.**—The Wilber L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**WYMORE, NEB.**—The Wymore L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**CHERRYVALE, KAN.**—The Cherryvale L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**HERINGTON, KAN.**—The Herington L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**SCOTT CITY, KAN.**—The Scott City L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**WILBER, NEB.**—The Wilber L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**NEW ORLEANS, LA.**—The New Orleans L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**ATLANTA, GA.**—The Atlanta L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**MIAMI, FLA.**—The Miami L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**NEWBERRY, FLA.**—The Newberry L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**ETOWAH, TENN.**—The Etowah L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**FRANKLIN, TENN.**—The Franklin L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

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**HERINGTON, KAN.**—The Herington L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

## Pacific States

**SEATTLE, WASH.**—The Seattle L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**PORTLAND, ORE.**—The Portland L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.

**SPokane, IDAHO.**—The Spokane L. L. & Pwr. Co. is now considering the use of gas and oil. The company is now considering the use of gas and oil. The company is now considering the use of gas and oil.



Traction, Lt. & Pwr. Co. expects to purchase one new switchboard panel for three-phase lighting and another for series tungsten lighting and 150 poles for the reconstruction of the entire distributing system. Very shortly there will be purchased also 40 toasters and 26 irons; also a sub transformer for a new series tungsten street-lighting system to comply with a new municipal ten-year contract.

**NEWPORT, WASH.**—The Northern Idaho & Montana Pwr. Co., through its local manager, J. G. Flynn, reports the recent electrical storm as the worst in years. Much damage was done to lamps and primary fuses, and hundreds of incandescent lamps were burned out.

**SNOHOMISH, WASH.**—The Everett Gas Co., which serves Monroe and Snohomish with gas and electricity, recently renewed its contract with the Washington State Reformatory at Monroe for two years.

**SOUTH BEND, WASH.**—The South Bend Electric Company has been absorbed by the Twin City El. Co., with headquarters at Raymond, Wash. Clyde Barett is local superintendent.

**SPOKANE, WASH.**—Eugene Enlow, S. E. Gates, W. C. Siber and associates have purchased the power plant of the Nickson-Kimmel Co., near Pateros, Wash., on the Methow River, and also the light and power plants at Okanogan. The purchasers are organizing a company which will be known as the Okanogan Valley Pwr. & Lt. Co., to be capitalized at \$200,000. Eugene Enlow will be president of the new company, S. E. Gates, vice-president, and W. C. Siber secretary and treasurer.

**VANCOUVER, WASH.**—The Southwestern Washington Tel. Co. has applied to the County Commissioners for a right-of-way for telephone lines from Manor to Battle Ground across to Heisson, Lucia and Yacolt, a distance of about 15 miles.

**WARDEN, WASH.**—The Washington Wtr. Pwr. Co. will extend its power and light lines into Hartline during the summer, arrangements for which are now being made.

**ARLINGTON, ORE.**—It is reported that the City Auditor will receive bids for the construction of an electric-light plant and pumping station. H. F. Shank is city auditor.

**BAKER, ORE.**—Stannard & Richardson, of Portland, engineers, have submitted estimates of the cost of the proposed municipal electric-light plant, which indicate that the plant can be constructed at a cost not to exceed \$25,000.

**BIG EDDY, ORE.**—John H. Lewis, state engineer, has submitted a report for developing 200,000 continuous hp at Big Eddy, a point 3 miles above The Dalles on the Columbia River. The head water is 73 ft. at low water and 42 ft. at high water and the mean flow of the river throughout the year is 235,000 cu. ft.

**MYRTLE POINT, ORE.**—The City Council has been petitioned for a light and power franchise for a period of 25 years by A. P. Miller, of Coquille, Ore., who offers to furnish light for city buildings and six arc lamps for each 1000 inhabitants free if the franchise is granted. The Council is considering the proposition.

**PORTLAND, ORE.**—The Southern Pacific Ry. Co. is said to be considering the proposition of establishing an electric-railway system from this city to San Diego, Cal., same to be completed and in operation before the Panama-Pacific Exposition. In connection with the proposed improvement the Southern Pacific has acquired water-power rights from Portland to Eugene, Ore. The extension recently built to Klamath Falls, Ore., will be electrified at once.

**ROSEBURG, ORE.**—The Douglas County Lt. & Pwr. Co. is installing an electric-light plant in Winchester. The equipment will consist of a 68-in. Allis-Chalmers waterwheel directly connected to a 500-kw vertical generator manufactured by the Allis-Chalmers Co. J. R. Thompson, of Portland, is engineer in charge.

**BAKERSFIELD, CAL.**—The San Joaquin Lt. & Pwr. Corp. has announced that it will reconstruct the Kern River power plant throughout immediately. The tunnel will be enlarged, new waterwheels installed and a new power house building erected. A. G. Wishon is general manager.

**COLFAX, CAL.**—Application has been made to the State Railroad Commission by D. C. Gillen, owner of the local electric-light plant, for permission to sell his property to the Pacific Gas & El. Co. for \$12,000.

**FRESNO, CAL.**—The San Joaquin Lt. & Pwr. Co. is planning the construction of a large number of additions to its present distribution systems at Santa Maria, San Luis Obispo and San Miguel. Some additions will also be made to the systems at Maricopa and Bakersfield. About \$2,000,000 will be expended. A. C. Balch is president of the corporation and A. G. Wishon is general manager.

**LOS ANGELES, CAL.**—The Midland Counties Public Ser. Co., of Los Angeles, recently organized, with a capital stock of \$2,500,000, plans to take over the Coalinga Wtr. & El. Co. of Coalinga; the Midland Counties Gas & El. Co., of San Luis Obispo; the Russell-Robinson Wtr. & El. Co., of Arroyo Grande, and the Paso Robles Land & Wtr. Co., of Paso Robles. The new company also has an authorized bond issue of \$3,000,000 awaiting the approval of the State Railroad Commission.

**NEWPORT BEACH, CAL.**—The Board of Trustees has authorized the sale of a 30-year electric franchise at the request of the Pacific Lt. & Pwr. Co. The franchise will be sold July 7 to the highest bidder. The sale was made last September to issue \$25,000 in bonds to install a municipal electric-light plant, but has not yet sold them.

**OROVILLE, CAL.**—The Board of Supervisors of Butte County has granted a franchise to the Great Western Pwr. Co. to build and operate

electric distribution systems in Butte County. The company will begin a high-tension transmission line into the county immediately from Plumas. Mortimer Fleishacker is president of the company.

**PORTERVILLE, CAL.**—Plans have been practically completed by the officials of the Mount Whitney Pwr. Co. for a large addition to the equipment of their substation at Fourth Street and Putnam Avenue.

**SAN FRANCISCO, CAL.**—The Pacific Gas & El. Co., of San Francisco, has applied to the State Railroad Commission for permission to purchase certain water rights, flumes and ditches in the vicinity of Gold Run from the United Water & Pwr. Co.

**SAN FRANCISCO, CAL.**—The San Diego Consolidated Gas & El. Co. has asked the State Railroad Commission for permission to issue \$639,000 in bonds. Of the proceeds, \$459,000 will be used in making extensions to the company's plant and the balance of \$180,000 will be used to pay existing indebtedness.

**VENICE, CAL.**—The City Trustees of Venice have requested bids on 312 five-lamp ornamental street-lighting posts to be installed in the canal district of the city. The bids should include the installation of the posts complete and ready for service.

**BONNER'S FERRY, IDAHO.**—The Moyea Wtr. Pwr. Co. has filed a claim on a power site at Moyea Falls, on which a 10,000-hp hydroelectric plant will be built. There will be utilized 5000 hp or 6000 hp to light Bonner's Ferry and surrounding country. A. H. Featherstone, Wallace, Idaho, is promoter of the project.

**DOWNEY, IDAHO.**—The City Council has granted the Utah Lt. & Pwr. Co. a franchise in Downey. The company will install a plant here at once.

**MONTPELIER, IDAHO.**—Negotiations have been completed by the Utah Pwr. & Lt. Co. for the purchase of the property of the Bear Lake Pwr. Co., of Montpelier, consisting of two plants, one at Georgetown and the other at Paris. The Bear Lake company furnishes electricity in the towns of Montpelier, Bloomington, Georgetown, Bennington, St. Charles and Ovid, Idaho.

**PARK CITY, UTAH.**—Louis A. Jeffs has petitioned for a franchise for an electric-light plant.

**FLAGSTAFF, ARIZ.**—The new plant of the Flagstaff El. Co. will have a capacity of 300 kw and give 24-hour service. The contract for the machinery has been closed with C. C. Moore & Co. G. T. Herrington is manager.

**CUT BANK, MONT.**—The Two Miracle Concrete Co., Great Falls, Mont., has been awarded the contract by the city of Cut Bank for supplying material and equipment and installing a water-works and lighting plant, at a cost of \$41,000.

**FORT BAYARD, N. M.**—Bids will be received by Lieut. C. E. Holmberg, quartermaster, Fort Bayard, until July 9 for sale of two Kewanee 100-hp return-tubular boilers, two 50-kw General Electric direct-current generators and engines, switchboard complete for two generators, one 7½-ton York ice machine, one 2-ton ice machine, 99 50-lb. ice cans and two steam pumps. Further information can be obtained on application.

**LAS VEGAS, N. M.**—Active work will begin this summer on the construction of a hydroelectric power plant near Indian Springs. The initial installation will provide for the development of 1500 hp, which will be transmitted to Las Vegas at 6000 volts. The water will be piped from the Charleston Mountain Range, a distance of 12 miles, with a fall of about 3000 ft. Five power stations, each with an output of 1500 hp, will be built. Midway on the line a dam forming a large storage reservoir will be built to impound the storm waters. A transmission line will also be erected through a pass in the mountains into the Pahrump Valley to supply electricity for operating pumping plants, and also extending to Goodsprings, where it will furnish energy to mines and mills. Water will also be furnished to irrigate about 16,000 acres taken under the Carey act by the Southland Irrigation Co. Ira McFarland, of Las Vegas, is interested.

## Canada

**SUMMERLAND, B. C.**—The installation of a 60-kw generator driven by a Diesel oil engine in the municipal electric-light plant is contemplated this year or next.

**MARKHAM, ONT.**—The Council has adopted a resolution to ask the Hydro-Electric Power Commission of Ontario to extend its line to furnish electricity here.

**NEWMARKET, ONT.**—The ratepayers have rejected the proposition of the Toronto & York Radial Ry. Co. to furnish the town with power at \$25.50 per hp per year, with the provision that the town install the necessary distributing system at a cost of \$12,000. This undoubtedly means that the Hydro-Electric Power Commission of Ontario will be petitioned to extend its lines into the town to furnish electricity here. The commission offers to furnish the service at \$27.90 per hp per year.

**OTTAWA, ONT.**—Tenders will be received by G. J. Desbarats, deputy minister, Department of Naval Service, Ottawa, Ont., until June 25 for the erection of masts and buildings for wireless-telegraph stations to be erected at Kingston, Toronto and Port Burwell. Plans and specifications and form of contract can be seen at the office of the general superintendent of the wireless service, Department of Naval Service, Ottawa, or at the offices of the postmaster, Kingston, harbormaster, Toronto, and postmaster, Port Burwell.

**TORONTO, ONT.** The Hydro-Electric Power Commission of Ontario has decided to start work at once on the St. Thomas-Windsor transmission line, contract for which has been awarded for some time. The commission has not yet decided upon the route between St. Thomas and Cuthbert.

**POINT ROQUE, QUE.**—Charles A. Julien, owner of the local electric-light plant, expects to purchase within the next six months 12 transformers and conductors, and connecting, working apparatus, etc.

RICHMOND, QUE.—The Canada Paper Co., of Montreal, has purchased the power rights at Fort St. Hubert on the St. Lawrence River and the right at Kamouristag, P. E. I., above the St. Francis River. It is estimated that two tall, new development units, 100 ft. high, are required, and that the water-power will be developed and energy transmitted to Windsor Mills to be used in the factories. Since the Canada Paper Co. and the Canadian Explosives, Ltd.

## New Industrial Companies

THE ENGLISH MANUFACTURING COMPANY, LTD., of New York, N. Y., has been incorporated with a capital stock of £100,000 by C. W. Crawford, W. J. Mackay, and G. M. Milner, all of Madison Avenue, New York. The company, proposed to manufacture and deal in engines, boilers, motors, tools, etc.

THE A. ESTELMANN COMPANY, INC., of New York, N. Y., has been incorporated by Harry A. Bell, James F. Johnson and Peter J. Warnke, 142 West 109th Street, New York, N. Y. The company is capitalized at \$15,000 and proposes to manufacture sewing machines.

GAGEN & BUTLER, INC., of New York 17, N. Y., is a corporation with a capital stock of \$1,000,000, doing general contracting and electrical business. The officers are: President, James M. Gagen; Vice President, James M. Gagen; and James M. Gagen, 20 West 14th Street, New York 17, N. Y.

THE GREATER NEW YORK ELECTRIC PROTECTIVE COMPANY, INC., of New York, N. Y., has been successful with a new stock of \$1,000. The new company is Philip C. Schmitt, of New York, Max Kivowitz and R. G. Little, of Philadelphia, N. Y.

THE GULF ELECTRIC COMPANY, of New Orleans, La., has been incorporated to do an electric light, heating and power generating and power plants and transmission system. W. F. Carpenter, of Baton Rouge, is president, A. W. Lee, of New Orleans, is vice president, and G. L. Champagne, of New Orleans, is treasurer. The office is at 100 Poydras Street, New Orleans.

**THE HOT POINT ELECTRIC HEATING COMPANY**, of Orange, Cal., has been incorporated with a capitalization of \$100,000 to manufacture and deal in electric heaters, radiators and electric stoves. The officers are: Franklin Booth, 810 O. Ave., B. B. 1, Los Angeles, president; E. H. Richards, 1 and 1/2 E. 5th St., Orange, secretary and treasurer. The first meeting was held on Oct. 10.

## New Incorporations

PHOENIX, ARIZ.—The Homeowners' Club, Incorporated, has been incorporated with a capital stock of \$100,000 by R. A. Roberts, Sec., Perry H. Decker and R. A. Peterson.

HARTFORD, CONN. The Hartford Family Electric Light & Power Company, organized with a capital stock of \$1,000,000, is now in process of construction of power plants and appliances.

NORFOLK, CONN.—The Western Realty and Ice Co., organized with a capital stock of \$500,000.

WILMINGTON, DEL.—The University of Delaware, which has been incorporated with a capital stock of \$1,000,000, and J. R. Brown, of Wilmington, is the chief incorporator.

WILMINGTON, DEL.—The General Transportation Commission has filed articles of incorporation to lay the law on the State of Delaware with a capital stock of \$1,000,000. The incorporators are E. E. Smith, W. J. Maloney and O. J. Reynolds.

CHARLOTTE, N. C.—The Charlotte T. L. & P. Co. has been incorporated with a capital stock of \$100,000. C. W. Barry is president of the company.

FAIRFIELD, IA.—The Iowa Electric Co. has been organized with a capital stock of \$250,000 for electric illumination and power. The incorporation was effected through the efforts of George M. Herbert, president of the Herbert House of Western Union, Inc., and others.

EMMITSBURG, MD.—The Emmitsburg City School and Industrial Institute, with a capital stock of \$1,000,000, has elected the following directors: Theodor G. Galt, president; A. C. M. Patterson, 1st vice president; and J. M. Vance and others.

MINNEAPOLIS, MINN.—The following are the members of the law firm and for the Findley Fl. Co., Inc., who are engaged in the litigation: The attorneys are: Thomas W. Findley, Samuel H. Johnson, Jr., and A. R. Conley, of Minneapolis.

ST. THOMAS, OXF. 17. Working on the 1000. His paper is reported with a capital study of the 1000 by C. A. Brown, C. G. Brown, and G. L. Wainey.

## Trade Publications

158. 1991. In: *Adaptive management: practical strategies for natural resource management*. Ed. S. R. Carpenter. 392 pp.

half-tone color, a really moving group by the British in Germany. The  
ling high

CELESTIAL CO. (INC.)—This is the first meeting for the month since the first of January. The meeting was held at the home of the speaker, Mrs. J. W. Smith, 1000 N. 1st St., and was held at 8:00 p.m. The speaker, Mrs. J. W. Smith, was the first speaker and was the first to speak.

**Abstract:** Inland flood management. Land use planning is the specific element in flood management by which flood damage can be reduced. Floods have to be risk-benefit-related and economic losses caused by floodplain growth can also be prevented by means of the measures. Floods caused and can also be avoided.

**NOTE.** **SMYTHING.**—The female gives a single cry when disturbed. No. 34113, containing a single specimen of *Smythingia*, was taken by Mr. G. W. Smyth, who has kindly loaned it to the collection. The holotype of this species is deposited in the British Museum, and the paratype in the collection of the author.

illustrate the importance of the literature in the study of the history of the United States. The book is a valuable addition to the literature on the history of the United States and is a must-read for anyone interested in the history of the United States.

[illegible][illegible]

## Business Notes

THE *Journal of Applied Gerontology* (ISSN 0898-2643) is a quarterly journal devoted to the study of aging and the needs of older persons. It is published by the American Psychological Association, 750 First Street, N.E., Washington, D.C. 20002. The Journal is published by the American Psychological Association, 750 First Street, N.E., Washington, D.C. 20002. The Journal is published by the American Psychological Association, 750 First Street, N.E., Washington, D.C. 20002.

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# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 10, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

- 1,063,950. **ELECTRIC-CURRENT-CONTROLLING DEVICE**; A. E. Berdon, Lafayette, Ill. App. filed July 5, 1910. For charging storage batteries of car-lighting systems.
- 1,063,999. **APPARATUS FOR ELECTRIC WELDING**; C. R. Murray, L. K. Brink and W. K. Malmstrom, Chicago, Ill. App. filed April 15, 1912. For welding pieces of different cross-section; opposed clamping jaws with an electrode lying in a plane central between the jaw faces.
- 1,064,025. **MOTOR CONTROLLER**; F. L. Stone, Schenectady, N. Y. App. filed Dec. 30, 1911. To prevent too rapid acceleration or retardation; controller can only be moved as fast as rotation of motor will permit.
- 1,064,026. **ELECTRICAL GENERATOR**; T. K. Strand, Roulette, N. D. App. filed April 3, 1911. Generator is mounted upon the rotatable head of a windmill.
- 1,064,033. **JUNCTION BOX**; J. F. Wagner, South Bend, Ind. App. filed Aug. 23, 1911. Knock-out portions formed by circular grooves in the wall of the box.
- 1,064,049. **APPARATUS FOR RECORDING CALLS MADE BY TELEPHONE**; E. H. Bridge, Spotswood, Victoria, Australia. App. filed Oct. 25, 1911. Effective calls are registered by meter only when both receivers are taken up for a conversation.
- 1,064,064. **METHOD AND APPARATUS FOR PRODUCING A GASEOUS REACTION BY A SILENT DISCHARGE**; M. W. Franklin, Schenectady, N. Y. App. filed Oct. 21, 1911. Ozonized air is produced by passing a current of fresh air through the ozone unit and mixing the fresh air with the ozonized air during successive stages of the ozonization.
- 1,064,065. **OZONATOR**; M. W. Franklin, Schenectady, N. Y. App. filed Oct. 31, 1912. Produces gaseous reaction by static discharge; difference of potential between electrodes produced by transformer.
- 1,064,078. **ELECTRIC WELDING MACHINE**; L. E. McKinnon and A. W. Southall, Buffalo, N. Y. App. filed June 17, 1908. For welding chains; clamps movable toward each other and carrying yielding and adjustably mounted electrodes.
- 1,064,079. **ELECTRIC WELDING MACHINE**; L. E. McKinnon, Buffalo, N. Y. App. filed June 17, 1908. Intermittent welding current produced by interrupting the circuit periodically and at greater or less frequency.
- 1,064,089. **MOTOR VEHICLE**; W. P. Rayner, Philadelphia, Pa. App. filed June 23, 1910. Vehicle is started and driven at low speed by electric motor and at high speed by gas engine.
- 1,064,096. **ELECTRICAL SWITCH**; W. M. Scott, Philadelphia, Pa. App. filed March 12, 1910. Operating handle is disengageable from switch mechanism to prevent operator from restoring it during a predetermined electrical condition.
- 1,064,115. **VAPOR-ELECTRIC DEVICE**; W. Weintraub, Lynn, Mass. App. filed Dec. 13, 1910. Mercury-vapor lamp with inner and outer envelopes and a conical closure operated by the vapor pressure to seal the inner envelope.
- 1,064,116. **VAPOR-ELECTRIC DEVICE**; E. Weintraub, Lynn, Mass. App. filed Aug. 12, 1911. Capillary passage between inner and outer envelopes of mercury-vapor lamps and a valve for equalizing the mercury level within and without the inner envelopes.
- 1,064,131. **POWER-FACTOR INDICATOR**; J. A. Craighead, Schenectady, N. Y. App. filed Oct. 7, 1911. For alternating-current circuits not affected by ordinary changes in frequency occurring in commercial circuits.
- 1,064,137. **ELECTRIC CLOCK**; J. F. Engle, Cleveland, Ohio. App. filed May 13, 1912. Self-winding, direct-acting contacts made and broken mechanically.
- 1,064,138. **LOW-WATER ALARM**; C. W. Ford, Pittsburgh, Pa. App. filed June 19, 1912. Differential expansion of certain parts causes other elements to contact and complete circuit.
- 1,064,142. **SAFETY DEVICE FOR RAILROAD TRAINS**; W. F. Greene, Huntington, Pa. App. filed Aug. 16, 1912. Breaking of arch bars of the trucks ruptures circuit and gives alarm.
- 1,064,190. **ELECTRIC AIR HEATER**; L. A. Bill, Cambridge, Mass. App. filed Dec. 14, 1912. For car-burners; conical wire-heating coil freely supported inside the air intake pipe.
- 1,064,205. **MOTOR-ACCELERATING DEVICE**; E. L. Gale, Sr., Yonkers, N. Y. App. filed Nov. 9, 1909. Combination of mechanical and electrical means for effecting acceleration of alternating-current motors in elevator work.
- 1,064,211. **CALVANIC CELL**; A. Heil, Frankfurt-on-the-Main, Germany. App. filed May 24, 1912. Produces depolarizing electrodes by saturating porous carbon with a solution of manganous nitrate and then drying and heating the carbon to decompose the nitrate.
- 1,064,224. **MOTOR-CONTROLLING MECHANISM**; J. D. Ihlder, New York, N. Y. App. filed Oct. 31, 1908. For automatically controlling an electric motor in an elevator car at predetermined points regardless of speed, load or friction.
- 1,064,228. **AUTOMATIC STARTING SWITCH**; C. D. Knight, Schenectady, N. Y. App. filed Dec. 1, 1905. Automatically provides the proper time intervals between charges in circuit connections.
- 1,064,258. **ELECTRIC HEATER**; G. E. Sharpe, Steubenville, Ohio. App. filed Oct. 19, 1912. Portable heater employing lamps as heating agent; heating effected by circulation as well as radiation.
- 1,064,295. **SUPPORT FOR END TURNS OR CONNECTIONS OF COILS FOR DYNAMO-ELECTRIC MACHINES**; W. F. Dawson, Rugby, England. App. filed Jan. 30, 1907. Clamping devices hold the end turns.
- 1,064,310. **DYNAMO-ELECTRIC MACHINE**; W. J. Foster, Schenectady, N. Y. App. filed Oct. 13, 1905. Rotating member of the smooth-core type specially balanced for high-speed work in connection with turbines.
- 1,064,318. **ELECTRICAL SWITCH**; H. R. Gilson, Beaver, Pa. App. filed April 19, 1912. Push-button type; spring contact having an incline engaged by a movable dog.
- 1,064,330. **ELECTRICAL HEATER**; A. C. Hulbert, San Francisco, Cal. App. filed April 24, 1912. Heater unit has a handle which lies in the handle of the utensil, and heater can be removed to permit use of utensil for ordinary purposes.
- 1,064,338. **ELECTRIC-WELDING PROCESS**; E. Katzinger, Chicago, Ill. App. filed May 9, 1910. For spot-welding sheets of different thickness together; stamps protrude from one sheet, which are pressed against the other sheet and welding current sent there-through.
- 1,064,358. **ELECTRIC STOVE**; C. Mettler, New Haven, Conn. App. filed Feb. 11, 1913. Weight of the cooking utensil on the stove closes the heating circuit.
- 1,064,379. **MULTIPLE-SERVICE BATTERY CABINET**; G. L. Patterson, New York, N. Y. App. filed Aug. 21, 1912. Plurality of series of multiple-battery units, the units of each series being suitably connected and the series of units each being provided with means for interconnection and with service terminals.
- 1,064,373. **TELEGRAPH TRANSMITTER**; E. C. Phillips and T. Rhoads, Chicago, Ill. App. filed Feb. 17, 1912. Typewriter transmitter.
- 1,064,402. **PIPE-CONDUIT FITTING FOR ELECTRIC INSTALLATION**; W. H. Vibber, New London, Conn. App. filed Oct. 3, 1910. For unthreaded conduits; fitting, "junction" or "terminal" made in two half-sections clamped together.
- 1,064,422. **PULL SWITCH FOR WALL BOXES**; F. Barr, New York, N. Y. App. filed Jan. 17, 1911. Inclosure, chain guide and insulation and switch mechanism.
- 1,064,423. **SOCKET FOR LAMPS, ETC.**; F. Barr, New York, N. Y. App. filed March 23, 1912. Cap lining; clip attachment.
- 1,064,424. **SOCKET CONSTRUCTION**; F. Barr, New York, N. Y. App. filed March 23, 1912. Cap lining and ring lock.
- 1,064,433. **METHOD OF REDUCING TELEPHONIC DISTURBANCES**; J. E. Blackwell and G. E. Anderson, Maplewood, N. J., and Oak Park, Ill. App. filed April 11, 1912. Combines the capacities of the groups of conductors so that they tend to balance.
- 1,064,434. **ALTERNATING-CURRENT RECTIFIER**; D. M. Bliss, West Orange, N. J. App. filed Aug. 21, 1911. Single rotating commutator and brushes.
- 1,064,471. **THERMOELECTRIC PHONE OR THE LIKE**; B. Gwozdz, Berlin, Germany. App. filed Nov. 15, 1912. Wollaston wire passing through a plastic hardening body with a bent portion projecting out of the same and a hard body surrounding and protecting the plastic hardening body.
- 1,064,492. **MUFFLER ATTACHMENT FOR TELEPHONES**; G. Kracke, Philadelphia, Pa. App. filed Jan. 18, 1912. Sound-muffling spiral surrounds the telephone mouthpiece, so as to muffle sound to the exterior without interfering with the proper transmission of the sound.
- 1,064,512. **ELECTROMAGNET**; F. W. Martini, Chicago, Ill. App. filed Oct. 2, 1912. Magnet has a solid core and an extendible plicatile armature.
- 1,064,541. **SYSTEM OF DISTRIBUTING ELECTRIC ENERGY**; I. J. Reuter and F. P. McDermott, Jr., Anderson, Ind. App. filed April 4, 1912. Switch reverses direction of current through current-consuming means each time that the current is started by the switch.
- 1,064,571. **BASE FOR ELECTRIC INCANDESCENT LAMPS**; P. G. Triquet, Paris, France. App. filed July 28, 1910. The terminal collar of the lamp is insulated from the metallic base of the lamp.
- 1,064,599. **TELEPHONE ATTACHMENT**; W. Binson, Philadelphia, Pa. App. filed Feb. 2, 1912. Receiver is supported in a holder which is actuated to cut in the receiver by a movement of the head.
- 1,064,658. **INCUBATOR ALARM**; C. W. Kelley, Wellington, Tex. App. filed Jan. 26, 1912. Thermostat closes circuit when temperature rises above or falls below predetermined points.
- 1,064,669. **ALTERNATING-CURRENT GENERATOR**; A. Scherbius, J. Jonas and H. Meyer-Delius, Baden, Switzerland. App. filed Feb. 28, 1912. Alternating-current collector machines having a series characteristic are marked as generators.
- 1,064,673. **DANGER SIGNAL FOR RAILWAYS**; C. N. Stevens, Owego, N. Y. App. filed Nov. 7, 1911. For grade crossings; shutters automatically thrown into indicating position.
- 1,064,682. **ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS**; A. T. Dawson and G. T. Buckhan, Westminster, London, England. App. filed Nov. 26, 1906. For communicating range, deflection, etc., from the conning tower of a ship.
- 1,064,685. **ELECTRIC-LIGHTING APPARATUS**; P. C. Hewitt, New York, N. Y. App. filed March 23, 1901. Vapor lamp; contacting electrodes are separated when the lamp is in operation.
- 1,064,686. **GAS OR VAPOR ELECTRIC APPARATUS**; P. C. Hewitt, New York, N. Y. App. filed March 23, 1901. A solid electrical connection between the two electrodes is provided, which is severed by electromagnets, one of which acts more slowly than the other.
- 1,064,688. **ELECTRIC LIGHTING APPARATUS**; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 23, 1901. Pivoted anode which is lifted from the mercury cathode to break the contact.
- 1,064,691. **VAPOR-ELECTRIC DEVICE**; P. C. Hewitt, Ringwood Manor, N. J. App. filed Dec. 6, 1910. Electromagnet for rocking the lamp from its normal horizontal position.
- 1,064,690. **AUTOMATIC STARTING DEVICE FOR VAPOR LAMPS**; P. C. Hewitt, New York, N. Y. App. filed May 2, 1903. Electromagnet arranged to lift a conductor which bridges between the positive and negative electrodes.
- 1,064,691. **SYSTEM OF ELECTRICAL DISTRIBUTION**; P. C. Hewitt, New York, N. Y. App. filed April 28, 1905. Electromagnet lifts a hinged supplementary starting anode out of contact with mercury cathode and a transformer with one coil in circuit with the starting anode.
- 13,572 (reissue). **SELECTIVE SYSTEM**; E. R. Carichoff, Schenectady, N. Y. App. filed May 3, 1913 (original No. 1,057,035, dated March 25, 1913). Means for automatically connecting control and lighting circuits of the car to the trolley or to the dynamo according to whether the car is on a high-potential or a low-potential section of the line.

# Electrical World

The consolidation of *Electrical World* and *Electrician* into a single publication.  
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Vol. 61

NEW YORK, SATURDAY, JUNE 28, 1913

No. 26

## Trade Fight in Cincinnati

The unfortunate contention existing between the Cincinnati electrical trade and the local central station (a review of which is presented on a following page) is a striking example of what happens when patience and forbearance are absent in the handling of trade-relation questions. For some years the retail dealers have had their way in the Queen City, and central-station development there has been slow and backward. Now the company, through its new management, has been forced to take a hand. But despite the company's assurance that prices are to be maintained on appliances, the local dealers have been anything but quieted by the repeated announcements of cut-price sales—sometimes on obsolete apparatus—and sales which in some cases were extended beyond the period limit promised. It is a fact that in four short months the Cincinnati company has accomplished some phenomenal results in increasing its sale of appliances, the great bulk of which have been disposed of at prices fair alike to customers and to other dealers. Nor will the central station's right to control lamp wattage by fixing prices to its customers be gainsaid. But it is a matter for doubt whether the small gain in load secured by slashing prices on a few hundred fans, fixtures or appliances could ever be worth alienating the local traders' friendship and arousing the present attitude of obstruction, especially at a time when constructive help is so needed from every possible side as is at present the case at Cincinnati. Two hands at the oar are better than one. It is high time for the Cincinnati factions to bury the hatchet and get together on a basis of mutual helpfulness.

## A Suggestion for Fly-Time

In every hanging screen door at the retail business section the electrical salesman should see possibilities for placing an electric fan that will run from ten to sixteen hours a day. For it is a fact that a ceiling fan located over an open doorway will keep out the flies as effectively as if the screen itself were there. Winged insects will not attempt to pass through the miniature tempest of the whirling blades' down draft. The screen door at best is messy, ugly and an inconvenience. It interferes to a considerable extent with free ventilation, and from the brightly lighted space it shuts off the view of the darker store interior almost as much as would a solid door. The fan guarded opening, on the other hand, presents an inviting appearance from the street, and the perspiring passer-by is encouraged to stop a moment in its refreshing protection to inspect the window display and possibly even enter and make the purchase thus suggested. Among other hot-weather hints here is a long-hour summer appliance worth developing.

## Electricity and the "Sane Fourth"

We cannot too frequently remind the public of the fact that the safe and sane method of celebrating the birthday of our republic is by a serious and sobering part through its devotion to the educational feature and all forms of showing a demonstration of skill. Nearly a year ago we took occasion to comment upon the public spirit displayed in that connection by the Van Hook Electric Company and other public-spirited companies which took an active part in providing illuminative displays for similar occasions. Truly was the wedding of art and human life and mind become for a day to an exalting public sentiment which favored the giving of the first-fruits, the national and the universal. In experience and consequent from the use of such explosives and economic-contrasting agents may be comparatively safe, but there is every reason for restricting their general use, particularly by the young and inexperienced. We need hardly recall the spent shells contributed to our greatest national battles, but even as in other things the principles of true conservation should be applied. To the central station an opportunity is thus given to perform a public service in cooperating with municipal authorities to devise suitable public displays in keeping with the real significance of the "Glorious Fourth" and at the same time to suppress in some degree that general disorder and confusion or public suffering of all kinds which is so easily aroused and so hard to find.

## Automatic Substations

The A. E. T. L. paper by Mr. H. R. Samuelson, Ontario, on page 1440, October 9th, of automatic substations recently installed in Detroit is of intensely suggestive value in its bearing on the future development of power-distribution, perhaps more broadly suggestive than its author has indicated. The paper is the development of one large central station feeding into the mass of smaller ones beyond the limit of local application. The low-volt direct-current system now prevailing would be beyond its economic scope, and the limited scope within it that is required for service to customers that might consist of going out to the customer's premises. Usually both horns of the standard three-phase transformer are distributed, have been distributed, where direct-current based in service for and distributing power distribution has been confined to the output supply. The practical result is a serious matter, but that the growth of a system of substation programming seems more intimate in their adjustment and method of operation. The costs of distribution due to distribution operation have been steadily rising, but at least the past decade. The ultimate financial loss has been more than met and more anticipated.



in apparatus, to say nothing of the steadily increasing labor cost. The installation described by Mr. Summerhayes represents a commendable attempt at simplification by means of a substation containing a 500-kw synchronous converter worked entirely by remote control. It is a comparatively modest equipment located about a mile from the main station in a heavily loaded residence district. The only connection between the two stations is a 4400-volt, three-phase cable carrying the main current. The whole work of handling the substation is done through this transmission-line control, in which there is an induction regulator with ample margin for furnishing the proper voltage at the converter terminals. The equipment has been in use long enough to show that it is actually simple to operate and that it does not require any special attention except daily inspection. The great difficulty is the possibility of failure and shut-down from causes which would not necessarily be operative in case an attendant were on hand. It would take a long period of active service to show how much of continuity is sacrificed by complete reliance on automatic apparatus. One cannot help wondering whether dependence on the single power cable is desirable and whether the actual operation of the station, including regulation, could not have been carried out more simply in the long run by the use of a pilot cable. Still further the question arises whether it is worth while to use direct-current apparatus at all in substation extension unless in some special case like the one before us where an existing direct-current installation carrying a fairly heavy load had outgrown its supply. A substation with only stationary transformers can be made extraordinarily simple, and perhaps most engineers would think it on the whole more reliable than one containing synchronous converters with the necessary means for protecting them, but certainly the Detroit automatic substation is a noteworthy example of extreme ingenuity in suiting the means to the end.

### The Goldschmidt Alternator and Radio-Transmission

In the June number of the *Philosophical Magazine* Dr. Oliver Lodge discusses two subjects of interest to radio-engineers but of very different character—namely, the theory of the high-frequency Goldschmidt alternator and that of the transmission of electromagnetic waves over the surface of the globe. The Goldschmidt alternator is a machine which, running at a fairly high speed, with resonant circuits comprising condensers and choking coils connected to both the stator and the rotor, builds up a final high frequency in a part of one of these resonant circuits, which is a harmonic of the rotation frequency. The fundamental differential equations of the system are shown to be very simple, but no direct solution for these has yet been discovered. A step-by-step solution is, however, offered under several forms.

In regard to the emission of waves from a simple vertical rod oscillator, it is shown that at a distance near the ground of about one-ninth of a half-wave length, or just about the region at which true waves are thrown off, the magnetic intensity is about 40 per cent greater than the electric intensity, whereas in any single true wave these intensities

must be equal. Consequently, any dissymmetrical means of intensifying the electric intensity at this distance will tend to throw off radiation waves stronger than along less favored directions. A rocky precipice is suggested as a possible cheap substitute for a ball antenna system, the energy losses in the rocky support being possibly no greater than in the metallic members of a large set of supporting towers.

An interesting action of the electromagnetic waves on free electrons is pointed out, whereby they are pushed along the lines of radiation or swept rectilinearly into the sky. The energy of the translatory motion is, of course, taken from the radiation, but, at constant velocity, there would cease to be loss. According to this theory, there might be lessened condensation of water vapor into cloud in the neighborhood of a powerful radio-active generating station as compared with more remote localities, by reason of the denudation of the elections, on which such vapor must nucleate if it condenses. The suggestion is also offered that a very feeble amount of ionization density in free space would be accompanied by an absorption of light-energy traversing such space, so that there might be a very small yet appreciable degree of opacity in free interstellar space, due to minute scattered ionization.

### Positive Rays and Chemical Research

Note is made in the *Digest* in this issue of a recent Royal Institution lecture by Sir J. J. Thomson on the use of positive rays in chemical investigations. Rarefied air in a glass chamber is subjected to an electric discharge. The cathode has a small hole in it, so that positively electrified material particles are projected, in a straight stream, down this hole. They are then allowed to emerge under a conjoined electric and magnetic field, which causes all particles of the same mass to spread over the surface of a right conical emergent stream, even though their velocities differ. All the hydrogen emerging molecules will therefore stream out on one conical surface, all the neon molecules on another, and so on, the various cones being nested coaxially. A photographic plate supported so as to receive the impacts of the molecules becomes chemically altered at the points struck, so that the successive cones leave parabolic lines on the finally developed plate. Each parabola is capable of being identified with some one and only one atomic weight. A particular parabola of atomic weight 3, not corresponding to any yet known substance, has a large share in this interesting discourse, which may be popularly described as a detective story for  $X_3$ .

Recent experiments with the positive ray analysis have developed some very curious things. For instance, in analyzing a mixture of the lighter gases obtained from the residues of liquid air there appear not only the lines of helium, neon and argon, each in its appropriate place, but also a new line of particles of which the deflection corresponds to a gas of atomic weight 22, a weight which does not fit any of the known gaseous elements. There is a bare possibility that it may be a new compound instead of a new element, and further investigation will be needed to determine the point. Still more curious is the persistent

appearance under certain circumstances, and very various ones, of lines calling for an element or compound of atomic weight 3, of which there is no other indication save a prediction by Mendeleef which does not seem very well to fit the circumstances of the case. Even more remarkable is the evidence found by this method of investigation of the occlusion by metals of gases so firmly held that they can be driven out only by bombarding the substance with cathode rays. It turns out that it is almost impossible to rid metals of such simple gases as hydrogen, CO, or CO<sub>2</sub>. Even after repeated heating has apparently eliminated all the gases from the mass, exposure to cathode rays will start a fresh outburst. It was this phenomenon, apparently, which was the origin of the latest suggestion of the transmutation of elements, commented on recently in these columns.

Sir J. J. Thomson thinks that there may be a quasi-chemical union between the gases and metals, perhaps similar to the holding of water of crystallization in salts. Certain it is that this method of positive ray analysis possesses a beautiful delicacy that is incomparably better suited to the minute analysis of gaseous mixtures than any other method known to science. It seems to get a direct and informing hold on quantities of matter so minute as to be quite beyond the possibility of detection by any other means. In particular it gives direct information as to the atomic or molecular weight of the gas concerned, and it apparently is to be, in the skilled hands of its discoverer, of great importance to physical science.

### Energy Transmission at Constant Current

We have repeatedly expressed the opinion that the long distance transmission of energy at constant current is by no means out of the running. It is not popular in this country, it is not a method of universal applicability, it is not even suited to the ordinary case of energy transmission, yet it has some features of merit which cannot be overlooked. In one of the papers read before the joint meeting of French and British electrical engineers at Paris and abstracted in this issue, Mr. J. S. Highfield considers at some length the status of constant-current transmission and gives an interesting analysis of some of the points which bear directly on the applicability of the system. At least a score of plants on this system are now in successful operation, the oldest of them having been in service for more than twenty years. That they have not been replaced is sufficient evidence that they possess practical operative qualities which have proved advantageous. The most important of the list is the Moutier Lyons plant, which is a straight-away transmission of 112 miles worked originally at nearly 60,000 volts at full load. The two additional stations more recently installed bring the total line pressure up to 75,000 kw and the total output to nearly 15,000 kw.

The strong point of the system is the ease with which it is adapted to transmission by underground cables. A continuous current, free from all difficulties connected with inductance or static capacity, is clear from resonance and produces very much less strain on the insulation than is the case with an alternating current of similar voltage. The cable in the Moutier Lyons plant has been in use for the

last seven years at nearly 60,000 volts and recently at 75,000 with good results. There is little doubt that this voltage with suitable cable construction can be doubled as an actual working pressure. It is the opinion of most engineers who have had experience with the constant-current system that cases of extremely long distance transmissions where continuity of supply is of the utmost importance can be dealt with more easily in this way than by the more familiar alternating-current system. Moreover, whether the line be overhead or underground, the loosened strain on the insulation with direct current lessens the life of the latter but very much.

Mr. Highfield presents estimates of cost on a 100-mile line of duplicate circuits transmitting 30,000 kw at 60,000 volts, and finds for the three-phase transmission a line cost of 47 cents per foot as against 45 cents for constant current. When it comes to underground construction it is a question whether anybody would venture to use a three-phase cable at anything like the voltage here considered, and Mr. Highfield finds that, taking the highest practicable voltage for underground work in either case, based on present experience, the cost of the lines for the alternating-current system would be more than double that by the constant direct-current system. In addition the latter has the advantage that it can be worked with the utmost readiness as a grounded circuit so that a complete metallic circuit once established can in case of a fault not involving both wires be operated as a grounded system and carry the load until repairs can be made.

With respect to station costs a constant-current system suffers under the disadvantage, in some cases, of relatively small size of units. At the present time it is practicable to build generators of from 100 hp. to 200 hp. with 5000 volts across the terminals, a limit which can probably be somewhat exceeded. A single-unit generator, however, can be pushed up to 1000 hp., or somewhat more. It is the custom to connect the units in parallel, and in the Moutier Lyons plant the largest contained unit has amounted to a 400-hp turbine coupled to two double generators giving somewhat more than 700 hp. even the very large size of long distances the constant-current system is at a material disadvantage in regard to the cost of the generating machinery. This, however, is somewhat compensated by the rudimentary character of the system as compared with the enormous and forbidding complications which have grown up around most alternating-current transmission systems. In the long run Mr. Highfield believes that the cost of station units will not be very different for the two systems, in heavy transmission work the advantages tending, however, to be with the alternating machines. As regards selection of the same station both good. Where frequency changing is unnecessary, as is likely to be the case in extremely long transmission systems, the two systems stand about on a parity. A few points of comparison on the Moutier Lyons system in its present state will doubtless give some valuable information on the matter of cost and reliability, but meanwhile it is sufficiently evident from the facts here presented that constant-current transmission remains a live issue.



# The News of the Week

## Activities and Events in the Electrical Field— Reports of Meetings—Commission Findings, Etc.

### Germans Honor Westinghouse

At the annual meeting of the Verein Deutsche Ingenieure, held at Leipzig, Germany, June 23, and attended by the visiting members of the American Society of Mechanical Engineers, the Grashoff gold medal was awarded to Mr. George Westinghouse. The medal was established by the Verein in 1894 in honor of one of its founders, Frank Grashoff, who died in 1893. Each year the memorial is presented to an engineer who has rendered distinguished service to technology. Mr. Westinghouse is the first American to receive the medal. Others to whom it has been awarded are Sir Charles A. Parsons, England; Mr. Gustav de Laval, Sweden; Count Ferdinand von Zeppelin, Germany, and Mr. Aurel Stodola. The award to Mr. Westinghouse is especially appropriate at this time when a party of 300 members of the American Society of Mechanical Engineers, of which he is past-president, are touring Germany as the guests of the German engineers.

Among the other honors granted Mr. Westinghouse have been the award of the Edison Medal, 1911, by the American Institute of Electrical Engineers; the John Fritz Medal, 1906, by the four American engineering societies, and decorations conferred by the French Republic and the Kings of Italy and Belgium. He has also received the degrees of doctor of engineering from the Königliche Technische Hochschule of Berlin and Ph.D. from Union College, Schenectady, N. Y. Mr. Westinghouse is an honorary member of the National Electric Light Association and the American Association for the Advancement of Science.

### Electric-Heating Rate Below Cost Authorized by Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued a decision approving the application of the municipal light board of the town of Marblehead for the right to establish a price of 5 cents per kw-hr. for electricity for heating. The computation submitted by the municipal board of the cost, as defined by the statute, was 6.56 cents per kw-hr. The commission states that without fully accepting the accuracy of this computation an examination of the plant's affairs makes it evident that the proposed price is less than cost, as defined by the Revised Laws, Section 22, Chapter 34. The board has had occasion to discuss the more important questions involved in this application in the similar Westfield case, summarized in the *Electrical World* for June 14, page 1303. Without repeating that discussion, the board points out that in deciding the petition it is not called upon to prescribe what rates shall be established nor specifically to approve that presented by the town, but rather to determine whether or not the rate proposed, with the limitations under which it is offered, is likely to be so prejudicial to the interests of the taxpayers or consumers generally that the board should interfere. Regarding this the commission says:

"The heating rate in question is urged by the municipal light board after experience with a schedule of higher prices has demonstrated that they were not sufficiently advantageous to secure the business. The price at which electricity can be used for heating is not necessarily or

under all conditions governed by the cost of supplying it, but depends rather upon its value to the customer. It may, moreover, under some conditions, be furnished for this purpose at less than what appears to be the average cost without actual loss to the town engaged in the supply. The propriety of trying to obtain this class of business must therefore largely involve at the outset questions of commercial expediency. If the endeavor results in materially increasing output without proportionately increasing costs, there will be some commercial justification for undertaking the experiment, and to a degree the interests of the taxpayers and customers generally may be promoted rather than injured."

### Annual Meeting of British Association for Advancement of Science

The eighty-third annual meeting of the British Association for the Advancement of Science will be held at Birmingham commencing Wednesday, Sept. 10, under the presidency of Sir Oliver Lodge, F. R. S., whose researches in electrical and physical science have given him a foremost place amongst scientific men of the present day. The engineering section of this meeting will be under the presidency of Mr. G. A. F. Aspinall, general manager of the Lancashire & Yorkshire Railway, which was the first important railway in the United Kingdom to adopt electric traction for its suburban traffic.

### Status of E. V. A. Publicity Campaign Fund

The publicity committee of the Electric Vehicle Association of America, through its chairman, Mr. Frank W. Smith, reports splendid progress in the work of soliciting funds to carry forward for another and second year the national co-operative publicity campaign to promote the use and adoption of the electric pleasure and commercial vehicle. The amount so far pledged approximates \$35,000, and the committee is making a final plea so as to bring the amount to at least the sum expended for the first year. An especial appeal has been made to the central-station interests, in the form of a very attractive circular and return stamped post card to those central stations which have not already subscribed, asking that every company make a "booster" or "good-will" contribution.

### Radio-Telegraph Patents Litigation

Judge Van Vechten Veeder, of the United States District Court for the Eastern District of New York, has for nearly two weeks been hearing rebuttal testimony in the cases brought by the Marconi Wireless Telegraph Company of America against the National Electric Signaling Company, owner of the Fessenden patents. Bills of complaint praying for damages and injunction against alleged infringement were filed by Messrs. Sheffield, Bentley & Betts, solicitors for the Marconi company, nearly a year ago. Answers were returned and prima facie and defense proofs taken before special examiners according to the old rules governing patent practice. The rebuttal testimony

was begun after the new rules of equity proceedings took effect, and therefore has been heard in open court.

There are two distinct suits comprising the present litigation, the first referring to Marconi's United States patent reissue No. 11,913 (original No. 586,193, filed Dec. 7, 1896, and issued July 13, 1897) and to No. 669,154 (filed Feb. 1, 1898, and issued Aug. 16, 1898) of Sir Oliver Lodge, while the second suit is based upon United States patent No. 763,772, issued to G. Marconi, June 28, 1904, on application dated Nov. 10, 1900. Prima-facie testimony in both cases was begun in August, 1912, by Mr. R. O. Wiegman, who stated that he had been employed by the defendant National company and who described in detail the arrangement of apparatus which constituted the alleged infringement. In October and November of the same year Mr. Frank L. Waterman, of New York, closed the complainant's proofs with his expert testimony. The first evidence in defense was taken by Mr. F. W. H. Clay, attorney for the National company, last February, when Prof. R. A. Fessenden took the stand. Professor Fessenden was followed by Dr. A. E. Kennelly and a number of other witnesses, including Messrs. E. I. O. Woodworth, Henry W. Fisher, S. M. Kintner, D. S. Wolcott, William Bradshaw and J. L. Hogan, Jr., whose testimony was not completed until April last. The rebuttal case of the first suit was opened before Judge Veeder on June 16 with testimony of Dr. G. Marconi, who held the stand for three days. Mr. Waterman then took the witness chair and submitted an examination by Mr. L. F. H. Betts, for the complainant, and Messrs. F. W. Winters and F. W. H. Clay, for defendant, until Monday evening last, at which time Mr. John W. Griggs, president of the Marconi company, gave a short deposition. At the present writing, Tuesday, June 24, opening arguments in the second case (Marconi's patent No. 763,772) are proceeding. It is expected that the latter suit will be concluded promptly, since much of the testimony is similar to that given in the first suit and may be read direct therefrom.

The only claim of No. 11,913 in issue is as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark producer at the transmitting station, an earth connection to one end of the spark producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end and a circuit through the contact, substantially as and for the purpose described."

According to Dr. Marconi and Mr. Waterman, on rebuttal, to this claim the broadest possible interpretation is to be given and it should be held to cover any system of radiotelegraphy utilizing grounded waves. The "imperfect contact" element is considered the keystone of the combination, since the complainant claims it to include all oscillation detectors, even those of the good contact, crystal or electrolytic types. The National company urges that the patent should be read in the light of wireless knowledge at the time of its application date and that Dr. Marconi's claims should be limited to the original invention as the inventor as shown by his early features and definitions. The complainant goes so far as to classify the hysteresis-type magnetic detector as within claim 3 above, stating that while it may not be an "imperfect contact" device, it acts like one and is therefore an equivalent. The defendant company is attempting to show that the crystal and electrolytic detectors are outside of the claim quoted, since if read in the light of the specification the "imperfect contact" is a resistance-carrying device which compels power from a local battery and makes signals thereby. It is claimed by the National company that when the crystal or electrolytic detectors are used all response given is induced by power received on the antenna, the local battery being used only to increase the sensibility of the detector, and the work of Dr. G. W. Pierce as well as of the com-

pany's experts is pointed out in confirmation of this view. Dr. Marconi also states that in addition to his invention of the combination including an imperfect contact he is also entitled to a monopoly covering the use of grounded waves for wireless telegraphing. Early work by Popoff, Lodge, Tesla and others has been quoted by defendant to offset this claim, and it is stated that the patent shows Marconi himself did not appreciate the true action or advantages of grounded gliding half-waves until long after his specification was filed. Numerous other points are in issue, and determination of the rights of the Marconi company under this patent will constitute settlement of what is probably the most important litigation which has occurred on the subject.

The Marconi claims patent was amended in its claims 3 and 5 according to the United States Telegraph Company in 1905 by Judge Townsend (No. 128 F. R., pages 647-681). In that instance infringement was determined mainly by the nature and use of the Dr. Marconi "goo" detector, which was held to be a true antiferret resistance-changing device. The testing of the earlier *bottom* upon the present case does not seem very direct, except in that Judge Townsend appeared to feel that he was extending a liberal range of equivalents to Marconi by placing the "goo" detector within the coherer class.

The Lodge patent, No. 669,154, has in issue claims 1, 2 and 5, of which the first is representative.

"1. In a system of horizontal-wave telegraphy, the combination with a pair of capacity arms of a self-inductance coil inserted between them electrically for the purpose of producing an electrical oscillation excited in the system and constituting such a system a radiator of a definite frequency or pitch."

This patent has never been infringed, nor is stated by the Marconi company to cover all plans for wireless telegraphy, grounded or ungrounded, wherein the radiating circuit includes an inductance in self loop. The defendant quotes a large number of references to work antedating the Lodge patent, and claims that the patent lacks novelty capable of such broad application.

The second suit, No. 44, upon Marconi's patent, No. 763,772, in which the relevant feature is not an assumed alleged infringement of other claims of the patent, including the following:

"8. A transmitting station employed in a wireless telegraph system, the combination of a transmitter whose secondary is connected to an open circuit including a radiating conductor at one end and capacity at the other end, a variable inductance being included in said circuit, and whose primary is connected to a condenser circuit discharging through a means which automatically causes oscillations of the desired frequency substantially as described."

"10. A system of wireless telegraphy, in which the transmitting station and the receiving station each contain an oscillation transformer, and circuit of which is an open circuit and the other a closed circuit, the two circuits at each station being in electrical resonance with each other and in electrical sympathy with the circuit in the other station substantially as described."

"11. In a system of wireless telegraphy, the combination at a receiving station of an oscillation transformer, an open circuit comprising at least one parallel resonant circuit and one end of the primary coil of the oscillation transformer, a connection from the other end of said coil to a capacity or variable inductance in said open circuit, and a second connection from the secondary end of the oscillation transformer to a condenser in circuit with a battery, the battery, capacity and inductance being a variable inductance substantially as set forth for the purpose described."

This is the United States patent of Marconi on "four-wave system," and it corresponds to the British 2777 patent of 1900, which was renewed by Mr. Thomas Parker



against the British Radiotelegraph & Telephone Company in 1911. It is stated to cover the use, in a wireless system, of tuned closed and open circuits, in combination, at sender and receiver. The defense of the National company is said to be based upon anticipations of the patent in the work and publications of Tesla, Fessenden and others.

Inasmuch as a decision interpreting the claims of these patents as broadly as is urged by the Marconi company would result, unless reversed by the District Court of Appeals, in a complete monopoly of wireless telegraphy in the United States, the litigation is being followed with much interest by all who are connected with radio work.

### A. I. E. E. Annual Convention

On June 23 amid the picturesque surroundings on the southern shore of Otsego Lake, at Cooperstown, N. Y., members of the American Institute of Electrical Engineers gathered for their thirtieth annual convention, with headquarters at the Otesaga. Approaching their destination from various directions, by rail, interurban cars and motor, about 125 members and guests reached their objective point in due season for the formal opening of the convention with a reception and dance on Monday evening. No little interest was added to the week's events by the circumstance that the meeting place lies in the heart of a region made famous by J. Fenimore Cooper in his "Leatherstocking Tales," thus abounding in historic associations as well as possessing the natural charm of lake and wooded mountain. Through the careful arrangements of the committee in charge those attending the convention found their comfort well provided for and an inviting program of both professional and social interest awaiting them.

#### OPENING RECEPTION

The convention exercises were formally launched by a reception and dance at the Otesaga on Monday evening, June 23. This pleasant event was held in the main ball-room, which lent charm to the occasion by its simple and harmonious decoration in the old colonial style. Standing in the receiving line were President R. D. Mershon, Past-president D. C. Jackson, President-elect C. O. Mailloux and Secretary F. L. Hutchinson. After all had been presented, although formal introductions were hardly the necessary order of the evening, dance music was provided by an excellent orchestra and the festivities continued until the early hours. What the event possibly lacked in numbers, as compared with similar occasions in former years, it more than made up in enthusiasm and enjoyment. The announcement that informal dancing each evening would be one of the features of the convention proved to be popular news and attested that the social side of the Institute's yearly gatherings is growing more and more attractive.

#### OPENING SESSION

On Tuesday, June 24, the first formal session was called to order at 10:30 a. m., with President Mershon in the chair and both members and their guests in attendance. First on the program was the president's address, an abstract of which appears below.

#### ADDRESS OF PRESIDENT MERSHON

Mr. Ralph D. Mershon in introducing his subject stated that it had been quite generally the custom for the retiring president to discuss some topic concerning engineering in general, and the exception, rather than the rule, to deal with Institute affairs. The latter topic was selected as the subject of his discourse in view of the eminent fitness of such a proceeding on the part of one who has long been connected with Institute affairs and has had its best interests always at heart.

He stated that while it is quite generally the wish of all concerned that the Institute's activities shall increase, for example in the appointment of new technical committees,

new sections formed, and additional section meetings held to discuss important topics, there is necessarily a limit to such increased activity imposed by the burden of its cost. This raises the general question of the relationship between income and expenditure. The cost of publishing and distributing the *Institute Proceedings and Transactions* is fast approaching the maximum permissible limit, and it becomes almost imperative to consider what measures of relief should be adopted in the near future. There seem to be, he said, three possible solutions. Either the present rate of increase in Institute activities must be reduced, the expenses must be cut in some manner, or the income must be increased. There being obvious objections to raising the dues or reducing the Institute activities, the most desirable course is that of reducing the expenses.

Printing is the largest single item of expense, and probably is much larger than is really justified. Probably the Institute occasionally prints papers which could more properly appear in the technical press. Moreover, all Institute publications are now sent to all members, whereas the interest of the individual members in them is limited to special topics, and the same matter is now sent twice to each member. Mr. Mershon appealed to the membership to consider this problem and assist in its solution.

Speaking of the effect of the formation of new engineering societies and their recruiting of membership, from the standpoint of the Institute's welfare and the effect upon its finances, Mr. Mershon said he could see no objection to such societies; on the contrary, he saw results of a possibly beneficial nature. And for similar reasons he saw no advantage in amalgamating the membership of engineering societies in one great organization, save by general representation—not individual membership—in a holding society of an all-embracing nature.

In discussing the scope of the Institute's activities, Mr. Mershon took occasion to emphasize the changing character of the times and the need for engineers to recognize the rapidly growing importance of the economic phase of their work and its related problems. There has long been a tacit tradition, he said, to limit Institute affairs to purely technical matters, but this in reality is a narrow viewpoint since the successful or useful engineer must be also an economist. This is evidenced by the increased consideration given to such questions as valuation, depreciation, operating costs, etc. He made a strong plea for the broadened viewpoint and an expansion of Institute activities along these lines.

Expressing his belief in the correctness of the Institute policy regarding local sections, the president made a plea for an extension of their activities and the inauguration of section technical committees, and particularly the institution of section membership committees to make an appeal for new members by direct and personal solicitation. Circularizing for new members he regarded as undignified, and certainly much less effective than direct personal appeal by local committees.

It is also desirable, said Mr. Mershon, for the membership generally to take a greater interest in Institute affairs and aid in solving its problems. This would be facilitated by a better geographical representation of membership on the board of directors, and could be effected by increasing the board membership by representatives—vice-presidents and managers—from the more remote sections of the country. He also urged a policy of greater frankness and publicity regarding the proceedings in meetings of the board of directors, so as to enlighten the membership to a greater degree in relation to Institute problems and stimulate interest in and discussion of them. Discussion or contention, if it be in a fair spirit, is not only desirable but is also a sign of a vigorous and active organization.

Tradition and precedent, while important and never to be neglected, remarked the president, should be overruled if contrary to any course that on careful consideration

One commercial company has been licensed by another to the extent to require cultural evolution at a somewhat low level, in that and the most has been defined "open"



and unresponsive to modern commercial methods and the attempts have been abandoned. During recent years the appliance and lamp business has been left almost entirely in the hands of the local dealers. For years public opinion in Cincinnati has not been altogether friendly toward the public-utility corporation, a condition which adds to the unfortunate aspects of the present electrical situation.

#### COMPANY'S BARGAIN SALE OF 12-IN. FANS

When, following the advent of a new commercial staff, a Union company advertisement recently appeared in the Cincinnati newspapers offering 12-in. fans (either alternating-current or direct-current) for \$9.98, complete with cord and plug, several local dealers declared this price to be less than they could buy such fans for in lots of 500. At a meeting of protest attended by some seventy-five persons interested the company's commercial manager took care to explain that this fan offer covered a limited consignment of 500 fans of last year's manufacture and of an obsolete finish, which had been purchased at a corresponding discount that permitted a small profit at the price quoted. One local retailer thereupon offered to buy outright the entire consignment at the advertised price, declaring that he had never been able to get such prices from even his jobber and that he could resell these fans at a good profit. The company agreed to the deal provided assurance was given that each fan should go to a customer using central-station service, but this the retailer refused to guarantee. The company also offered here, as on other occasions, to furnish to small dealers who might suffer from the effects of rate slashing by others appliances at the cost prices obtained through central-station purchases made in large lots. It was further explained that the cut-price sale at \$9.98 was scheduled to last only two weeks, after which time the offer would be withdrawn. At the date set the offer had not, however, been withdrawn as promised, and the dealers again protested. Four days later the fan sale was actually brought to a close, the explanation given for having prolonged it beyond the original fortnight being that during ten of these scheduled fourteen days the street-car strike was in progress, arresting business generally and interfering with sales. In addition to the bargain fans the company also sold to persons attracted to its display room a number of the latest-type oscillator models, disposing of these at list prices as in the case of its other appliances.

#### "RUMMAGE SALE" OF APPLIANCES

Advertisements for a "rummage sale" of show-room shop-worn devices at low prices by the central station later served to arouse anew the uneasiness of the dealers. This sale, it is explained, was held solely to clear out an old stock. But this rummage sale seems to have caused the dealers to forget that the company's appliance sales over its counter have, with this exception, been carried on strictly at maintained list prices. Indeed, in only four months these display-room sales, all at such maintained prices, have increased at the remarkable rate of 2600 per cent over the amount recorded during the first month of the present campaign. In fact, declares the company, it is itself that is most in need of protection against price cutting on the part of the dealers—for inquiry among electrical stores in Cincinnati revealed ranges in prices of 10 to 25 per cent on various articles with little attempt to maintain uniformity.

Another special offer made by the company which provoked criticism was an assembled crow-foot pendent fixture, complete with reflector and 250-watt lamp, which was sold for \$2. The dealers declared the lamp alone should bring \$2.50, while for the fixture complete they said they must charge at least \$5.50. One dealer inquired the size of the stock of these fixtures which the company had on hand, and, as in the case of the fans, proposed buying the entire lot outright at the advertised price in order to resell them at a profit. In answer to the objections raised this time the

company explained that this fixture sale again represented a limited-period clearing of old stock, including some out-of-date reflectors. At the expiration of the time limit the fixtures were restored to their present price, \$4. The company promises that all its other fixtures sales will, as in the past, be conducted on a strictly merchandising basis with maintained prices.

#### COMPANY WILL FIX OWN LAMP PRICES

On the subject of tungsten-lamp prices to its customers the company, however, asserts its right to fix its own schedule. First announcement of the cut in prices in line with this intended policy came in March, although the cut then decided upon was not actually enforced until June, the delay having been due to the desire to co-operate with the dealers. As then finally fixed, the prices which went into effect for the Union company's customers were as shown in the table. Free renewals are granted for the larger sizes.

UNION GAS & ELECTRIC COMPANY'S LAMP PRICES

Lamp, Watts	List Price	Customer's Price
15-25	\$0.40	\$0.35
40	0.45	0.35
60	0.60	0.45
100	0.90	0.75

As finally enforced, these prices were applied the middle of June, only a few weeks before the general price cut (see *Electrical World*, April 26 and June 21) scheduled for July 1, after which date all the Cincinnati dealers will be privileged to meet the prices which the central station has been offering. Meanwhile the latter is of course getting the credit locally for having put down the price of tungsten lamps. The Cincinnati central-station company insists, however, on its right to sell lamps to customers at any price it sees fit in order to develop the business and to encourage use of the larger sizes.

#### HOUSE-WIRING CO-OPERATION

From several sides has come the repeated statement that the company asked contractors to do house-wiring jobs on a basis of 3 per cent profit over labor and materials. No confirmation of such an offer or even any recollection of it could be obtained from the company's officials. The contractors have also protested against the unit schedule for estimating wiring prices on the basis of outlets, etc., declaring that unless a given contractor has a large number of such jobs accorded to him the law of averages assumed is not fulfilled and may work injustice in individual cases. Several local contractors have, however, since accepted the company's terms and are doing its work with apparent satisfaction at the prices obtained.

Avowing their wish to co-operate with the company even further, the contractors also declare that they offered to put extra solicitors on their own staffs to go after house-wiring contracts. The contractors' committee which submitted this proposal was, however, in no way authorized to sign an agreement as to the number of men who would be detailed to this work, and this plan also fell through. The company then went ahead marshaling its own organization for an aggressive campaign which is now under way.

#### CO-OPERATIVE ADVERTISING WITH DEALERS

A plan for co-operative newspaper advertising in the form of an "electrical page" was another subject on which the two parties failed to agree. The dealers declare that after they had promoted such a page, the prospects for which seemed bright, the electric company refused to take part in it on the excuse of an insufficient advertising appropriation, although shortly thereafter the newspaper advertisement began to appear announcing the cut in tungsten-

lamp prices. The reason given by the company for failure to participate in the "electrical page" is that it doubted the wisdom of spending \$75 weekly on a feature appearing only once a week in a single newspaper. In addition, the company would have been required to collect and edit the reading matter for the page. Instead of the single newspaper page once a week the company explained that it would prefer to hold off until some form of daily electrical advertising could be secured in all the papers, and expressed its willingness to co-operate at such time.

#### MAINTAINED PRICES AND BARGAIN SALES FOR ELECTRICAL SHOP

At the "Electric Shop" which the Union Gas Electric Company is preparing to open on Race street in the center of the downtown retail section prices of appliances are to be maintained, and the store, it is promised, will be conducted on a merchandising basis such as to pay its own way. List catalog prices will be generally observed, with the exception of bargain day sales. On those days to attract customers, following the department store practice, but prices bordering on bare-cost values will be offered on certain appliances for a day at a time. The company justifies this policy on the basis of the lost merchandising experience in the general field, pointing out that retail stores suffer little if any from the bargain sales conducted by department stores. It has offered to let local dealers share in these bargain-day sales if they desire.

Meanwhile, however, even a casual visitor may discover that co-operation is just now a rather remote quality in the Cincinnati field. The dealers and contractors, having themselves plunged into a campaign of price slashing, are suspicious and envious of one another, as they themselves will admit, and whatever community of spirit there is among them seems to find expression in antagonism to the central-station company. Some of the larger dealers are more temperate in their attitude, adopting the philosophic view that whatever the company may do to stimulate and develop the electrical business locally will ultimately redound to their own benefit. The rank and file of the electrical dealers and contractors in Cincinnati appear to recognize that the company holds the whip hand in the local situation. The only means of retaliation suggested, among all the protests filed by the dealers and contractors, relates to isolated plan development, and this they declare they will encourage and recommend if the electric company continues to overlook their own rights in the local field. While the trade is thus embittered against the company, the latter seems to have about lost patience with any further attempts to conciliate the local field, and the spirit now in evidence is one of "fight" until the party least fitted to stand the siege shall surrender.

### Illinois Public Utilities Commission Created

A bill passed by the Illinois Legislature last week and now awaiting the action of Governor Deneen creates a state public utilities commission of five members. The commissioners are to be appointed by the governor, and not more than three shall be affiliated with the same political party. Eventually the term of office will be six years, the appointments being so timed that not more than two new members can be named in any year. The governor shall designate the chairman. The commission shall appoint a secretary, an attorney, accountants, engineers and other employees. Each commissioner is to receive a salary of \$10,000. The secretary's salary is \$8,000 and the attorney's \$6,000. The office of the commission will be in the capitol at Springfield and shall be open for business throughout the year.

#### DUTIES OF THE COMMISSION

The commission shall have general supervision of all public utilities. It shall examine franchises, capitalization,

rates and other charges, and also the service rendered. Rules and regulations to this end may be adopted. An annual report to the Governor shall be made in December, 1914, and thereafter.

Public utilities owned or operated by municipalities are specifically excluded from the control of the commission. All other public utilities are directed to furnish the commission all required information, to deliver required documents, accounts and records and to obey the orders of the commission. Public utilities are defined as individuals, firms, corporations and associations that own, control, operate or manage for public use any plant, equipment or property and so use or intend to use in connection with the transportation of persons or property or the transmission of telegraphic or telephone messages between points within this state, or for the production, storage, transmission, sale, delivery or distribution of heat, cold, light, power, electricity or water, or for the conveyance of mail or by pipe line, or for the storage or transportation of goods, or for the conduct of the business of a hotel, restaurant, garage or franchise giving the right to engage in such business, are also regarded as public utilities.

#### REPORTS AND ACCOUNTS

Power is given to the commission to establish a system of accounts, to classify utilities for accounting purposes and to prescribe the manner in which accounts shall be kept. The system of accounts established shall be similar with those of the interstate commerce commission. Such accounts shall distinguish clearly between payments for operating expenses and those for new construction. Utilities may be required to keep such accounts as will adequately reflect depreciation, obsolescence and the progress of the work. The commission may fix the rate of depreciation.

Annual reports to the commission shall be made by the utilities in the form required. Monthly reports of earnings and expenses must be given if asked by the commission, also special reports when requested. All reports shall be under oath.

#### CONTROL OF SERVICE, RATE, ETC.

The power of public utilities to own, stock, lease, sell, operate, build, hold and otherwise conduct a business shall be exercised by the commission. Securities authorized by the commission shall be affected as such. For certain specified purposes, the state may issue securities after first securing permission from the commission. Such purposes, usually, shall not be such as are reasonably chargeable to operating expenses or income. The law provides in detail for a grand investigation by the commission when application is made to it for authority to issue stocks or bonds. If necessary, an independent valuation may be made. The proceeds of the sale of securities may be applied as required by the commission's order. After receiving not less than three months' notice, the board without the consent of the commission, but subject to its veto, may create or issue bonds to amount for a single year less than five years, without interest. In case of emergency the commission may issue securities as a preliminary to making the sale of the issued stock of the utility and the commissioners or not also may add such bonds to the sale for emergency funds. Seven percent are allowed on the issuing of securities pending the payment of the sale. In the case of individual companies, however, of one year or less term is imposed on bonds. The act is not to be construed as any limitation on power, of past, present or future.

#### MAINTENANCE OF SERVICE CONTRACTS

Persons or organizations claiming to be the proper owners or controllers of electric utility or for the sale of them or use in similar. The laws existing applying to franchises, licenses, permits or certificates and public



must file a petition setting forth all the circumstances, and the commission must decide, attaching such conditions as it deems necessary.

#### MUST BE ILLINOIS CORPORATIONS

After the law is in force, no franchise shall be granted to any public utility, except common carriers engaged in interstate commerce, other than a corporation incorporated under the laws of Illinois. No public utility shall be exempt from the provisions of the act by reason of the fact that it is incorporated under the laws of another state.

#### VALUATION

The commission is to have power to ascertain the value of the property of every public utility in the State and every fact which in its judgment may have a bearing on such value. It shall have power to make revaluation from time to time.

#### RATES AND SCHEDULES

All rates shall be just and reasonable. Schedules showing all rates, charges and classifications must be filed with the commission and be open to public inspection. Without the consent of the commission these rates must not exceed those in effect on July 1, 1913. The commission has, however, power to fix rates in excess of those of the date mentioned or below them. Contracts between public utilities in relation to furnishing service or products must be filed with the commission. No utility shall increase any rate without a finding by the commission that such increase is justified. Provision is made for a hearing on the propriety of any rate, either on complaint or on the initiative of the commission. Neither more nor less than the schedule rate shall be charged, nor shall there be any refunds or rebates. Discrimination between customers is forbidden. Differences in rates as to localities or classes of service must be reasonable. Specific provision is made for the fixing of rates by the commission, after a hearing, where it is found that existing rates are unjust. No telephone or telegraph company shall charge more for sending a message for a shorter distance than for a longer distance over the same line.

#### JOINT USE OF FACILITIES

Every telephone and telegraph company must interchange with every other with which a joint rate has been established or with which a physical connection has been made. Physical connections between two or more public utilities may be ordered by the commission after a hearing. The conduits, subways, tracks, wires, poles, pipes or other property of one utility may be used by another if the commission finds such joint use of public convenience or necessity and also that it will not result in substantial detriment to the service of the first utility. This, however, does not apply to utilities mainly or primarily within a city.

#### SERVICE AND EQUIPMENT

The commission shall prescribe rules for the performance of any service by any public utility. Additions, repairs or improvements to plant and equipment may be ordered, if needed, after a hearing. The commission is authorized to regulate the conditions in contracts with customers. Also it may fix suitable standard commercial units of service, as, for instance, initial voltage. It may test meters and appliances and establish standards of accuracy. Any consumer may have any meter tested upon payment of the fees fixed by the commission. Commissioners and their agents may enter upon the premises of any public utility for the purpose of examination and test.

No utility shall begin the construction of any new plant which is not in substitution for any existing plant or an extension thereof without a certificate of public convenience and necessity from the commission. No new utility shall transact business without obtaining such a certificate. Rights given by such certificates must be exercised within two years.

#### INVESTIGATION OF ACCIDENTS

Reports of all accidents must be filed with the commission. If the accident causes loss of life or limb, the utility must give notice of the fact immediately to the commission, using the speediest means of communication. The commission may investigate accidents, but neither the report from the utility nor the findings of the commission shall be admitted in evidence in any damage suit. Safety appliances may be ordered.

#### MANNER OF PROCEDURE

All hearings shall be in public. Commissioners may issue subpoenas, compel the attendance of witnesses and administer oaths. No subpoenaed witness, testifying under oath, shall be subject to any penalty for anything he may divulge. Neglect to appear under subpoena is a misdemeanor. The commissioners and their duly accredited agents have the right, at any and all times, to inspect the papers, books, plant and equipment of any utility. When complaints are filed with the commission a copy shall be served on the utility. Utilities themselves can make complaints as well as citizens, societies, municipal corporations or others. Hearings may be had on complaints and rehearings if sufficient cause appears. On rehearing the commission may rescind or alter its decision. Appeal from the decision of the commission may be taken to the Circuit Court of Sangamon County. No new evidence may be introduced on appeal. From the Circuit Court the case may be appealed to the Supreme Court. The methods of enforcing the act are carefully set forth in several sections.

#### OLD RAILROAD COMMISSION ABOLISHED

By the terms of the act the Illinois Railroad and Warehouse Commission, established in 1871, is abolished. The rights, powers and duties of this board are transferred to the State Public Utilities Commission of Illinois.

If the Governor does not veto the bill, the act will take effect and be in force on Jan. 1, 1914.

#### Tires for Electric Vehicles

Fifty-one additional electric-vehicle registrations were made in New England between June 1 and June 14, according to figures presented at a meeting of the Electric Motor Car Club of Boston on June 19. President Day Baker occupied the chair, and at the conclusion of the usual dinner a joint meeting was held at the Edison Building with the New England Section of the Electric Vehicle Association of America, Chairman Fred M. Kimball presiding. It was announced that in addition to the figures of electric-vehicle registrations printed in the *Electrical World* of June 14, page 1299, the following have been made: New Hampshire, three pleasure cars and one truck; Vermont, two pleasure cars and one commercial vehicle; Massachusetts, four passenger electric cars and three trucks; Rhode Island, two pleasure equipments and one truck; Connecticut, seven pleasure and eight commercial electric cars. The club membership is now 110, four new members having been added at the meeting, and there are seven more charging stations in New England than on June 1. Fliers are soon to be available for central-station mailing lists, these being prepared in red and black under the general direction of the club and advocating the electric vehicle for varied services.

#### DISCUSSION OF ELECTRIC-VEHICLE TIRES

Tires for electric-vehicle service were considered at length at the meeting, papers being presented by Messrs. Alexander Churchward, consulting engineer, New York; James E. Hale, Goodyear Tire & Rubber Company, Akron, Ohio; W. W. Duncan, Hood Rubber Company, Watertown, Mass., and T. H. McGiehan, Motz Tire & Rubber Company, Akron, Ohio. Mr. Churchward's paper pointed out

that the tire has more influence upon mileage than any other feature of vehicle equipment. Taking a Palmer single-tube tire as a standard, the energy consumptions of a number of standard modern tires in watt-hours per ton-mile on hard, level asphalt were as follows: No. 2, 115 per cent; No. 3, 132 per cent; No. 4, 133 per cent; No. 5, 143 per cent; No. 6, 158 per cent; No. 7, 163.5 per cent, all measurements being made by recording instruments under the author's direction. A standard pneumatic gasoline car tire required 169 per cent of the Palmer energy consumption, and the energy consumption of solid tires varied from 142 to 210 per cent of the above standard. Some special tires of the block type took only 140 per cent more energy than the Palmer standard, on account of the high quality of their material. A thirty-cell electric runabout with a fifteen-plate battery made 115 miles at 16 miles per hour with double-tubed Palmer tires. With another make of electric special tires it made 82 miles at 16 miles per hour; with ordinary pneumatics, 68 miles, and with a good grade of solid tire, 68 miles. The outlook is excellent for ultimate standardization of tires on the basis of traction effort and ton-mileage relationships.

Mr. Hale's paper outlined the fundamental principles of tire development and emphasized the need of more scientific research in this field. It was pointed out that gasoline-car tires absorb more energy than tires for electric vehicles, the fabric being so rigid that considerable work is necessary in flexing the walls of the tire. Well made electric vehicle tires are less rigid, the difference being easily seen by depressing them when deflated. From the manufacturer's viewpoint it is difficult to secure long tire life and a construction flexible enough to give low energy consumption. Under-tiring of cars has forced some excellent types of tires off the market. At present the most efficient tires made by the author's company are of soft base, reinforced with cross wires, attached to the wheel with side flanges. The other speakers urged the standardization of tire tests, criticised the existing guarantees of mileage now exacted by many tire purchasers, and advocated closer attention to fitting the proper sizes of tires to vehicles. Mr. Churchward brought out the point that the ordinary tractive effort required to overcome friction on a level roadway in using electric tires is about 24 lb. per ton. A brief discussion also occurred regarding the adequacy of dual 5-in. tires on 3-ton electric trucks, the point being made by Mr. Dan Baker of the General Vehicle Company, that over 100 such trucks are in successful service. On hilly roads it was conceded that larger tires might be advisable, but for ordinary service Mr. Baker preferred to use the 5-in. tire even if it involved a slight sacrifice in life in operating on grades. The increased investment required in using larger tires is not always compensated for by the resulting life gains.

### Convention of the Illinois Electrical Contractors' Association

On account of the labor trouble existing between the Building Construction Employers' Association and the Building Trades Council in Chicago, the semi-annual convention of the Electrical Contractors' Association of the State of Illinois, which was held in the Hotel La Salle, Chicago, June 26 and 27, was not so well attended as usual.

Mr. William McGonness, president of the association, called upon Mr. Ernest H. Freeman of Chicago, president of the National Electrical Contractors' Association, for a few words of welcome. The remainder of Friday morning was devoted to the discussion of various phases of the contracting business.

#### RELATIONS OF CONTRACTOR, JOBBER AND PUBLIC

The business relations of the contractor, jobber, manufacturer and public were the main topic of discussion. Sev-

eral Chicago contractors said that this relation was not what it should be in Chicago. Among those who took part in the general discussion were Messrs. J. A. Hoeyler, G. A. Harter and George Doolittle, of Chicago; J. Marron, of Rock Island, Ill.; H. M. Butler, of Peoria; A. S. Schulman, C. E. Creider, G. H. Lounsbury, J. E. Barron and E. H. Freeman, of Chicago; Guy Carlton, of Bloomington, Ill.; J. B. Van Allen, of Peoria; E. W. Postman and F. W. Donohoe, of Chicago; C. E. Stagg, of Peoria, and Clark Methot, of Chicago.

Mr. Harter criticized contractors for getting into the hardware business because the two industries are closely allied. He also emphasized the fact that contractors having a wide acquaintance among architects would be able to establish satisfactory relations in that line.

Mr. Marron said that the only way to keep the jobber from being a central supplier to the consumer or wholesale price was to purchase a big certain amount of business. He expressed the opinion that a joint committee consisting of contractors and jobbers could be instrumental in improving mutual operating relations.

Mr. Butler, of the Mills Electric Company, said that his company was endeavoring to sell only to electrical contractors, large consumers like central stations, and railroads, which would not solicit the services of the contractor anyway.

Mr. Creider said that if jobbers were trying to establish a uniform retail price for consumers they were not doing anything new. He said in a contract which he recently completed and in which it was required to make a price on the material used which resulted in a loss rather than a profit. The jobber said that there are two industries in which there is such a tendency to sell to the consumer at a wholesale price as there is in the electrical industry.

Mr. Freeman expressed himself as being in favor of increasing wholesale prices for the contractor and the consumer. At manufacturers and jobbers would get together on a national basis, he felt that the consumer would be placed in a better position. Mr. Freeman added that many jobbers in Chicago were purely brokers. The larger contractors do not depend on the jobber for supplies, but buy direct from the manufacturers. Hence the jobber does not feel in a position to protect the contractor.

Mr. Barron, replying to Mr. Marron regarding co-operation of jobbers and contractors, said the Society for Electrical Engineering had established in long the doubt.

Mr. Freeman said that he did not think the author had been unfair in his discussion, and that the jobber would not expect credit from the legitimate contractor. The case with which anybody can get into the contracting business and obtain credit, he said, is surprising.

Mr. Carlton outlined the tendency of manufacturing companies to require the small contractor to maintain a certain retail price relationship and often use large amounts as well as use prices. He believed that the manufacturing companies could control the same situation.

Partly in answer to these statements, Mr. Van Allen said that the electrical industry in general was trying to keep the same retail price for the jobber and a joint meeting would out the illegitimate contractors.

Mr. Freeman made the author's concluding statement that the electrical industry was in a desperate situation at a stumbling block in contracting that of the "black market" because of the fact that many places they have an employment situation and also require work which the contractor does not.

In response to Mr. Carlton's statement, Mr. Donohoe said that the Electrical Hardware Company attempts to administer a uniform retail price by advertising the prices at its factory stores in printed literature and by direct retail purchases. In addition, it tries to get the contractor, under its name and connection as a general basis by its method of advertising.



Mr. Methot claimed that the Manhattan Electrical Supply Company tried to maintain separate prices for dealers and consumers. He told of the city ordinance which has been passed in Chicago requiring all buildings of a certain size to be equipped with electrical fire-alarm systems. The installation of these equipments was pointed out as a productive field for the electrical contractor, and he urged that contractors in other cities have a similar ordinance introduced in their respective city councils.

Friday afternoon and Saturday morning were devoted to executive sessions at which the various committees reported, delegates were elected to the national association, and officers for the state association were elected. The "state boosters" committee submitted a valuable suggestion to the effect that members from the different cities visit the meetings of the local sections in other cities and exchange ideas. The routine matters of the committee will be handled by Mr. W. L. Collins, of Chicago, who is at present secretary of the state and Chicago sections of the Electrical Contractors' Association and the Chicago section of the Faraday Electrical Association.

#### ELECTION OF OFFICERS

The officers for the ensuing year are as follows: Mr. W. J. Ball, of Moline, Ill., president; Mr. J. T. Marron, of Rock Island, Ill., vice-president; Mr. M. Blumenthal, of Chicago, secretary; Mr. J. N. Pierce, of Chicago, treasurer. The last three men were re-elected to the positions which they held last term. Mr. Ball is also president of the Tri-City Electrical Employers' Association.

Three delegates were elected to the national association as follows: Mr. F. L. Decker, of Chicago, to succeed Mr. R. C. Biedeman, and Messrs. C. E. Stapp and J. T. Marron, who were re-elected.

On Saturday evening a banquet and a dance were held in the Hotel La Salle. Mr. Marron acted as toastmaster in the absence of Mr. Ball, who was called home on account of illness in his family. "Shop talk" was prohibited under a penalty, and a pleasant evening was enjoyed by those present. Short talks were given by Messrs. Freeman, Creider, Collins, McGuineas, J. Cronin and A. Knauber, of Chicago.

The next meeting of the Illinois Electrical Contractors' Association will be held at Springfield, Ill., about the middle of January, 1914.

#### Convention of Brooklyn Company Section, N. E. L. A.

The fifth annual convention of the Brooklyn Company Section of the National Electric Light Association was held at the Oriental Hotel, Manhattan Beach, on June 25, 1913. The meeting was opened by an address by Chairman C. E. White, after which the official business of the section was transacted, including presentation of various reports.

A technical review of the salient points brought out in the reports of the N. E. L. A. committees on progress in lamp manufacture, street-lighting, meters, electrical apparatus, and underground construction, which were presented at the Chicago convention, was read by Mr. E. W. Babcock. The following took part in the discussion of this review: Messrs. W. Y. Vedder, William Eichert, J. H. Sinkinson, J. Laurencot, H. P. Pope, A. G. Paulsen, William Schaller, M. J. Shugrue, W. H. Grove, R. Stevenson, A. Hussey and F. E. Hanchet. The discussion was largely confined to local situations, but it was pointed out by Mr. Sinkinson that the committee on underground construction had overlooked in its report the fact that the temperature in the conduits and manholes varies enough to cause a creep in the cable of 4 in. on a 300-ft. run. Instances were cited where this had led to ruptures in the lead sheathing. It was recommended that a straight run of at least 4 in. be allowed

at the entrance of each duct as assurance that the sheath of the cables would not be chafed by the creeping movement.

A paper prepared by Mr. F. H. Paterson and read by Mr. T. W. Flowers, entitled "The Relation of the Accounting Department to Other Departments of the Company," was discussed by Messrs. C. W. Hafstrom, T. S. Bates and William Trompen.

Mr. M. S. Seelman, Jr., quoted briefly from papers which had been presented at Chicago on the subjects of electrical merchandising, "Salesman's Handbook," wiring of existing buildings, refrigeration, and steam heating by central stations. These papers were discussed by Messrs. J. L. Wiltse, G. L. Leibman and C. H. Stevens. It was brought out in the discussion that there is a regrettable dearth of reliable data on steam heating, as applied to central-station service, and Mr. Stevens expressed his hope that in the next report of the committee such a compilation of data would be secured if possible.

At the close of the annual dinner given to the members of the Brooklyn Company Section by the Edison Electric Illuminating Company Chairman White announced that, although it was impossible for General George H. Harries, of the Louisville Lighting Company, who was to have been the guest of the section, to be present, Mr. W. F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn, and Mr. W. W. Freeman, vice-president of the Alabama Power Company, would address the diners. Mr. Wells briefly discussed the increase in the company's business and stated that during the past year the output of electrical energy had been increased by 20 per cent and the net income by 6 per cent. He accounted for the seeming discrepancy by stating that the increase had been generally confined to large customers who paid low rates for energy. Mr. Wells also said that it is highly probable that the profit-sharing plan which the company now has in force will be retained, as there have been many instances in which it has been of true benefit to the employees.

Mr. W. W. Freeman recounted the marvelous natural resources of the State of Alabama and told of some of the hydroelectric projects which the Alabama Power Company has in course of development. He stated further that in that district, which the average New Yorker is prone to think upon as a wilderness, within the course of a short time there would be in operation plants aggregating 100,000 hp, delivering 250,000,000 kw-hr. of energy yearly, an output which is approximately twice that of the Brooklyn company's plants.

At the close of the evening session the names of the officers for the ensuing year were announced. They are as follows: Mr. C. E. White, chairman; Mr. W. H. Grove, vice-chairman; Mr. F. C. Hill, treasurer; Mr. J. G. Bogart, secretary; executive committee: Mr. E. A. Leslie, chairman; Messrs. P. H. Bugg, W. J. Honan, R. J. Freese, T. Cusack, H. J. Tilden, J. G. McNelis, W. F. Schaller, J. P. Butt, S. B. Mentram and W. F. Wells, ex officio.

#### Massachusetts Public Service Commission Act

By the passage of the so-called Washburn railroad bill (Chapter 784, Acts of 1913) the Massachusetts Legislature has materially extended the powers of the Railroad Commission and reorganized it into a new body with enlarged membership requirements under the name of the Public Service Commission. The present Gas and Electric Light Commission's duties are in no way altered by the act, but the supervision of telephone, telegraph and any other organizations for the transmission of intelligence is transferred thereby from the Massachusetts Highway Commission to the new board. The latter has complete powers of regulation over common carriers of all kinds and possesses the power to initiate investigations regarding rates, service

and capitalization. It has substantially all the powers of the former Railroad Commission, with much greater scope of action and larger resources in the way of staff and advisory assistance. Liberal provision is made for the attendance of the board at state or federal hearings and proceedings outside Massachusetts, with ample powers relating to the conduct of its own work and offices, the examination of books and papers, compulsion of attendance of witnesses and papers, prescription of accounting forms, and valuation of properties.

A section of the act relaxes somewhat the conditions surrounding the issuance of bonds designed to retire other evidences of indebtedness. Free passes and service are prohibited except in specified cases. The board is to consist of a chairman, with an annual salary of \$8,500, and four associated commissioners, at \$8,000 each, an annual appointment being made by the Governor with the approval of the Council, for a term of five years.

The membership of the board, and the periods of service are: Messrs. Frederick J. McLeod, of Cambridge, five years; George W. Anderson, of Boston, four years; George P. Lawrence, of North Adams, three years; Clinton White, of Melrose, two years; George W. Bishop, of Newton, one year. Messrs. McLeod, White and Bishop were members of the Railroad Commission.

### Lexington (Ky.) Franchise Annulled by Referendum

Opponents of the franchise recently granted to the Kentucky Utilities Company, of Lexington, Ky., have succeeded in having it annulled by a referendum vote, this feature having been incorporated in the new charter of the city which is governed by a commission. It is the only Kentucky city so organized. Plans are now being considered for a new franchise, a referendum committee of citizens having arranged for the employment of an expert to assist in drawing up a franchise ordinance which will be submitted to the company. Mr. Percy M. Chandler, president of the company, has indicated that if a reasonable franchise is submitted the company will approve it.

### Louisville Merger Company Ready July 2

The formal merger of the public-service corporations of Louisville, Ky., under the name of the Louisville Gas & Electric Company will, it is expected, be accomplished July 2, as meetings of directors of the companies interested have been called for that date, when the required consent of two thirds of the stockholders should have been obtained. The component companies of the new merger are the Louisville Lighting Company and the Louisville Gas Company, which have been owned by H. M. Byllesby & Company, of Chicago, and the Kentucky Electric Company and the Kentucky Heating Company. H. M. Byllesby & Company have purchased the franchise offered by the city of Louisville at the upset price of \$250,000, and agreed to a schedule of electric rates which had been discussed previously, so that there is no longer any obstacle to the formal consolidation. The city of Louisville is preparing to withdraw its suit to prevent the merger of the Kentucky Electric Company and the Louisville Lighting Company, a legal detail which will be accomplished without difficulty.

General George H. Harries, president of the Louisville Lighting Company and Louisville Gas Company, who is to be president of the Louisville Gas & Electric Company, expects the merger to become an active operating company by July 15. He has announced that none of the officials of the Kentucky Electric Company will be taken into the organization of the new company. This leaves Mr. Robert E. Hughes, president, Mr. T. S. Strong, chief engineer, Mr. C. C. Ousley, assistant to the president, and others at

liberty. The consolidation will add but one new executive of importance to the present staff of the Louisville Lighting and Gas companies, Donald McDonald, president of the Kentucky Heating Company, who is scheduled to become vice-president and general manager of the Louisville Gas & Electric Company. Announcement has been made of the prospective retirement on July 1 of Mr. J. J. Humphreys, who has been chief engineer of the Louisville Gas Company, and Mr. A. T. Macdonald, head of the new-business department of the Louisville Lighting Company. Mr. McDonald will handle the details which have fallen to the lot of Mr. Humphreys heretofore, while the post of new-business manager will be abolished and the work distributed among other officials. The company's readable monthly publication, *Chained Lightning*, was recently discontinued.

The Standard Gas & Electric Company will be the holding company for the Louisville Gas & Electric Company. None of the stock of the latter will be marketed except that used in acquiring the Louisville Heating Company, the holding company of the Kentucky Heating Company, which is the gas company entering the merger. The stock of the Kentucky Electric Company, amounting to \$3,600,000, has been practically all pooled with A. J. Carroll, attorney for the company, who will receive a profit of \$474,000 in payment for it and distribute it among the stockholders. The stock is sold to the new company at \$74 a share.

### Public Service Commission News

New York Correspondence

The Public Service Commission has received special permission from the Public Service Commission of the First District to put into effect seven days after publication a supplement to its schedule of rates for motor service. The new supplement gives a schedule of discounts to be allowed on monthly rates ranging from 25 per cent on quantities between two and ten hp-hr. to 50 per cent on quantities in excess of 80,000 hp-hr. In its application the company states that recently it had a request from an industrial firm for the supply of electrical energy in quantities so large that it is necessary to extend the old scale of discounts to make an attractive rate to the prospective consumer.

The Public Service Commission for the First District has been served with a writ of certiorari issued by Supreme Court Justice L. A. Giegerich on the application of the Richmond Light & Railroad Company. The application asks for a review of the commission's order of March 1, 1913, and March 15, 1913, regarding the completion of the double-track on the company's street railroad line known as the Camden Avenue or Brighton Heights line, between Second and New England and Broadway, West Line Brighton Station Island. The writ is returnable to court days. It is supplementary to the writ of certiorari issued by the Public Service Commission in 1912 to require a single-track or a double-track line.

Ohio Correspondence

The Cincinnati Gas, Light and Electric Co., of the Cincinnati & Eastern Trusting Company of Cincinnati, is now \$3,000,000 in debt for a subscription issued to obtain energy purchased from the Cincinnati Electric Illuminating Company. The subscription, issued originally on the ground that there is no permanent home for electrical power that cannot be obtained from some other source, is now in a state of liquidation.

Albany Correspondence

The action of the Maryland Public Service Commission ordering a reduction in the rates for gas and electricity to Baltimore and its vicinity has been set aside by the consolidated First Electric Light & Heat Company in making preparations for the increase in prices to be made by the



new rates. In the electric division the standard maximum rate for service will be 8.5 cents a kw-hr., with a minimum charge of \$1 a month. A rate of 10 cents has heretofore been in force. There is a change as to minimum charges. Formerly the minimum rate was \$12 a year. Now it is \$1 a month. It is considered likely that after the new rates have been in force for some months a movement will be started looking to the establishment of a sliding scale for gas and electricity.

## Current News Notes

**AUTOMOBILE LAMPS TOO POWERFUL.**—A Municipal Court judge in Chicago recently fined two men \$5 and costs on the charge of having lamps on their automobiles so constructed and so equipped with reflectors that the light therefrom was projected more than 300 ft. from the machine.

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**TREASURY DEPARTMENT ADOPTS METRIC WEIGHT FOR DIAMONDS.**—Assistant Secretary of the Treasury J. F. Curtis has notified the collectors and other officers of the customs that on and after July 1 the unit of weight for imported diamonds, pearls and other precious stones will be the metric carat of 200 milligrams.

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**NORWEGIAN-AMERICAN RADIO-TELEGRAPHY.**—On June 20 the Norwegian parliament took steps to ratify a contract between the government and the Marconi company providing for a wireless service between Norway and America. Under the contract the Norwegian government is to spend \$560,000 in the erection of a station at Stavanger which will be connected with a station at Boston.

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**TELEPHONE RATES IN CHICAGO.**—Acceptance of the ordinance passed by the Chicago City Council on May 26 fixing telephone rates was filed by the Chicago Telephone Company on June 16. The main provisions of this new schedule of rates have already been indicated in this journal. The acceptance of the ordinance means that the rates of the Chicago Telephone Company in Chicago are fixed for the next five years, regardless of any action the Legislature may take in establishing a state public service commission.

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**COMMISSION FORM OF GOVERNMENT FOR CITIES.**—At the recent session of the Illinois Legislature the law permitting the commission form of government for Illinois cities was amended so that after trying the commission plan cities can go back to the old plan of government by mayor and city council after a trial of two years rather than four years, as the law has read heretofore. Another amendment relates to the recall of municipal officers under the commission form of government. Hereafter an election contemplating the recall of municipal officers, except judicial officers, may be held on petition of 25 per cent of the registered voters instead of 50 per cent, as heretofore.

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**PROPOSED ELECTRICAL DISPLAY IN NEW YORK ON JULY 4.**—A plan is on foot in New York City to do away this year with the municipal fireworks display and substitute for it extensive electrical illumination features, which it is thought will be equally spectacular and at the same time set an example for the more general adoption of the "safe and sane" celebration of Independence Day. An appropriation of \$25,000 has been voted by the Board of Estimate for this purpose, of which it is reported that \$10,000 will be devoted to the electric lighting display. It is understood

that this money will be used in providing special illumination in various parks and for general electrical decorations. William R. Johnson is chairman of the illumination committee.

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**TERMINAL SITUATION IN CHICAGO.**—The Western Society of Engineers, the City Club of Chicago, the Cook County Real Estate Board and other organizations have asked the Chicago City Council committee on railway terminals to appoint an expert technical commission to make a thorough study of railroad terminal plans and proposals, recommending the plan which will serve best the future growth and development of the city. The matter was presented to the committee at a meeting held on June 23, but the aldermen did not seem to be impressed, declaring that the present subway and harbor commissioners of the city were competent to act as technical advisers. By a vote of nine to four the Council committee has expressed its opposition to the idea of a central union passenger station for all the railroads.

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**WARNING TO LINEMEN USING HEMP HANDLINES.**—One of the helpful suggestions which many of the delegates to the Chicago N. E. L. A. convention took home with them was the note of warning included in an experience related by Mr. W. L. Abbott, an operating engineer for the Commonwealth Edison Company. A lineman upon a pole threw a dry handline to a fellow workman standing on the ground underneath him. After falling the line lay across a 2200-volt lead. Although it was a perfectly dry day, the man on the ground picking up the line, supposedly of pure hemp, was instantly killed. Close examination of the hemp rope showed that each strand of it contained a single fine iron wire about the size of that used in lamp cord which had acted as a conductor for the current that had caused the fatality. It would be well for all central-station operators whose men use hemp handlines near high-voltage lines to examine these lines to prevent similar accidents.

\* \* \*

**SWORDS INTO PLOWSHARES.**—A regular army bayonet, converted from an instrument of war and destruction into an implement of peace and conservation, now forms part of the hand-telephone kit of every forest ranger in the United States Forest Service. These bayonets have binding posts fixed to their ferrules and are used as ground rods to establish a return connection with the single-conductor telephone lines which are being built through the wilds of the principal national preserves. The most important use for these lines is the reporting of forest fires. When a ranger wishes to communicate with headquarters he takes a coil of bare wire from his kit, throws it over the nearest telephone wire, and "saws" on the two ends until a good connection is established. Meanwhile his bayonet has been thrust deep into a moist place in the ground, and with the circuit thus completed the lonely wayfarer can talk with civilization, report his position or summon help.

\* \* \*

### SOCIETY MEETING

**ELECTRIC CLUB LUNCHEON.**—On June 19 a committee of the Electric Club of Chicago submitted a report on the pending patent legislation which contained a discussion of certain sections of the Oldfield bill and offered suggestions for improving the situation. Mr. Alonzo Burt, vice-president of the Chicago Telephone Company, who was the principal speaker of the day, cited some amusing occurrences in the telephone world and read an interesting paper on the organization of the telephone business. In this paper he said that "organization is most important next to capitalization" in any business enterprise.

## Wiring of the Bankers' Trust Building

**Features of the wiring installation and riser-shaft construction in a thirty-one-story office building on Wall Street, New York City**

THE Bankers' Trust Building, No. 14 Wall Street, New York, is a thirty-one-story office building of 8000 sq. ft. floor area. Of the four basements the lowest contains the boilers and engines, while the main part of the third basement is occupied by the ventilating equipment. The floors above up to the third are used by the Bankers' Trust Company, and from fourth floor up there are rentable office floors.

Energy for lighting and motor service is supplied by one 100-kw, 250-volt, and three 150-kw General Electric two-wire generators directly connected to Corliss engines. The generators can carry 50 per cent overload for two hours and momentary overload of 100 per cent. Wiring for lighting is on the three-wire system, there being two balancer sets, each capable of taking care of 100 amp in the neutral. Wiring for motors is on the 250-volt, two-wire system. The main motor load consists of sixteen elevators, eleven being of the traction type, the ventilation system of the bank offices, and various motors operating vacuum cleaners, a pneumatic tube system and other appliances.

Two sets of generator busbars are provided. Each generator may be connected to either busbar through solenoid-operated switches controlled from a benchboard. The benchboard is in the form of a desk, on top of which are mounted the contact buttons. The switchboard was manufactured by the General Electric Company and is a remarkable piece of switchboard design and engineering. The generator buses are in the form of lead-covered cables and are installed in a subway under the engine-room floor. The lighting load is controlled by fused knife switches and the motor load through circuit-breakers. The ventilating fans are controlled from a sub-switchboard, the feeder to which may be connected to either the lighting or the motor bus.

A room which extends to the riser shaft is provided between the switchboard and the ceiling. In this room the riser cables are racked. These cables are in conduit supported at each floor by a 0.5 in. baffleplate drilled to receive the conduit. Cable support boxes are provided at intervals, the cables being supported by conical maple clamps. The panel boxes are installed in the riser shaft, a grill floor being provided at each floor.

The general distribution system for lighting on the rent-

able floors differs entirely from that employed in the Bankers' Trust Company quarters. In each bay there are five ceiling outlets connected together by mainlines and with the main corner outlets connected to switch boxes on the columns. These outlets were fed from the switch box which was found most suited to the arrangement of each individual tenant and the other boxes were capped. Wherever necessary new outlets were installed and extended from the above. Each floor is provided with a long ceiling space, and in making changes in the ceiling outlets it is necessary merely to put a hole in the ceiling location and to fish a flexible conduit from the nearest present outlet. Four mainline receptacles are installed on each corner column, and two on each side column at the floor. All outlets on the columns are so arranged that a partition can be located on the center or at either side of the column, as desired.

The supplies, telegraph, telephone, ticker and other low-voltage circuits are taken from a gallery just inside the building at the first basement down to the third basement, where a separate room is provided for each class of supplies. The service lines of the various contractors supplying ticker, service for elevators, are brought to separate lines, mounted on the wall of one of the rooms, and these lines are grouped around the five main 250-volt buses. An exception to this arrangement is made in the room provided for the telephone service, where connections are made to a rack.



FIG. 1.—ILLUMINATION FROM THE RISER-SHAFT CENTER

For telegraph and messenger service a separate room is provided with many cables and wiring for each floor. These positions are installed at the outside walls and are divided into sections by the main basement and the other low-voltage distribution buses. The positive routing of these messenger cables is considered to be a serious one and the location boxes by conductors. The routing of all larger cables and is used for sub-distribution either directly from one of the above positions or from the corner junctions to the interior columns. The backbone section at each of these junctions is connected by conductors to a main junction in the riser shaft on each floor. A long cable is carried in messenger conduit from the telephone rack to the telephone junction on each of the vent shaft and fixed up in horizontal strips. From these junctions the telephone supply lines run to the small junction boxes on the



outside walls and distributes from the latter by conduits to columns or picture moldings. Where a tenant's switchboard requires a cable larger than a fifty-pair one a conduit from the main junction in the riser shaft to the board is installed.

A No. 12 duplex conductor is carried up through two of the seven riser shafts to junctions on the outside walls and

electrical reset type. Almost the entire building was rented before completion and all tenants moved in during three successive week-ends. As the final connections of the call-bell systems could not be made in many cases until desks were in place, this condition presented a serious problem. An elaborate schedule was made giving every desk a num-

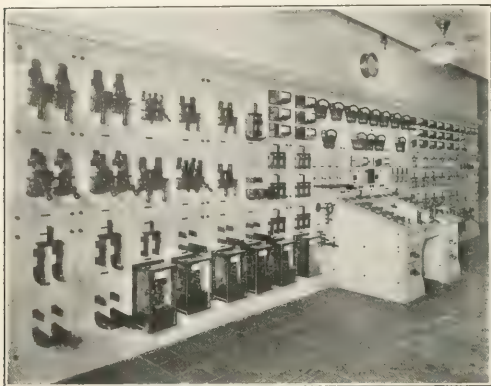


FIG. 2—VIEW OF SWITCHBOARD



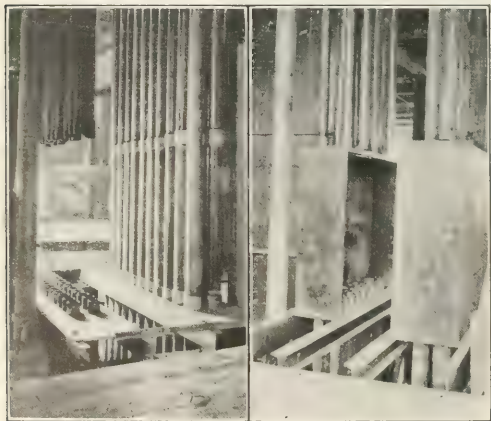
FIG. 5—MAIN BANKING ROOM, FIRST FLOOR

also to the main junctions in the riser shafts for "battery" service. Energy for this service is supplied by two 250-watt, 240-to-30-volt motor-generator sets and a twelve-cell, 10-amp discharge storage battery. This equipment also supplies energy to the elevator-signal system and telephone system, the local telegraph system throughout the building and a system of emergency lighting in the engine and boiler rooms. The lamps of the emergency system are automatically switched on in case the regular lighting circuit should fail. Although the lighting circuits in the machinery room are connected back of the generator circuit-breakers, the emergency system is very desirable at night when only one generator is running.

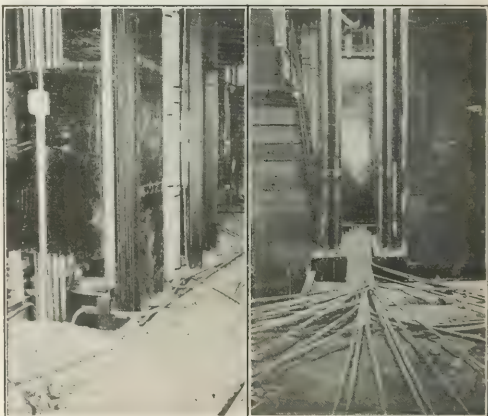
Practically every tenant in the building has an extensive

ber, and before the desks were put in place all the material required for connection was packed together separately for each desk until it was needed. The extent of the system for some of the tenants may be judged from the fact that in several cases from 10,000 ft. to 12,000 ft. of wire was installed on a single floor and that some annunciators have as many as fifty-five drops. On one floor the system was so complicated as to require sub-junction boxes with interconnection strips to be installed with cables between and to annunciators.

The horizontal wiring for these systems was installed on the picture molding and in the conduits from junctions on the outside walls to the interior columns where these were available. From the picture molding down to the



FIGS. 3 AND 4—DETAILS OF RISER-SHAFT CONSTRUCTION



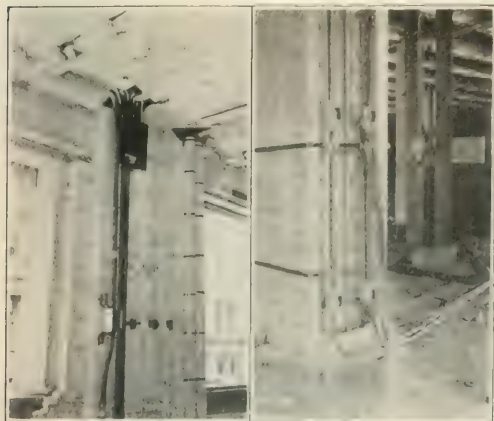
FIGS. 6 AND 7—RISER SHAFT AND BRANCH CIRCUITS

call-bell system. In every case the circuits were installed by the electric contractor for the building under the direction of the engineers, this resulting in uniformity throughout. All wire is of No. 18 gage insulated with a 1/32-in cover of 30 per cent Para compound and an outside cover of a distinctive braid. All annunciators are of the De Veau

annunciators and desks use was made of conduits buried in walls or metal molding.

The picture molding is of steel, and although care was taken in mitering the corners many sharp edges were left. The call-bell wires were also disturbed by the various companies installing tickers and other wires in the molding, and

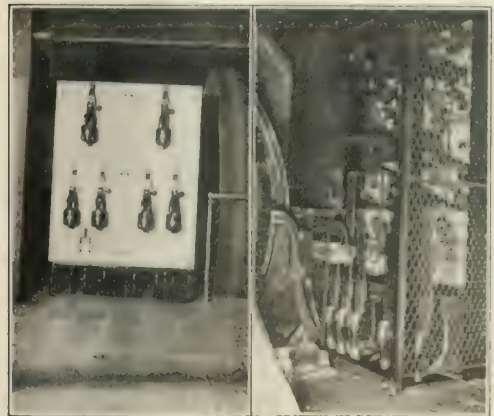
as a result grounds were frequent. The bell plant was therefore seriously loaded, and it was practically impossible to keep the system free from grounds. Finally a small fuse was installed at the points where battery service was taken off for each floor and the positive side of the battery system was grounded through a switch. In this manner the



FIGS. 8 AND 9—LOW-TENSION WIRE JUNCTION BOXES AND CONDUIT WORK ON COLUMNS

trouble was cleared at once, because a ground on any floor opened the fuse at that floor. A complaint from a tenant then located the trouble. To keep the positive side of the system free from accidental grounds the permanent ground is transferred to the negative side at intervals.

The Bankers' Trust Company's quarters were treated in an entirely different manner from the rentable floors. The lighting is controlled from panels conveniently located, certain groups of lamps being controlled from separate sections or panelboards through remote-control switches. The lighting for these quarters is for general illumination only



FIGS. 9 AND 10—FRONT AND REAR VIEW OF GENERATOR PANEL

and all desks are provided with reflector fixtures manufactured for this purpose by the I. P. Frink Company. The counters behind the banking screen are lighted from reflectors at the cornice of the screen. The lighting fixtures on the first and second floors and in the public space on the third floor are of the plaster glass basin type. The cen-

ter of the second-floor banking room is lighted indirectly by lamps equipped with reflector plates on top of the screen partition and covered with colored glass screens. The remainder of the general lighting is of the direct type.

A gridiron system of lighting and floor lines was provided for both the lighting and low-tension wiring of wires, telephones and call bell wiring is installed in the same conduits. This system was made necessary by the constant changes required in the arrangement of desks. The equipment of the office was entirely decided when the work was in progress. The difficulty of a desk with connections or thirty or more wires from one side of the floor in order to be readily changed was avoided. At the first stage of construction it was necessary merely to remove a few blocks and put the floor into a permanent position, so as to give the correct line of the counter, and install floor lines, under furniture and in the gridiron system. It was then necessary only to change the floor position and the floor was not affected in any way by the change. A network of sub-junction boxes is connected to each other and to the main lines and to each other by cables, some bonded at junction points, and these boxes were connected to the under-floor system by conduits. To change the arrangement for a desk it was necessary merely to install wires from the main line to the floor, to the junction box, and to the desk structure, and to make other connections in other rooms that of routine nature.

With cables are connected from a main battery rack in the basement to the main junction in the banking room



FIG. 11—TYPICAL CEILING CONSTRUCTION IN WORKING ROOM

ters, and all cross-connections are made in this box. There are two separate telephone systems operated from separate switchboards, one for interior and one for outside calls. In all cases only one instrument is installed on each desk and a transfer box is provided. On a number of desks there is also provided a "talking key" so that one line may be held while the other is connected to the instrument. In several cases visible signals are grounded to indicate which line is calling and only one line is permitted.

The wiring in the underfloor system is from main to each junction or sub-junction boxes, where floor covered sub-junction boxes are installed. In making connections to desks the cable from the floor was terminated in connection strips mounted on a short brass pipe. From this strip the connection to the desk was installed in a sub-junction box. The lamp connection in connection was installed in a small brass connection, which was mounted on a short brass pipe. This arrangement allows considerable latitude in the location of the furniture and also allows the furniture to be moved for cleaning without disconnecting the wires.

Automatons are generally of the Van Nostrand type with electrical front, but one is made of several hand type sets, some of which are equipped with lines. A skeleton of hand type sets is shown in the banking room. The bank yard, which extends through the first and second floors, is



approximately 40 ft. square. Wiring for the interior was installed through channels cut in the plates when the vault was being built. These channels are staggered in successive plates. The wiring for lighting is controlled from two remotely operated switches, one for each level, and located outside the vault, so that when these are opened at night there is no current inside the vault.

The electrical equipment in this building was designed by Messrs. Henry C. Meyer, Jr., and Bassett Jones, associated consulting engineers, Architects' Building, 101 Park Avenue, New York City, and installed by the Lord Electric Company.

### Electrical Rehabilitation of the Rock Island Railroad Shops in Chicago

Among recent improvements and additions made at the Forty-seventh Street shops and yards of the Chicago, Rock Island & Pacific Railroad in Chicago were the installation of a new generating plant, the replacement of steam-driven shafting by electric group drive and the rearrangement of the lighting distribution to meet present needs more efficiently. The changes were made primarily to avoid the smoke nuisance and also because the old generating equipment was entirely inadequate and so antiquated as to entail serious losses in operation. During the periods of maximum demand the pressure on the 110-volt lighting circuits would

Battey and the supervision of construction in charge of Mr. H. H. Dickinson, of that company.

#### GENERAL CONSIDERATIONS

Group drive was considered preferable for the old machine tools owing to (1) the saving in the cost of new motors, (2) the utilization of the old shafting, and (3) the higher load-factor of operation obtained for each motor.

Interior lighting for the shops was laid out on the basis of 0.25 cp per square foot of floor area. This figure represents an average of 0.6 watt demand per square foot of floor area, which is slightly lower than the average of modern illumination.

The site chosen for the power plant is as close to the center of demand for steam, air and electrical energy as the surrounding conditions would permit. Owing to the nature of the soil, it was necessary to drive 200 piles, each at 2-ft. distances center to center, before the foundation was started.

The power-house building is a fireproof steel structure supported on concrete footings and walls, which extend up to the level of the generator-room floor. Fig. 3 is a view of the generator room, Fig. 1 is a general plan of the whole power house, and Fig. 2 is a cross-section. Concrete is used for the floors, roof, windowsills and copings.

Natural light for the generator room, which is 40 ft. by 90 ft., is provided by corrugated glass windows set in steel frames, which occupy the greater portion of three

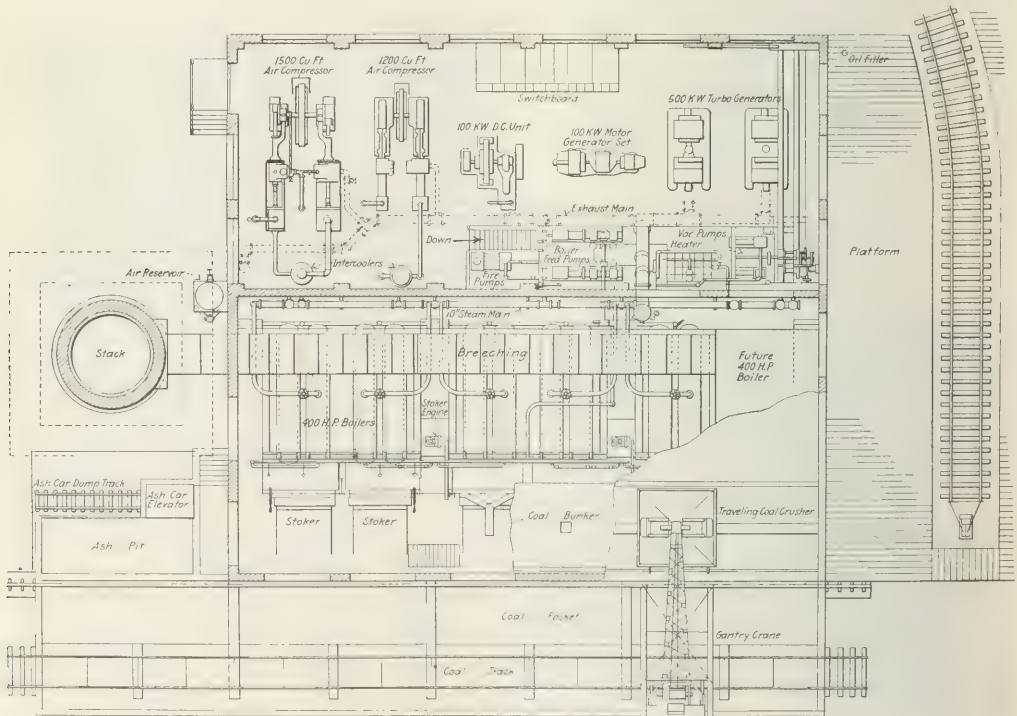


FIG. 1—GENERAL PLAN OF THE POWER HOUSE

drop as low as 60 volts, owing to insufficient steam supply for the engines. The lighting and motor wiring throughout the buildings and yards was also in such poor condition as to necessitate immediate attention.

The task of rehabilitating the various facilities at these shops was intrusted to The Arnold Company of Chicago, the engineering being in the immediate charge of Mr. P. L.

walls. White enameled brick is used for the wainscoting to a height of 6 ft., the floors and side walls being joined by a rounded concrete finish to prevent the accumulation of dirt. The floors have had a granite-chip finish to reduce the possibility of concrete grit getting into the bearings of the machines. Artificial light is furnished by ten 250-watt tungsten lamps.

## ELECTRICAL EQUIPMENT IN POWER HOUSE

In the generator room are two 625-kva, 480-volt, three-phase, 60-cycle General Electric alternators directly connected to two non-condensing horizontal Curtis steam turbines running at 3600 r. p. m. Ventilating blades on the generator shaft maintain a circulation of air around the machine. The air used for cooling the generators is drawn

past the and expelled from the generating room. Ventilating and also serve to distribute energy for lamps and motors in the various shops. On the panel controlling the synchronous motor are two handles actuating remote oil switches for the starting and running conditions of the motor. On starting, the fields of the machine are left open-circuited, and the motor is brought up to speed by indu-

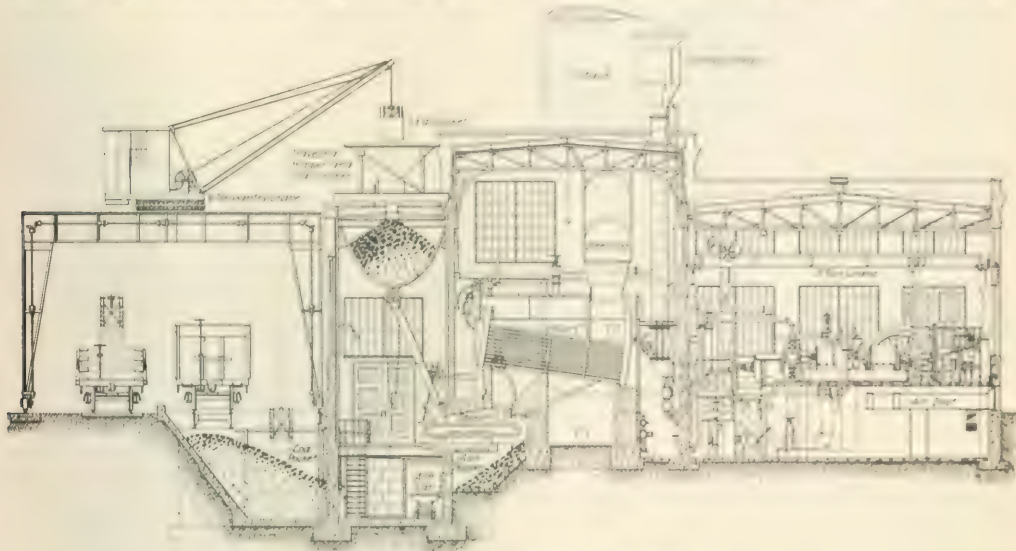


FIG. 2. CROSS-SECTION OF LOWER FLOOR

in from outside through ducts. At the end of each turbine is a board on which are mounted a steam gauge, a vacuum gauge and a speed indicator which gives the percentage above or below speed. The turbo-generators are used for supplying practically all of the electrical energy used in the shops and yards. Fig. 3 shows one of these units, the motor-generator set, and the oil switches mounted back of the switchboard.

In the middle of the room is a motor-generator set which runs at 900 r. p. m. This set consists of a 100-hp, 480-volt, three-phase, 60-cycle synchronous motor, a 100-kw, 220-110 volt interpole, compound-wound, three-phase generator and a 25-kw, 125-volt interpole, compound-wound generator for excitation service. The 100-hp, 480-volt generator which is also directly connected to the synchronous motor is used for supplying energy for the three-wire direct-current lighting system and for direct-current motors in the shops.

In addition to the generators mentioned, there is a 100-kw, 250-volt Westinghouse direct-current generator directly driven by a 150-hp Ideal steam engine, which runs at 275 r. p. m. This set is one of the few pieces of the old equipment which were found in condition to be utilized. In case the alternators are shut down temporarily for any reason and it is desired to furnish direct-current, the 220-110-volt generator of the motor-generator set is operated as a motor by energy supplied by the steam-driven 100-kw generator.

The small steam-driven generator may be used to convert the direct-current feed alone in case the motor-generator set becomes inoperative, or may be operated in parallel with it.

## SWITCHING AND CONTROL EQUIPMENT

A sixteen panel switchboard is supported on a frame of steel resting on the east side of the generator room. The panels, which are equipped with the usual

motor action. When the running switch is closed and the starting switch is opened, the motor runs as a synchronous motor. An automatic trip operated by a time-lag relay, energized through the motor, is provided to prevent an excessive overload.

Switches are also arranged so that the current from the current generator can be run in parallel with one side of the three-wire system but cannot be reversed. The bus can be opened so as to insure that this current will not be transmitted.

One of the panels has been furnished specially to supply energy for the lamp equipment. A three-phase double-throw switch permits of supplying this equipment with energy from either the three-wire system or the three-phase system after it has been stepped down to 120-volt supply. The lighting of the structure is kept constant by a constant electric voltage regulator.

## SAVED MONEY BY REPAIRS

Besides the electrical equipment, there were in the power house many other items of equipment, which were being used in the old equipment. These are made of high-quality materials and are of a high standard of construction. A very few of these items were found in condition to be utilized.

Some of the items found in the power house were of a high standard of construction and were of a high standard of construction. A very few of these items were found in condition to be utilized. Some of the items found in the power house were of a high standard of construction and were of a high standard of construction. A very few of these items were found in condition to be utilized. Some of the items found in the power house were of a high standard of construction and were of a high standard of construction. A very few of these items were found in condition to be utilized.



added economy of condensing. The exhaust steam is utilized for the heating system during cold weather.

#### STEAM RAISING AND FUEL HANDLING

Five 400-hp boilers with 4080 sq. ft. heating surface are installed in a 44-ft. by 90-ft. room adjoining the generator

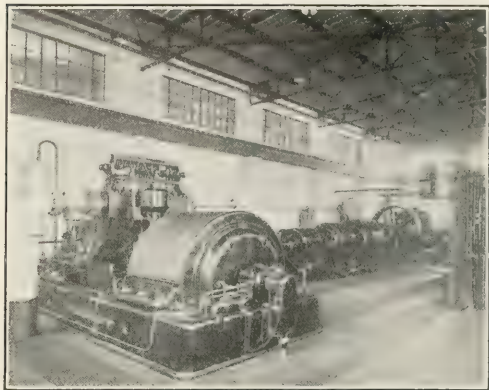


FIG. 3—GENERATOR ROOM IN POWER HOUSE, ROCK ISLAND RAILROAD SHOPS

room. Special attention was paid to the design of the combustion chambers, which are of the Dutch-oven type so as to insure smokeless combustion. The throat of the combustion chamber is flared, but is kept at a small cross-section so as to make the velocity of the gases high. A baffle placed in the path of the gases deflects any unburned particles back into the furnace, where they are consumed. After installation it was found almost impossible to force the boilers above their rating, owing to the design of the combustion chamber. To remedy this, the arches of two



FIG. 4—GANTRY CRANE FOR COAL HANDLING

boilers have been raised, increasing the cross-section and allowing the boilers to be forced above rating. This is being done tentatively, however, subject to the approval of the city smoke inspectors, on condition that the change shall not prevent practically smokeless combustion.

Fuel handling at this plant presents some interesting features. Underground concrete hoppers having space for

500 tons of coal were built adjacent to the boiler room (Fig. 2). Coal is unloaded directly from hopper-bottom cars on a track immediately above the bunkers or else by means of an electrically operated gantry crane, shown in Fig. 4. This crane is also available for handling shop material from cars on a track paralleling the power house, storehouse and forge shop. The underground bunkers are divided into separate compartments by concrete walls and are supplied with water-piping connections for drawing off or transferring from one compartment to another. From the outside bunkers the coal is transferred by the crane to a hopper and coal crusher traveling on rails on the roof of the boiler room. This crusher runway is immediately above the overhead inside coal bunkers, and the latter are large enough to contain 200 tons of coal in addition to the 500 tons in the underground bunkers. Ashes are taken to a pit by dump cars and thence loaded into railroad cars by means of the gantry crane. One 37-hp induction motor performs all the operations on this crane.

#### High-Tension Direct-Current Transmission

In a paper presented by Mr. J. S. Highfield before the joint meeting of the British Institution of Electrical Engineers and the French Société Internationale des Electriciens in Paris, on May 21 to 24, was discussed the transmission of electrical energy by continuous current using the series scheme. A detailed description was given of the Thury high-tension system of operation with series generators and motors. Data were also presented comparing the cost of three-phase alternating-current and series direct-current transmissions for various line pressures. There are examples given which make it evident that in many cases the cost per kilowatt-mile of overhead lines is indeed greater than the cost of the continuous-current underground-cable system. While such is not invariably the case, it is interesting that in some cases this result is shown. The underground system permits the use of cables in cities where overhead lines would be prohibited. Such cables are also safe from damage and involve less maintenance expense.

In conclusion, the author enumerated the following advantages of the direct-current series system: (1) The cost of the line is less than the cost of a line of similar capacity for alternating current, more particularly where underground transmission is desirable. (2) By the use of the earth as one of the conductors a very large saving in the cost of the line can be made, a saving not possible with alternating current. (3) The switch gear and switching operations are very simple. (4) The operation of several stations in series is less difficult than the operation of several stations in parallel. (5) The uniform section of the cable permits of an increase in load, supplied at first from one point, to be readily provided for at the other suitable points on the line by other stations, without adding to the cable system. (6) Very efficient speed regulation of the motors is obtained.

Opening the discussion, Mr. Thury said that, as a sort of confession of faith he would himself admit that the applications of the series direct-current system are limited. Constant potential remains the system for distribution, and alternating-current transmission suits this in most cases. The series system is advisable, however, for very long-distance transmission and when underground cables are desirable. For distribution the series system is limited to cases in which there are only a few consumers of large size. It has also enabled problems to be solved which would be impossible with alternating current. For instance, in crossing small stretches of sea in an American installation, series operation was adopted because the cable makers would give a guarantee only in the case of single cable. Tests show that direct-current cables absorb a negligible

amount of energy, and this is confirmed by its being possible to test them with a small electrostatic machine. At Lyons it was found that a cable with insulation only 0.07 in. thick would stand 300,000 volts. Mr. Thury placed the limiting size of generator at a higher figure than Mr. Highfield and referred to a recently developed scheme involving the use of 5000 kw divided between two armatures.

In answer to a question by Mr. Claude, Mr. Thury said that no electrolytic troubles occur in the cables, since by the process of manufacture there is no trace of moisture in them.

Mr. Boissonas described a special case in which several generating stations were wanted, and although it would have been possible to run them in parallel, it was yet deemed advisable to make use of the high-tension direct-current system. The arrangement ultimately decided upon was to have two groups of stations, three high-tension direct-current plants and three three-phase plants, the two groups being interconnected and working on to the same distributing network.

On the St. Maurice and Lausanne system, Mr. Thury said that iron earth-pieces were used which, although they should theoretically have been destroyed by electrolysis in less than two months, nevertheless worked as well after a year as they did on the first day, owing to the formation of a protective film of oxide iron. No electrolysis of pipes had been noticed. If necessary, one might have to go several miles to find a place for a good ground.

Mr. J. F. C. Snell said that while the series system simplifies distribution, it complicates the generating system. The small size of units is one of the difficulties.

Mr. F. C. Raphael remarked that in case of a ground on the cable the automatic regulator in the station would continue to maintain the current at its regular constant value no matter how large a proportion was leaking at the fault, so that the result would be an enormous drop in pressure at the substations and consumers' connections.

Mr. Thury said that he had had practically no experience with faults on the line. He recalled only two cases in which he had had to shut down the generating station in consequence of them. He mentioned one other case in which a fault had been sufficient to set fire to the pole and burn it through, thus re-insulating the line, as the spot part remained suspended in the air.

return were used for the signaling with direct-current wires. With a voltage pressure of only 2 volts, but no trouble had been experienced. Mr. Smith said he was impressed by the simplicity of the substation arrangement. Adjoining some of the substations there were armatures which were in all

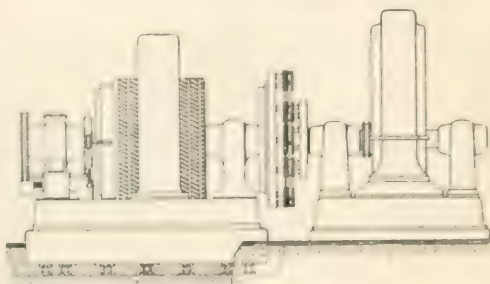


FIG. 2.—SUBSTATION FOR DIRECT-CURRENT SYSTEM.

type that he thought the transformer would be used in the substations in the substations.

Mr. B. M. Jenkins said that he was not sure of the proper simplicity of the arrangement.

## The Rating of Induction Motors

BY ALFRED GRAY

If the rating of induction motors is changed from one with an overload guarantee to a single rating with no overload margin, certain damage will be done in the design of the machine.

The standard induction motors now on the market are able to carry full load continuously with a temperature rise which is less than 75 deg. C. and can carry 25 per cent overload continuously with a rise in temperature of less than 90 deg. C.

The present tendency of the manufacturers, and it is a reasonable one, is to use overhead machinery in the line

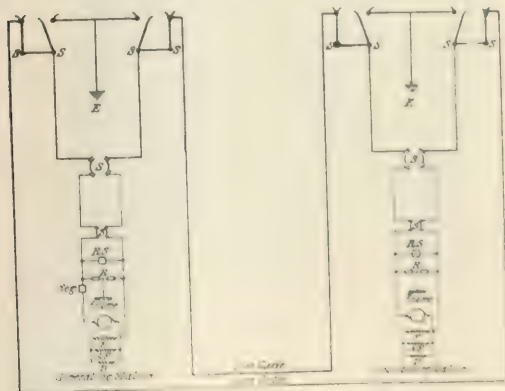


FIG. 1.—DIAGRAM OF CABLE SYSTEM FOR HIGH-TENSION DIRECT-CURRENT SYSTEM.

Mr. Roger Smith said that 1200 kw is about the power needed for an average freight train, and that this rating would be a suitable unit for motor generators on a railway system. One earth cable, he said, had been flowing for months under the Great Western Railway, where all

TABLE 1.—INDUCTION MOTOR PERFORMANCE DATA FOR THE MOTOR

Motor	Power	Speed	Efficiency	Temperature Rise
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000
1000 kw	1000	1000	1000	1000

which it had 1000 (nominal) watts the rise in temperature at 100 per cent was 75 deg. C. The ordinary induction motor, when in operation, will rise to 75 deg. C.

If the standard of rating be reduced to be increased by the standardization committee of the American Institute of Electrical Engineers, it seems that the rise in temperature required in standard motors is a change of temperature of 75 deg. C. would have to be changed to 90 deg. C. and would be rated at 100 per cent of temperature rise at 100



deg. C., but it would be the same machine as before and would therefore be expected to do the same work and no more. It is the purpose of the present article to point out that other changes will be made, which will compel the use of temperatures higher than those now found in standard machines.

Fig. 1 shows the "circle diagram" for a 10-hp standard induction motor. The guarantees which would be made on this machine under the two methods of rating are given in Table I, it being assumed that the motor is the same in each case.

The guarantees based on the single rating show a smaller starting torque, a higher half-load power-factor and a lower full-load efficiency and speed than is expected by the purchaser. In an endeavor to make these guarantees

TABLE II—VARIATION WITH DIFFERENT WINDINGS

	Old Winding	New Winding
Horse-power	19	19
Speed, in r.p.m.	1135	1143
Efficiency		
Half load, in per cent	87.5	87
Three-quarters load, in per cent	88	88.5
Full load, in per cent	86.8	88
Power-factor		
One-half load, in per cent	81	76
Three-quarters load, in per cent	88	85.5
Full load, in per cent	90.5	88.5
Temperature rise at full load, in deg. C.	50	45
Starting torque, times full load	1.45	1.7
Starting current, times full load	4.7	5.7
Maximum torque, times full load	2.4	2.9

more attractive the flux per pole will be increased by decreasing the number of conductors and the size of each conductor will be increased so as to keep the total weight of copper constant. The characteristics of the machine will then be changed in the following way:

The starting torque will be increased since it is proportional to the square of the flux. Full-load current in the rotor will be obtained with a smaller slip and therefore the full-load speed will be increased. The core loss will be increased because of the increase in flux; the copper loss will be decreased because of the decrease in the number of conductors and the increase in their cross-section. The efficiency will be increased and therefore the temperature rise will be less than 50 deg. C. The magnetizing current will be increased and the power-factor at fractional loads decreased.

Fig. 2 shows the circle diagram for a 15-hp standard motor when wound with 10 per cent fewer conductors of 10 per cent larger cross-section than standard, the rotor being unchanged.

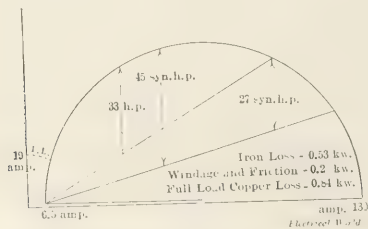


FIG. 1—CIRCLE DIAGRAM FOR A 15-HP, 440-VOLT, THREE-PHASE, 60-CYCLE, 1200-R.P.M. MOTOR

From these figures it may be seen that the machine with the increased flux has more attractive guarantees than the machine which has the winding unchanged. Thus the tendency under the single rating will be to produce machines with flux densities which are higher than those at present in use.

The statement is often made that in changing from the present rating with an overload guarantee to a single rating with no overload guarantee motors will be rated 25 per cent higher but will be used for the same load as before. If, however, the flux is increased, as is sure to be the case in order to make the guarantees as attractive as possible.

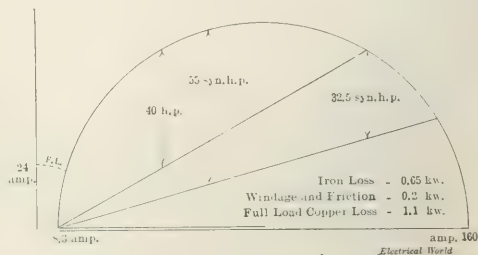


FIG. 2—CIRCLE DIAGRAM FOR A 19-HP, 440-VOLT, THREE-PHASE, 60-CYCLE, 1200-R.P.M. MOTOR

then, in order to show a high power-factor at light loads, the average load on the machine must be greater than at present. Therefore preparation should be made for the higher operating temperatures which are certain to follow.

### Hydroelectric Station for Construction Purposes

In connection with the construction on the White Salmon River, Washington, 75 miles east of Portland, Ore., of the 20,000-hp hydroelectric development it was found necessary by the Stone & Webster Engineering Corporation to establish a temporary hydraulic plant for the purpose of furnishing electricity for carrying on the work incident to the building of the large plant.

A flume 9 ft. 3 in. wide, built of wood, diverts water from the stream right through the new 125-ft. dam now in process of construction, carrying it to a point a few hundred feet below the dam where the small wooden power house has been established. The prime mover is a 54-in. turbine built by the S. Morgan Smith Company, York, Pa., operating under a 13-ft. head and capable of delivering a maximum of 300 hp. The turbine is directly connected to a generator rated at 150 kw and 440 volts and the electrical energy is used for various purposes on the immediate work, including quarrying on top of the hill 400 ft. above the dam, operating concrete mixers, lighting, drilling, etc. It is also used at a point more than a mile down the river where the power house is being built, to which point it is transmitted at 6600 volts. The depth of water in the flume is kept at 6 ft. by an ingenious arrangement of gates such that when the water falls below 6 ft. a by-pass is closed and the flow is built up; when the water tends to exceed 6 ft. the by-pass is opened wide and the excess water is thrown into the bed of the stream between the big dam and the temporary power house.

The main development, which is to be operated by the Northwestern Electric Company of Portland, will have a head of 175 ft. and an impounded volume of 40,000,000 cu. ft. of water. This water is gathered from a drainage area of 350 sq. miles and is held back by a concrete dam of the solid gravity type, 470 ft. long with a 250-ft. spillway 125 ft. in height. Water will be carried from the dam to the power house by a wood-stave pipe 5100 ft. long and 13.5 ft. in diameter, emptying into a concrete forebay. From this point two pressure pipes 700 ft. long and 9 ft. in diameter will give the operating head of 175 ft. Part of the energy will be used near by and part transmitted to Portland for general lighting and industrial purposes.

# Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

## "Home-Made Week" at La Crosse, Wis.

"Home-made Week" was celebrated by the people of La Crosse, Wis., during the closing days of May. For the time being the merchants of the city gave up their show windows to the manufacturers, nearly a hundred of whom



"HOME-MADE WEEK" EXHIBIT OF LA CROSSE COMPANY

took advantage of the opportunity to have their products made better known locally. Among the prominent displays was that of the La Crosse Gas & Electric Company, which occupied a corner building and was brilliantly illuminated. The accompanying illustration shows the window exhibit of the central-station company, which included an electric dining room, complete with toaster, percolator, stove, fan, etc. Mr. Thurston Owens is manager of the La Crosse Gas & Electric Company.

## Jurisdiction of Public Service Commissions

The Indiana Railroad Commission having issued an order directing the placing of headlamps of not less than 1500 cp on locomotive engines of railroad companies operating in Indiana, suit was brought by the Vandavia Railroad Company to enjoin the enforcement of this order and the collection of penalties for failure to comply. Judgment was rendered for the defendant and the case was appealed. Judge Erwin, of the Indiana Supreme Court, in affirming this decision (101 N. E. 82), gave the following opinion:

(1) All powers not delegated to the federal government by the Constitution are reserved to the states. (2) The states have full power over interstate commerce and may pass such laws regulating the same as they may deem expedient. (3) Since Congress had passed no law covering the case, the Indiana Legislature had power to pass a law authorizing the Indiana Railroad Commission to prescribe and require the use of headlamps on locomotives, even though this might affect interstate commerce. (4) The granting of such power was not equivalent to investing the Railroad Commission with legislative powers. (5) The act granting such power was not unconstitutional as being a law which in order to take effect depends on any authority. (6) The act was not unconstitutional on the ground that its subject was not contained in its title. (7) It is not essential to a valid law to a statute that the subject be expressed in exact terms if it is fairly deducible from the terms employed. (8) Since a supplementary law gave to the railroad company the right to have orders of the com-

mission reviewed in the proper court, the act in question was not unconstitutional as depriving the railroad of its property without the assent of law. (9) The passing of said act was a proper exercise of the police power of the state. (10) An order of the Indiana Railroad Commission requiring the placing of headlamps of not less than 1500 cp was not fatally defective through uncertainty of its terms.

## A 13,200-Volt, 2-Mile Transmission for City Factory Service

The electrically motor-driven load at the Worcester (Mass.) Electric Light Company has made it necessary to build a new-line substation in the heart of the city to handle the service in factories near the business district. The company's main generating plant is Webster Street, 2 miles from the center of the city; delivery service is the distributing system at 2300 volts, but the size of the factory load in the vicinity of the substation necessitated the inauguration of a 13,200-volt transmission. The substation is now under construction and is a 20-ft. by 25-ft. brick building, with concrete floor and roof, at the intersection of Southbridge and Sargent Streets close to a number of metal-working and textile industries. It will contain three 300-kva transformers with a five-panel switchboard and single set of buses and will supply energy over local three-phase and single-phase 2300-volt lines for both power and factory lighting service. Three underground cables will connect the substation with the Webster Street plant. The unusual feature of the work is the use of a 13,200-volt transmission for so short a distance, to enable the company to serve economically a district of dense manufacturing requirements.

## Electric Business in Clifton Forge, Va.

The Virginia Western Electric Company owns the franchise for furnishing electric service in Clifton Forge, Va., which expires in 1937. The city has a population of 6900, of whom about 1000 are colored. It is a fairly well railroad town, fully served by the lines of the Chesapeake & Ohio Railroad Company, so that heavy consumption of electricity cannot be expected. However, there are now 200 motors installed and there are over 4000 kilowatt-hours at the moment. The city has a large factory lighting load, some 1000 kw. in capacity, and the city has storage for some 5000 kw. hours, from a water reservoir. The city council has for the night of 1913 authorized some at the rate of \$100,000, and has passed a resolution for the company to supply the service. The terms are very liberal to the Chesapeake & Ohio Railroad Company. Most of the company's work is done in the form of back-purchase of power for industrial purposes in the city. At the present time the maximum load on the system is 1000 kw. and the city has a large day load, which is mostly supplied in the form of the Chesapeake & Ohio Railroad Company's power. The city has a large number of its consumption, but the rate of a 1000 kw. per hour for lighting service and 1000 kw. per hour for power service. Mr. W. H. Matthews is president of the Virginia Western Electric Company and Mr. A. C. Cook is secretary, treasurer and general manager.



### An Electric Ball-Game Window Display

The accompanying illustration shows the ingenious lamp and fan window display of the Kentucky Electric Company, Louisville, Ky., mention of which was made in these columns June 14. The players are represented by incandescent lamps mounted on black-wire bodies and legs in most lifelike poses, and the contest is between the "Tungsten" and

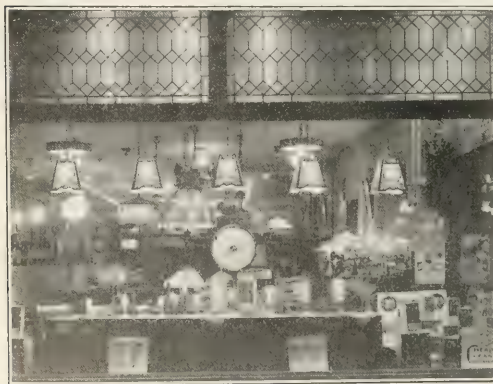


ELECTRIC BALL-GAME WINDOW DISPLAY AT LOUISVILLE, KY.

the "Carbon" teams, with the former winning three to one. A frosted lamp personifies the umpire. During the exciting moments of the game the electric "fans" grouped on the bleachers give vent to their enthusiasm by spinning wildly with much breezy chatter. A flasher mechanism beneath the diamond controls the lamps and fans to produce the effects described. Local interest is added by dubbing the winning nine with the names of the Louisville team, while on the grand stand are those of well-known enthusiasts.

### Counting the Cost to the Customer

The passer-by who tarries for a minute in front of the display window of the Metropolitan Electric Company of Reading, Pa., can learn just what it costs to run each of



A "LOW-COST-OF-LIGHTING" WINDOW DISPLAY AT READING, PA.

the various lamps there shown, ranging from 25 watts to 250 watts, as they are flashed on in succession by a motor-driven switching device. A Donkin "cent-hour-meter," which forms the central feature of the exhibit, is connected in circuit with the various lamps as they are lighted, so that the pointer indicates directly the number of cents per hour it costs to operate each unit.

The display includes both tungsten and carbon lamps, affording the layman an opportunity to compare the energy consumption of each, and thus to confirm the statements he has heard or read. All the lamps are fully labeled with explanatory legends detailing the wattage, candle-power, etc., of each and directing attention to the reduced energy consumption of the modern high-efficiency units. The attractive window display of the Metropolitan Company is shown in the accompanying illustration.

### Electric Pumping Outfits at Stockton, Cal.

In San Joaquin County, Cal., in which Stockton is located, the underground water level is so near the surface that it is found cheap to raise the water by electric pumping for use in irrigation. Accordingly more than 300 electric pumping outfits are in operation in San Joaquin County and the surrounding territory, operated from the lines of the Western States Gas & Electric Company. Since the beginning of 1913 the company has gained 2250 hp in motor business.

### Oakland's Bid for Manufactures

Every progressive community is anxious to have factories located within its bounds and will do everything possible to promote their welfare. That the Pacific Coast must become

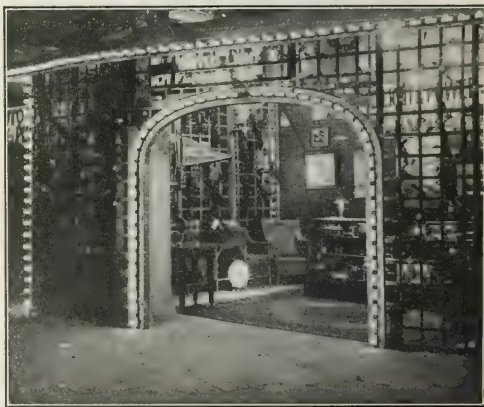


FIG. 1—ENTRANCE TO ELECTRICAL BOOTH, OAKLAND MANUFACTURES EXHIBIT

a great manufacturing community in order to supply the wants of the millions of people who will settle there in the near future is keenly appreciated by the coast cities and they are exerting themselves to attract these industries to their own particular fields. Electric service companies are not usually classed as manufacturers, but their officers realize the great benefits to be derived from association with and promotion of all civic organizations working for the development of manufacturing. During April the manufacturers' committee of the Oakland (Cal.) Chamber of Commerce held an exhibition of products manufactured in the county.

The United Light & Power Company of Oakland was represented by a unique exhibit, installed in an artistic low-roofed garden house, constructed of green lattice-work having 6-in. squares, interwoven throughout with strands of autumn leaves. The interior was lighted by 60-watt ceiling lamps and reflectors. In the background a large glass showcase contained a great variety of electric appliances, and on the wall behind it were shown photographs





## Economy of Electric Drive for Air-Compressor Service

As an example of desirable day-load service extending through several hours at a time the accompanying data from a central station report on the electric driving of an air compressor in a large foundry plant suggest helpful methods of securing this class of business. The compressor was required to deliver 310 cu. ft. of air per minute against 100 lb. pressure, and a 50-hp engine or motor was determined upon as necessary for its operation. The service conditions required the operation of air blast five hours each forenoon at full capacity, with an afternoon operation for molding machines equivalent to filling the storage tank in the establishment three times to 1000 lb. pressure. The motor-service survey indicated that to drive the compressor with a 50-hp engine would call for an investment of \$1,200, the annual cost of the service being shown in Table I.

TABLE I—STEAM OPERATION

Interest, depreciation and repairs, 15 per cent.....	\$180
Coal, 390 tons at \$4.....	1,560
Engineer, \$1 per day (proportional).....	310
Water, 750,000 gal. at 10 cents per 1000 gal.....	75
Oil, waste and ash removal.....	50
Total.....	\$2,175

The above coal estimate is based on a consumption of 5.5 lb. per hp-hr., running seven hours per day at 50 hp, with 600 lb. of fuel per day allowed on the average for banking the boiler, including Sundays and holidays. Feed water is based on 8 lb. per pound of coal.

The investigation indicated that the operation of the compressor by an electric motor on central-station service would require an investment of about \$600 for a 50-hp, three-phase induction motor and \$100 for wiring. Allowing 15 per cent for interest, depreciation and repairs, the estimated total yearly cost of electrical operation is given in Table II.

TABLE II—ELECTRICAL OPERATION

Interest, depreciation and repairs.....	\$105
Power, \$141 per month, approximately.....	1,690
Heating, 50 tons coal at \$4.....	200
Engineer's time, \$1 per day, 150 days.....	150
Total.....	\$2,145

The estimated monthly energy consumption is 6720 kw-hr., with a maximum load of 70 hp. The afternoon operation includes one-half hour's total service, equivalent to filling the storage tank three times as above mentioned. Although the above comparison shows about the same cost in each case, the central station points out that the electric drive is more advantageous, enabling the service to be handled flexibly and releasing space otherwise tied up by engine-room equipment, coal pockets and ash pits, permitting the enlargement of productive apparatus and easier rearrangement of the latter to meet new conditions. The point was also made that electric rates are fixed definitely for various loads, decreasing as the power consumption increases and from year to year becoming less as the company's business grows.

Subsequent to the above investigation the company pointed out that the installation of an automatic motor starter costing \$238 and a pressure governor at \$27 to operate it would enable the motor to be shut down a minimum of fifteen minutes per day, when it would otherwise operate at 25 per cent of normal load, carrying merely the friction load. It would in this way save a yearly interest charge of over \$13.20, figuring the interest at 5 per cent, through the decreased energy consumption.

## Illumination and Wiring

### An Inexpensive Double-Reading Night Sign

In the arrow design shown in the accompanying illustrations it is only the filaments of the lamps which are lined up in the pattern to be reproduced, the frame on which their sockets are mounted being necessarily distorted slightly.



FIG. 1—ARROW SIGN AT NIGHT

The lamps, it will be noted, are held in the vertical plane so that the display appears the same from both sides. The sign is, of course, essentially a night display, but when lighted its appearance is extremely attractive viewed from either side.

Thirty-three 15-watt tungsten lamps are used in the stem and barbs, with a 60-watt unit at the point of the arrow. The receptacles employed are No. 50,715 sockets, screwed and soldered to the double frame, which is of galvanized iron. Galvanized-iron wire forms the barbs of the arrow point. The two parts of the frame are held together by the



FIG. 2—ARROW SIGN IN DAYTIME

lamp connections only, and thus serve as conductor buses in addition to forming the framework for the sign. All parts of the frame, receptacles, etc., are painted black, so that at night only the lighted lamp filaments are visible. At a distance of 100 ft. or more the lines of light appear continuous. The cost of the sign, complete, was \$28.85, including lamps and labor of hanging.

The arrow sign shown is in use in front of a motion picture theater at Arlington, Wash., but the novel idea of its construction is not of course confined to such displays alone. Mr. E. G. Robinson, manager of the Jim Creek Water, Light & Power Company, of Arlington, Wash., devised and installed the sign described.

### Electric Sign of Associated Advertising Clubs

The accompanying illustration shows an electric sign erected by the O. J. Gude Company, of New York, for the annual convention of the Associated Advertising Clubs of America held recently in Baltimore, Md. The sign was 60 ft. high and 60 ft. wide and bore a reproduction of the



ELECTRIC SIGN OF ASSOCIATED ADVERTISING CLUBS

slogan of the Associated Advertising Clubs. The lettering was in white, the outline of North and South America in green, and the two circles in red. The word "Truth" remained lighted constantly, then the outline of the two continents appeared, then the outer circle of red and finally the lettering. The sign was presented to the association by Mr. O. J. Gude for use at future meetings of the Associated Advertising Clubs.

### Magnetite-Lighting Costs at Dallas, Tex.

An ornamental street lighting installation consisting of 423 4-amp direct-current series magnetite lamps supported on ornamental posts has been completed at Dallas, Tex. This new lighting system includes three installations on the main business streets, the one on Elm Street between Market and Harwood being composed of 102 lamps, while the other two installations, on Main and Commerce Streets from Market Street to Central Avenue, together include 321 lamps. The ornamental posts are 40 ft. high and are bringing the arcs 15 ft. above the street level and are staggered on each side of the street at 70 ft. intervals.

By the terms of the contract with the city and property owners on Elm Street the owners pay \$2,000 front foot for the installation, while the city pays for lamps on public grounds and at street intersections. The average running foot on Elm Street was lower than that charged on Main and Commerce Streets owing to the fact that the concrete sidewalks did not extend to the curb line, which made the installation of the underground work less expensive.

In the case of Main Street and Commerce Street a charge of \$2.50 per front foot was assessed against the property owners, the city paying for the street intersections and public buildings. This assessment is intended to

cover the cost of the posts erected and the underground work complete. The Dallas Electric Corporation furnished all overhead wires from the generating station to the point of delivery to the underground system as well as two switchboard panels and instruments which were needed at the power house.

Under the terms of the contract, which extends over a period of five years, the lighting now 400,000 ft. 445 per lamp per year, the low cost system being made out of the electricity generated there and the other foot being made by the city. During the five-year period the central station company will also maintain the system.

### Lighting of the Roman Bath, S.S. "Imperator"

Deep in the huge hull of the great steamship *Imperator*, which last week completed her maiden voyage across the Atlantic, the swimming bath is spacious and magnificent Roman bath and swimming pool enclosed in the heart of the famous natatorium of the London Automobile Club, an illustrated description of which was given in these columns Aug. 10, 1910. The bath aboard the great ship was given in lavish disregard for the limitations of space which space extravagance failed to the traveler accustomed to the ordinary steamer stateroom accommodations. This main Roman salon, elaborately finished in bronze and marble, measures 30 ft. long and 40 ft. wide, extending through two decks. Surrounded by massive Pompeian pillars and marble benches in the pool itself, 20 ft. by 30 ft. in plan and 7 ft. deep.

An ingenious adaptation of "skylight lighting" gives the room, extending deep in the bowels of the ship, the appearance of an open-deck compartment. The ceiling is divided into seventy-five panels of diffusing glass, behind each of which there is mounted a ring-shaped fixture supporting four powerful tungsten lamps. These units project a uniform, diffused illumination upon the blue waters of the pool below, filling the entire apartment with an unusually agreeable quality of light.

At the level of the intermediate deck a visitors' gallery encircles the room, behind pillars. The passageway beneath this gallery affords access to the various showers, Turkish, Russian, hydropathic, electric-light and electrical bath rooms.



SWIMMING POOL

interior which extends to the bow of the ship. These passageways are lighted by means of a direct beam of light from the ceiling. The interior is finished with marble and is equipped with all the modern conveniences of a first-class hotel.

For the convenience of the passengers, the bath is lighted by the electric and gas of the Imperator. The bath is a most complete and modern, equipped with all the latest in lighting and heating equipment, including a 200-hp. generator.



to which there is an emergency set driven by an internal-combustion engine and located on the upper deck, which is held in reserve to furnish energy for corridor lighting and wireless signaling in case of the flooding of the main engine room.

### Unusual Uses of Electric Signs by Churches

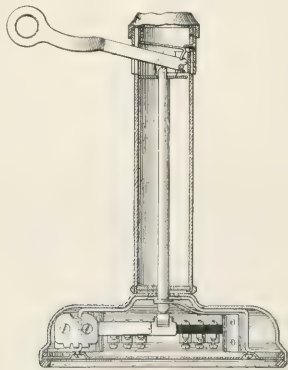
Churches are using electric-sign advertising to an increasing extent to show the way to grace and for other purposes. Two 500-watt tungsten lamps have been attached to the spire of the Immanuel Baptist Church on Michigan Avenue, Chicago, at a height of about 250 ft. It is planned to have the lamps lighted at dusk and burn until dawn. Electricity for the entire church is supplied by the Commonwealth Edison Company of Chicago. The lamps have been installed to remind the public of the presence of a church and will eventually, it is hoped, serve to increase the attendance.

Electric lamps on a prominent Baptist church were installed for a somewhat different purpose. A cluster of five lamps, arranged to flash every two minutes, was intended to show the birth rate in China. By this method it was hoped to impress those attending the Northern Baptist Convention with the need of a larger missionary fund.

### Recent Telephone Patents

#### DESK INSTRUMENT

While the desk telephone has long since reached a standard form, its internal design varies widely. In a desk stand patented by Mr. N. Pederon, of Chicago, the switch springs are located in the base with the induction coil. One spring of the set carries a rubber roller against which a vertical spindle acts to shift the contacts. The spindle in turn is



TELEPHONE DESK INSTRUMENT

driven by the hook lever which is removable and is latched in position by a spring. A section of the stand is shown in the illustration herewith. The patent has been assigned to the Cracraft-Leich Electric Company.

#### SYSTEM FOR USE ON MOVING TRAINS

Mr. H. Von Kramer, of Birmingham, England, has invented a system for signaling from moving trains. His system includes both telephone and telegraph signaling. A loop circuit is arranged along the track and look circuits are wound around the cars to lie in a plane parallel to the track. Transmission is effected by induction between the loops. Separate receiving and transmitting loops are arranged so that conversation or signals both ways may be had simultaneously.

#### ANTISEPTIC DEVICE

A rather elaborate antiseptic device is described in a patent granted to Mr. E. A. Dieterich, of New York City. A containing box is secured to the transmitter front by the clamping action of the mouthpiece. Two drums are provided so that a strip of fibrous material may be drawn across the mouthpiece from one to the other. The storage drum is hollow and loaded with perfume which reaches the inside surface of the strip. The outer surface is hand-treated with disinfectant from a revolving brush the spindle of which is driven by the storage drum.

#### PARTY-LINE SYSTEM

The feature of the party-line system patented by Mr. B. C. Groh, of Trenton, and assigned to the Stromberg-Carlson Telephone Manufacturing Company lies in the method of short-circuiting simultaneously all receivers on the line. If the operator wants the line while it is in use by two or more of the stations connected thereto, she may apply energy from the battery. Relays then operate at each station to cut out the receivers. The transmitters are not cut out of the circuit, and hence the operator may determine which party wishes to continue to use the telephone.

## Letter to the Editors

### The Myriawatt

*To the Editors of the Electrical World:*

SIRS:—Those interested in one way or the other in the attempt being made, largely through the instrumentality of the American Institute of Electrical Engineers, to erect a trade rating to the status of a scientific unit will, it is hoped, have accorded to them at some future time the privilege of reading in the *Transactions* of the Institute an account of the discussion on the "myriawatt" which formed part of the program of the mid-winter meeting of that body in February. What follows has been held awaiting such publication, and is now presented while the matter to which it relates, and which is subject to final action at any time, is yet more or less within the memory of those who read the announcement of the proposed "new unit" about a year ago.

This discussion recalled the traditional attitude of the party orator toward a delicate political situation, which he evades by occupying his time on the floor with eloquent tributes to the constitution. As a glorification of the metric system the discussion was a success, but none would learn from the remarks of many of the speakers that the actual subject under consideration was a boiler rating. When the proposed rating, euphemistically styled "a new power unit," was specifically referred to, it was with little reference to its assumed merits, but rather to its character as a cunning expedient whereby recalcitrant "mechanicals" were to be enmeshed in the metric net. That in a public discussion plans and specifications should be revealed of a trap set for brother engineers is certainly ingenious, and seemingly implies a sorry opinion of the intelligence of those to be overcome.

The discussion might, however, have been much enlivened if an analysis had been offered at the meeting showing the absolute lack of any scientific basis for the proposed "new power unit"; by pointing out the absurdity of endeavoring to perpetuate, without possibility of further revision, a boiler power rating based upon an engine heat consumption per horse-power-hour corresponding to the thermal units in 34.5 lb. of steam evaporated from and at 212 deg. Fahr.—this at a time when a lengthy search would have to be made to find an engine of such inferior efficiency, in a day when steam prime movers are sold on a guarantee, on the above basis, of less than 10 lb. of water, and when a claim is made for a figure below 8 lb. Further incitement to

debate might have been offered by pointing out that the decimal relation upon which the myriawatt rests is entirely fortuitous in any scientific, or even schoolboy, sense—that the relation would actually be 20 or 30 instead of 10 if the horse-power rating of boilers more nearly corresponded with present-day engine efficiencies; by dragging out of the woodpile for closer inspection the fact that the fundamental and sole base of the proposed "unit," the quantity 33,479, or approximately ten times the value of the kilowatt-hour in pound-Fahrenheit thermal units (3,415), is merely the product of 34.5 (pounds of water) by 970.4 (thermal units) to evaporate 1 lb. of water from and at 212 deg. F. a. b. t.; furthermore, by showing that any rating connecting a boiler with an engine which is based upon a standard evaporation is a scientific absurdity, for the reasons, among others, that there is no physical relation between the boiler evaporation and the specific steam consumption of an engine, and that the rate of evaporation which fixes the supply of energy to the engine depends upon many independent boiler variables, such as heating surface, ratio of grate to heating surface, type of boiler, kind and quality of coal, kind of draft, method of firing, etc. One sufficiently brave might even have been tempted to point out that scientifically and practically the "new unit" would have little more status than a hydraulic power unit based, in connection with a "standard" head, upon the size of a water-powered dam.

But it may be thought by some that if the proposed "unit" should serve a useful practical purpose the matter of its hybrid character, its unscientific basis, could well be overlooked. This would be a regrettable position for a member of the American Institute of Electrical Engineers to take on a proposition committing that body to an action so astonishingly at variance with its past enviable record in relation to units; though, of course, commercially justifiable if the proposition were one put forward instead by a boiler-manufacturers' association to meet an unsatisfactory trade boiler-rating situation.

The myriawatt, however, has not even this excuse, either from the standpoint of the engineer or the manufacturer, for, as previously pointed out, it does not in a single particular differ from the existing trade horse-power boiler rating except in name and in an increase of about 2 per cent in value. The grave practical fault of a boiler rating based upon a standard evaporation—a fault which has prevented the use of such a rating in Europe, has led to its entire neglect in this country by the marine engineering profession and by boiler designers, and to its little use by technically educated engineers in general, so that it does not even give a close clue to the size of a boiler for a specific service. For example, the boilers at the Detroit Delray generating station, which would be rated in the proposed nomenclature at 2365 myriawatts each, are said each to supply steam for the generation of 7500 kw. Again, a boiler of 100 myriawatts actual on the basis of natural draft and anthracite coal for fuel would, say, increase to 125 myriawatts actual with good soft coal, to 150 myriawatts actual with high chimney draft, and to 200, 300 or more myriawatts actual with forced draft.

Although a matter of relatively little moment, the name of the "new power unit" is also not free from objection both as relates to the prefix "myria" and to the status of the "ten-thousand" metric multiple. While it is true that the word from which it is derived means, in Greek, ten thousand, in English it has never had that definite meaning, but, as every one knows, has the indefinite significance of "a great number." Even as employed in the single instance in scientific nomenclature aside from the metric system, the Greek meaning is ignored; for the genus "myriapod" comprises those crawling things having, not ten thousand, but numerous legs, such as the centipede. Even the French, with their racial characteristic to follow an idea to its utmost possible consequences, have hated the

the "myria" metric nomenclature, which has never received practical adoption in France or elsewhere. The reason for this is perhaps that it was unconsciously felt to be illogical to use a unit that would increase five to three or seven of its say, four ten-thousands instead of forty thousand.

The sad part of the attempt to make the engineering public as a whole and the engineering trade rating having originally no common base, almost in value has become obsolete, and which in its proposed form would not admit of being brought up to date in the illustration given here of the American Institute of Electrical Engineers through its committee on the metric system. In the past that committee had taken the lead among the professional bodies of the world in advocating and securing the adoption of scientific units. Those who, by the adoption, in 1884, through the efforts of the committee, of the metric system, had taken the lead in the matter of organized the Institute, which body subsequently and most in securing the international adoption of the metric system of measurement. It secured the international adoption of the metric system of the metric system, and the largest factor in this was the practical use of the metric system in the metric system, and also to those countries which are not yet metric. In this and in other similar work the Institute previously closely adhered to scientific method—to the method of taking the metric system minds that have laid down the principles of scientific physical relation, and which scientific standardization should be based in order that such standardization shall aid in the future progress of the metric system. It is a pity that the Institute, in its attempt to secure the practical politics in order to advance the cause of the metric system, it is a pity that the metric system, that the metric system is an isolated system in its history.

With absolutely no hope of international adoption; with little hope of securing adoption in other countries in the vicinity of which it is simple to disregard from existing trade rating, obsolete in value, persistently agreed by great bodies of engineers and to which there have been given merely a new name and form that render impossible future revision of value, a proposition that was not derived from the European engineering press and submitted for presentation before the group meeting, meeting of the International Electrotechnical Commission, had not been given to it even the courtesy of mention in the official report of the meeting—these and other considerations surely present a situation which seems to call for some serious official action on the part of the American Institute of Electrical Engineers. The probable natural death of the "new power unit" would not absolve the Institute from such responsibility as it is really assumed in giving it life; for the real effect of its endorsement will linger beyond the grave. The case appears to call for a definite official announcement by its governing body, in regard to the privilege of the Institute in the name and action of its representatives.

In conclusion, it may be pointed out that as a result of attempts made to connect, possibly another American engineering body, to the metric system, which would have imposed an official obligation on the entire membership, the entire society, so far as its constitution is concerned, to grant a preliminary official endorsement of propositions of which the myriawatt was a part, as an official standard, but to which the entire society, which is a body of members from the governing body, with representatives, was not admitted to the vote of the membership at large. A similar endorsement to the A. I. E. E. constitution would be the same and would most gravely compromise the position of the governing body in such a situation, and of course, as will be made the subject of this article.

—E. J. HARRINGTON, Jr.

W. D. WATKINS



# Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

## Connection Board for Metering Power

The accompanying illustration shows an improved arrangement for reading the current in three lines using only one ammeter, as well as for reading three-phase watts with only one single-phase wattmeter. The board is "fool-

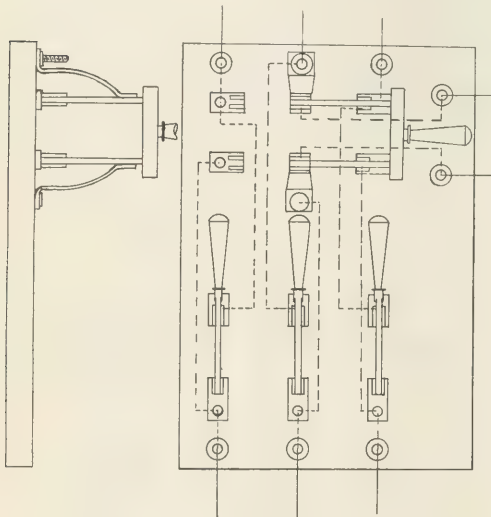


DIAGRAM OF CONNECTION BOARD

proof" when properly wired up, and it is difficult to make an error in connections.

No interlocking mechanical parts are necessary. The number of special pieces required is reduced to a pair of raised clips which convert the double-pole switch into a triple-throw connection. The three single-pole switches serve as line switches and as ammeter-short-circuiting switches.

If the three lines coming from the source of power are connected to the three terminals at the top of the board and the load is connected to the three terminals at the bottom, the circuit is closed by using the three single-pole switches. The current in the left line is read by connecting the ammeter to the two terminals at the side of the board and closing the main switch to the left. Opening the left single-pole switch allows the current in this line to pass through the meter. Next, by closing the single-pole switch, moving the main switch to a position vertical to the board so that it makes contact with the raised clips, and opening the middle single-pole switch, the current in the middle line can be read. For the current in the third line, close the last single-pole switch, move the main switch to the right and open the right-hand switch.

To measure power with a single-phase wattmeter, the current coil of the instrument is connected in series with the ammeter, and one end of the potential circuit is led to the middle terminal at the top of the board. The other potential terminal of the wattmeter is then led to the left-

hand or right-hand line corresponding to the one in which the current coil is connected. The sum of the two readings gives the total power being transmitted. No wattmeter reading is, of course, taken with the current coil in the middle line. When the power-factor is less than 50 per cent the smaller wattmeter reading will be negative and should be subtracted from the larger.

The connections indicated by the dotted lines are made on the back of the board. Equipped with 60-amp, 125-volt switches and suitable terminal posts for the external connections, the board measures 12 in. by 20 in.

Two of these boards have been in use for two years in a very busy laboratory and have given entire satisfaction.

## The Attendantless Rotary-Converter Substation at Detroit

The Rowena Street 500-kw rotary-converter substation of the Edison Illuminating Company of Detroit is operated with no attendant in the substation itself, all the operations of starting, stopping, voltage control and load adjustment being performed from Station I, a mile away.

The automatic substation feeds into the Edison three-wire network in a residential section which has recently enjoyed unusual growth. For the latter reason the Edison company was faced with the alternatives of installing excessive feeder copper or putting in a new substation to hold up the voltage on this part of the system. No control wires connect the automatic station with the operating point, the only conductors extending between the two stations being the main 4400-volt triple-conductor primary cable carrying the main energy from Station I to the converter equipment. Automatic devices installed also protect the equipment in case of disturbances on the line or accidents within the substation itself.



FIG. 1—INTERIOR VIEW OF AUTOMATIC ATTENDANTLESS SUBSTATION

An account of the installation and operation of this automatic substation was given by Mr. H. R. Summerhayes before the convention of the American Institute of Electrical Engineers at Cooperstown, N. Y., June 23. Referring to the diagram of the circuits, Fig. 5, there is installed in the main station a 4400-volt, 60-cycle, three-phase starting compensator with one-third, two-thirds and

full voltage taps and an induction regulator with 20 per cent voltage range. Of the four oil switches, No. 1 is a magnetizing switch, Nos. 2 and 3 connect with the compensator, and No. 4 is a running switch.

The converter at the substation is a six-phase, twelve-pole, 250-300-volt direct-current machine running at 600 r.p.m. A bank of three 175 kva. 4400-205 volt oil-cooled transformers supply energy to its alternating current side. The substation building is without windows to prevent noise being heard in the street, while light and ventilation are obtained through roof openings.

#### OPERATION AND STARTING

To start up the converter, the operator at Station 1 proceeds as follows:

First, the induction regulator is set at maximum lowering position.

Second, the magnetizing switch is closed.

Third, the one-third-tap switch is closed, throwing one-third voltage on the line leading to the Battery Street substation. The converter starts on this low and reaches synchronism in twenty or thirty seconds. Within 5 per cent of synchronism, the governor closes the control circuit of the field contactors and the four-pole contactor, permit-

ing so as to give the rotary full normal field current. The control circuit of this contactor was closed by the governor at the same time as the other contactor, but its operation was delayed by a time-limit relay. The operation of this contactor is immediately evident to the operator at Station 1 by the increase in current on the alternating-current line.

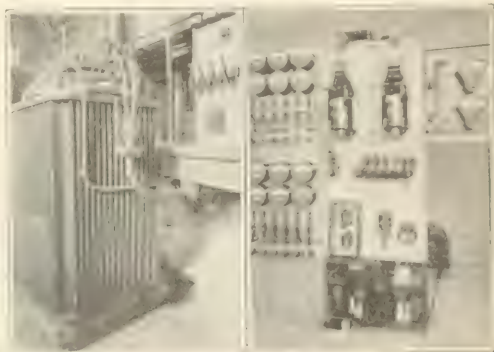


FIG. 1—INDUCTION REGULATOR AND CONTROL PANEL FOR ROTARY CONVERTER

ting the changing of the power-factor from lagging to leading.

Fourth, at this point the converter is running at synchronous with full field and correct polarity and is all ready to be connected to the direct-current main, excepting that its voltage is low, owing to the position of the induction regulator. The operator now brings up the voltage by the induction regulator, and at the same time raises the number of the converter tap to a very small percentage low voltage on the line, the current making sufficient current. This device is differentially wound, and is being connected to the bus and the other to the brushes of the converter. The voltage may vary at different times of day from one to four per cent, and even 10 percent the lower. This differential device acts only when the synchronous generator voltage exceeds the full voltage by a small percentage. The normal value is low.

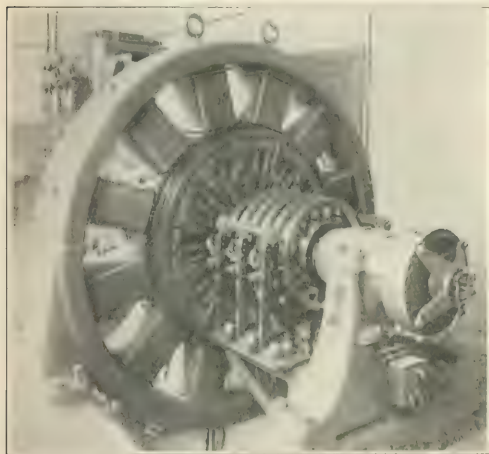


FIG. 2—SLIPPING END OF CONVERTER WITH A WORKER

immediately, exciting the rotary converter field from the bus so as to give it the correct polarity, but with a considerable resistance in series with the field. As soon as this weak field is thrown on, the rotary converter falls into synchronism with the proper polarity but at one-third voltage. This operation is made evident to the operator at Station 1 by watching his alternating current ammeter, on which the current decreases from the initial starting current to about one-half and suddenly increases as the field is automatically applied, then settles to a low and steady value as the converter falls into synchronism.

Fourth, just after the automatic application of the field, the operator opens the one-third-tap switch and closes the two-thirds-tap switch.

Fifth, the operator then opens the two-thirds-tap switch and closes the running switch. After the closing of this switch the converter is in synchronism, but is operating at a low direct-current voltage on account of the position of the induction regulator and operating with a very weak field. On account of the weak field the power-factor at this time will be lagging.

Sixth, within a few seconds, the second field contactor automatically operates, cutting out sufficient field flux to

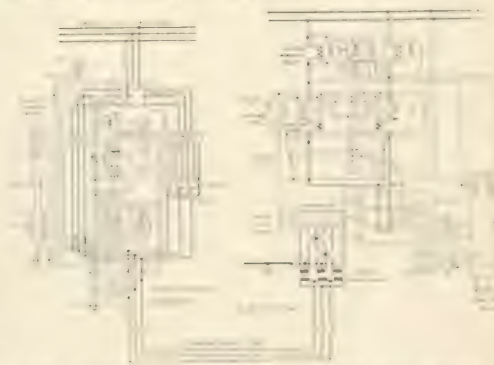


FIG. 3—SCHEMATIC DIAGRAM OF CONVERTER AND CONTROL CIRCUIT

cut through the control relay wind, restoring the closing coil of the two-thirds-tap switch and connects the synchronous generator to the busbars. The action is so constructed that the rotary can be made to take any percentage of load that is required. Ordinarily it is so adjusted that when the busbar load is near the converter rating about one-third load.



### CONTROL AND AUTOMATIC PROTECTION

The voltage at points on the Edison three-wire system in the neighborhood of the Rowena Street station is observed at Station I by means of the pressure wires ordinarily used on these Edison systems, and the amount of load taken by the converter at Rowena Street is changed by the operator to meet the voltage conditions on the system. The change in load is effected by manipulating the induction regulator.

The amount of load at any time is indicated by the alternating-current ammeters in connection with the indicating wattmeter and the power-factor meter.

To stop the synchronous converter, the running switch at Substation I is opened. This disconnects the alternating-current supply and leaves the synchronous converter running as a direct-current motor. The reverse-current relays are set so that they will operate on the current which the converter takes as a direct-current motor and their operation opens the main circuit-breakers and disconnects the converter from the direct-current busbars. As the converter slows down, the governor resumes its starting position and the field contactors open so that everything is ready for a new start.

### PROTECTION

In case of a short-circuit on the alternating-current system the direct current feeding back from the latter systems through the synchronous converter operates the reverse-current relays and opens the solenoid circuit-breakers.

In case of a local alternating-current short-circuit the alternating current feeding into the short-circuit operates the overload relay and opens the main switch at Station I, disconnecting the converter from the line. If both reverse-current relays should fail, the speed-limiting device and the overload coil are both available to open the circuit-breakers.

The field of the converter is protected by a double-pole overload relay. The shut-down of the converter from any cause is indicated by the underload relay at Substation I. The bearings are of the ring oiling type, so that very little trouble may be expected.

In addition to the governor for closing the field circuit, the synchronous converter is equipped with the usual centrifugal speed-limit device.

The illuminating company expects to extend this remote-control system to other substations. The fire risk is practically nil, except for the chance of the windings of the machine taking fire from an accidental burnout. This may be minimized by automatic extinguishers.

Automatic rotary-converter substations of this type, said Mr. Summerhayes in conclusion, enable the Edison three-wire system to be extended as a means of economical distribution over territories much greater than now possible. With the labor expenses limited to daily inspections, it becomes possible to operate substations where previously the density of the load would not have warranted such installations. By using smaller substations set more closely together it will also be possible to reduce the investment in feeder copper.

### An Electromagnetic Window Display

Characteristic of many of the window displays made by branch offices of the National Cash Register Company an interesting electrically operated advertising scheme has been attracting considerable attention recently at the Chicago office of the company on East Randolph Street. Although there is no outward evidence of electrical application, the whole operating mechanism, concealed in the base of apparatus, is electrically driven.

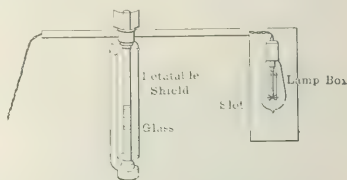
The apparatus consists of a tank about 8 ft. long and 3 ft. wide, filled with water and imitation rocks, so as to rep-

resent a harbor on some rocky coast. A miniature steel ship bearing the name *Good System* skilfully plies its way between the rocks which menace its course, although other boats lie wrecked and stranded on these rocks, which represent business dangers.

Beneath the tank containing the water is a circular track on which runs a small truck carrying a double-pole electromagnet. The magnet receives its energy from the rails, and the ship, which has a soft iron keel, is of course forced to follow the magnet throughout its route. The truck is pulled along the track by a chain which engages with a sprocket on the shaft of an electric motor. The apparatus operates on 110-volt direct current.

### Safety Water-Column Shield and Lamp Box

Safety engineers are recommending the use of rotatable shields on the water-column glasses of boilers, the arrangement being such that the metal protector can be swung around between the workman and the glass when changing



SAFETY WATER COLUMN SHIELD AND LAMP BOX

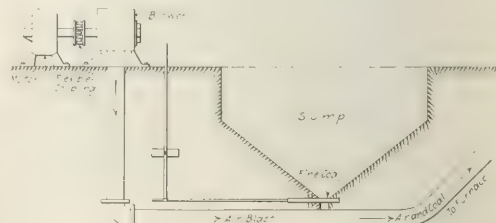
glasses. At other times the shield is moved to a position, as shown in the accompanying sketch, where it serves as a reflector for the light coming from the slotted lamp box, thus aiding the eye in judging the height of the water column. When installing these glasses the workman is cautioned to see that the glass fits loosely and that the glands are in perfect alignment, so that free expansion may take place without danger of breakage.

### Saving the Fine Coal

Can you describe some method of reducing the labor connected with reshoveling fine coal which has fallen unconsumed through furnace grates?

M. R. T.

One of the ingenious devices mentioned in the report of the N. E. L. A. committee on prime movers at the Chicago convention was an arrangement for saving fine coal and getting it upon the grate in a fashion that prohibited it from again falling through the stokers. The company using this



APPARATUS FOR HANDLING FINE COAL

device has installed a motor-driven blower so that it draws air from a sump in the fine-coal pit and discharges it into the furnace above the fire. When it is desired to clean the fine-coal pit the coal is scraped into the sump and the blower started. In a short time all of the fine coal is thus blown into the furnace and the greater part of it is burned before falling to the grate.

# Digest of Current Electrical Literature

## Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

### Generators, Motors and Transformers

**Leblanc "Exciter."** P. EUBENASS. The first part of an illustrated discussion of the principles of operation of the Leblanc "exciter"—that is, an auxiliary polyphase commutator machine connected to the slip-rings of the induction motor to be regulated. Its action with respect to the induction motor is analogous to that of the direct-current exciter of a synchronous motor or alternator. It furnishes to the rotor of the induction motor the magnetizing ampere-turns which are necessary for excitation. It permits one to increase the power factor to unity and even to overexcite the induction motor. The exciter also permits regulation of the speed of the induction motor. This machine has found only a limited number of applications, but it possesses desirable characteristic properties, is small in size and simple in operation.—*La Lumière Elec.*, June 7, 1913.

**Induction Motor Control.**—A note on a recent British patent (No. 8070, 1912) of the Siemens-Schuckert Company. To adjust the speed by varying the frequency and pressure of the power current, a self-excited series-connected commutator generator is joined to a transformer through a choking coil, saturated so that as the frequency of the generator is reduced by altering the ratio of the stator and rotor pressures the effective magnetic characteristic simultaneously drops and stable pressures are produced approximately proportional to the frequency. A transformer with adjustable secondary in parallel with the stator may also be added to the main.—*London Elec. Eng'g.*, June 5, 1913.

**Standardization Rules.**—An article giving in tables a comparison of the standardization rules of the British Electrical and Allied Manufacturers' Association and the corresponding rules of the American Institute of Electrical Engineers and those of the German Association of Electrical Engineers. The comparison is chiefly given in a convenient form in tables.—*London Elec. Review*, May 30, 1913.

### Lamps and Lighting

**Modern Electric Sources of Light.** BEETHOLD MONSEN. A report of recent developments in arc lamps, incandescent lamps and vacuum tubes, to be presented at the next convention of the German Association of Electrical Engineers. The arc-lamp industry has now two competitors, namely, the tungsten lamp in sizes up to 200 cp and compressed gas in larger units. Success has been obtained in the arc lamp industry in the construction of flameless lamps with special electrodes with a life of from 70 to 100 hours. Schaeffer has developed a three-phase arc lamp and Wolfke the white-light cadmium vapor lamp; it is not known whether these two lamps are in commercial operation. The mercury-vapor lamp with quartz globe has been developed for seawater circuits. In the incandescent lamp industry the carbon lamp is being replaced more and more by the tungsten lamp. The tungsten lamp has been improved in two entirely different ways, one of which has been the invention of ductile tungsten while in the other the old compression method is employed but certain secret additions are made to the tungsten so as to yield a ductile and strong filament. The two methods are said to be in strong competition with each other at present. Among vapor-tube lamps the Moore lamp is finding more favor

for interior lighting and the lighting of buildings. Claude has obtained with his neon tubes an even better efficiency than is obtainable with the flameless black lamp.—*Elek. Zeit.*, June 5, 1913.

**Moore Vacuum Lamp.**—The operation of three vacuum tubes by three-phase currents is of importance as it avoids the fluctuations of light during one period. It has been found that if the three tubes are connected to the three secondaries of a transformer in such a way that a single phase on the primary side can be disconnected the corresponding vacuum tube in the secondary circuit is extinguished. This has the advantage that the three tube sections can be placed in different rooms and can be connected and disconnected without affecting the other sections, so that any one or two of different rooms can be illuminated without regard to the others. While thus far the maximum length of tube is 55 m, installations can be made in which the length of the tube equals the product of 55 m and the number of phases, so that it is 165 m with three-phase currents. Another recent improvement is



FIG. 1. IMPROVEMENT IN MOORE VACUUM LAMP

illustrated in Fig. 1, where  $\lambda$  is the tube and  $C'$  and  $C''$  are the two electrodes which are supplied with energy from the high-tension transformer  $t$ . The novel feature is the provision of a second circuit containing a spark-gap  $d$  ( $E$  being the earth). This spark-gap is also connected to the two electrodes. The transformer charges periodically the two electrodes  $C'$  and  $C''$ , which are then discharged partly through the tube and partly through the spark gap  $d$ . This permits the production of different spectral effects. For instance, lines in a certain part of the spectrum can be made lighter so that the color of the light may be changed. When gas mixtures are used certain spectral lines of one gas may be strengthened and those of the other may be weakened.—*Elek. Zeit.*, May 30, 1913.

### Generation, Transmission and Distribution

**Current Losses.** WILHELM ABE. The first part of a long report to be presented at the next general convention of the German Association of Electrical Engineers. The authors first discuss the critical minimum voltage at which the formation of corona around the wire takes place and then discuss the current losses with a voltage above the critical minimum value. They finally give an account of an experimental investigation carried out in the Institute of Technology at Dresden. The paper is to be concluded.—*Elek. Zeit.*, June 5, 1913.

**Direct Current Supply System.** J. S. HUBBARD. An illustrated paper read at the recent joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Electriciens in Paris. The



author compares the direct-current series transmission system of Thury with the more usual three-phase system, dealing with questions of cost, earthing and design as affecting generating and substations from this point of view.—*London Electrician*, June 6, 1913.

**Bordeaux.**—J. REYVAL.—A continuation of the long illustrated serial on the electricity supply of Bordeaux. The substation at Bordeaux-Centre and the Temple steam plant are described and details are given of the distribution networks within the city of Bordeaux.—*La Lumière Elec.*, May 31 and June 7, 1913.

### Traction

**Multiple-Unit System.**—An illustrated description of the new multiple-unit rolling stock of the Ouest-État railway in Paris.—*London Electrician*, June 6, 1913.

### Installations, Systems and Appliances

**Central-Station Statistics of Denmark.**—R. J. JENSEN.—A review of the latest central-station statistics of Denmark compiled by Paul Vinding. In 1911 there were built fifty-seven new stations, of which ten are in cities and forty-seven in the country. The total number of stations was 75 in 1906 (7000 hp), 236 in 1910 (24,650 hp) and 293 in 1911 (31,100 hp). This does not include the stations in Copenhagen and Frederiksborg, with a rating of 33,240 hp. All citizens in Denmark with more than 5000 inhabitants have electric stations.—*Elek. Zeit.*, May 29, 1913.

**Horn-Gap.**—A. W. BURKE.—The two principal defects of the horn-gap are the slowness of the arc in rising on the horns and the necessity of a close setting of the air-gap. The author gives a number of illustrated descriptions of various designs of a horn-gap in which attempts are made to overcome these defects.—*Elec. Journal*, June, 1913.

**Safety of Electric Installations.**—G. DETTMAR.—A conclusion of his long statistical article on the various applications of electricity in Germany with reference to accidents and fires. The figures show that the safety of electric installations has steadily increased and is still increasing. It is further shown that the number of accidents or fires which have been avoided by the use of electricity is very much larger than the number of accidents or fires which have been caused by electricity.—*Elek. Zeit.*, May 22, 1913.

**Large Distribution Networks in France.**—E. DE LONGUEVAL.—A statistical article illustrated by maps, giving a historical sketch of the evolution of large electric distribution networks in France.—*La Lumière Elec.*, May 10, 1913.

**French Electrical Industry.**—The first part of a long statistical article on the development of the electrical industries of France.—*London Elec. Review*, May 16, 1913.

**Flatirons.**—G. H. ELLIOTT.—An illustrated article giving details on construction and installations of electric laundry irons.—*London Elec. Review*, May 16, 1913.

### Electrophysics and Magnetism

**Efficiency of the Electromagnet.**—L. SCHÜLER.—A conclusion of his illustrated mathematical paper in which the author shows how to predetermine the variation of the current in time and the motion of the armature during its attraction by an electromagnet. From this the electrical work and the mechanical work, hence the efficiency, can be found. Numerical examples are given.—*Elek. Zeit.*, June 5, 1913.

**Positive Rays.**—SIR J. J. THOMSON.—An address before the Royal Institute of Great Britain on some further applications of the methods of positive rays. The first application described is to detect the rarer gases in the atmosphere. The second application is the discovery and investigation of a new substance. He has found a gas having apparently an atomic weight of 3. This must be either a new element or a polymeric modification of hydrogen represented by  $H_3$ .—*Popular Science Monthly*, June, 1913.

**Molecular Structure of Insulators.**—H. M. DOWSETT.—The author bases his explanations upon Sir J. J. Thomson's

electronic theory of the structure of the atom. Concerning the state of the atoms that gives certain substances their property of insulation, or, in other words, of resisting the electronic transfer between their atoms, he says that, except in the case of certain inactive gases which are supposed to have no free electrons, in all insulating substances the atoms are either (a) very closely crowded, so that their electrons are incapable of movement or (b) are spaced so far apart that their mutual action, tending to free each other's electrons, is too weak to take effect. Of the (a) order is the element sulphur, which, with its atoms closely packed together, has a resistivity  $2 \times 10^{11}$  times that of copper, while the resistivity of selenium measured in the dark is  $2 \times 10^{12}$  times that of copper. Of the (b) order are the vapors of all conducting metals and gases in which the molecules have become so diffused as to cause a state of insulation. Again, conductivity in liquids and gases involves a breaking up of the molecular state before it can take place, owing to the fact that the electrons being relied upon to hold the atoms of a molecule together are less free in this state and tend to a state of insulation. In regard to the influence of the molecular grouping of the substances, the amorphous or structureless state, in which all the molecules are independent of one another, is that which gives the best insulating properties compared with that of definite structure or crystalline state, although there are at the same time many good insulators such as mica and quartz that have a definite structure. When sulphur is changed from its amorphous to a crystalline state its insulation falls. Selenium unexposed to light is an insulator, but on being exposed to light receives a structure and its resistance drops very considerably. Glass is a good example of high insulation obtained by a structureless state. Blown glass shows a marked superiority in insulation over molded, rolled or spun glass of the same composition, owing to the straining apart of the molecules in the process of blowing. The diamond offers an interesting exception to this rule as regards structure. Although of octahedral crystalline structure, it is a good insulator, and conversely, when converted by the heat of the electric arc to the state of a structureless solid, it becomes a good conductor. The explanation of this is that the diamond having been formed by nature under a process of intense heat and pressure, the great heat has deprived the carbon of its free electrons, and the atoms, having been forced by great pressure into very intimate contact, are unable until released again by the application of intense heat to allow the normal number of free electrons to return to their respective orbits and so give a conducting property to the substance.—From *Wireless World* (abstracted in *London Electrician*, June 6, 1913).

**Polarized Roentgen Radiation.**—J. CROSBY CHAPMAN.—All the experimental evidence obtained within the last few years indicates the fundamental identity of X-rays and light. This evidence includes experiments on the properties of the scattered, fluorescent and corpuscular radiations, as well as on the polarization, interference, reflection and velocity of X-rays. These seem to establish the theory that X-rays are merely light waves of exceptionally short wave-length. Previous to the recent experiments on interference one of the most significant properties which Roentgen rays had been shown to possess was that of polarization. Barkla showed that it was possible to produce a secondary beam of X-rays which shows fairly complete polarization. Up to the present all experiments on the rotation of the plane of polarization have been made using light of a wave-length of the order of that found in the visible spectrum. The results indicate that the magnitude of the rotation in quartz and other active substances varies inversely as some power of the wave-length. This power over a considerable portion of the spectrum examined is the square, but it does not hold over a wider range. On the assumption that Roentgen radiation is merely light of

exceptionally short wave-length, it seemed possible that a great rotation of the plane of polarization of X-rays might be obtained under suitable conditions. The object of the author's research was to test directly whether anything corresponding to a rotation of the plane of polarization could be obtained with X-rays. Three substances—iron in a magnetized state, quartz and active sugar solution—were examined to see whether they have any power of rotating the plane of polarization of X-rays. The X-rays themselves are assumed to be essentially similar to light but of exceptionally short wave-length. In all cases a negative result was obtained, indicating the limited range of wave-length over which the usual rotation formulas hold. Iron absorbs a polarized beam of X-rays to the same extent whether magnetized or unmagnetized. The absorption of a plane polarized beam of X-rays by tourmaline cut parallel to the optic axis is independent of the orientation of its axis with reference to the plane of polarization of the X-rays.—*Philos. Mag.*, June, 1913.

#### Units, Measurements, and Instruments

**Radiometry.**—W. W. COBLENTZ.—A long paper on the latest attainments in the construction of instruments used in measuring spectral radiation. The paper deals especially with four instruments for measuring radiant energy, namely, the radiomicrometer, the linear thermopile, the Nichols radiometer, and the bolometer with its auxiliary galvanometer. As a result of this historical inquiry and by experiment it is shown that the radiomicrometer is capable of great improvement by reducing its weight, by lengthening its period and by placing it in a vacuum. On account of para-magnetism and dia-magnetism the sensitiveness of the short period radiomicrometer is limited to perhaps only one-half that of the best vacuum bolometers described. The instrument is free from magnetic disturbances, which permits the use of a longer period, and by placing it in a vacuum of 0.1 mm or less pressure its sensitivity is comparable with that of a good bolometer. By properly shielding it from sudden changes in temperature and by using a long period the sensitivity of this instrument should excel all the other types. The Rubens thermopile is only about one-half as sensitive as a bolometer; but it can be greatly improved by using thinner wires (0.06 mm to 0.08 mm diameter) and by using the instrument in a vacuum. The computed errors, due to the Peltier effect, are about 1 part in 300. The thermopile is not so well adapted as in the bolometer for instantaneous registration of radiant energy, and it does not admit so great a range in variation of sensitivity, but on account of its greater steadiness it commends itself for measuring very weak sources of radiation, for example, the extreme ultra-violet and infra-red region of the spectrum. A thermopile of bismuth-silver is described. It is easily constructed, and its sensitivity is from two and one-half to three times that of the iron-constantan pile. A surface thermopile is also described, the radiation sensitivity attained being six-sevenths the theoretical value. The Nichols radiometer can be made just as sensitive as the bolometer, but its period will be much longer. The Nichols radiometer is not selective in its action and hence can be used for measuring ultra-violet radiation. The main objection to the use of a Nichols radiometer is its long period, but since it is easily shielded from temperature changes and since it is not subject to magnetic perturbations, this long period is of minor importance so long as one is dealing with a constant source of radiation. In spectral energy work its usefulness is limited to the region in which the window is transparent. The fact that the Nichols radiometer deflections cannot be obtained in absolute measure is a minor objection, since in only a few cases thus far at least has it been necessary to determine the deflection. The action of a Nichols radiometer is somewhat analogous to a photographic plate in that it will detect weak radiation, provided one can wait for it, and on account of its great

steadiness it is, of all the instruments considered, probably the best adapted to search for infra-red fluorescence. A bolometer installation is so distributed that it is difficult to shield it from temperature changes. In spite of its small heat capacity the bolometer has a "drift" due to a slow and unequal warming of the strips. Air currents which result from the hot bolometer strips also cause a variation in the deflections of the auxiliary galvanometer. Nevertheless, despite these defects, it is the quickest acting of the four instruments considered and is the best adapted for registering the energy radiated from a rapidly changing source. For precision work it is necessary to keep the bolometer balanced in less than 1 cm deflection. A vacuum bolometer is described, and here are given reasons that it is the quickest acting, the most reliable and the most sensitive of all the instruments described having a short period. The auxiliary galvanometer is the main source of weakness in measuring radiant energy, and in places subject to great magnetic perturbations a period greater than five seconds, still being, is to be avoided. Notes are added on the cylindrical radiometer and a modification of the auxiliary galvanometer.—*Bulletin Bureau of Standards*, Vol. 18, No. 1, 1913.

#### Telegraphy, Telephony and Signals

**Condenser Telephony.**—L. A. CUTLER AND JOHN RUBENS.—An account of the advances made by the authors in the construction and application of condenser telephones. They first used impregnated thin tissue paper as dielectrics, but they are now using India rubber. The construction of a rubber condenser telephone is shown in Fig. 2. On an

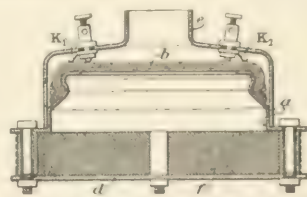


FIG. 2.—RUBBER CONDENSER TELEPHONE

aluminum drum *a*, 10 cm in diameter, the rubber leaves are stretched in the manner of a drumskin. They are fixed around a periphery so that no irregular vibration can take place. Each leaf is from 1/4 mm to 1/2 mm in thickness and weighs about 100 mg. The drum is covered by a cap *c*, provided with contacts *K<sub>1</sub>* and *K<sub>2</sub>*, making connection with the plates, and a back plate *d* is fixed at a distance from the case as a reflector for sound from the inner surface of the condenser. A polarizing voltage as high as possible must be used to secure good volume. The breakdown emf of the condenser used by the authors was between 500 volts and 600 volts, and for most experiments they used a unidirectional set of 200 volts from lighting or motor-service mains. With 200 volts they found that the volume was equal to that of an electromagnetic loud-speaking receiver and increased substantially with emfs of 300 volts and 400 volts. The theory of the condenser telephone is given. The losses occurring in a condenser telephone are due principally to dielectric hysteresis and are exceedingly small with a rubber dielectric. The useful work done as sound is also extremely small, the phase angle having been found by measurement to be very nearly 90 deg. In the electromagnetic telephone, on the other hand, losses from heating hysteresis and eddy currents combine to give an angle of much less than 90 deg. although the angle corresponding to the useful work is almost negligible. H. Abraham has estimated the efficiency of a receiver at 0.1 per cent. For loud-speaking purposes the condenser has the great advantage that the line current can be increased by using heavy-current transmitters, without any "rattling"



of the diaphragms.—From *Archiv. f. Electrotechnik* (abstracted in *London Electrician*, June 6, 1913).

**Telephone Transmission Calculations.**—A. J. ALDRIDGE.—An abstract of a paper read before the (British) Institution of Electrical Engineers. The author considers the theory of telephonic transmission from the non-mathematical point of view, describing an apparatus for simplifying the calculations and showing its applications to various problems. Some experimental results are also given. The subjects discussed in some detail include calculations of loaded lines and reflection losses. The paper is to be concluded.—*London Electrician*, June 6, 1913.

**Lead Alloys for Tapes.**—A note on a recent British patent (No. 25,090, 1912) of the Weston Electric Company for the construction of tapes primarily intended for telephone switchboard cables. It is stated that by using an alloy composed of from 93.25 to 96.75 parts lead, 3 to 6 parts antimony and 0.25 to 0.75 part tin the tape need be only about half as thick as usual with pure lead tapes to obtain equal strength.—*London Elec. Eng'g*, June 5, 1913.

**Wireless Telegraphy.**—SIR OLIVER LODGE.—A mathematical paper in the first part of which the author gives a summary of the principles and a mathematical theory of the Goldschmidt high-frequency generator for any number of circuits up to a magnifying ratio of 10. The second part of the paper deals with obstacles to electric wave transmission due to various kinds of opacity, or virtual opacity, in the atmosphere. It emphasizes the important influence which the highly conducting layer necessarily existing at a certain height must have, with fluctuations according to whether it is uniformly spherical or irregular in shape, and with reference also to the distribution and amount of its ionization. It is suggested that sunshine interferes with this layer either by altering its shape through heat or by making its transmission more gradual through general supply of beta particles. It is also suggested that under the action of solar radiation of all kinds electrons may be momentarily set free enough to promote several newly expected kinds of atmospheric capacity. Incidentally a useful practical expression for radiation from an aerial is given in an equation stating that the radiation power in kilowatts equals four times the square of the amperes times the square of the ratio of height to wave-length.—*Philos. Mag.*, June, 1913.

#### Miscellaneous

**German Association of Electrical Engineers.**—A report by G. Dettmar on the work of the German Association (Verband) of Electrical Engineers. The number of members is 5286. Twenty-two local societies belong to the association. A review is given of the work of the different committees.—*Elek. Zeit.*, June 5, 1913.

**British Electrical Engineers in Paris.**—An account by J. B. Picot of the proceedings of the joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Electriciens in Paris.—*La Lumière Elec.*, May 31, 1913. The alphabetical registry list shows that there were present 230 French and 141 British electrical engineers.—*La Lumière Elec.*, June 7, 1913.

**British Institution of Electrical Engineers.**—An account of the annual meeting of the (British) Institution of Electrical Engineers. W. W. Duddell was re-elected president. An account of the annual report is given. At May 1, 1913, the membership of the institution was 7084 compared with 6537 last year. This total was made up of seven honorary members, 1549 members, 3535 associate members, 671 associates, 260 graduates and 1062 students. The corresponding numbers last year were 7, 1389, 3089, 806, 0 and 1247.—*London Electrician*, June 6, 1913.

**Ebonite.**—An account of exhaustive and severe tests of various grades on ebonite made at the British National Physical Laboratory for the purpose of preparing a specification of ebonite.—*London Elec. Review*, May 30, 1913.

## Book Reviews

**DYNAMO LABORATORY OUTLINES FOR STUDENTS IN ELECTRICAL ENGINEERING.** By John Fay Wilson. New York: McGraw-Hill Book Company. 130 pages, illus. Price, \$1.

A very practical laboratory manual for electrical engineering students. It consists essentially of a series of laboratory tests on electrical machinery and apparatus, giving the directions to be followed, the connections to be used, references in technical literature to be consulted and questions to be answered on the measurements. Twenty-three tests are recited in direct-current measurements and sixteen in alternating-current measurements, making thirty-nine in all. Each test contains ordinarily more than one series of observations to be made. The book will be useful to laboratory instructors of electrical engineering classes in colleges and technical schools.

**THE ELECTRIC MOTOR AND ITS PRACTICAL OPERATION.** By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. 192 pages, illus. Price, \$1.50.

Valuable information on electric-motor theory and practice is presented in this book in clear and simple language. The author states that he has treated the subject in a way to appeal to the practical electrician or mechanic who has not the technical training to master more advanced texts. The book would seem to be valuable in just that field. Starting with a brief account of the discoveries in the fields of magnetism and electricity, from which the electric motor was developed, the author quickly takes up the practical explanation of power and efficiency, counter-emf and losses. Windings and commutation are discussed, and the three main types of direct-current motors are explained, together with the necessity and use of starting equipment. Some attention is also paid the subject of alternating-current motors. The last three chapters of the book are devoted to the general subject of motor applications and operation, covering speed-control methods, motor troubles and problems of selecting and installing motor equipment. In the appendix is given a valuable tabulation of machines used in various industries and the approximate power required to drive them.

**WIRELESS TELEGRAPHY AND TELEPHONY SIMPLY EXPLAINED.**

By Alfred P. Morgan. New York: The Norman W. Henley Publishing Company. 154 pages, 156 illus. Price, \$1.

The book represents an effort to tell the main facts in the story of wireless signaling in an attractive and easily understandable form. It cannot be classed either as deeply theoretical or as giving a comprehensive practical treatment, but it occupies a middle ground, containing sufficient simple theory and enough practical detail to make it valuable as a source of general information. An explanation is given of some elementary theory and its bearing on wireless phenomena. Then the subjects of transmitting apparatus and operation, receiving apparatus and methods and the theory of tuning and couplings follow in logical order. The section devoted to wireless telegraphy closes with a chapter on its applications along commercial, naval and military lines. There is next given some matter relating to the human ear and to various forms of speech transmission, followed by a lengthy discussion of the subject of wireless telephony. The reader should be warned that, while a good deal has been accomplished in this field, the wireless telephone is still far from a commercially practicable thing. In the closing chapter the author indulges in some mild speculations as to possible future developments along these lines, and particularly with reference to wireless energy transmission.

# New Apparatus and Appliances

## An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

### Pull Receptacle for Outlet Boxes

In the past it has been the practice to mount on outlet boxes a pull receptacle which had been primarily designed for use as a wall receptacle, as there was no especially designed receptacle for outlet boxes. The firm of Pass & Seymour, Inc., is placing on the market a pull receptacle for use with 4-in. wall boxes. The porcelain projecting ring shown in the accompanying illustration insulates

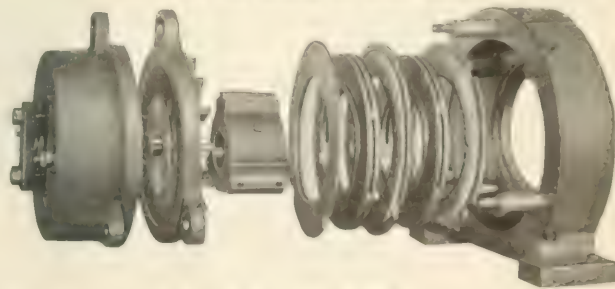
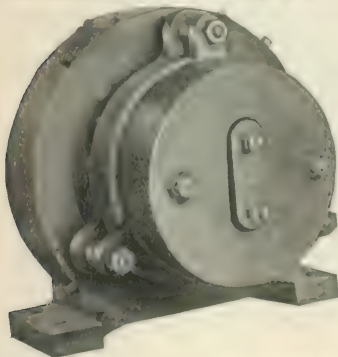
the metallic shell from the box and from the ceiling, thereby permitting its use on metal work. This device is fitted with a pull chain as indicated.



PULL RECEPTACLE

### Ventilated Magnetic Brakes

The selection of the correct size of magnetic brake has in the past been more or less a matter of guesswork, as the brakes have usually been rated by the manufacturers in horse-power. This manner of rating has been rather indefinite, since the size of the brake required depends upon other factors of service. To eliminate uncertainty and to allow the selection of the proper size of brake for all cases the Cutler-Hammer Clutch Company, Milwaukee, Wis., has developed for the market an improved type of ventilated magnetic brake rated in horse-power, maximum torque in pounds-feet, and work in foot-pounds per minute. These brakes consist of a hub, a series of stationary and rotating disks, an inclosing case, a spiral spring and an electromagnet. The hub, which is mounted on the shaft,



FIGS. 1 AND 2. END VIEW AND DISASSEMBLED VIEW OF MAGNETIC BRAKE

carries the rotating disks. These disks are interleaved between the stationary disks which are anchored to the inclosing case. The friction linings on the stationary disks are made from a patented product consisting of a weave of asbestos and brass wire and are riveted to the stationary disks by countersunk copper rivets. The material of these linings has been chosen on account of its wearing and

braking qualities, determined by a comprehensive series of tests.

The rotating disks are provided with internal radial air passages similar to those found in the runner of a centrifugal pump. When set in motion, air is forced through inter passages in the hub and casing from outlets provided in the side of the disk-inclosing frame under the cover. The ventilation secures cooling capacity and cooling qualities. No lubrication is required and little attention is need to be necessary. Normally, the stationary and rotating disks are pressed into frictional engagement by means of a spiral spring. The electromagnet serves to compress this spring and release the pressure on the disks when it is desired to release the brake. The intensity of the braking force can easily be adjusted, and brake application and release are made without shock or hammer. The actuating forces being balanced within the brake, no end-thrust is imposed on the shaft to which they are attached. All parts of the brake are easily accessible, as loosening the three bolts at the end of the magnet case, shown in Fig. 1, allows the disks to be slid out along the shaft.

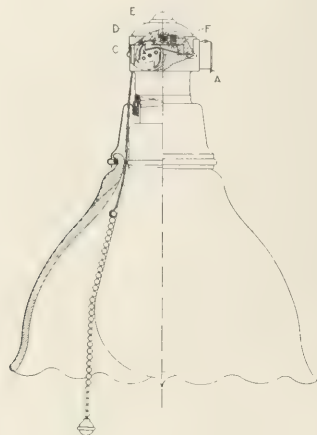
### Vertical Chain-Pull Angle Socket for Incandescent Lamps

A vertical, straight-away chain-pull angle socket for incandescent lamps has been put on the market which possesses several creditable features. The accompanying cross-sectional view of the assembled socket lamp and reflector shows the interior details. Wires supplying the lamp with electricity enter the socket through the bushing marked A, which is rigidly fastened to the socket and not to the cap, thus avoiding any right-angle turns through which to thread the wires and thus eliminating any strain on the cap, which is usually subjected to the socket by clips or delicate screws. Chain B is made fast in such that it may pass between the socket and the reflector.

lower end of the chain consists of the usual series of links which constitute a portion of the pull chains used at present. The chain operates the conical shaped fiber piece C, carrying the mouth of which bears a spiral spring D. Spring E is connected to one of the wires furnishing the lamp with electricity. Spring F is connected to the position shown and is secured from fiber alone at its right-hand end. Spring G



is connected through the axis of the cam *C* to the central terminal of the incandescent lamp. When the chain *B* is pulled from the position shown, *C* turns counter-clockwise, raising spring *F* into contact with *E* and at the same time making contact with *D* and lighting the lamp. Another pull of the chain rotates the cam farther in the direction stated with a snap movement, during which two



DETAILS OF PULL SOCKET

series gaps are inserted in the circuit by the separation of *D* and *F* and *F* and *E* respectively. The series break assisted by the snap action of the cam extinguishes the arc which occurs on breaking the electric circuit. The chain pulls along the tangent to the cam, and the action is very easy and thus relieves the fixture of considerable strain. The socket is manufactured by the Benjamin Electric Manufacturing Company of Chicago.

### Safety Device for Line Crossings

To protect the conductors of transmission lines from arcs occurring at the insulators and to give greater assurance of safety to telephone or low-tension wires crossing beneath high-tension lines the Clark Electric & Manufacturing Company, of 149 Broadway, New York City, has developed several types of overhead clamping sets. In Fig. 1 are shown typical clamps for use in connection with wooden poles on lines carrying a potential of 2300 volts or less.

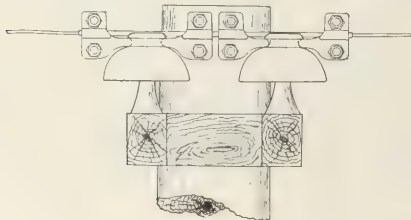


FIG. 1—CLAMPS FOR LINES CARRYING 2300 VOLTS OR LESS

These insulator clamps are made either of a copper composition possessing high tensile strength or of galvanized or sherardized malleable iron and are fitted with galvanized or copper-plated steel bolts. It is said that in some localities the copper clamps give better satisfaction when used on bare copper conductors and the iron clamps on steel or aluminum conductors as this arrangement precludes the

possibility of electrolytic action occurring between the two metals.

The type of overhead clamping set shown in Fig. 2 has been designed to meet railroad companies' specifications for high-tension line crossings. The turnbuckle shown in the figure is provided to take up any variation in dimensions between the insulators but may if desired be replaced

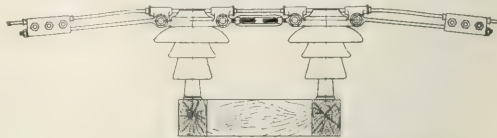


FIG. 2—CLAMP FOR HIGH-TENSION LINES

by a flat steel bar. These insulator clamps are sometimes made with upper as well as lower bolts and a top connecting member. Either copper or aluminum bushings, depending on the nature of the conductor, are provided at the clamp to prevent injury to the line wire.

It is stated that tests have been made which show that although the conductor may become severed at a point over the head of the insulator directly between the clamping members of the set, the broken line wires will not be pulled through the clamp.

### Portable Testing Battery

The portable testing battery sets manufactured by Mr. E. Marcuson, of 136 Liberty Street, New York City, described in the *Electrical World* Feb. 17, 1910, have recently been improved by the addition of switching apparatus which quickly puts at the command of the operator any one of a number of different potential values. Formerly different voltages were obtained by the use of a "tapping clip," but that method was found to be inconvenient. In the accompanying illustration is shown a 160-volt battery equipped with such a switch. The eight cells in this battery are arranged in ten equal groups, each capable of giving 16 volts. By means of the switch any or all of the ten sections may be connected to the two binding posts in any manner desired. By placing the switch arms in the proper posi-



PORTABLE TESTING BATTERY

tions the following voltage combination can be obtained: 16, 32, 48, 64, 80, 96, 112, 128, 144, 160 volts; 80 volts multiple series; 16 volts multiple series. The spring clip attached to the side of the box may be used for tapping at points in any section for obtaining intermediate voltage steps. The dimensions of the containing box of the 160-volt battery are 10.5 in. by 10.5 in. by 7 in. and the total

weight of the battery ready for use is 34 lb. All parts of the battery are visible, accessible and removable, and it is claimed that the low maintenance cost of these outfits allows them to compare favorably with other types of potential batteries.

### Push-Button Accessible from Several Directions

An electric push-button for operating automobile horns, which can be pressed from a variety of directions, is shown in the accompanying cross-sectional view. The novel feature of this push-button is the fact that the top as a whole is the movable element. With this design of push-button it is possible to close the contact by pressing it on the side or top with the elbow when it is not within easy reach of



FIGS. 1 AND 2—EXTERNAL VIEW AND CROSS SECTION OF PUSH-BUTTON

the fingers. The device is 1 7/8 in. in diameter and can be clamped to one of the arms of the steering wheel. The device is manufactured by the Dean Auto Devices Company, Chicago.

### Vacuum Horse-Grooming Set

The New York City park department has recently purchased a motor-driven vacuum horse-grooming set for the Central Park stables. By the use of this machine the effectiveness of the usual curry comb is obtained with the added advantage of the removal of all dirt and dandruff in a sanitary manner. The dirt is not brushed from place to place and does not get into the air to be inhaled by the groom, but is instantly sucked away through a vacuum hose and blown into a gunnysack.

The illustration shows the park department's horse-grooming set mounted upon a special truck for ease in



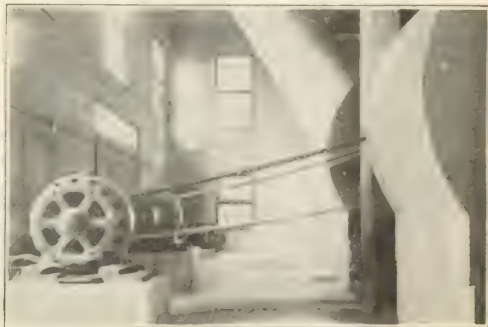
MOTOR-DRIVEN HORSE-GROOMING SET

handling. As the set weighs only a few pounds and can be carried by hand the truck may be dispensed with if it is desirable. The horse-grooming set is particularly effective in removing all of the loose hairs after clipping.

This electric vacuum cleaner horse-grooming set was built by the B. F. Sturtevant Company, Hyde Park, Boston, Mass., and was sold by the Western Electric Company.

### Pre-Cooling Refrigerator Cars Electrically

The accompanying illustration shows two 7-ft. Sirocco blowers driven by 75-hp motors which are used by the Pacific Fruit Express Company, Roseville, Cal., for pre-cooling fruit cars previous to filling their refrigerators with ice. Air is drawn from cooling rooms, in which the temperature is kept at about 18 deg. F., by electric



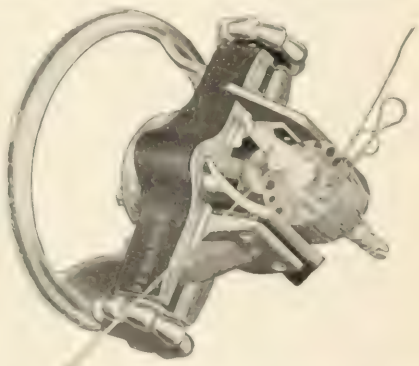
MOTORS DRIVING SIROCCO BLOWERS

expansion ammonia coils, and is forced into the cars, reducing their temperature and effecting a considerable saving in ice during transportation.

By means of specially designed motor-driven valves the air current can be reversed so that the fans exhaust cool air from the cars previous to pre-cooling. The motors for this installation were supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

### Universal Armature Winding Machine

Many repair men have found that small motor armatures cannot be rewound by hand at a price which will justify attempting the work. An armature winding machine which will wind any small drum armature having diametrical or skewed chord windings in straight, open or



ARMATURE BEING WOUND WITH SMALL CANNULAS IN JAW

winding slots as shown in Fig. 1. The machine consists of a universal straight guide to form the armature, the jaws being closed to guide the wire into the slots. The series steps can be moved the full arc and for fixing the point at which the first grip the armature so that when the upper arm is correctly set and the armature held against the steps the other slot will be in the correct position to



receive the wire. A wrench wheel of such proportions that it will not permit the operator to exert excessive pressures upon the armature cores is provided for tightening the clamping jaws. The large hand-wheel which is seen at the back of the machine is valuable for stopping and backing and for turning the armature slowly in starting or finishing the coil.

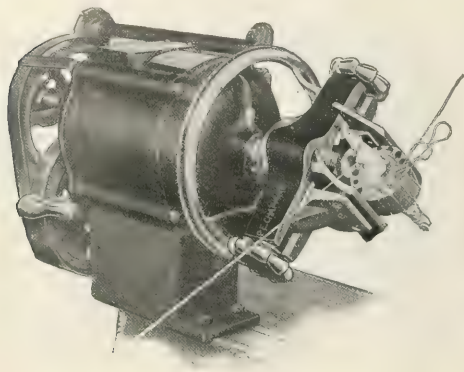


FIG. 2—SUGGESTION FOR MOUNTING ARMATURE WINDER

For driving the armature winder a 1/6-hp motor operating at from 300 r.p.m. to 400 r.p.m. is recommended when used with a foot controller. The drive should have a revolution-counter attachment for recording the number of turns of wire. The coils are wound successively, and the armature is shifted after the required number of turns have been placed. For winding armatures with skewed slots the jaws are made adjustable to any diagonal line and the winding operation is identical with that for straight slots. Fig. 2 contains a helpful suggestion for mounting the armature winder.

This machine has recently been put on the market by the P. E. Chapman Electrical Works, of Tenth and Walnut Streets, St. Louis, Mo.

### Electric Furnace for Tool Hardening

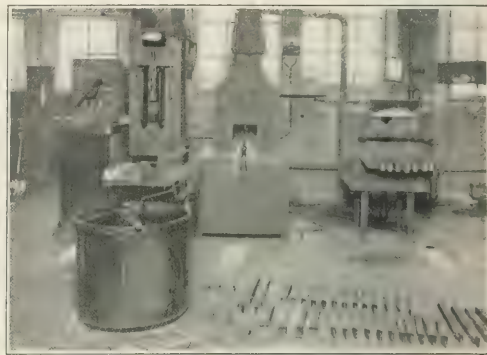
To harden properly the many tools and dies in the mammoth plants of the present day requires scientific methods and reliable apparatus. In the electric furnace shown herewith the crucible for the bath is lined with firebrick slabs cemented together to prevent leakage of the bath. The dimensions of the crucible are 8 in. by 8 in. by 12 in. deep, although the bath is only 8 in. deep. The lining is surrounded by heat-insulating material and the entire container is held in a sheet-iron case. Two iron electrodes on opposite sides of the crucible are of sufficient area to allow the current to flow through practically every part of the bath, thereby insuring uniform temperature.

A regulating transformer is provided for varying the potential impressed on the bath and consequently the temperature of the bath. The secondary coils of this transformer are directly connected to the furnace electrodes, while the primary coils are subdivided into a number of sections, taps from the latter being brought out to a dial switch. By turning the dial through two revolutions twenty-one adjustments can be made, varying the temperature from that necessary to keep the bath just above the melting point to that required to start the furnace.

For hardening carbon steel where the temperature required varies from 750 deg. to 1000 deg. C. a mixture of barium chloride and potassium chloride is used. For ordinary tool steel equal parts by weight of the salts are

recommended. For hardening high-speed steel, where temperatures up to 1300 deg. C. are required, barium chloride only should be used.

The equipment shown in the illustration is installed in a blacksmith shop for hardening high-speed steel and about 65,000 tools are handled per year. The tools are first placed in the preheater, which is oil-fired, the air blast having a pressure of 8 oz. The shelf on the front of the preheater

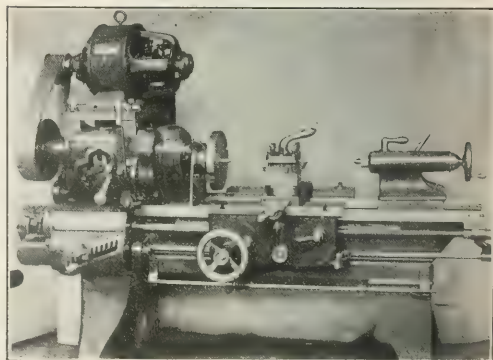


ELECTRIC FURNACE AND AUXILIARY EQUIPMENT

is used as a receptacle for the tools which are to be hardened. The tools are quenched in the oil bath shown to the left, which is agitated by air to keep it cool. The electric furnaces described above are manufactured by the General Electric Company, Schenectady, N. Y.

### Motor-Driven Geared-Head Lathe

The illustration herewith shows a motor-driven 16-in. geared-head lathe designed to meet conditions imposed by the use of high-speed steels. The controlling levers are all within easy reach from one position in front. There are eight mechanical changes of speed for the spindle with the main shaft running at a constant speed of 900 r.p.m. On four speeds the spindle is driven directly through the



MOTOR-DRIVEN GEARED-HEAD LATHE

tumbler and gear cone, and on the other four it is driven through the back gearing. The minimum spindle speed is 11 r.p.m. and the maximum speed is approximately 687 r.p.m.

The headstock of the lathe is of the improved tie-bar pattern, with annular bearings of special metal. The carriage is stopped automatically at the end of the desired

travel when either feeding or screw cutting—an arrangement that is highly valuable for internal work and for duplicating pieces.

The lathe, which is manufactured by the Hendey Machine Company, Torrington, Conn., is driven by a 2,75-hp Westinghouse motor.

### Inclosed Motor in Woodworking Plant

Totally inclosed motors are now deemed a necessity in a woodworking shop as a security from damage by fire. In the illustration herewith is shown a totally inclosed motor with automatic controller operating a band-saw. The motor is fitted with solid cast-iron end-bonnet on the pulley end and provided on the commutator end with inclosing doors which lock with a wing nut latch and are hinged to



INCLOSED MOTOR DRIVING BAND-SAW

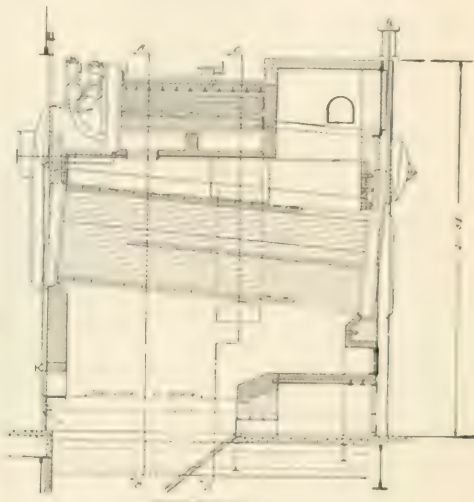
open either side. In this manner ready access to the commutator is gained. An inclosing block of porcelain protects the terminals so that a hammer or other tool accidentally dropped on top of the motor does not endanger the shop or the motor itself through arcing or short-circuiting. Although totally inclosed, this machine operates at a temperature rise of less than 50 deg. C. under continuous full load. The motor, which is rated at 2 hp and operates at 1100 r.p.m. on 220-volt direct-current circuits, is made by the Diehl Manufacturing Company, of Elizabeth, N. J.

### Double-Pass, Two-Drum Boilers

The illustration which is presented herewith shows a longitudinal section of a 635-hp boiler with superheater which is in operation at the Grand Central Terminal in New York City. The horizontal baffling on the lowest row of tubes may be seen extending over the furnace and back over the bridge wall, forming the roof of the combustion chamber. In this boiler the middle baffle is located on the ninth row of tubes and consists of a special cast-iron baffle extending from the rear water leg toward the front water-leg with a sufficient opening for the passage of the gases. On the top row of tubes are placed T-tiles extending from the front water leg to within a few feet of the rear water-leg. The effective path of travel of the gases is long and the boiler surface is compactly arranged, so that there is efficient absorption of the heat in the gases, even with the comparatively high furnace temperatures resulting from the design of the combustion chamber.

Another interesting point shown in this drawing is the superheater design. Two superheater units placed above the water line in a firebrick chamber are used for each boiler. A flue connects each chamber with the furnace, and a small percentage of the furnace gases flow up these flues and supply heat to the superheater tubes. The hot gases make two passes over the superheater and then flow out of

the superheater chamber at the end nearest the front header, and before reaching the uptake they pass under the boiler drum. A damper in the superheater outlet gives complete control of the amount of gases flowing over the tubes, thereby permitting temperature regulation and also the entire cutting off of the supply of hot gases when saturated steam is desired or when there is no boiler load. No



635-HP BOILER WITH SUPERHEATER

provision is made for flooding the superheater as this operation is unnecessary. Since flooding is unnecessary, deposits of scale-forming impurities are not made within the superheater tubes.

The performance of one of these 635-hp units at the city

#### TEST OF 635-HP HEISE BOILER WITH SUPERHEATER

Station, Grand Central Terminal	25
Coal, Anthracite, made at Hance, Pennsylvania, New York City	
At pressure	
Maximum	4.96
Ash	2.04
Heat value, per lb. of coal	13,880
Dry steam	
per hour	20,002
Heat value, per lb. of steam	448.00
Total Quantity	
Energy of heat of steam, per hour	8,166
Heat value of fuel, per hour	26,075
Heat value of steam, per hour	8,942.05
Heating Efficiency	
Dry steam, per hour	5,045
Equivalent evaporation, per hour and at 212 deg. F., from 20	10,040
At pressure, per hour	
Steam, per hour, at 200 lb. pressure	176
Equivalent evaporation, per hour	47
Superheat, per lb. of steam	1.02
At pressure	
At 200 lb. pressure	735
At 212 deg. F.	119
Equivalent evaporation	
Water, evaporated, per hour, per boiler	6.36
Equivalent evaporation, per hour and at 212 deg. F., per boiler as fired	8.16
Equivalent evaporation, per hour and at 212 deg. F., per boiler	8.98
Efficiency	
Equivalent evaporation, per hour, per boiler as fired	73.67

at station at the Grand Central Terminal, it given in the accompanying table. The test was made with No. 2 black-wheat anthracite, coal and natural draft, and an efficiency above 70 per cent was obtained. The boiler was manufactured by the Heise Safety Boiler Company, St. Louis, Mo.



# Industrial and Financial News

## Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

**Boiler Equipment Sent to Mexico.**—An order for a 260-hp boiler for use on a Mexican sugar plantation was recently obtained by the Abendroth & Root Manufacturing Company, through Carr Brothers, exporters, of 32 Broadway, New York.

**Lighting Installation at Rochester, N. Y.**—The department store of E. W. Edwards & Son at Rochester, N. Y., is being equipped with wall and pendent fixtures—1000 in all—by the Goodwin & Kintz Company, of Winsted, Conn. The latter company is also supplying the fixtures in the Henry W. Oliver Building in Pittsburgh, Pa.

**New Electrical Appliance Recently Put Out.**—The Shelton Electric Company, of 14 East Forty-second Street, New York, has recently put on the market a new form of electric drink mixer for soda fountain and similar use. The apparatus, it is claimed, is more efficient and more serviceable than other machines previously employed for this work.

**Electrical Business Good in the Carolinas at Present.**—From Robinson, Nelson & Company, electrical supply dealers and jobbers, of Richmond, Va., word is received to the effect that business conditions in and about that city have been somewhat dull during the month of June, but that their business in both North and South Carolina has been very good.

**Safety Lamp Approved by the Bureau of Mines.**—The Ceag portable electric mine lamp, made by the Mannesmann Light Company of America, 55 John Street, New York, has recently been tested and approved by the Bureau of Mines and certified as permissible for use in gaseous mines. The company is planning to start an active campaign for the introduction of the improved device into the coal-mining and allied industries.

**Adjustable Fixture Hangers Used in Big New York Buildings.**—Among the large buildings in New York City recently equipped with the Knight adjustable fixture hangers are the Municipal Building, the new Stern Brothers department store, on West Forty-second Street, and the Hotel Theresa, at 125th Street and Seventh Avenue. A number of apartment houses have also been furnished with these hangers. They are manufactured by the Empire Engineering & Supply Company, of 227 Fulton Street, New York.

**Biscuit Company Equips a Large Plant in New York.**—The Loose-Wiles Biscuit Company, of Kansas City, Mo., has put up a large plant in Long Island City and has placed orders recently for extensive mechanical and electrical equipment for the same, including a 1500-hp Babcock & Wilcox boiler and superheater, three 625-kva Curtis turbo-generators, a 25-kw and 15-kw exciter set, a 14-kw motor-generator set, and 105 motors of ratings between 2 hp and 35 hp for drive purposes in various parts of the factory. The electrical apparatus is all of General Electric make.

**General Electric Sales to Industrial Companies.**—Electrical generating, drive and control apparatus of General Electric Company manufacture will be installed in the near future by the following industrial and railway companies: American Printing Company, Fall River, Mass., two 1500-kw Curtis turbo-generators; Atlas Portland Cement Company, Ilasco, Mo., eight synchronous motors of various ratings, with exciter equipment, nine 215-kva transformers, three 600-kw rotary converters and switchboard panels; Fisk Rubber Company, Chicopee Falls, Mass., motors and switchboard apparatus; Robert Gair Company, Brooklyn, N. Y., a 300-kw Curtis turbo-generator; Colgate & Company, Jersey City, N. J., a 500-kva generator, a 22-kw exciter and switchboard; Delaware & Hudson Company, of

Albany, N. Y., a 665-kva frequency-changer set and switchboard apparatus, and the Fort Dodge, Des Moines & Southern Railroad Company, of Des Moines, Ia., thirty-nine motors of ratings between 1 hp and 50 hp, and thirteen transformers with switches and control panels.

**Mica Schedule Thought Too Complicated.**—Interviewed early this week as to the effect of the change in the mica schedule proposed by the Senate, A. O. Schoonmaker, of 66 Park Place, New York, stated that while as an importer of mica the changes if finally approved would be of some benefit to him, especially on the higher grades of mica, he would rather see a uniform rate for all grades, as involving less confusion and red tape all around. Concerning the present conditions in the trade, he said that there had been a good demand for mica all through the spring and that prices had been maintained at a fairly good level. Just at present there is a slight falling off, due to the usual summer let-up in general business activity.

**Present Status of the Tariff.**—On June 20 the Senate finance committee completed the draft of a new tariff bill which is designed to replace the Underwood bill and which contains some rather unusual features both of general interest and of particular interest to the electrical industry. A large number of changes were made in the rates proposed in the House bill and the estimated net result is a gain of about \$5,000,000 in revenue, but, contrary to the custom in past years, when the Senate has invariably suggested material increases in rates, there are only a few classifications on which important increases have been made. The free list was extended considerably in the Senate bill and the general tendency was to reduce the rates on necessities and increase those on articles and material of secondary importance. Several changes were made in classifications of special interest to electrical manufacturers and importers of material used in that industry. In place of a 30 per cent duty on mica and manufactures of mica there were promulgated the following rates: value 15 cents per lb. or under, 4 cents per lb.; between 15 and 75 cents per lb., 25 per cent; over 75 cents per lb., 20 per cent; cut mica, 30 per cent. The net result of the change is thought by importers to be a little in their favor. The carbon schedule has been extended by the addition of the classification "carbons for flaming-arc lamps not especially provided for," on which a duty of 30 per cent is proposed. This means, if it is passed, that the duty on high-grade German and Austrian electrodes will be materially increased, since under the classification in the Underwood bill these electrodes were to be admitted at the same rate as the ordinary lamp electrode, namely, 15 cents per 100 ft. Importers of these high-grade electrodes claim that the proposed rates will be almost prohibitive and will greatly retard the growth of the flaming-arc lamp industry in this country. In the iron, steel and aluminum schedules there were substantial decreases in rates on the rougher grades and scrap and slight increases on the fabricated forms. The revised bill was submitted to the Democratic caucus on June 21 by Senator F. M. Simmons, chairman of the Senate finance committee. It was predicted that within a week it would be reported to the Senate. No definite action had been taken on the income-tax feature of the bill at this writing, but the section relating to the examination of the books of foreign manufacturers (which has caused much unfavorable comment and some rumors of retaliatory measures by European governments) was eliminated, along with the proposed plan for a reduction of 5 per cent on goods imported in American ships. It is very probable that provision will be made for an increase in duty by the President's order in the case of imports from countries which discriminate against the United States.





tion) by the John A. Roebling's Sons Company, of Trenton, N. J., and the steel for the towers by the McMeiller Interstate Company, of Cleveland, Ohio. Most of the special wireless apparatus was supplied by the British Marconi Company.

**Electrical Industry in Germany Growing.**—With the exception of turbine and lamp prices, which were unsteady during 1912, the prices obtained for German electrical material and apparatus during that year were an improvement over those for 1911. The German export trade in electro-technical products was larger both in volume and in value during 1912 than for the previous year. The shipments of generators, motors, transformers, electric lighting and energy transmission apparatus, telephone and telegraph instruments and supplies, signaling devices, incandescent and arc lamps, all showed an increase over those for 1911, but the exports of electric cable showed a falling off from the figures for that year.

**Generating Stations Increase Their Equipment.**—Additions will be made shortly to the electrical equipment of the following central stations: Great Falls Power Company, Butte, Mont.; South Carolina Development Company, Peake, S. C.; Columbus Power Company, Columbus, Ga.; Georgia-Carolina Power Company, Augusta, Ga., and Eastern Michigan Power Company, Jackson, Mich., the latter two concerns being the heaviest purchasers. The apparatus to be installed includes generators, transformers, motor-generator and rotary-converter sets, one large frequency changer and a large amount of switchboard apparatus, all of which is being supplied by the General Electric Company, of Schenectady, N. Y.

**Electric Railway Extensions in Brazil.**—Because of the rapidly increasing demand for rapid transit in the city of Belo Horizonte, Minas Geraes, Brazil, it has been decided by the Empresa de Electricidade e Viacao Urbana, of that place, to add 1600 hp to its motive power and to make improvements on its transmission line, for which latter item orders have been placed for structural steel towers. The new line will use a larger conductor than was formerly employed and will be about 25 miles long, with 300 towers and 27 posts, the latter being used within the city limits. Work on the new construction began early this year and a number of the towers have already been placed. Further increases in the generating equipment are contemplated and additions are to be made to the rolling stock. Plans are also on foot for double-tracking along many of the streets of the city.

**Electricity and the Automobile.**—Conferences recently held at some of the principal automobile factories between dealers and car designers foreshadow a decided increase in electrical applications upon gasoline-motor vehicles for the 1914 trade. At least two makers have adopted the electrical gear shaft, which eliminates the need of a shift lever requiring an appreciable time for manual operation and hence increasing the difficulty of meeting emergencies with sufficient celerity. In this equipment the changing of gears will be effected by the mere pressing of a button corresponding to each speed change, the arrangement in one car consisting of a circle above the steering wheel containing buttons for each of the three forward speeds, with one for the reverse and one for the neutral. On this car are also placed buttons operating the electric self-starting apparatus and the electric horn of the machine. With the electrical gear shift the operation of the car requires a greatly reduced amount of laborious manipulation which can only be appreciated by the experienced driver, and the now well-standardized electric starting equipment needs no emphasis as a valuable feature of an up-to-date gasoline automobile. In the field of car lighting further departure is anticipated from the lamp locations common to the days of oil and acetylene, and a notable recent improvement consists in the replacement of rattling and cumbersome side lamps with bull's-eyes. In one instance the head-lamps have been incorporated in the front of the wheel guards. Experiments are understood to be in progress in the field of electrically operated brakes, and the whole trend of development tends to confirm a prediction not long since made that in time the only function of the gasoline engine will be to drive a generator equipment supplying electricity for all features of car control and operation.

**Electrical Properties Have Successful Year.**—Financial statements of seven electrical properties controlled by the Electric Bond & Share Company, of New York, for the year ended May 31 show an average increase in net earnings of 14.7 per cent over figures for 1912. Gross earnings for the seven companies averaged for that period 14.8 per cent higher than for 1912. The companies embraced in the above statement are the Southwestern Utilities Corporation, Canton Electric Company, Marion Light & Heating Company, Muncie Electric Light Company, Rockford Electric Company, Scranton Electric Company and Wheeling Electric Company. Excluding the first-named, on which figures are not available, the average increase for these companies in surplus after deduction of charges is 19.3 per cent over the figures on the same item for 1912.

**Recent Installations of Dead-Front Switchboards.**—Dead-front switchboards for stage and auditorium lighting control have been supplied by the Worcester Electric & Manufacturing Company for installation in the William Fox Theater and Roof Garden, at Ninety-seventh Street and Broadway and in the Boulevard Theater, Westchester Avenue and Southern Boulevard, New York. At the former two boards were supplied, one for the theater proper and one for the roof garden. Each measures 11 ft. by 6½ ft. and carries between fifty-five and sixty switches and dimmer attachment. The board at the second-mentioned location is 7 ft. by 6½ ft. in size and carries thirty or thirty-five switches and dimmer. The installation work in each case was done by the Haskell Electrical Contracting Company, of New York.

**Foreign Inquiry for Federal Products.**—Mr. W. W. Beachboard, of the Philadelphia office of the Federal Sign System (Electric), has sailed for a European journey to last three months. He will visit London, Paris, Berlin, Bologna and other cities in the interest of Federal products. The Federal porcelain-enamel steel sectional signs are gaining popularity abroad to such an extent that the company feels justified in sending a representative across the water.

## Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	June 18	June 25
Allis-Chalmers, t.r., 5th pd	\$19,800,000	.....	.....	71*	71
Allis-Chal., pf, t.r., 5th pd	16,050,000	.....	.....	134*	14
Amalgamated Copper	153,887,900	14	0	66*	68*
American Tel. & Tel.	344,471,400	1	0	128	128*
Electric Storage Battery	16,074,425	1	0	47*	45*
General Electric	101,363,600	2	0	136*	137*
Mackay Cos., c.	41,380,400	14	0	88*	88
Mackay Cos., pf.	50,000,000	1	0	69*	68
Western Union Tel.	99,747,600	1	0	63*	61*
Westinghouse, E. & M., c.	34,496,400	1	0	60	60
Westinghouse, E. & M., pf.	3,998,700	14	0	109*	109

\*Last price quoted.

## NEW YORK METAL MARKET PRICES

Copper:	June 17		June 24	
	Bid	Asked	Bid	Asked
Standard, spot	14.00	to 14.50	13.62½	
London, standard, spot	64	17 6	63	15 6
Prime Lake	15.00	to 15.25		14.75
Electrolytic	14.87½	to 15.00		14.50
Casting	13.75			14.37½
Copper wire, base	16.00	to 16.25	15.75	to 16.00
Lead	4.35		4.35	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	7.25		7.25	
Spelter, spot	5.00	to 5.15	5.15	to 5.20
Tin, spot	44.25	to 44.75	43.25	to 43.75
Aluminum:				
Prompt delivery	25.00	to 25.50	23.50	to 24.50
Future	25.00	to 25.50	22.00	to 23.00

## OLD METALS

Heavy copper and wire	13.50	14.50
Brass, heavy	9.00	8.75
Brass, light	7.87½	7.75
Lead, heavy	4.25	4.25
Zinc, scrap	4.12½	4.12½

## COPPER EXPORTS

Total tons to June 24	22,465
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## Personal

**Mr. Frank E. Filer** has been appointed manager of the Winnipeg (Man.) office of the Packard Electric Company.

**Mr. S. G. Retue** has been appointed general superintendent of the Northumberland County Gas & Electric Company, with headquarters at Sunbury, Pa.

**Mr. J. B. Harvey**, manager of the Aurora (Neb.) Electric Company, has been appointed manager of the York (Neb.) Gas & Electric Company as successor to Mr. Pfeffer.

**Mr. Edward Hendry** has been appointed superintendent of the municipal electric-lighting system and water works at Wilmet, S. D., succeeding Mr. H. J. Christianson.

**Mr. Charles Pfeffer** has resigned as manager of the York (Neb.) Gas & Electric Company. He, however, retains his interest in the utility as chairman of the board of directors.

**Mr. R. Niver** has been appointed superintendent of the electrical department with supervision of power plants and electrical distribution of the City Light & Traction Company of Sedalia, Mo.

**Prof. Alexander Graham Bell** received the honorary degree of Doctor of Laws from Dartmouth College at its one hundred and forty-first commencement in recognition of his invention of the telephone.

**Mr. W. D. Weaver** has been elected a member of the Chamber of Commerce, Charlottesville, Va., and appointed a member of the committee on transportation and vice-chairman of the committee on electric lighting.

**Dr. A. E. Kennelly**, professor of electrical engineering, Harvard University, sailed on the Hamilton American S.S. *Rhiner* from Boston for Plymouth on June 24. Dr. Kennelly will remain abroad for about two months.

**Mr. H. O. Edward**, for the past twelve years advertising manager of the Canadian General Electric Company, Ltd., and its subsidiary companies, has resigned to become sales manager of the Photo Engraving, Ltd., of Toronto.

**Mr. Hartwell Jolonick**, now business manager of the Texas Power & Light Company, Dallas, Tex., has been transferred to the Brownwood, Tex., Gas & Electric Company, which is controlled by the Texas Power & Light Company.

**Mr. P. A. Rothwell** has been appointed secretary, treasurer and manager of the Buffalo Manufacturing Company, which supplies electric service in Buffalo, Wyo. Mr. H. P. Rothwell, formerly secretary and treasurer, has been made vice-president of the company.

**Mr. J. T. Young**, president and general manager of the Muskegon (Mich.) Traction & Lighting Company, has been appointed manager of the Grand Rapids (Mich.) Gas & Light Company, which is also one of the properties of the American Light & Traction Company.

**Dr. J. B. Whitehead**, formerly professor of applied electricity in Johns Hopkins University, has been appointed head of the department of electrical engineering in the new School of Technology of the university. Dr. Whitehead is a fellow of the American Institute of Electrical Engineers.

**Mr. John S. MacLean**, formerly in charge of the publicity and advertising work of Allis-Chalmers-Buller & Ltd., of Montreal, has been appointed to a similar position with the Canadian General Electric Company and the Canadian Allis-Chalmers Company, Ltd., with headquarters in Toronto.

**Prof. George W. Lamke**, of Washington University, St. Louis, Mo., has resigned his position as assistant professor of electrical engineering to take a position in the advertising department of the Wagner Electric Manufacturing Company, St. Louis, Mo. Prof. Lamke is a member of the American Institute of Electrical Engineers.

**Mr. H. Chamberlain**, for many years superintendent of engineer and electrician of the Weatherly (Pa.) municipal electric light plant, has resigned in order to accept the post of superintendent of the plant at the Hatwood Electric Light Company at Freeland, Pa. Mr. C. Ketchum has been appointed successor to Mr. Chamberlain at Weatherly.

**Mr. J. C. McPherson** has resigned as superintendent of the northern division of the Pacific Electric Railway Company to become general manager of the Southern Pacific's electric lines in Alameda, Oakland and Berkeley with headquarters in Oakland. The resignation of Mr. McPherson terminates a service of twenty-two years with the Pacific Electric.

**Mr. E. H. Houghton**, of Chicago, general manager of the Bryan-Marsh Works of the General Electric Company, sailed for Europe on July 1 on the steamer *Hamburg* of the Hamburg American line. He was accompanied by his father-in-law, Judge Malcom Yeaman, of Henderson, Ky. The two will make their first stop at Genoa, after which they will sit upon the deck and glass of historical and scenic interest. They will return about Sept. 1.

**Mr. William B. McKinley**, president of the Illinois Traction System, Peoria, Ill., was the guest of honor at a grand ball dinner tendered to him at the Elgin Country Club at Springfield, Ill., recently by business and professional men of the latter city. Mr. McKinley has been elected president of the Chicago Gas, Light & Power Company and the Chicago Gas & Electric Light Company, Chicago, Ill., which were taken over in 1910-1911 by Mr. and Mrs. McKinley.

**Mr. David Barker Rushmore**, who was elected a member of the executive committee of the Hydroelectric and Transmission Section of the National Electric Light Association at its recent convention in Chicago, is widely known among electrical engineers.

He was born in Old Westbury, N. Y., Aug. 21, 1870, and was graduated from Swarthmore College in 1892 with the degree of B. S. Three years afterward he received the degree of C. E. He spent a year at Sibley College, Cornell University, after leaving Swarthmore, specializing in electrical engineering, and received the degree of M. E. from that institution in 1897. Mr. Rushmore spent two years in testing and inspection work at the East Pittsfield plant of the Westinghouse Electric & Manufacturing Company, and in 1900 went to Montreal with the Brown Electric Company, at that time the Canadian branch of the Stanley Electric Manufacturing Company, Pittsfield, Mass. He subsequently joined the staff at the Stanley company and remained at Pittsfield until 1905, when since that time he has been chief engineer of the power and strong department of the General Electric Company. Mr. Rushmore has contributed to the proceedings of many scientific bodies and has gotten up many papers for a national engineering institute. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Society of Mining Engineers, the American Electrochemical Society, the American Mining Engineers and the Engineers Club, New York.



D. B. Rushmore

## Obituary

**Mr. Wilbur F. Davidson**, of the Post Office, 120 N. 1st Light & Power Company, died in his home in that city on June 18. Mr. Davidson was a pioneer in electrical engineering and spent much of his life in Michigan and with the first electric plant ever installed in that State. He was the friend of Mr. James F. Davidson, at present vice-president and general manager of the Electric Power & Light Company of Portland, Ore., and well known in electrical engineering circles both on the Atlantic and Pacific coasts. Having been formerly connected with the Pennsylvania Traction Company of Philadelphia, Mr. Davidson was a member of the Northeast Portland Association and the New England Society of the N. E. E. A. and corresponding member of the Michigan Electrical Association.



## Construction

### New England

**CHICOPEE, MASS.**—The transmission line from the Amherst Pwr. Co.'s plant at Amherst to Chicopee, which is to supply 1500 kw to the latter city, is almost completed. It is rumored that the Amherst company has offered to take the city's lighting plant off the hands of the municipality.

**WESTFIELD, MASS.**—The members of the municipal light board have had another conference with the Amherst Pwr. Co. in regard to the contract by which it is proposed to sell electricity to the local board. The board looks favorably upon the plan, and at a forthcoming public meeting the citizens will be asked to vote upon it.

**WEYMOUTH, MASS.**—The town lighting committee has decided to install 100 additional street lamps throughout the town.

**WILLIAMSTOWN, MASS.**—The Williamstown Gas Co. is contemplating extending its electrical service to South Williamstown.

**MONTVILLE, CONN.**—The Connecticut Pwr. Co., through the New London Gas & El. Co. division, is extending its wires from Montville to Kiteauga. The company also contemplates an extension to Palmerstown in the near future.

**NAUGATUCK, CONN.**—The changes recently approved by the Board of Wardens and Burgesses which called for the better illumination of the town are now being made by the United Elec. Lt. & Wtr. Co. F. J. Lyon is superintendent.

### Middle Atlantic

**BUFFALO, N. Y.**—The Cataract Pwr. & Conduit Co. is to erect an addition to the power house at Front Avenue and Niagara Street at a cost of approximately \$20,000.

**MANASQUAN, N. Y.**—After inspecting the lighting plants at Alentown and Lawrenceville, Mayor W. F. Lefferson and several councilmen of Manasquan favored the establishment of a municipal lighting plant in conjunction with the water system.

**NEWBURGH, N. Y.**—The Central Hudson Gas & El. Co., of Newburgh, has submitted a proposition to the Water Commissioners to furnish electricity to operate the pumping station of the water-works system. At present the station is operated by steam-power.

**NIAGARA FALLS, N. Y.**—Falls Street from the State Park at Riverway to Fourth Street will be illuminated in a decorative manner. The poles will be about 70 ft. apart, and suspended from each pole, at a distance of 4 ft., will be magnetite inverted luminous arc lamps. The illumination will cost \$13,000. Maintenance cost will be met by the city and the power company will supply the power.

**SYRACUSE, N. Y.**—The ornamental street-lighting committee of the Chamber of Commerce has filed with the Mayor a revised plan for the extension of the ornamental lighting system.

**SYRACUSE, N. Y.**—Improvements will be made to the power plant of the Syracuse Ltg. Co., to cost about \$100,000, to provide an emergency service in case of failure of the service of the Niagara, Lockport & Ontario Pwr. Co. The new equipment will include a 7500 hp steam turbine and generator.

**HONESDALE, PA.**—The Wayne County Ry. Co., recently incorporated, plans to build a 15-mile electric line. M. B. Allen is interested.

**INTERCOURSE, PA.**—The Intercourse El. Lt., Ht. & Pwr. Co. has purchased the equipment for the installation of 150 kva. There is no day service at present, but connections will shortly be made with the Edison El. Co. of Lancaster and 24-hour service given. There is a promising outlook for a motor load. Enos L. Zimmerman is secretary and treasurer of the Intercourse company. J. E. Kershner, of Lancaster, Pa., and John L. Livers, of Charlottesville, Va., are also interested in the new project.

**NICTOWN, PA.**—It is reported that the G. W. Blabon Co. is to erect a power plant at this place at a cost of \$20,000.

**PHILADELPHIA, PA.**—Plans are being prepared by the Philadelphia Rapid Transit Co. for the construction of a new substation (96 ft. by 54 ft.) at its Thirteenth Street and Mifflin Street carhouse.

**PHILADELPHIA, PA.**—The Electrical Bureau has enlisted the aid of Mayor Blankenburg for a plan to have the city's wires gradually placed underground and to replace many of the old poles now carrying wires overhead. The department is making an early start to obtain the appropriation from the 1914 budget. It is proposed to construct underground conduits at the rate of 10 miles per annum. The system is to begin at City Hall.

**BURLINGTON, N. J.**—The Public Service Corporation (Newark) is negotiating for property on the Delaware River and plans the erection of a power station, which is later to supplant the company's stations at Burlington, Bordentown and Cinnamond.

**FARMINGDALE, N. J.**—The Board of Public Utilities Commissioners has given its approval of an ordinance of the Board of Freeholders of Monmouth County granting the Farmingdale Ltg. Co. permission to operate its system on the road between Freehold and Farmingdale.

**HOLMDEL, N. J.**—The Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. is extending its system to this place. Ten lamps have been ordered placed on two roads at an annual cost of \$30 per lamp.

**SHEPHERDSTOWN, W. VA.**—Major Randolph Stalnaker has purchased the plant of the Shepherdstown El. Lt. & Pwr. Co., formerly owned by John L. Livers and others.

**WASHINGTON, D. C.**—Sealed proposals will be received at the Treasury Department until 3 P. M., July 21, for the construction, complete, including electric conduits and wiring and interior lighting, of the United States Post Office at Cartersville, Ga. O. Wenderoth, supervising architect.

### North Central

**CASSOPOLIS, MICH.**—An ornamental lighting system for the downtown district is under consideration here.

**DETROIT, MICH.**—The residents of Rhode Island Avenue, Highland Park, have petitioned the Village Council for the installation of five-lamp clusters on street corners in place of arc lamps, offering to defray the additional cost. The Council is favorably considering the plan for beautifying this section of the suburban district.

**DUNDEE, MICH.**—N. D. Carpenter, Detroit, Mich., is reported to have purchased the electric-light plant, with the idea of improving and operating it. It now has a capacity of 300 hp.

**ONSTED, MICH.**—Plans are being considered for the installation of an electric-light system here. W. F. Morrill is interested in the project.

**ROSCOMMON, MICH.**—Since the destruction by fire of the municipal electric-light plant the Village Council is investigating water-power possibilities before taking further action in regard to establishing a new plant. Should the plan prove feasible, Council will order special election to bond village for necessary funds. G. S. Casson, city clerk.

**ARCHBOLD, OHIO.**—The Archbold El. Lt. & Pwr. Co. expects to install a new street lighting system in the business section, but has not yet decided whether to use flaming-arc lamps or tungsten lamps erected on standards. The company has recently installed a storage battery to take care of the day load. R. Rodenhuis is manager.

**LIMA, OHIO.**—The Board of County Commissioners is contemplating a number of improvements to the County Infirmary, among which will be the installation of an electric-light and power plant, a chapel and hospital.

**WARREN, OHIO.**—The Trumbull Public Service Co. is planning to expend \$40,000 for improvements to its plant.

**LOUISVILLE, KY.**—A. L. Kaercher Furniture Co. will require a number of motors in the equipment of its factory.

**LOUISVILLE, KY.**—The Board of Park Commissioners is considering the advisability of replacing the acetylene lamps on the parkways by a system of electric lighting. Representatives of the Louisville Ltg. Co. are advising with the commissioners on this subject.

**PADUCAH, KY.**—The City Council is considering appropriating \$9,000 for the equipment of a new pumping station, in which the pumps will be motor-driven. L. A. Washington, city engineer.

**SPICELAND, IND.**—George Otis Spencer, of this place, has been given legal notice by the Town Council of its acceptance of his proposition to install an electric-lighting plant here. Mr. Spencer is to install and maintain at least 60 60-cp incandescent lamps, for which the town will pay \$20 per annum each. The contract is for 10 years.

**ALEDO, ILL.**—The Tri-County Lt. & Pwr. Co. contemplates improvements involving an expenditure of \$300,000. A network of lines will carry electricity to all the surrounding towns for use by farmers for light and power. Fifty-four five-lamp clusters for street lighting have just been installed. Adolph A. Barton is general superintendent.

**BELVIDERE, ILL.**—The building committee of the Boone County Board of Supervisors has awarded to Greenlee & Wilson the contract for electric wiring and fixtures for the county almshouse, including two gasoline engines.

**BLOOMINGTON, ILL.**—A movement has begun for the installation of ornamental lamps on Monroe Street between Center and Madison Streets, on Madison Street between Monroe and Jefferson Streets, and on Jefferson Street between Center and Madison Streets. E. Sellman is interested.

**CAIRO, ILL.**—During the next four months the Cairo Ry. & Lt. System will be in the market for wire and meters. M. C. Whiting is superintendent of the electrical department.

**CARLINVILLE, ILL.**—The City Council has voted to change the street lighting system and use 250-watt tungsten lamps. The McKinley company, which has the contract to supply energy for street lighting, will make a rate of \$5 a lamp a year.

**CHICAGO, ILL.**—Bids will be received until July 1 by L. E. McGann, commissioner of public works, for furnishing and delivering a 275-kva single-phase transformer at the Twenty-second Street pumping station, 2260 South Ashland Avenue.

**CLAYTON, ILL.**—During the next six months the Central Illinois Public Service Co. expects to erect a substation, transformer tower and transmission lines to replace the local plant. The company expects to purchase within the next few months switchboards, instruments, switches and arresters to replace those now in use. The entire distribution

system will be rebuilt within the next two months. A new constant-current regulator will be purchased and new 250-watt lamps will be installed. A new supply of electric appliances and supplies will be included among the next purchases by the board within the next half year. E. B. Jones, chief superintendent at Canton.

**JACKSONVILLE, ILL.**—The city board has been authorized to authorize for bids for a 250-hp., three-phase, 60-cycle, 110-volt generating field generator.

**LENA, ILL.**—During the past few months the Lena El. Lt. & Co. expects to erect a 75-kva. generator plant near Pearl City, but the company has a major franchise. It has also secured the lighting contract for 10 years. Within the next thirty days the 10-phase 75-kva to 100-kva, 60-cycle generator will be purchased. G. A. Bender is manager.

**LENGTON, ILL.**—The Board of Public Works, A. R. & L. S. Co., is planning to erect a power plant at its new plant in the plant, recently purchased from the Lexington El. Lt. Co. A transmission line will be erected from Chicago to connect the plant with the Lexington plant.

**MASCOUTAH, ILL.**—The Mascoutah El. Lt. Co. has been purchased by the city of Mascoutah, and the new plant and electric system are now under construction. C. J. M. is manager.

**MORRISON, ILL.**—The City Council has granted a 10-year franchise to the Rock River El. & Pw. Co. to construct and operate a power system here. The rate will be reduced at the end of the first five-year period. The city has purchased the equipment for the plant, and the expiration of the franchise period. The city is now in the process of erecting a new plant to be used in connection with the new building.

**PARIS, ILL.**—The City Council has voted to appoint a committee consisting of the Mayor, city engineer, city auditor and city clerk to make an investigation and secure estimates of the cost of supplying electricity for the municipal waterworks system.

**PEARL CITY, ILL.**—The Village Board has granted a franchise to the Lena El. Lt. & Pw. Co. to erect a new plant and power system in the city. The board has also awarded a contract for lighting the streets for \$900 per annum, for which a transmission line will be built from Lena to Pearl City. Thirty 100-watt incandescent lamps will be used.

**PITTSFIELD, ILL.**—The City Council and the Central Illinois Public Service Co. at Moline, Ill., are said to have reached an agreement whereby a reduction in rates for electric service will be made and the Council will grant a franchise to the company.

**HAZOCK, WIS.**—The new electric light plant at the city is now ready for service. W. H. Burwell is the consulting engineer and superintendent of the work.

**SHAWANO, WIS.**—We are informed that the City of Shawano, Wis., expects to erect within the next three or four months a new plant about 40 in. in diameter and 50 ft. high. The plant has been purchased on a 15-kva constant-current system and is being constructed. The plant to be purchased shortly includes one 15-kva generator, one 1100-volt instrument transformer and about 500 ft. of line, one 1100-volt meter and one 1100-volt lighting fixture. P. E. C. is superintendent.

**SOLDIER'S GROVE, WIS.**—Within the next few months the Soldier's Grove El. Co. expects to purchase 10 poles and 100 ft. N. E. 1000-volt street post wire. Thomas O. Sims is manager.

**CROOKSTON, MINN.**—Plans are under foot to erect a lighting plant.

**DULUTH, MINN.**—Residents are earnestly urging the railroad board and the increase of the street lighting. Commissioner Leonard M. Ryan, head of the division of public utility, is having a thorough investigation made as to the cost of the city in the division.

**DULUTH, MINN.**—The Great Northern Paper Co. is expected to have voted an agreement to the city of Duluth, Minn., for the sale of the State of Minnesota, the capital of the State of Minnesota, for \$11,000,000. It is indicated that the power company would have a franchise to the Duluth city to erect a new plant.

**FAIRMONT, MINN.**—Plans are under foot to erect a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting.

**GRASSY, MINN.**—The Electric Machinery Co., Inc., has been granted a franchise of erecting and maintaining power lines, wires and other electrical equipment in the city.

**GREAT FALLS, MINN.**—It is expected that \$1,000,000 will be spent in the erection of a new plant in the city.

**HITCHCOCK, MINN.**—The city will be expected to have a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting.

**ONAMIA, MINN.**—At a special meeting held June 1, the city of Onamia, Minn., voted to erect a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting.

**PIPESTONE, MINN.**—Plans are under foot to erect a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting.

**WARREN, MINN.**—Consolidation is being given to the city of Warren, Minn., to enhance the municipal lighting plant. W. H. Jones is superintendent.

**WISCONSIN.**—The city of Wisconsin, Wis., is expected to have a new plant and increase of the street lighting. The city is expected to have a new plant and increase of the street lighting.

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## Southern States

ROCK HILL, N. C.—Electricity for the new pumping station here will be furnished by the Southern Pwr. Co., Charlotte, N. C.

RIDGELAND, S. C.—A vote will soon be taken on a bond issue to construct an electric-light plant and water-works here.

SPARTANBURG, S. C.—It is reported that the Southern Pwr. Co. will begin the construction of a substation near Saxon Mills to supply energy for the operation of the cars of the Greenville, Spartanburg & Anderson Ry. The company will install a 2000-hp plant, containing three transformers and two generators. Alternating current from the company's 100,000-volt transmission line will be changed to direct current at 750 volts. The plant is expected to be completed in the fall.

ADEL, GA.—The municipal electric-lighting plant, of which F. R. Sutton is superintendent, expects within the next six months to purchase one 4-kw, 120-volt exciter, a portable voltmeter and several 1-kw, 2300-110-volt transformers.

FORT GAINES, GA.—At an approximate cost of \$10,500, one-half of which will be subscribed by local business men, it is planned to erect an electric-light plant on the Chemochechobee Creek, 1½ miles north of the town.

GRIFFIN, GA.—The Tonaliga Falls Pwr. Co. in the near future plans to buy one 1200-kw, 2300-volt, 60-cycle, three-phase generator and water wheel. Frank Mayes, superintendent.

LAVONIA, GA.—T. R. Knox informs us that the Shoals Creek Pwr. Co. has leased its plant for a period of twenty years to the J. B. McCrary Co., of Atlanta, Ga.

LAWRENCEVILLE, GA.—Within the next eight months the city expects to purchase apparatus for equipping one substation, to be used for transforming energy from 11,000 volts to 2300 volts for city lighting. The energy will be delivered from Tallulah Falls and will be purchased from the North Georgia Pwr. Co. at 1½ cents per kw-hr. The price was formerly 5 cents. The plant is now owned by the J. B. McCrary Co. Edward Tarpley is city electrician.

SCOTT, GA.—T. J. Burke is planning to install an electric-light plant.

ALACHUA, FLA.—The Council is reported to have engaged the J. B. McCrary Co., of Atlanta, Ga., to prepare plans for an electric-light plant and water-works, to cost about \$24,000.

MULBERRY, FLA.—The Mulberry El. Co. expects to purchase within the next two months tub transformers, street series fixtures, mast arms and other equipment. H. J. Pratt is superintendent.

ST. AUGUSTINE, FLA.—The lighting system of the St. John's Lt. & Pwr. Co. will be extended from St. Augustine to Chetachqua Beach, a distance of 6.5 miles, within the next two months, and superheaters installed on all boilers. T. P. Alston is general manager.

TALLAHASSEE, FLA.—The municipal water, gas and electric-light plant is reconstructing the entire distribution system. It has recently built new lines extending outward from the city for two or three miles, from which a profitable load is expected. Within a few months a new boiler will be bought.

HUNTSVILLE, ALA.—The engineers of the Alabama Pwr. Development Co., Talladega, Ala., have measured the quantity of water pumped for the city with a view to making a contract for running the pumps by electricity.

PERKINSTON, MISS.—An electric-light plant is being installed at the Agricultural High School, which will light the buildings of the school as well as the town and a number of residences. A system of water-works is also projected.

MARIANNA, ARK.—The property of the Marianna Lt., Ht. & Wtr. Co., including the street-car system, light and water plant, has been purchased by the Light & Devel Co., of St. Louis, Mo.

PLAINVIEW, ARK.—A company has been organized by local business men to install an electric-light plant in Plainview. Application will soon be made to the Council for a franchise. Electricity for operating the system will be supplied by the Fort Smith Lumber Co.

BASTROP, LA.—A complete renovation of the municipal electric-lighting plant and additions, which will involve an outlay of approximately \$12,000, is contemplated for this year. C. F. Lockwood is manager and chief engineer; J. K. Skipworthy, Mayor.

BREAUX BRIDGE, LA.—The erection of an electric-light plant is being discussed.

COLORADO, TEX.—One 65-hp Rumley oil engine has recently been installed in the plant of the Colorado El. Lt. Co. R. M. Webb is secretary and treasurer.

TEMPLE, TEX.—Increased lighting of Nineteenth Street and Avenue H and Freeman Heights has been ordered.

WACO, TEX.—In the first district at this place all the wires have been ordered placed underground at once.

WHITESBORO, TEX.—At a recent election it was voted to install a municipal electric-lighting plant.

WHITESBORO, TEX.—J. C. Jones, city secretary, informs us that the city has issued a bond issue of \$5,000 with which to install an electric-light plant, to be run in connection with the city water-works. The contract will probably be let within the next sixty or ninety days.

## Pacific States

CASHMERE, WASH.—The Town Council recently authorized the rebuilding of the present substation and pumping house. The rapid growth of the light and power system calls for a reconstruction of the distribution system. Contracts have been let for the installing of a tungsten series street-lighting system, to include 120 ornamental posts in the business section and principal residential streets. At the next meeting of the Town Council the kind of post to be used will be decided upon. O. M. Carter is superintendent of the water and light department.

COLVILLE, WASH.—The Little Pend Oreille Tel. Co., recently organized, will erect a telephone line from Colville to Pend Oreille, a distance of 27 miles. J. S. Gnagy is president.

SEATTLE, WASH.—Daniel Huntington, city architect, has completed plans for a four-story brick and concrete power plant to be erected at Richmond Heights, Seattle. Estimated cost, \$20,000.

SPOKANE, WASH.—The Methow River Pwr. Co. is planning to extend its transmission line up the Okanogan River, from Brewster to Riverside, Wash., a distance of 30 miles. Nixon & Kimmel, electrical engineers, Spokane, have the contract.

SPOKANE, WASH.—The Okanogan Valley Pwr. & Lt. Co. has been organized and has taken over the power plants of the Nixon-Kimmel Co. (Spokane), the Big Bend Lt. & Pwr. Co. (Spokane) and the Grangeville (Idaho) Lt. & Pwr. Co. The systems will be combined and many improvements made. Eugene Enloe, Medical Lake, Idaho, is president.

AMITY, ORE.—Plans are being prepared for a complete water system, to consist of pumping station and distributing system and to cost about \$25,000. Bids for construction will be called for after the sale of bonds has been completed.

ARLINGTON, ORE.—LePage, McKenny & Company, Yesler Way, Seattle, Wash., will be awarded the contract for furnishing all materials and constructing an electric-lighting plant and pumping station for the city of Arlington. Louis C. Kelsey, Selling Building, Portland, Ore., is engineer.

EASTSIDE, ORE.—Application for a franchise for the establishment of an electric-light and water system has been made by E. C. Drews, manager Coos Bay Home Tel. Co.

MEDFORD, ORE.—The State Railroad Commission of California has granted the California-Oregon Pwr. Co., of Medford, permission to purchase the electric light and power plant of R. E. Cavanaugh at Edgewood, Cal., for \$10,000, and the electric plant in Sisson, Cal., owned by George H. Johnson, for \$15,000, both in Siskiyou County.

BERKELEY, CAL.—The Newberry Bendheim El. Co. has been awarded the contract for the construction of five-lamp electroliers on University Avenue, from Shattuck Avenue to Grove Street, for \$75 per electrolier. The Joshua Hendy Co. received the contract for three-lamp electroliers on University Avenue for \$408.

BURBANK, CAL.—It is reported that plans are now being discussed for supplying electrical energy for lighting and domestic purposes by the municipal lighting plant at Glendale, of which H. B. Lynch is manager.

CASA VERDUGO (NORTH GLENDALE), CAL.—Negotiations are now in progress to form a lighting district to be served by the municipal lighting plant at Glendale, which for several years has furnished energy for domestic purposes. Casa Verdugo now wishes its streets lighted from the same source.

ELSINORE, CAL.—The board of trustees has approved the plan urged by prominent citizens of placing ornamental street lamps on Main Street and extending the city lighting system. It is estimated that 19 reinforced-concrete poles, supporting a cluster of 60-watt tungsten lamps, would cost between \$350 and \$400.

FONTANA, CAL.—A new town site was opened at this place on June 2. Improvements under way include a modern electric-light plant.

GARDENA, CAL.—The State Railroad Commission has granted the Southern California Edison Co. permission to purchase the local electric-light plant, owned by the Pacific El. Ry. Co., at \$17,500.

HOLLISTER, CAL.—Dr. H. J. Macomber has signed a contract with the Coast Counties Gas & El. Co. for the extension of its lines from Hollister to Paicines.

PASADENA, CAL.—The Pacific El. Ry. Co. is planning to spend \$300,000 in additions and improvements in the city of Pasadena. Included in this work is the double-tracking of the line on Lake Avenue between Colorado and Washington Streets.

PIEDMONT, CAL.—Consideration is being given to the proposition to install a municipal electric-lighting plant.

RICHMOND, CAL.—The lines of the Great Western Pwr. Co. will be extended at once into Richmond. Rust, San Pablo, Pinole and Rodeo, the company having recently been granted a franchise by the county supervisors. It is reported that the company proposes to build over 159 miles of new lines, at a cost of \$200,000 in Contra Costa County.

SACRAMENTO, CAL.—The State Railroad Commission has granted permission to the Northern El. Ry. Co. to build and operate electric lines in Sacramento. Work is to begin at once on these lines to give a route to the company's through lines into the business section of Sacramento.





**HULL, QUE.**—The Ottawa & Hull Pwr. & Mfg. Co. is to build a station at Hull to supply electricity for motor service. Equipment to be purchased includes two 9500-hp waterwheel governors and two 7650-kw, 12,000-volt generators. Wm. Kennedy, Jr., Montreal, Que., is the engineer in charge of the work. Hon. W. C. Edwards, Ottawa, is president; R. Blackburn, Ottawa, is secretary-treasurer.

**ST. ROSE, QUE.**—Bids will be received until July 7, it is reported by J. A. Ely, secretary-treasurer, for constructing a water tank, sewage-purification system, filtration plant, pumps and power house for the water-works system. Plans and specifications may be obtained from Ouimet & Lesage, Montreal, Can.

**SOREL, QUE.**—The City Council has under consideration the installation of an electric fire-alarm system.

**PRINCE ALBERT, SASK.**—Plans and specifications are being prepared for a modern steam generating station, prime movers to be condensing steam turbines connected to 2000-kw alternators; 5000-hp water-tube boilers with mechanical stokers, and coal-handling machinery. R. Wright, electrical superintendent.

**SASKATOON, SASK.**—An expenditure of \$15,000 is planned for the extension of the electric light and power system. Andrew Leslie, city clerk.

**YORKTON, SASK.**—A by-law was submitted to the electors on June 20 authorizing the expenditure of \$140,000 for extending the present plant of the town and for distribution for light, heat and power purposes.

## New Industrial Companies

**HERRICK AIKEN & COMPANY,** of Lawrence, Mass., has been incorporated with a capital stock of \$100,000 by Herrick Aiken, Arthur L. Fulkerson and Walter J. Keating. The company proposes to do a general electrical business.

**THE DAYTON-DICK COMPANY,** of Quincy, Ill., has been incorporated with a capital stock of \$30,000 to manufacture magneto coils and deal in all kinds of electrical apparatus. The incorporators are Judge C. E. Epler, August R. Dick and Henry F. Dayton.

**THE ELECTRIC STEEL & METALS CO., LTD.,** has been incorporated to carry on business as railway, civil, mining and electrical engineer and dealer in electrical supplies, with headquarters at Welland, Ont.

**THE INDUSTRIAL DEVELOPMENT CORPORATION,** of Portland, Maine, has been organized with a capital stock of \$500,000 for the purpose of carrying on electrical and industrial enterprises of all kinds. John H. Pierce is president and Robert M. Pennell, treasurer, both of Portland, Maine.

**THE ISRAEL & PINE MANUFACTURING COMPANY,** of New York, N. Y., has been incorporated with a capital stock of \$5,000 by Charles L. Apfel, Abraham Kamen and Lucien Ebert, of 165 East 128th Street, New York, N. Y.

**THE MODERN EQUIPMENT COMPANY,** of Ashtabula, Ohio, has been incorporated by Clinton C. Faust, J. L. Smith, David Loeb, George Walker and W. F. Rowdon. The company is capitalized at \$10,000 and proposes to manufacture and deal in power plants, home laundries and home equipment.

**THE NATIONAL STAMPING & ELECTRIC WORKS,** of Chicago, Ill., have increased their capital stock from \$50,000 to \$75,000.

**THE OCTO ENGINEERING ASSOCIATION, INC.,** of Rochester, N. Y., has been incorporated with a capital stock of \$10,000 to carry on an electrical and mechanical engineering business. The incorporators are: Joseph M. Stabel, John J. Eyre and Louis A. Kaplan, of 13 Fien Street, Rochester, N. Y.

**THE O'SHEA-WRIGHT ELECTRIC CORPORATION,** of Elmira, N. Y., has been incorporated by David S. O'Shea, Charles O. Wright and Frank W. Wright, 409 Jefferson Street, Elmira. The company is capitalized at \$5,000 and proposes to do a general electrical business.

**THE PHONE CALL RECORDER COMPANY,** of Wilmington, Del., has been incorporated by R. Boyle Cooling, Clarence J. Jacobs and Henry W. Davis, all of Wilmington, Del. The company is capitalized at \$250,000 and proposes to manufacture and deal in electrical utensils of all kinds.

**HARRY A. PORTER, INC.,** has been granted articles of incorporation for the purpose of buying, manufacturing and selling electrical appliances. Capitalization, \$2,500. Incorporators: H. A. Porter, Roland L. Porter and J. L. Porter.

**THE RADIO ENGINEERING COMPANY OF AMERICA,** of New York, N. Y., has been chartered with a capital stock of \$100,000 to manufacture and deal in electrical, magnetic and mechanical devices. The incorporators are: T. Nieman Lally, B. S. Rockwell and Thomas T. Tammall, all of 71 Broadway.

**THE SANTA CLARA CONSTRUCTION COMPANY** has filed articles of incorporation under the laws of the State of Maine with a capital stock of \$500,000 for the purpose of constructing and dealing in electric railroad and electric plants. E. M. Leavitt, of Winthrop, Maine, is president.

**THE SCHAEFER-FRENZEL COMPANY,** of Detroit, Mich., has been organized with a capital stock of \$50,000 to manufacture and deal in air compressors, machinery and electrical appliances.

**THE TILSONBURG ELECTRIC CAR COMPANY,** of Tilsonburg, Ont., Can., has been incorporated with a capital stock of \$40,000 by T. J. Bailie, A. E. Medhurst and J. Chandler Prescott.

**THE UNIVERSAL EQUIPMENT COMPANY, INC.,** of New York, N. Y., has been incorporated with a capital stock of \$50,000 by George Gray, Theodore W. Hatfield and Isaac B. Ownes, 617 West 143d Street, New York. The company proposes to manufacture and deal in internal combustion engines and motors.

**THE VOLT ELECTRIC COMPANY, LTD.,** of Toronto, Ont., has been incorporated with a capital stock of \$40,000 to manufacture and deal in electrical appliances, etc. The head office of the company will be in Toronto.

**THE VOLTA MACHINE MANUFACTURING COMPANY, INC.,** of New York, N. Y., has been incorporated with a capital stock of \$20,000 to manufacture machinery used in generating electricity. The incorporators are: Thomas D. Finizio, Frank V. Gliberti and Antonio Petraglia, 2258 First Avenue, New York, N. Y.

**THE WABASH ELECTRICAL CONSTRUCTION COMPANY,** of Chicago, Ill., has been incorporated with a capital stock of \$2,500 to do an electrical contracting and construction business. The incorporators are: Fred Frost, Joseph L. Tooley and John P. O'Shaughnessy.

## New Incorporations

**ASHTON, IDA.**—The Ashton & St. Anthony Pwr. Co., Ltd., has been incorporated with a capital stock of \$250,000 by A. Whitten, L. M. Capps, N. N. Holm and E. M. Harris. The company will erect a power plant three miles from Ashton.

**SPRING VALLEY, ILL.**—The Spring Valley Utilities Co. has been incorporated with capital stock of \$1,000,000 to manufacture electrical energy for all purposes. The incorporators are Charles H. Brown, Roy W. Brown, Constant Brown and Harry E. Brown.

**BURT, IA.**—The Burt Lt. & Pwr. Co. has been incorporated with a capital stock of \$15,000 by L. M. Owens, president; M. J. Mann, vice-president; C. B. Chipman, secretary; H. O. Beull, treasurer.

**MINNEAPOLIS, MINN.**—The Pioneer Pwr. Co. has been incorporated with a capital stock of \$50,000, for the purpose of developing water-power and operating electric light and power plants. The incorporators are B. N. Johnson and O. A. Johnson, of Fergus Falls, Minn., and R. A. Lundquist, of Minneapolis, Minn.

**LIBERAL, MO.**—The Liberal Lt. Co. has been incorporated with a capital stock of \$7,200 by C. Lipscomb, M. M. Jones and C. H. Dixon.

**OMAHA, NEB.**—The Republican River Pwr. Co. has been incorporated with a capital stock of \$100,000, by F. B. McDonald, M. L. Gardner, A. E. Hansen, L. R. Yost and C. G. Eckman. The company proposes to do a general water-power business and to generate and distribute electricity for lamps and motors.

**MORRISTOWN, N. Y.**—The Gregory El. Co. has been incorporated by Arthur W. Gregory, Edna M. Gregory and A. Sophia Gregory, all of Morristown. The company is capitalized at \$4,000.

**NEW YORK, N. Y.**—The Eastern Tennessee Transportation & Development Co. has been incorporated with a capital stock of \$10,000 by George H. Burt, John Foster Dulles and John K. Byard, 155 East Seventieth Street, New York, N. Y. The company proposes to generate electricity, manufacture ice, salts and chemical products.

**THELMA, N. C.**—The Roanoke River Development Co. has been incorporated by W. C. Whiner, Fritz Sitterding and others of Richmond, Va. The company will take over the Roanoke Navigation & Wtr. Pwr. Co., which was organized to construct a hydroelectric power plant on the Roanoke River.

**SPRINGFIELD, OHIO.**—The Gray Electric Co. has been incorporated with a capital stock of \$10,000. The incorporators are M. H. Gray, A. E. Spining, H. M. Snyder, George P. Arnold and O. G. McCain.

**WEST LAFAYETTE, OHIO.**—The West Lafayette Lt. & Pwr. Co. has been incorporated with a capital stock of \$10,000 by C. H. Howell, K. K. Garret, E. A. Crawford, W. A. Himebaugh and F. E. Pomerene. The company proposes to install an electric-light system in West Lafayette. Electricity to operate the system will be secured from the Coshcon plant.

**OKLAHOMA CITY, OKLA.**—The Pub. Ser. Corp. of Oklahoma has been incorporated with a capital stock of \$3,000,000 to operate gas and electrical plants, street and interurban railways and ice plants. The principal place of business will be located in Oklahoma City, with branch offices in Tulsa, Guthrie, Vinita, Atoka, Lehigh, Coalgate, Chickasha and Lawton, and a business office in Chicago, Ill. The incorporators are: H. I. McCracken, C. Sullivan, A. E. Johnson, E. J. Cligett and John Rapp.

**TULSA, OKLA.**—The Ox-Bow Bend Pwr. Co. has been chartered with a capital stock of \$100,000 for the purpose of building a hydroelectric power plant on the Arkansas River, about 60 miles from Tulsa. The incorporators are: C. P. Chenault, L. D. Lewis, Floyd E. Lewis, J. O. Campbell and L. W. Masan.

**EASTON, PA.**—The Dolaburne Pwr. Co. has been incorporated with a

capital stock of \$5,000 by E. V. Stanton, 459 West One Hundred and Second Street, New York, N. Y.

**HARRISBURG, PA.**—The Wayne Gunite RR. Co., Honesdale, Pa., recently incorporated with a capital of \$100,000. M. B. Allen, Honesdale, chief incorporator.

**PHILADELPHIA, PA.**—The Northampton El. Co. has received a charter with a capital stock of \$7,000. J. S. Marzaglio, of West Chester, is among the incorporators.

**PHILADELPHIA, PA.**—The Holbrook El. Co. has been incorporated with a capital stock of \$5,000. Walter L. Bracken, 1212 Second Street, Germantown, is one of the incorporators.

**HOT SPRINGS, S. D.**—The Cheyenne River Power & Light Co. has been incorporated by George A. Tanner, John W. Parks, and Henry Marty. The company is capitalized at \$3,000 to develop electric power on the Cheyenne River in the Black Hills section.

**HUDSON, S. D.**—The Hudson El. & Power Co. has been incorporated with a capital stock of \$10,000 by J. B. Hayden, C. F. Johnson, T. N. Tonkinson, P. F. Way and others, all of Hudson.

**MEMPHIS, TENN.**—The Blue Ridge Power Co. has been incorporated with a capital stock of \$25,000 by James G. Gorman, W. H. G. G. Gore and E. N. Rogers.

**HAMILTON, TENN.**—The Hamilton Mill & Power Co. has been incorporated with a capital stock of \$5,000. The incorporators are: H. M. Weiser, C. E. Horton and W. B. Clonard.

**LADONIA, TENN.**—I. A. Bishop & Co. has been incorporated with a capital stock of \$15,000 for the purpose of generating and transmitting power and manufacturing iron, etc. The incorporators are: J. A. Bishop, Grover Bishop and W. W. Boman.

**SALT LAKE CITY, UTAH.**—The Sage Creek El. Co. has been incorporated with a capital stock of \$25,000. The incorporators are: E. E. Shusser, Ota Transstrom, E. M. Eggenrud, Ota Transstrom and J. J. Howell.

**VANCOUVER, WASH.**—The Washington Farm Land Co., through James P. Stapleton, has been incorporated with a capital stock of \$1,000,000.

**CHARLESTON, W. VA.**—The Mineral El. & Power Co. has been chartered with a capital stock of \$50,000 to generate electricity for lamps, heaters and motors and to own and operate coal mines, etc. The incorporators are: I. H. Gammes, A. B. Kosciusko, G. G. Todd, J. R. Hayslett and R. Kemp Morton, all of Charleston.

## Trade Publications

**GUY CLAMPS.**—A booklet with the imprint of W. N. Matthews & Brother, St. Louis, Mo., refers to their "Guy" clamp gas company. The phrase is laid on the strength of this new "Guy" clamp. A third phase is made.

**POLES AND BRACKETS.**—The Loring P. Martin Iron Works, Inc., 90 West Street, New York, have issued Catalog No. 21, Section No. 1, which contains illustrations, brief descriptions and dimensions of all plain and ornamental are and mounds cut lamp poles, for various fittings.

**TELEPHONES.**—Bulletin No. 1, issued by Murray I. Mann, Delaware, Ohio, describes and illustrates the Mann telephone. Its several new features are set forth, among which are the accessibility of the induction coil and condenser without the aid of any tool, a switch hook easily accessible and ample room for inspection.

**AUTOMOBILE TELEPHONE.**—The Page-Singer Phone Company, New York, has issued an illustrated, double-sided, eight-page, which refers to its passenger-driven, instant-answering, loud-speaker, "phone," called the "entelphone." The cover is printed in colors and the orders of the passenger of a car to the operator, the time being suggested.

**PAPER-MILL ENGINES.**—The American Paper Machinery Co., Brook, N. J., has issued a letter to the paper mill industry. It illustrates the new American Bell type of engine, which is a four-cylinder engine with a wide speed range. It shows a number of the most modern angle-type, variable-speed engines and how the three-cylinder, horizontal, variable-speed, paper-mill engine.

**AIR WASHERS.**—In its Bulletin No. 1, the Sauer Engineering Company, 901 De Witt Street, Boston, gives a complete description of its system of washing and cooling air in large buildings. The system is said to be suitable for purifying the air and removing the dust from the dry atmosphere in buildings in winter. The working principle is explained in the text and by figures.

**CONSULTING ENGINEERS' BROCHURE.**—An interesting brochure being sent out by the H. A. Stone & Company, Stone Building, Chicago, are sent with the request of the company to those taking consulting, designing, supervising and general engineering work. Miniature illustrations accompanied by brief descriptions of the successful installation are planned by the company.

**ARC LAMPS.**—Bulletin No. 4, issued by the Edison Electric Company, describes various incandescent lamps and their uses and direct-current circuits of other lamps in all sizes. It also contains a number of recommendations as to the best way to use the lamps.

the lamp, which may be used in any of the following ways: 1. As a general lighting lamp. 2. As a lamp for use in the laboratory. 3. As a lamp for use in the factory.

**THEORY OF THE ELECTRIC CIRCUIT.**—The theory of the electric circuit is a subject of great importance in the study of electricity. It is the study of the flow of electric current through a circuit. The theory of the electric circuit is a subject of great importance in the study of electricity. It is the study of the flow of electric current through a circuit.

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**RAILROAD WORK.**—Under the new "Work Law" passed by the U. S. Congress, the railroad industry is now required to provide for the safety of its employees. This law is a landmark in the history of labor legislation in the United States. It is the first time that a law has been passed which requires an employer to provide for the safety of his employees.

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## Business Notes

**STEEL CITY ELECTRIC COMPANY.**—Mr. Dale B. Scarborough has been appointed sales representative for the Steel City Electric Company in eastern Pennsylvania, New Jersey (except Newark and north thereof), Delaware, Maryland, Virginia and the District of Columbia, with offices at 5522 North Third Street, Philadelphia. Mr. R. W. Young will represent the company in the New England States, the metropolitan district of Greater New York, the city of Newark and the territory north thereof, with offices at 27 Thames Street, New York. The Steel City Electric Company, the main offices of which are in Pittsburgh, manufactures outlet boxes, bushings, lock nuts, fixture stems, conduit benders, etc.

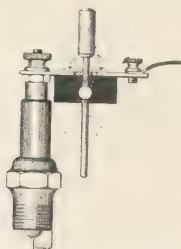
**MANUFACTURERS' SALES SERVICE.**—An enterprise that promises to be of benefit to manufacturers located at a distance from New York City and not represented there by a branch office or resident salesman has just been announced. The Manufacturers' Sales Service, as the name indicates, will render an introductory and selling service to manufacturers similar to that of a branch office. The service is offered only to manufacturers in the building trades lines whose products are of interest to architects, owners, engineers, builders and sub-contractors on buildings. The office will be in the new Architects' Building, 101 Park Avenue, New York City. Mr. William R. Pertak is the manager of the Manufacturers' Sales Service, which will aim to keep a limited number of subscribers in different non-competitive lines in touch with New York City building operations and prospects.

# Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 17, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

- 1,064,719. **TELEPHONE TRUNKING SYSTEM;** E. D. Fales, La Grange, Ill. App. filed July 6, 1908. Two-way trunk in a two-wire automatic phone-exchange system.
- 1,064,722. **RHEOSTAT;** W. G. Gillig, Chicago, Ill. App. filed Feb. 1, 1913. A movable pressure member forces successive portions of a flexible contact member into contact with successive convolutions of the resistance wire.
- 1,064,724. **CASING;** M. Guett, Hartford, Conn. App. filed Sept. 15, 1911. Multiple lock for lamp-socket shells.
- 1,064,739. **ELECTRICALLY HEATED SOLDERING IRON;** M. H. Johnson, Utica, N. Y. App. filed Dec. 18, 1909. Heating coil is hermetically sealed in heater case having autogenous joints.
- 1,064,749. **ELECTRIC-CURRENT CONTROLLER;** H. W. Leonard, Bronxville, N. Y. App. filed Dec. 12, 1904. Current is automatically maintained within such limits as are required for the desired operation of the device. (Sixty-four claims.)
- 1,064,805. **SYSTEM OF TELEGRAPHY;** G. Wood, Kansas City, Mo. App. filed April 29, 1909. Receiving instrument prints the messages in page form.
- 1,064,809. **MOTOR CONTROLLER;** T. E. Barnum, Milwaukee, Wis. App. filed July 26, 1909. Circuits of both the motor armature and shunt-field winding are controlled from a distant point.
- 1,064,810. **TIFFANY KEY;** H. L. Dauphinais, Fargo, N. D. App. filed Nov. 27, 1912. Flat, obliquely extending finger piece secured to the knob of the key lever.
- 1,064,831. **PULL SOCKET;** H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Operating lever pivoted outside of shell and connected by insulating link to the switch mechanism.



No. 1,065,327—Spark-plug Connector and Switch.

- 1,064,832. **PULL SOCKET;** H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Reversible operating lever pivoted within the shell and extending out through an opening in the shell.
- 1,064,833. **SEPARABLE ATTACHMENT PLUG;** H. Hubbell, Bridgeport, Conn. App. filed Jan. 2, 1912. Engaging contact blades carried by cap and base.
- 1,064,834. **PULL SOCKET;** H. Hubbell, Bridgeport, Conn. App. filed May 6, 1912. Operating bar made in two insulated separably connected parts.
- 1,064,846. **ACCESSORY FOR THE IGNITION SYSTEMS OF INTERNAL COMBUSTION ENGINES;** M. H. Merrill, Boston, Mass. App. filed May 10, 1911. Cutout switch attached to spark plug.
- 1,064,893. **INSULATING COMPOUND AND PROCESS OF MAKING THE SAME;** G. F. Dreher, Schenectady, N. Y. App. filed Dec. 29, 1908. For commutator segments, etc., powdered refractory earth, asbestos and silicate of soda compressed and fired under pressure at high temperatures.
- 1,064,899. **TRAIN ANNUNCIATOR;** L. W. Givan, Spring Lake, Ky. App. filed May 13, 1911. To enable the dispatcher to ascertain at any time if a train has passed a station since the last time he called.
- 1,064,900. **CONNECTOR FOR ELECTRIC WIRES;** D. R. Lovejoy, Chicago, N. J. App. filed Sept. 27, 1912. For making connection between circuit wires and fixture wires of a chandelier, etc.; shell with concentric grooves and clamping screws with concentric grooves.
- 1,064,901. **ANNUNCIATOR OPERATING MECHANISM;** E. J. Pace, Los Angeles, Cal. App. filed May 29, 1912. For operating indicators, signals, etc., on moving trains.
- 1,064,902. **CONNECTING DEVICE;** E. G. K. Anderson, Chicago, Ill. App. filed July 29, 1910. Lamp socket with bayonet joint with a base.

- 1,064,957. **ELECTRICAL CONNECTING APPARATUS;** G. A. Betu-lander, Södertörns Villastad, Sweden. App. filed Jan. 4, 1912. Selector of automatic telephone exchange.
- 1,064,981. **SYSTEM AND METHOD OF PRODUCING BY MEANS OF COMBUSTION ENGINES ELECTRIC CURRENT;** W. A. T. Müller, Berlin-Steglitz, Germany. App. filed March 29, 1909. Independent generator sets driven by independent gas engines are all controlled by one man by starting one unit and exciting the other generator units as co-generators.
- 1,064,983. **ELECTRIC BATH CABINET;** T. E. Murray and G. K. Jessup, New York, N. Y. App. filed Dec. 30, 1912. Hollow wall sections flexibly connected and lamps seated in recesses in said sections.
- 1,064,988. **ELECTRIC CUT-OUT;** T. A. Murray, Jr., New York, N. Y. App. filed Feb. 4, 1913. Fuse carriers mounted detachably on a pivoted support so that they may be moved into and out of co-operation with the contacts.
- 1,064,991. **ELECTRODE HOLDER;** H. J. Potts, Kansas City, Mo. App. filed June 20, 1912. A flat-sided adjusting screw for manually advancing the electrode through the holder jaws; for headlamps, etc.
- 1,964,992. **METALLURGY OF ZINC;** A. L. Queneau, Philadelphia, Pa. App. filed April 7, 1909. Furnace lining with solid peripheral conductors separated by breaks which are bridged by molten resisting material.
- 1,064,997. **SIGNALING SYSTEM;** H. O. Ragh, Sandwich, Ill. App. filed Jan. 20, 1910. Selective system in which the various devices at the substations are operated by current supplied at the central station.
- 1,065,009. **CONTROLLER;** P. S. Turner, Chorlton-cum-Hardy, England. App. filed Jan. 15, 1913. Shunt circuit around motor armature is made and broken and amount of resistance therein is varied independently of the amount of resistance in series with the motor.
- 1,065,015. **RESISTANCE;** W. R. Youmans, Columbus, Ohio. App. filed Oct. 21, 1909. Continuous flexible resistance element held under tension in an extensible frame.
- 1,065,037. **HEATING UNIT;** B. Falkenberg, Ontario, Cal. App. filed May 27, 1912. For percolators, etc.; semi-cylindrical heat-conducting members with an interposed sheet of insulation around which a wire is wound.
- 1,065,068. **PROTECTOR FOR TELEGRAPH AND TELEPHONE CROSS ARMS AND PINS;** H. G. Newell, Le Raysville, Pa. App. filed Oct. 7, 1912. Annular washer with knifelike flanges which bite into the wood, the washer serving to cover the joint between the cross-arm and the pin seated in the arm.
- 1,065,090. **APPARATUS FOR UNIFORMLY COATING STRIPS OF METAL WIRE AND THE LIKE UNDER CONTINUOUS ACTION;** F. Werth, Milan, Italy. App. filed Sept. 4, 1912. Metal to be coated is moved between channeled anodes.
- 1,065,114. **ELECTRIC RAILWAY SIGNALING SYSTEM;** F. P. Cremona, Baltimore, Md. App. filed April 11, 1910. Contact rails on track and brush on train.
- 1,065,130. **SEALING TOOL;** L. A. V. Hull and H. B. Moorehead, McComb, Ohio. App. filed March 8, 1913. Stick of sealing material is guided in end of tool; switch is located within handle of tool.
- 1,065,141. **PROJECTOR CARBON;** J. F. Kerlin, Lakewood, Ohio. App. filed Jan. 8, 1912. Lengthwise furrow in carbon causes the arc to remain stationary; furrow is rounded at the bottom to prevent the carbon cracking when baked.
- 1,065,144. **METHOD OF AND MEANS FOR HEATING GASES TO HIGH TEMPERATURES;** C. F. R. Von Koch, Stockholm, Sweden. App. filed June 10, 1911. Preheats gas and encloses it in envelope of comparatively cool gas and advances the preheated gas with its enclosing envelope past a further source of heat.
- 1,065,148. **ELECTRIC COOKER;** C. C. Lillibridge, Hutchinson, Kan. App. filed Aug. 12, 1912. Electric heat radiator removably engaged within the cooker so as to heat the cooker simultaneously with the heating of the radiator.
- 1,065,151. **ELECTRIC SIGNALING SYSTEM;** R. H. Manson, Elyria, Ohio. App. filed Dec. 27, 1909. For appraising driver of the vehicle that the regular signal has failed.
- 1,065,190. **STRAIN RELIEF;** T. J. Tobin, Albany, N. Y. App. filed Nov. 10, 1912. Flat plate of flexible insulating fiber with independent wire passages.
- 1,065,195. **SOLDERING IRON;** J. White, Philadelphia, Pa. App. filed Oct. 17, 1912. Compressed air used to force the molten solder.
- 1,065,302. **MEANS FOR TRANSFERRING LOAD FROM ONE GENERATOR STATION TO ANOTHER;** E. F. Dutton, Schenectady, N. Y. App. filed Nov. 2, 1911. Automatic circuit-breakers and connections by which load may be transferred in whole or in part to either generator station without interrupting supply of current to the load and without throwing stations into multiple more than momentarily.
- 1,065,327. **SPARK-PLUG CONNECTOR AND SWITCH;** C. E. Semple, Jr., Youngstown, Ohio. App. filed April 27, 1911. For attachment to spark plug to provide a connection to the plug or to short-circuit current to the base of the plug.













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